ArchSurgRes Volume 2, Issue 4
Oct-Dec, 2021

A Peer Reviewed Quarterly Scientific Journal of Surgical Art, Science and Education

ASR ISSN: 2709-684X (Print), 2709-6858 (Online)

Archives of Surgical Research

Bringing Surgical Science and Art Closer

Archives of Surgical Research (ASR) is a double blind peer-reviewed quarterly ICMJE and COPE compliant journal dedicated to the local, national, and global advancement of surgical research, education and clinical practice. It aims to promote continued development in surgery through the dissemination of knowledge, ideas and good practice across surgical specialties. ASR provides readers with critically peer-reviewed, carefully selected and edited, and up-to-date publications about advancements in all surgery specialties.

Published by
Pakistan Endocrine & Thyroid Surgeons Association (PETSA)
537-S, Imperial Garden Homes, Paragon City, Lahore, Pakistan

Archives of Surgical Research

A Peer Reviewed Journal of Surgical Research & Education

Editor in Chief: Prof Khwaja M Azim FRCS

Published by
Pakistan Endocrine & Thyroid Surgeons Association (PETSA)
537-S, Imperial Garden Homes, Paragon City, Lahore, Pakistan

About Archives of Surgical Research

Archives of Surgical Research (ASR) is dedicated to the local, national, and global advancement of surgical research, education and clinical practice. It aims to promote continued development in surgery through the dissemination of knowledge, ideas and good practice across surgical specialties. ASR provides readers with critically peer-reviewed, carefully selected and edited, and up-to-date publications about advancements in all surgery specialties.

The journal aims to uphold the highest standards at the cutting-edge of research, provide a focus for evidence-based medicine through the publication of review articles and special issues, and give the findings context through the publication of editorials, commentaries and letters from the surgical community. We ensure enforcement of reporting guidelines and mandate the registration of all research involving human participants in a publicly accessible research registry.

As a journal covering all surgical specialties, ASR aims to facilitate the transfer of important ideas and thought systems between and across specialties. Hence, ASR will help prevent the trend of increasing sub-specialization which leads to 'tunnel-vision' and the unfortunate concealment of important surgical advances within specific specialties.

Editor in Chief

KMA

Editorial Team

PREFACE

Shalamar Medical & Dental College has exceptionally excelled in the field of science, education and research over the last decade and has produced quality graduates who are currently serving around the world. Quality of education and research in surgery has been instrumental in this regard under the leadership of Prof Khawaja Muhammad Azim to achieve our core objective of producing quality education. Inception of Pakistan Endocrine & Thyroid Surgeons Association (PETSA) has aligned well to my vision, institutional requirements and overall rapport of the institution.

I witnessed and supported the birth of Pakistan Endocrine & Thyroid Surgeons Association here at Shalamar Medical College three years back and during this period it has evolved into a mature tree and is bearing fruits to surgical education and training here at our institution. Legacy of its founding visionary, Late Prof Syed Zafar Haider has continued. PETSA has been conducting Annual Thyroid & Parathyroid Master Class since its inception with great reception. Currently, we are the largest endocrine surgery center in Pakistan with highest volume turnover.

Now the introduction of "Archives of Surgical Research" is another feather into our institutions' cap. This journal would not only satisfy the needs of the society but would also serve to promote culture of science, education and research within our institution. This culture advocacy remains instrumental in promoting the quality of learning process of the medical graduates within our institute and is aligned with my vision about this medical college.
In the end, I am happy to write about "Archives of Surgical Research" and its inaugural issue and wish the editorial team best of luck for their endeavors for years to come.

Prof Zahid Bashir

Principal

Shalamar Medical & Dental College, Lahore

MESSAGE FROM THE PRESIDENT

Pakistan Endocrine & Thyroid Surgeons Association (PETSA)

Prof Zafar Haider was the teachers of the teachers and a great surgeon. He was the one who made thyroid and endocrine surgery safe in Pakistan and we carry the light now with aim to improve the endocrine surgery in light of modernization in the field of the surgery.

Archives of Surgical Research aims at improving the standard of surgical research and education. It would function as official Journal of Pakistan Endocrine & Thyroid Surgeons Association (PETSA).

The journal would cover endocrine, breast and surgical oncology primarily. It would also focus on the surgical education for medical students and residents to enhance the learning process through addition of technology, blended learning and modern concepts in medical education.

Prof. Khwaja M Azim FRCS
President PETSA

Contents

Archives of Surgical Research | Prof Syed Zafar Haider Memorial Feature

Prof Syed Zafar Haider: Bright Star of Surgical History of Pakistan

Asaf Beg Mirza

IMPORTANCE Prof Syed Zafar Haider has been a shining beacon of light for the younger surgical lot for past four decades. He had exceptional qualities as a surgeon, leader and teacher. His services for developing endocrine surgery and esophageal surgery within Pakistan have been phenomenal and exemplary. Many have learned from him and have benefited the society. His role in creating a great surgical class of surgeons in Pakistan would be acknowledged forever.

KEY WORDS Prof Syed Zafar Haider; Surgery; Pakistan

HOW TO CITE Mirza AB. Prof Syed Zafar Haider: Bright Star of Pakistani Surgical History. *Archives of Surgical Research*. 2021, 2 (4):1-2. https://doi.org/10.48111/2021.04.01.

PSZ Haider Memorial Feature

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author:

Prof Asaf Beg Mirza, Consultant Surgeon, Ittefaq Hospital Trust, Lahore

https://doi.org/10.48111/2021.04.01

Prof. Dr. Syed Zafar Haider is a very well-known name in the field of surgery in Punjab. I have had long cherished association with him as an undergraduate student and his assistant professor in King Edward Medical College and Mayo Hospital, Lahore.

Shah Ji, came from a very educated and respected Syed family. As his undergraduate student, I remember his enthusiastic approach towards teaching clinical methods and skills. He would ensure students participation and full attention to the subject.

Prof. Syed Zafar Haider after passing MBBS from K.E Medical College became house surgeon to Prof. Dr. Ameer ud Din in Mayo Hospital, Lahore. He was very proud that he received his training in good discipline and profession when Dr. Amir ud din was at his climax as a teacher and surgeon. All his life he stayed closely associated with Dr. Ameer ud din for his advice and guidance.

Syed Zafar Haider proceeded to UK for further training and received his FRCS. He spent 5 years in UK, learning English manner, discipline and to behave as a gentleman. He had lot of praise for English teachers and surgeons and would like his own students in Pakistan to conduct themselves gracefully.

Returning to Pakistan was appointed in teaching cadre and served at Nishter Medical College and Hospital, Multan. Because of love for teaching surgery he soon became very popular with his medical students he was very keen to make his surgical ward most presentable and providing best possible care to his patients, because of his profound engagements, actually he attained his own professional climax in Nishter Medical College Multan. From Multan he brought Dr. M. Azeem Khawaja as his registrar in Mayo Hospital, Lahore. Azeem Khawaja was equally fond of Syed Zafar Haider and would carry out faithfully all teaching and operation orders of SZH. In Mayo Hospital, besides other surgical work, they specialized in thyroid and parathyroid surgery and also taught their technique to other surgical colleagues.

For a short period SZH also served as the Medical Superintendent, Mayo Hospital Lahore. He especially ensured supply of quality surgical instruments and other supplies to surgical units.

Prof. Syed Zafar Haider was a very versatile personality and was well aware of country politics and religious aspects of society. He was devout practicing Muslim and was always very helpful to his patients, trainees and assistant colleagues.

Shah Ji also had a loving soft corner for me, mainly because I trained with Dr. Amir ud din as a house surgeon and registrar. During my interview for assistant professor surgery in Punjab Service Commission, he was medical advisor and he ensured that I get selected.

Many people do not know that when Punjab government decided to make a medical college in Lahore general hospital, "SZH" along with his 'son' Syed Ali Haider worked hard and convinced the authorities that the proposed medical college must be named "Ameer-ud- din Medical College " and they were successful in their endeavor that goes to show Syed Zafar Haider's respect and love for Dr Ameer-ud-din's strict professionalism.
Syed Zafar Haider got married to his uncle (Dr. Bahadur Ali Shah's) daughter Tahira Bukhari who herself became

professor of anatomy. They had three beautiful children, two daughters and a son named, Syed Ali Haider. Syed Ali Haider was house surgeon in East Surgical Ward Mayo hospital, Lahore, when I was assigned Professor Surgery there. He was a handsome, intelligent and hardworking young man. He got his FRCS ophthalmology from U.K and was trained retinal surgeon. Unfortunately, during a secterial violence he was gunned down and martyred along with his younger son. Naturally such a tragic incident was condemned by all the society but this shock had to be borne by Syed Zafar Haider, Tahira Bukhari, his sisters and family.

No doubt Syed Zafar Haider was a great man with lot of good qualities; though at times he got angry when things he thought were right, were not carried out according to his wishes.

In the end, I pray that Allah Almighty bless him and grant him high place in heavens Amen.

ARTICLE INFORMATION Accepted for Publication: October 08, 2021, Published Online: December 25, 2021.
https://doi.org/10.48111/2021.04.01

Author Affiliations: Prof Asaf Beg Mirza is a retired Professor of Surgery who has been previously received life time achievement award from the Society of Surgeons Pakistan. He is currently working as a consultant surgeon at Ittefaq Hospital Trust, Lahore.

Archives of Surgical Research | Editorial

Harnessing Power of Artificial Intelligence in Surgery

Hira Ashraf, Faisal Rafiq

IMPORTANCE Artificial Intelligence (AI) is driving significant changes in surgical planning and navigation. However, the potential role of AI in surgery still requires exploration. Available data shows promising reduction in surgical trauma and improved patient recovery through the use of AI. AI has been a subject of speculation for many decades and research is still focused on the development of this field. Its use in surgery took a longer time than other specialties, however, the data is promising and points towards a revolution in surgical education, training and practice.

KEY WORDS Artificial Intelligence, Surgery, Robotics, Training,

HOW TO CITE: Hira Ashraf et al. Harnessing power of Artificial Intelligence in Surgery. *Archives of Surgical Research*. 2021;2(4):3-4. https://doi.org/10.48111/2021.04.02

Editorial

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author:
Faisal Rafiq, Assistant Professor ENT, SIMS, Lahore; Email: faisal.rafiq@hotmail.com
https://doi.org/10.48111/2021.04.02

Advancement in the field of artificial intelligence has led to a revolution in healthcare through machine learning (ML) and natural language processing (NLP). Recent research on computational implementation in surgery marks the role of AI as a supplement rather a replacement of surgeons. AI is driving significant changes in surgical planning and navigation. However, the potential role of AI in surgery still requires exploration. Available data shows promising reduction in surgical trauma and improved patient recovery through the use of AI.

Traditionally, pre-operative planning is based on patient's medical records, image-analysis techniques and traditional machine-learning for classification. Pre-operative planning is being boosted by deep learning which has been used for anatomical classification, detection segmentation and image registration. Deep learning algorithms make emergency care possible in abnormalities such as calvaria fracture, intracranial hemorrhage and midline shift via identification from CT scans. Deep learning recurrent neural networks (RNN), used to predict renal failure in real time, and mortality and postoperative bleeding following cardiac surgery, have obtained improved results. It indicates that critical care can be enhanced by giving more attention to high-risk patients.

Foundation of minimally invasive surgery (MIS) is computer-assisted intraoperative guidance. AI learning strategies have been implemented in several areas of MIS. Accurate tracking of tissue deformation is a challenging task in MIS. An online learning framework based on algorithms identifying the appropriate deformed tissue tracking method has been developed for intraoperative guidance and navigation in MIS.

Surgical robots are computer manipulated devices that are designed to assist with surgical instruments' manipulation and positioning. AI assistance through surgical robotics helps in improving skills and performance of surgeons, obtaining superior surgical outcomes and decreasing healthcare expenditure. Asensus Surgical has performance guided laparoscopic AI robot that provides information such as tissue size, thereby supplementing surgeons. While, it requires surgeons' skills for programming by demonstration and for learning by imitating operations conducted by surgeons. Learning from Demonstration (LfD) is robot training in two stages. First stage LfD is splitting complex surgical tasks into subtasks and basic gestures, while, second stage LfD is recognizing model and conducting subtasks in sequential mode. JHU-ISI Gesture and Skill Assessment Working Set analyzed three standard surgical subtasks (suturing, needle passing and knot tying) conducted by surgeons of Johns Hopkins University using kinematics and stereo video. Gestures performed during execution of each subtask were recognized with an accuracy of 80%. Result is promising but indicates room for improvement. Reinforcement learning (RL) is a frequently used ML paradigm. Its' algorithms are formatted based on policies learned from demonstration, hence, RL reduces time required for learning process.

Several different examples of AI-assisted surgeries is available in literature. Surgeons can operate surgical robots through touchless manipulation by using head or hand movements, speech or voice recognition and gaze. Head movements have been used to control robotic laparoscopes, while, FAce MOUse is a human robot interface that monitors in real time facial motions of the surgeon. Maastricht University Medical Center in the Netherlands used an AI-driven robot to suture blood vessels between 0.03 and 0.08

millimeters in a lymphedema patient in 2017. This surgical robot also fixed trembles in the surgeon's hand movements, ensuring that device conducted the procedure accurately. Robotic Hair Restoration enables surgical robots to harvest hair follicles and graft them into precise areas of scalp without the need of donor area removal or manual extraction of each hair follicle. Da Vinci cardio surgery is robotic cardiac surgery used in coronary artery bypass, valve surgery, cardiac tissue ablation, tumor removal and heart-defect repair. Gestonurse is a robotic scrub nurse designed for handling surgical instruments in the operating room.

AI has been a subject of speculation for many decades and research is still focused on the development of this field. Its use in surgery took a longer time than other specialties, however, the data is promising and points towards a revolution in surgical education, training and practice[1-3].

ARTICLE INFORMATION Accepted for Publication: December 30, 2021.
Published Online: December 31, 2021.
https://doi.org/10.48111/2021.04.02

Author Affiliations: Faisal Rafiq, Assistant Professor ENT, SIMS, Lahore; Email: faisal.rafiq@hotmail.com

Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest

REFERENCES

1. Hashimoto DA, Rosman G, Rus D, Meireles OR. Artificial Intelligence in Surgery: Promises and Perils. *Ann Surg*. 2018;268(1):70-76. doi:10.1097/SLA.0000000000002693

2. Miller RA, Pople HEJ, Myers JD. Internist-I, an Experimental Computer-Based Diagnostic Consultant for General Internal Medicine. *New England Journal of Medicine*. 1982;307(8):468–476.

3. Monsalve-Torra A, Ruiz-Fernandez D, Marin-Alonso O, et al. Using machine learning methods for predicting inhospital mortality in patients undergoing open repair of abdominal aortic aneurysm. *J Biomed Inform. 2016;62:195–201.*

Archives of Surgical Research | Original Research Communication

Preoperative Difficulty Index for Thyroidectomy (PreoDIT™): A Novel, Reliable, Content Valid, and Valuable Tool

Talat Waseem, Zaitoon Zafar, Safia Zahir Ahmad, Muhammad Hasham Ashraf

IMPORTANCE A thyroidectomy can be a complex operation, currently there are no preoperative tools available to predict cases which may prove to be challenging procedures, or tools to grade potential thyroid procedures according to difficulty, based on a pre-operative assessment. The aim of this study is to develop such a tool; the Preoperative Difficulty Index for Thyroidectomy (PreoDIT™) and assess its reliability and validity.

MATERIALS AND METHODS To define factors contributing to the complexity of a thyroidectomy, qualitative methods were used to retrieve qualitative data, in addition to an extensive literature review. A focus group was arranged in which a panel of 8 experts with extensive experience in thyroid surgery participated; and a tool, PreoDIT™, was developed. This tool was then utilized on 513 patients to test its reliability, validity and efficiency.

RESULTS PreoDIT™ scores strongly correlated with operative times, blood loss and postoperative complications; proving the reliability of this novel tool.

CONCLUSIONS PreoDIT™ is a reliable and valid tool to measure the difficulty index of a thyroidectomy. This tool was designed to help surgeons optimize and manage their teams, operation theatre resources and resident training in a more objective way, before committing to a procedure.

KEYWORDS thyroidectomy, endocrine surgery, surgical oncology, quality improvement

HOW TO CITE Waseem T, Zafar Z, Ahmad SZ, Ashraf MH. Preoperative Difficulty Index for Thyroidectomy (Preodit™): A Novel, Reliable, Content Valid, and Valuable Tool. *Archives of Surgical Research*. 2021, 2 (4):5-11. https://doi.org/10.48111/2021.04.03

Original Research

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author: Dr. Talat Waseem FRCS Eng, FACS, Associate Professor of Surgery, Shalamar Medical & Dental College, Lahore twaseem@gmail.com 092-333-8078705
https://doi.org/10.48111/2021.04.03

Thyroidectomy, once considered horrid butchery associated with high morbidity and mortality rates, has become quite safe when done with a methodical approach[1–8]. In fact, Theodor Kocher was awarded the Nobel Prize for Medicine in 1909, for reducing mortality to a minuscule 1% in this testing operation, where compulsive haemostasis and meticulous dissection within planes is pre-requisite to avoid post and per-operative complications[9]. Surgeons have identified factors which add to the difficulty of a thyroidectomy; these included vascularity, inflammation, gland toxicity, friability, fibrosis and large size of the gland[10]. Schneider et al. developed a Thyroidectomy Difficulty Scale for preoperative assessment of difficult cases[11]. This scale gives a good estimate of the per-operative assessment of the difficulty of the thyroidectomy, however, there was still a need for a tool to predict the difficulty preoperatively to aid direction, planning and organization, in order to reduce postoperative complications.

In our opinion, there are multiple additional factors which contribute to increased difficulty in this operation, they were recently identified by Patoir et al. and many others[4,12–15]. For example; extent of retrosternal extension, extent of operation, T staging of the cancer, type of cancer, range of neck extension available to operate around, pre-existing loss of the recurrent laryngeal nerve and BMI. These factors certainly play a role in our practice and add to the difficulty of the operation[14,16–21]. Similarly, use of preoperative Lugol's iodine may decrease vascularity of the gland, which aids a surgeon[15,22–25]. Hence, a scaling system is required which comprehensively encompasses all possible factors involved in a difficult thyroidectomy and which predicts, preoperatively, difficult cases for which an experienced team can be employed, to prevent possible complications, and further help in managing operation theatre times and assignment according to surgical training, more appropriately[26].

This study is intended first, to analyze all possible factors which could possibly make a thyroid operation difficult, and second, to develop a tool to help predict the difficulty of an operation, preoperatively. Such a tool would help surgeons plan in advance and help lower postoperative complications.

METHODS

The study consists of qualitative and quantitative clinical components to complement the find-ings of the data. Figure 1 shows study flow chart.

Qualitative Component of Study & Development of PreoDIT™ Application:

Extensive literature review was done to identify various factors responsible for the difficulty of a thyroidectomy operation. Based on literature review, a discussion guide was developed for a Focus Group Discussion (FGD), in which 8 endocrine surgeons, with extensive experience in endocrine surgery, participated. FGD was conducted as described previously[27] transcribed discussions were managed using QSR NVivo (V.9). Iterative analysis, following tenets of grounded theory, was used to identify themes and their inter-relationships. Researchers went through transcripts line by line to categorize and describe data, and then developed themes through selective and conceptual coding. Newer themes were subjected to subsequent use in e-Delphi consensus building[28]. Analysis was run along the interviewing session. Thematic analysis was done and meaningful themes and subthemes were identified.

The findings of initial FGD were subjected to e-Delphi technique-based consensus building to develop a scoring system which was named as Preoperative Difficulty Index for Thyroidectomy (PreoDIT™). e-Delphi technique was administered as described previously[28]. The relative im-portance of the factors was identified on a Likert Scale and consensus building was done with 80% cut-off value. The content validity of the items was assessed through estimation of Content Validity Index (CVI) (data not shown here)[29]. Table 1 shows the relative values of various fac-tors which were subsequently used in the PreoDIT™ Application. IT experts were involved to develop the scoring system online (accessible through http://archivessr.com/calc/) and in the form of a mobile phone application (accessible through Google Play Store). The difficulty asso-ciated with lobectomy & isthmectomy of a small non-toxic nodule without significant risk fac-tors as described below was considered the baseline.
The maximum PreoDIT™ score can be up to 53. To make the score more user-friendly, and to compare with other scoring systems, scores were equated against PreoDIT™ Grades ranging from 1-5. The grading of the score was done according to the criteria: Grade 1: <= 1; Grade 2: 1.1 – 3; Grade 3: 3.1-5.9; Grade 4: 6-8; Grade 5: 9+.

Prospective Blinded Clinical Piloting:

Patients undergoing thyroidectomy (n=513) were enrolled for the trial, in order to explore the reliability and strength of correlation with other scoring systems and difficulty parameters. Pre-operatively, PreoDIT™ scoring was done which was not revealed to the operating surgeons. Postoperatively, respective surgeons filled a survey to score difficulty of the preceding procedure (labelled as Postoperative Difficulty Index for Thyroidectomy—PostoDIT) on a Likert scale of 1-5 and were asked to fill in the Thyroidectomy Difficulty Scale items developed by Schneider et al. (with up to 20 possible score). General demographics and parameters related to operative procedures such as blood loss, operative time, hospital stay and complications were recorded.

Statistical Methods & Analysis:

SPSS Version 21 was used for statistical analysis. Means, averages, standard deviations were estimated as per standards. In e-Delphi technique inter-rater reliability and concordance was measured through intra-class coefficient kappa values. CVI for the e-Delphi was measured as described previously to assess the content validity of the scale[28,29]. For the clinical component, the intra-rater and inter-rater reliability, intra-class coefficient were measured. For measuring correlations among the scoring systems and other parameters, Pearson, Spearman and Kendal Tau B were used as appropriate for the data. A correlation of 0.4-0.59 was considered moderate, 0.6-0.79 as strong and equal or above 0.8 was considered very strong. A p value of 0.05 was considered statistically significant.

RESULTS

Literature review identified various factors responsible for adding to the difficulty of thyroidec-tomy. Based on the literature review, these factors were further explored in a FGD. 12 factors were identified. Column 1-3 in Table 1 describe various themes identified and their representa-tive statements.

e-Delphi was employed for developing consensus among the experts about the relative value of various factors identified before incorporating into the questionnaire and validating its construct and content validity (Table 1-Column 4,5).

	Focus Group Discussion (FGD)		e-Delphi Technique Consensus Building on Relative Value of Factors	
	Factor	Representative Statement	Preoperative Scale (PreoDIT™)	
1	Thyrotoxicosis	"The gland I fear the most is not the big gland but a small gland with Graves' disease". "Gland is red hot like iron and has got enormous supply. The vessels are thin walled and they bleed like anything". "Operating a Graves' disease gland is the real test of surgeon's quality and gentleness of dissection" "The gland is friable like anything. If you scratch a small area, it won't forgive you especially if the patient has not taken Lugol's iodine preoperatively".	No Toxicity	0
			Primary Thyrotoxicosis	5
			Primary Thyrotoxicosis treated with Lugol's Iodine	2
			Secondary Thyrotoxicosis	4
			Secondary Thyrotoxicosis treated with Lugol's Iodine	2
			Tertiary Thyrotoxicosis	1
2	Retrosternal Extension/ Intrathoracic Goiter	"Short neck people have higher chance of development of retrosternal extension and most of the time it is cervico-mediastinal extension". "More than 90% can be delivered trans-cervically. Difficulty of thyroidectomy is proportional to depth of extension into mediastinum" "Most of the extensions are into the anterior mediastinum and can be delivered trans-cervically". "Cervico-mediastinal extension into posterior mediastinum is unlikely to be delivered transcervically and would be better dealt with thoracotomy". "True intrathoracic goiter is rare but adds significant difficulty. All need thoracotomy."	No Extension	0
			Cervicomediastinal Extension (Below clavicle and sternum) Grade 1	1
			Cervicomediastinal Extension (up to left brachiocephalic vein) Grade 2	4
			Cervicomediastinal Extension (up to aortic arch) Grade 3 (Anterior Mediastinum)	6
			Cervicomediastinal Extension (behind major mediatiastinal vessels) Grade 3 (Posterior Mediastinum)	9
			Intrathoracic Goiter	11
3	Thyroiditis	"Thyroiditis makes dissection more difficult and adds vulnerability to nervi and parathyroids"	No	0
			Yes	2
4	Carcinoma T staging	"T1,2 lesions don't hurt much, it is the T3 or T4 lesions with direct spread into trachea, esophagus or carotid sheath and surrounding lymph nodes, that really adds difficulty to the operation". "T4 lesions are real challenge. The balance between oncological clearance and the safety comes with experience".	No	0
			Carcinoma T Stage 1	0
			Carcinoma T Stage 2	0
			Carcinoma T Stage 3	2
			Carcinoma T Stage 4	4
5	Carcinoma Type	'Type certainly matters. Papillary and Anaplastic have higher degree of local invasion." "There are more chances of having a better clearance with T3 follicular lesions instead of papillary and anaplastic lesions".	Follicular Lesion	3
			Papillary Carcinoma	4
			Medullary Thyroid cancer	6
			Anaplastic Carcinoma	7
6	Recurrent Surgery	"Redo is always a challenge". "It becomes difficult to explore immediately in first few weeks following surgery". "Fortunately many of the re dos are on the contralateral sides". "Ipsilateral redo are the hardest and increase the complication rates enormously".	No	0
			Contralateral Recurrent	3
			Ipsilateral Recurrent	6
7	Unilateral Palsy	"Unilateral palsy makes you nervous and you don't have any chance". "The burden of one cord is too heavy for the thyroid surgeon to carry".	No	0
			Yes	4
8	Size of the Gland	"There many other more important factors but size does matter". "Huge glands certainly add to complexity, longer operative times and blood loss".	Small (palpable only)	0
			Moderate (visible on deglutition)	0.5
			Large (visible)	3
			Massive	6
9	Extent of Thyroidectomy	"Extent of Thyroidectomy really matters and adds to the difficulty of the procedure. Extent of resection and the surrounding nodes in form of neck dissection adds to the operative time and difficulty".	Lobectomy isthmectomy	1
			Subtotal Thyroidectomy	2
			Total Thyroidectomy	2.5
			Total Thyroidectomy with Central Neck Dissection	3
			Total Thyroidectomy with Block Neck Dissection	5
10	Limited Neck Extension	"Fat people, and the patients having cervical spondylosis are likely to have limited neck dissection. This leads to difficulty in procedure as we lose the ease that we get when we extend the neck for better exposure".	Fully extendable	0
			Limited neck extension	1
			No neck extension	2
1	Short Neck	"Short neck again adds to the difficult dissection."	No	0

1		"Mobilization of the superior and inferior poles becomes difficult due to limited space and retrosternal extension".	Yes	0.5
1	BMI	"High BMI is associated with short neck and limited neck extension with higher chances of the retrosternal extension".	Upto 35	0
2			>35	0.5

Table 1: Thematic analysis of qualitative assessment of factors involved in difficult thyroidectomy determined through FGD & PreoDIT™ Scoring Chart based on e-Delphi Consensus

This questionnaire formed the basis of development of this application. Thyrotoxicosis, retrosternal extension, gland size, fibrosis and malignant in-vasion were found to be the dominant drivers of operative difficulty with high relative im-portance scores. Other factors included T staging of the cancer, type of cancer, extent of surgery, unilateral RLN palsy, short neck, reduced neck extension, high BMI and preoperative use of lugol's iodine. The themes have been summarized in Table 1 along with their determined relative importance scores.

The findings of the qualitative components study were piloted in a huge cohort of the patients. The general characteristics of the patients have been summarized in Table 2 and 3.

Measurement Parameter		**Patients undergoing Thyroidectomy (n=513)**
Age		48.58±11.46
Gender		
	Female	418 (81.5%)
	Male	95 (18.5%)
Clinical Diagnosis		
	Follicular Lesion	32 (6.2%)
	MNG	21 (4.1%)
	MNG involving Single Lobe	30 (5.8%)
	Papillary CA	229 (44.6%)
	Primary Thyrotoxicosis	16 (3.1%)
	Suspicious Solitary Nodule	161 (31.4%)
	Toxic MNG	24 (4.7%)
Histological Diagnosis		
	Benign Follicular Lesion	170 (33.1%)
	Benign Hyperplastic Glands	45 (8.8%)
	Suspected Follicular Carcinoma	40 (7.8%)
	Primary Thyrotoxicosis	16 (3.1%)
	Papillary Carcinoma	240 (46.7%)
	Hashimoto's Thyroiditis	2 (0.03%)
Clinical Status		
	Euthyroid	435 (84.8%)
	Hypothyroid	5 (1%)
	Toxic Adenoma	40 (7.8%)
	Toxic MNG	33 (6.4%)
ASA Status		
	ASA-I	456 (88.9%)
	ASA-II	26 (5.1%)
	ASA-III	21 (4.1%)
	ASA-IV	10 (1.9%)
Gland Size WHO Classification (1974)		
	WHO Class I	21 (4.1%)
	WHO Class II	8 (1.6%)
	WHO Class III	409 (79.7%)
	WHO Class IV	74 (14.4%)
Type of surgery		
	Lobectomy and Isthmectomy	191 (37.2%)
	Total Thyroidectomy	265 (51.7%)
	Completion Thyroidectomy	21 (4.1%)
	Total thyroidectomy + Neck Dissection	36 (7%)

Table 2: General Characteristics of the Patients participating in the study

Measurement parameter	
Mean length of surgery (minutes)	118.17±39.57
Peri-operative mean blood loss	44.07±24.53
Postoperative Drain Output	53.55±38.51
Mean length of postoperative stay (Hours)	34.88±12.82
Mean pain score (maximum = 10)	3.2±1.3
Median postoperative analgesic requirements as per WHO pain ladder	Level II
Complications	
Wound infection	0.9%
Hematoma requiring drainage	3/513 (0.5%)
Seroma formation requiring drainage	5.3%
Transient hypocalcemia	58 (11.3%)
Permanent hypocalcemia	1/513 (0.19%)
Transient recurrent laryngeal Nerve compromise	32 (6.23%)
Permanent recurrent laryngeal nerve compromise	3/513 (0.5%)
Recurrence (Over period of at least 6 months-7 years)	2/513 (0.38%)

Table 3: Patient Surgery Characteristics including Complications

The scoring systems were explored in terms of their intra-rater and inter-rater reliability and their correlation with each other. PreoDIT™ scores and grades have strong intra-rater and inter-rater reliabilities as measured by the intra-class coefficients (Table 4).

Scoring System	**Agreement / Concordance measured by Intra-Class Coefficient**	
	Intra-rater reliability	**Inter-rater reliability**
PreoDIT™ Score	0.991 (0.989-0.992); p<0.000	0.992 (0.991-0.994); p<0.000
PreoDIT™ Grade	0.969 (0.963-0.974); p<0.000	0.950 (0.941-0.958); p<0.000
PostoDIT Score	0.953 (0.936-0.965); p<0.000	0.846 (0.713-0.906); p<0.000
TDS Scoring	0.884 (0.834-0.967); p<0.003	0.763 (0.723-0.841); p<0.004

Table 4: Scoring systems and their respective intra-rater and inter-rater reliability measured by intra-class coeffi-cient.

PreoDIT™ scores and grades have a strong correlation with postoperative surgeon assessment, measured as PostoDIT (Table 5).

	Correlation Among Various Scoring Systems	
	Correlation Coefficient	**P Value**
PreoDIT™ Score vs PreoDIT™ Grade	0.809	0.000
PreoDIT™ Grade vs. PostoDIT Score	0.848	0.000
PreoDIT™ Score vs TDS Scoring	0.576	0.000
PreoDIT™ Grade vs. TDS Scoring	0.526	0.000

Table 5: Strength of Correlation among the PreoDIT™ Score, PostoDIT Score, PreoDIT™ Grade and TDS Score

Correlation with Schneider's TDS was however moderate at best. PreoDIT™ proved to be a reliable and valid tool in gauging the complexity of a planned thyroid procedure. Scores and grades attained through PreoDIT™ correlated with operative times, operative blood loss and complications moderate to strongly (Table 6), and thus helped in both, pre-operative and post-operative management.

	Correlation Among Various Scoring Systems	
	Correlation Coefficient	**P Value**
PreoDIT™ Score vs Operative Time	0.813	0.001
PreoDIT™ Score vs. Blood Loss	0.795	0.000
PreoDIT™ Score vs Complications	0.647	0.000
PreoDIT™ Grade vs Operative Time	0.623	0.000
PreoDIT™ Grade vs. Blood Loss	0.763	0.000
PreoDIT™ Grade vs Complications	0.611	0.000

Table 6: Correlation of PreoDIT™ Score and Grade with complications, operative times and blood loss

DISCUSSION

Thyroidectomy still remains a delicate and demanding operation which sometimes proves to be difficult owing to varying reasons[30–32]. Thyroidectomy difficulty scale (TDS) proposed by Schneider et al. correlates well with operative times and complications of thyroidectomy[10,11,33]. This scale calculates difficulty index based on surgeon's peri-operative assessment hinging on four important parameters, toxicity, tissue friability, size and fibrosis of the visible thyroid gland. There are however two important limitations of this scale. Firstly, it is a subjective as-assessment which can only be made once the patient is anesthetized and dissected, with the surgeon ready to operate. Secondly, this scale does not regard multiple other important factors like retrosternal extension, cancer stage, RLN palsy, neck extension and BMI, which significantly influence the difficulty of operation[12]. However, it would be infinitely more beneficial for both patient and surgeon, to make an assessment preoperatively so that operation theatre resources and surgical staff are managed more appropriately.

Operative difficulty is a subjective assessment and remains intuitively variable and non-uniform. To develop an application which objectively measured the difficulty of an operation preoperatively with the added goal of making it reproducible and uniform among users, we needed to rely on solid, objective preoperative assessment. Carefully considering the aforementioned dozen factors and their relative contribution to the difficulty of a thyroidectomy was important as it would provide us with objective data to predict the operative difficulty before the operation was initiated. Qualitative and consensus methods were used to know the relative value of these factors and their content validity. As we explored the relative value of these factors, it became quite apparent that toxicity of the gland, retrosternal extension, gland size and adhesions either due to redo-related fibrosis or malignancy-related local invasion played a dominant role in determining the difficulty of the operation. As data points are relatively objective, the results were uniform, leading to strong intra-rater and inter-rater reliability. PreoDIT™, therefore, provides comprehensive estimates in the form of more reliable and objective scores.

To assess and compare the relative value of PreoDIT™ scores and grades to postoperative measurements such as PostoDIT and TDS score statistical correlation was studied, this was moderate to strong in most instances. Similarly, PreoDIT™ scores and grades strongly correlate with operative time, peri-operartive blood loss and complications, demonstrating their value in clinical application. The PreoDIT™ scores are better predictive measures as opposed to PreoDIT™ grades, however, grades were more user-friendly.

Limitations: This study has many limitations. Converting a subjective assessment into objective data is al-ways difficult. The scores and relative values selected for various scores have been derived from the experience of only 8 endocrine surgeons and more input, especially in clinical settings, by even more surgeons, is crucial in optimizing the scoring system and in improving its sensitivity and specificity. Furthermore, surgeon experience and the volume of surgeries performed also influences outcomes[12]. This score has been applied to only 2 surgeons and 1 clinical set up where surgeons had similar technique and operative conditions, wider application in diverse set ups and their

feedback is important in its optimization to assess and improve its external validity.

CONCLUSION

PreoDIT™ is a content valid, novel tool which promises to be helpful for endocrine surgeons to prepare and measure preoperatively, the difficulty of their planned thyroid operation. The tool takes into consideration a dozen factors which make a thyroid procedure complex, out of which thyrotoxicosis, retrosternal extension, size of gland and adhesions due to either redo-related fi-brosis or local malignant invasion play a pivotal role. This information can be useful for sur-geons to optimize and manage their teams, OR resources and resident training preoperatively. This may also aid in development of application aided referral services for better patient care. Overall, PreoDIT™ predicted the difficulty of a thyroid procedure accurately and proved to be a tool which helped in maximizing efficiency both inside the operation theatre, and outside of.

ARTICLE Accepted for Publication: November 18, 2021 Published Online: December , 2021.
https://doi.org/10.48111/2021.04.03

The article has been previously published in Journal of American College of Surgeons as an abstract.

Author Affiliations: Associate Professor of Surgery, Shalamar Medical & Dental College, Lahore

Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest

REFERENCES

1. Sarkar S, Banerjee S, Sarkar R, Sikder B. A Review on the History of 'Thyroid Surgery.' *Indian J Surg*. 2016;78(1):32. doi:10.1007/S12262-015-1317-5
2. Snyder SK, Hamid KS, Roberson CR, et al. Outpatient thyroidectomy is safe and reasonable: experience with more than 1,000 planned outpatient procedures. *J Am Coll Surg*. 2010;210(5):575-582. doi:10.1016/J.JAMCOLLSURG.2009.12.037
3. Consorti F, Milazzo F, Notarangelo M, Scardella L, Antonaci A. Factors influencing the length of the incision and the operating time for total thyroidectomy. *BMC Surg*. 2012;12(1):1-4. doi:10.1186/1471-2482-12-15/TABLES/2
4. McManus C, Luo J, Sippel R, Chen H. Is thyroidectomy in patients with Hashimoto thyroiditis more risky? *J Surg Res*. 2012;178(2):529-532. doi:10.1016/j.jss.2012.09.017
5. Upile T, Jerjes W, Mahil J, et al. How to do it: The difficult thyroid. *Head Neck Oncol*. 2011;3(1):1-11. doi:10.1186/1758-3284-3-54/TABLES/1
6. Wilhelm SM, McHenry CR. Total thyroidectomy is superior to subtotal thyroidectomy for management of graves' disease in the United States. *World J Surg*. 2010;34(6):1261-1264. doi:10.1007/S00268-009-0337-3
7. Duclos A, Peix JL, Colin C, et al. Influence of experience on performance of individual surgeons in thyroid surgery: prospective cross sectional multicentre study. *BMJ*. 2012;344(7843). doi:10.1136/BMJ.D8041
8. Mazeh H, Chen H. Advances in surgical therapy for thyroid cancer. *Nat Rev Endocrinol*. 2011;7(10):581-588. doi:10.1038/nrendo.2011.140
9. Hannan SA. The magnificent seven: a history of modern thyroid surgery. *Int J Surg*. 2006;4(3):187-191. doi:10.1016/J.IJSU.2006.03.002
10. Mok VM, Oltmann SC, Chen H, Sippel RS, Schneider DF. IDENTIFYING PREDICTORS OF A DIFFICULT THYROIDECTOMY. *J Surg Res*. 2014;190(1):157. doi:10.1016/J.JSS.2014.03.034
11. Thyroidectomy N, Scale D, Times WO. Novel Thyroidectomy Difficulty Scale Correlates. 2014;38(8):1984-1989. doi:10.1007/s00268-014-2489-z.NOVEL
12. Patoir A, Payet C, Peix JL, et al. Determinants of operative time in thyroid surgery: A prospective multicenter study of 3454 thyroidectomies. *PLoS One*. 2017;12(7). doi:10.1371/JOURNAL.PONE.0181424
13. Bothra S, Sabaretnam M, Kannujia A, et al. Patient, thyroid, and surgeon related factors that make thyroidectomy difficult-cohort study. *Ann Med Surg*. 2020;49:14. doi:10.1016/J.AMSU.2019.11.010
14. D'Orazi V, Sacconi A, Trombetta S, et al. May predictors of difficulty in thyroid surgery increase the incidence of complications? Prospective study with the proposal of a preoperative score. *BMC Surg*. 2019;18(Suppl 1). doi:10.1186/S12893-018-0447-7
15. Tsai CH, Yang PS, Lee JJ, Liu TP, Kuo CY, Cheng SP. Effects of Preoperative Iodine Administration on Thyroidectomy for Hyperthyroidism: A Systematic Review and Meta-analysis. *Otolaryngol Head Neck Surg*. 2019;160(6):993-1002. doi:10.1177/0194599819829052
16. Bajwa SJ, Sehgal V. Anesthesia and thyroid surgery: The never ending challenges. *Indian J Endocrinol Metab*. 2013;17(2):228. doi:10.4103/2230-8210.109671
17. Stevanovic KS, Sabljak VD, Toskovic AR, et al. The most difficult complications in thyroid surgery. *Acta Medica Mediterr*. 2017;2017(6):929-937. doi:10.19193/0393-6384_2017_6_147
18. Rosato L, Avenia N, Bernante P, et al. Complications of thyroid surgery: analysis of a multicentric study on 14,934 patients operated on in Italy over 5 years. *World J Surg*. 2004;28(3):271-276. doi:10.1007/S00268-003-6903-1
19. Hardy R, Bliss R, Lennard T, Balasubramanian S, Harrison B, Dehn T. Management of Retrosternal Goitres. *Ann R Coll Surg Engl*. 2009;91(1):8. doi:10.1308/003588409X359196
20. Vieni S, Graceffa G, Rizzo GEM, Latteri F, Latteri MA, Cipolla C. An evaluation score of the difficulty of thyroidectomy considering operating time and preservation of recurrent laryngeal nerve. *Updates Surg*. 2019;71(3):569-577. doi:10.1007/S13304-018-0604-7
21. Kikuchi S, Perrier ND, Cheah WK, Siperstein AE, Duh QY, Clark OH. Complication of Thyroidectomy in Patients With Radiation-Induced Thyroid Neoplasms. *Arch Surg*. 2004;139(11):1185-1188. doi:10.1001/ARCHSURG.139.11.1185
22. Robert J, Mariéthoz S, Pache JC, et al. Short- and long-term results of total vs subtotal thyroidectomies in the surgical treatment of Graves' disease. *Swiss Surg*. 2001;7(1):20-24. doi:10.1024/1023-9332.7.1.20
23. Ansaldo GL, Pretolesi F, Varaldo E, et al. Doppler evaluation of intrathyroid arterial resistances during preoperative treatment with Lugol's iodide solution in patients with diffuse toxic goiter. *J Am Coll Surg*. 2000;191(6):607-612. doi:10.1016/S1072-7515(00)00755-9
24. Rodier JF, Janser JC, Petit H et al. [Effect of preoperative administration of Lugol's

solution on thyroid blood flow in hyperthyroidism] - PubMed. *Ann Chir*. 1998;52(3):229-233. Accessed November 19, 2021. https://pubmed.ncbi.nlm.nih.gov/9752450/

25. Mercier F, Bonal M, Fanget F, et al. Does Surgery Without Lugol's Solution Pretreatment for Graves' Disease Increase Surgical Morbidity? *World J Surg*. 2018;42(7):2123-2126. doi:10.1007/S00268-017-4443-3

26. Pollei TR, Barrs DM, Hinni ML, Bansberg SF, Walter LC. Operative time and cost of resident surgical experience: effect of instituting an otolaryngology residency program. *Otolaryngol Head Neck Surg*. 2013;148(6):912-918. doi:10.1177/0194599813482291

27. Kitzinger J. The methodology of Focus Groups: the importance of interaction between research participants. *Sociol Health Illn*. 1994;16(1):103-121. doi:10.1111/1467-9566.EP11347023

28. Struyf T, Tournoy J, Verbakel JY, Van den Bruel A. International Consensus Definition of a Serious Infection in a Geriatric Patient Presenting to Ambulatory Care. *J Am Med Dir Assoc*. 2020;21(5):578-582.e1. doi:10.1016/J.JAMDA.2020.01.015

29. Yusoff MSB, Abdul Rahman YR, Mohamed Rouse F. Strengthening Education in Medicine Journal Through Collaboration with Malaysian Association of Education in Medicine and Health Science (MAEMHS). *Educ Med J*. 2018;10(1):1-2. doi:10.21315/EIMJ2018.10.1.1

30. Giddings AEB. The history of thyroidectomy. *J R Soc Med*. 1998;91(Suppl 33):3. doi:10.1177/014107689809133S02

31. Agarwal A, Mishra AK, Gupta SK, et al. High incidence of tracheomalacia in longstanding goiters: Experience from an endemic goiter region. *World J Surg*. 2007;31(4):832-837. doi:10.1007/S00268-006-0565-8/TABLES/1

32. Sosa JA, Bowman HM, Tielsch JM, Powe NR, Gordon TA, Udelsman R. The importance of surgeon experience for clinical and economic outcomes from thyroidectomy. *Ann Surg*. 1998;228(3):320-330. doi:10.1097/00000658-199809000-00005

33. Mittendorf EA, McHenry CR. Thyroidectomy for Selected Patients With Thyrotoxicosis. *Arch Otolaryngol Neck Surg*. 2001;127(1):61-65. doi:10.1001/ARCHOTOL.127.1.61

Archives of Surgical Research | Meta-Analysis

Enhanced Recovery After Surgery (ERAS) versus Traditional Care in Patients Hospitalized for Colorectal Surgery: A Meta-Analysis

Hamza Azhar, Muhammad Hassan Hafeez, Safia Zahir Ahmed

IMPORTANCE Enhanced Recovery after Surgery (ERAS) is a program designed to minimize surgery-related stress and total length of stay at the hospital in patients undergoing major surgical intervention. It has proven to enable patients to recover quickly with lesser readmissions and risk of morbidity and mortality. This study aims to compare the outcomes of ERAS protocols with those of traditional care in colorectal surgery.

METHODS A PRISMA-compliant literature search was performed on the PubMed and Cochrane library and 29 eligible RCTs were extracted in which ERAS protocol was compared with conventional care in colorectal surgery.

RESULTS Twenty-nine RCTs included 4349 patients; 2164 in the ERAS care group and 2185 in the traditional care group. ERAS group had reduced time to flatus resumption (Weighted mean difference (WMD): —0.78 days, 95% CI —1.05 to —0.52, p < 0.00001), a shorter total length of stay (WMD: -3.13 days, 95% CI —4.16 to —2.10, p < 0.00001) and postoperative hospital stay (Weighted Mean Difference: —2.21 days, 95% CI —2.87 to —1.55, p < 0.00001), shorter time to mobilization (WMD: —16.28 hours, 95% CI —22.04 to —10.53, p < 0.00001), shorter time to first fluid intake (WMD: —89.96 hours, 95% CI —119.89 to —60.03, p < 0.00001) and solid food tolerance (WMD: —1.91, 95% CI –2.34 to —1.48, p < 0.00001) as compared to a traditional care group. The number of readmissions was lesser in the traditional care group as compared to the ERAS group (OR: 1.09, 95% CI 0.78 to 1.51, p = 0.74). The number of total complications was lower in the ERAS care group as compared to the traditional care group (OR: 0.49, 95% CI 0.36 to 0.66, p = 0.0003).

CONCLUSIONS Our results prove that ERAS is comparatively a better choice of surgical care protocol than conventional care, for patients who undergo colorectal surgery.

KEYWORDS Enhanced Recovery after Surgery, ERAS, Fast-track surgery, FTS, Enhanced recovery protocol, colorectal surgery

HOW TO CITE Azhar H, Hafeez MH, Ahmed SZ, Waseem T. Enhanced Recovery after Surgery (ERAS) versus Traditional Care in Patients Hospitalized for Colorectal Surgery: A Meta-Analysis *Archives of Surgical Research*. 2021, 2 (4):12-23. https://doi.org/10.48111/2021.04.04.

Meta-Analysis

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author:

Hamza Azhar
Shalamar Medical & Dental College, Lahore

https://doi.org/10.48111/2021.04.04

Enhanced Recovery after Surgery (ERAS) or enhanced recovery protocol or fast-track surgery program, represents multimodal, evidence-based perioperative care pathways, intended to achieve rapid postoperative recovery, reduce surgical stress response and optimize bodily functions in patients experiencing major surgical procedures[1]. In the 1990s, Dr. Henrik Kehlet, a Danish surgeon and professor, initially put forward a multimodal protocol to provide patients with a fast recovery period after colonic surgery[2]. In 2001, a group of international surgeons and anesthesiologists, including Kehlet, formed an ERAS study group in London, to provide a consensus protocol of around 20 items for perioperative care of patients undergoing colonic resection surgery[3]. After the inception of the ERAS society in 2010, a series of perioperative care guidelines have been published and being practiced in colorectal surgical care settings globally. The latest ERAS guidelines for colorectal surgery highlight preoperative counseling, prehabilitation, perioperative fluid and electrolyte therapy, bowel preparation, anesthesia and analgesia protocol, perioperative nutritional care, and perioperative prevention of complications [4, 5]. Many studies and trials, as of now, have concluded that the principles of ERAS protocol, in contrast to traditional care, yields a reduced length of hospital stay, a more rapid return of gut function and mobilization, and a lesser incidence of postoperative complications and readmissions. Some studies have shown ERAS and traditional care to give the same results. Several meta-analyses have been conducted but they have used either a small number of trials or those of poor caliber. Some meta-analyses have reported outcomes of ERAS and traditional care in only laparoscopic colorectal surgery patients. Our meta-analysis attempts to compare and analyze the outcomes and efficacy of ERAS and traditional care, entailing a larger number of high-quality studies in patients undergoing colorectal surgery using any surgical approach.

METHODS

Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines were followed to carry out this meta-analysis

Literature Search

A systematic literature search of randomized controlled trials (RCTs) was conducted on the databases of PubMed and Cochrane library on 2/4/2021 according to PRISMA guidelines, using the following search terms: (enhanced recovery after surgery OR ERAS OR fast track surgery OR FTS) AND (colorectal surgery OR rectal OR colorectal cancer OR colorectal OR rectal cancer OR colon cancer). The literature search was performed on the PubMed and Cochrane library databases. All RCTs published between 1/7/2017 and 2/4/2021 were filtered out. Additionally, relevant articles were explored by manually searching the references.

Inclusion of Articles

After the PRISMA compliant literature search, 100 articles were identified through PubMed and 298 articles were identified through the Cochrane library. After the removal of 15 duplicate articles, 407 articles were screened. Of these papers, 80 articles were picked based on their titles and abstracts. Full texts of these articles were obtained and 29 articles were finally included for quantitative analysis. Only full-text English language papers were selected. All RCTs which compared ERAS care programs with traditional care in patients hospitalized for colorectal surgery were selected. All those studies which did not include a comparison of interest were excluded. Studies other than RCTs were also excluded. This has been illustrated in Figure 1.

Data Extraction and Quality Assessment

Using structured forms, the authors extracted the data on study and patient characteristics and patient outcomes from each study that met the inclusion criteria. If data were reported in medians, they were converted into values of means and standard deviations. The quality assessment of selected RCTs was done using the Cochrane collaboration risk of the bias assessment tool, as shown in Figures 2 and 3. The performance bias, selection bias, reporting bias, detection bias, attrition bias, and other biases were estimated for each study. We graded the risk of bias of each study as low, high, or unclear. In a large number of the included RCTs, the probability of performance bias was high as blinding of the surgeons, investigators, and patients were not feasible. Most of the studies showed a low risk of selection, attrition, and reporting bias.

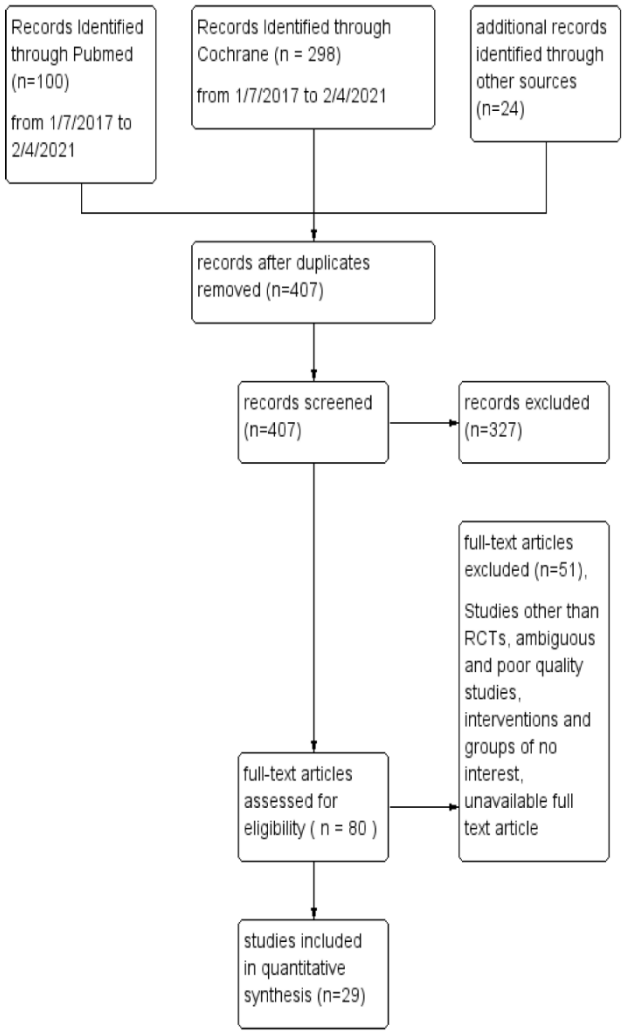


Figure 1: Showing PRISMA flow diagram

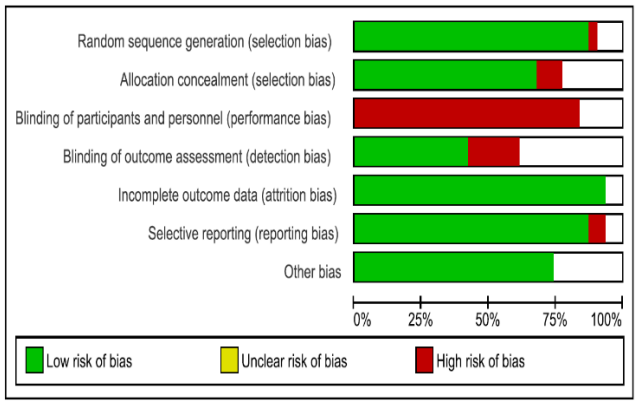


Figure 2: Risk of Bias Graphs of the Included Studies

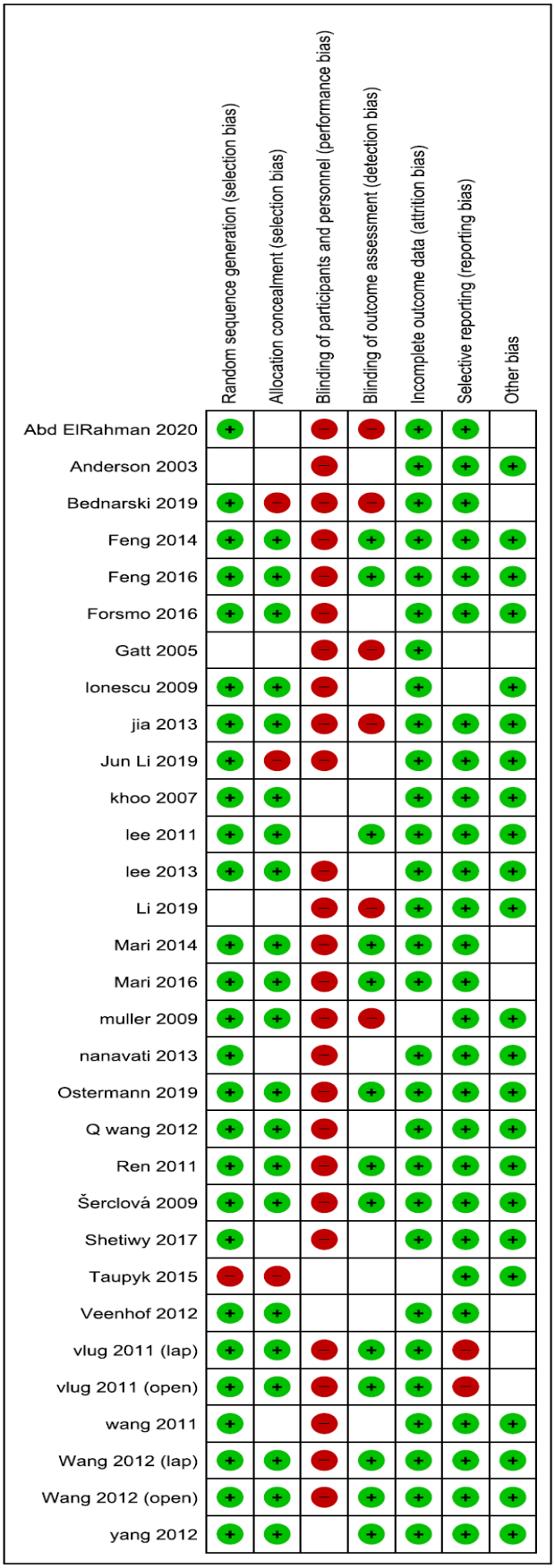


Figure 3: Risk of Bias Summary of the Included Studies

Study outcomes and Statistical Data Analysis:

We studied the outcomes of time to flatus resumption after surgery, a total length of stay and postoperative hospital stay (PHS), time to the first mobilization, time to first fluid and solid intake after surgery, readmissions, and the total number of complications. The continuous and dichotomous variables, where appropriate, were used to assess outcomes of the RCTs that compared ERAS with conventional care in colorectal surgery. Mean difference with inverse variance was used to calculate continuous variables and Odd's Ratio (OR) with the Mantel-Haenszel method with 95% Confidence Interval (CI) was used to calculate dichotomous variables. The random effect was used in the population with the heterogeneity of more than 50% and the fixed effect was used in the population with the heterogeneity of less than 50%. The Review Manager 5.4 was availed to perform the meta-analysis using the 2 x 2 Chi-square test.

RESULTS

Following the PRISMA guidelines, a literature search was done in PubMed and Cochrane library, from which 29 articles[6-34] fell under our eligibility criteria and were included in the quantitative analysis. All the included studies were randomized controlled trials. The characteristics of the studies including the number of participants, study design, type of intervention, mean age, and male to female ratio have been given in Table 1. Each study compared the ERAS care protocol with traditional care in different colonic/colorectal surgeries.

A total of 4349 patients admitted for colorectal surgery were added to the analysis with 2164 patients belonging to the ERAS care group and 2185 patients, to the traditional care group.

Time to First Flatus

Sixteen studies reported this parameter including 1363 patients in the ERAS group and 1523 patients in the traditional care group. We analyzed that the time to flatus resumption was shorter in the ERAS patients as compared to the traditional care patients (Weighted Mean Difference: —0.78 days, 95% Confidence Interval (CI) —1.05 to —0.52, $p < 0.00001$). Owing to the heterogeneity being high (92%), we used a random-effects model.

Study	Year of publication	Study Design	Type of surgery	No. of participants		Age (Mean ± SD)		Gender (M/F)	
				ERAS	TC	ERAS	TC	ERAS	TC
Abd ElRahman et al	2020	RCT	Colon cancer surgery	40	40	49.5 ± 10.4	49.7 ± 8.4	20/20	20/20
Ostermann et al	2019	RCT	Colorectal surgery	75	75	80.06 ± 4.38	78.27 ± 4.17	26/49	35/40
Li et al	2019	RCT	Colorectal cancer surgery	100	100	56.2 ± 5.5	55.3 ± 5.3	65/35	68/32
Mari et al	2014	RCT	Colorectal surgery	25	25	63.3 ± 13.7	63.3 ± 13.7	12/13	12/13
Mari et al	2016	RCT	Colorectal surgery	70	70	63.78 ± 8.65	66.43 ± 10.12	39/31	35/35
Jun Li et al	2019	RCT	Colorectal cancer surgery	172	170	59.8 ± 10.09	61.3 ± 11.21	110/62	103/67
Bednarski et al	2019	RCT	Colorectal cancer surgery	14	16	58.7 ± 12.6	59.3 ± 10.2	6/8	10/6
Forsmo et al	2016	RCT	Colorectal surgery	154	153	64.24 ± 12.46	65.15 ± 13.98	83/71	82/71
Šerclová et al	2009	RCT	Open intestinal resection	51	52	35.1 ± 11	37.6 ± 12.5	20/31	32/20
Anderson et al	2003	RCT	Colorectal surgery	14	11	62.18 ± 10.70	69.47 ± 8.48	6/8	5/6
Feng et al	2014	RCT	Rectal cancer surgery	57	59	53.95 ± 11.95	56.31 ±, 11.52	36/21	40/19
Feng et al	2016	RCT	Colorectal cancer surgery	116	114	58.12 ± 11.04	58.31 ± 10.89	66/50	63/51
Gatt et al	2005	RCT	Colorectal surgery	19	20	67.36 ± 13.61	66.64 ± 10.37	9/10	14/6
Ionescu et al	2009	RCT	Colorectal cancer surgery	48	48	60.94 ± 9.9	63.1 ± 12.19	30/18	31/17
Jia et al	2013	RCT	Colorectal cancer surgery	117	116	75.66 ± 4.18	74.78 ± 4.01	76/41	70/46
Khoo et al	2007	RCT	Colorectal cancer surgery	35	35	67.66 ± 32.00	67.66 ± 29.52	12/23	15/20
Lee et al	2011	RCT	Colon cancer surgery	46	54	61.9 ± 11.2	60.6 ± 0.0	26/20	30/24
Lee et al	2013	RCT	Rectal cancer surgery	52	46	61.2 ± 10.8	61.7 ± 10.8	34/16	28/18
Muller et al	2009	RCT	Colon cancer surgery	76	75	59.88 ± 48.36	62.52 ± 37.79	37/39	40/35
Nanavati et al	2013	RCT	Intestinal surgery	30	30	34.77 ± 14.40	33.5 ± 12.36	17/13	15/15
Yang et al	2012	RCT	Colorectal cancer surgery	32	30	57.2 ± 11.70	59.5 ± 12.10	20/12	22/8
Ren et al	2011	RCT	Colorectal cancer surgery	299	298	53.38 ± 40.22	53.63 ± 43.95	178/121	190/108
Shetiwy et al	2017	RCT	Colorectal cancer surgery	35	35	48.54 ± 12.29	53.63 ± 11.5	21/14	24/11
Taupyk et al	2015	RCT	Colorectal cancer surgery	31	39	58.5 ± 8.4	57.4 ± 10.1	22/9	20/19
Veenhof et al	2012	RCT	Colon cancer surgery	36	43	63.38 ± 10.17	66.05 ± 9.88	10/9	19/4
Vlug et al	2011	RCT	Colon cancer surgery	193	207	66 ± 9.4	67 ± 7.95	107/86	127/80
Wang et al	2011	RCT	Colorectal cancer surgery	106	104	54.53 ± 23.29	53.94 ± 20.29	65/41	60/44
Wang et al	2012	RCT	Colon cancer surgery	81	82	56.45 ± 17.7	55.75 ± 15.7	51/30	51/31
Wang et al	2012	RCT	Colorectal cancer surgery	40	38	72.41 ± 12.30	73.06 ± 13.09	22/18	20/18

Table 1: Overview and Characteristics of Included Studies

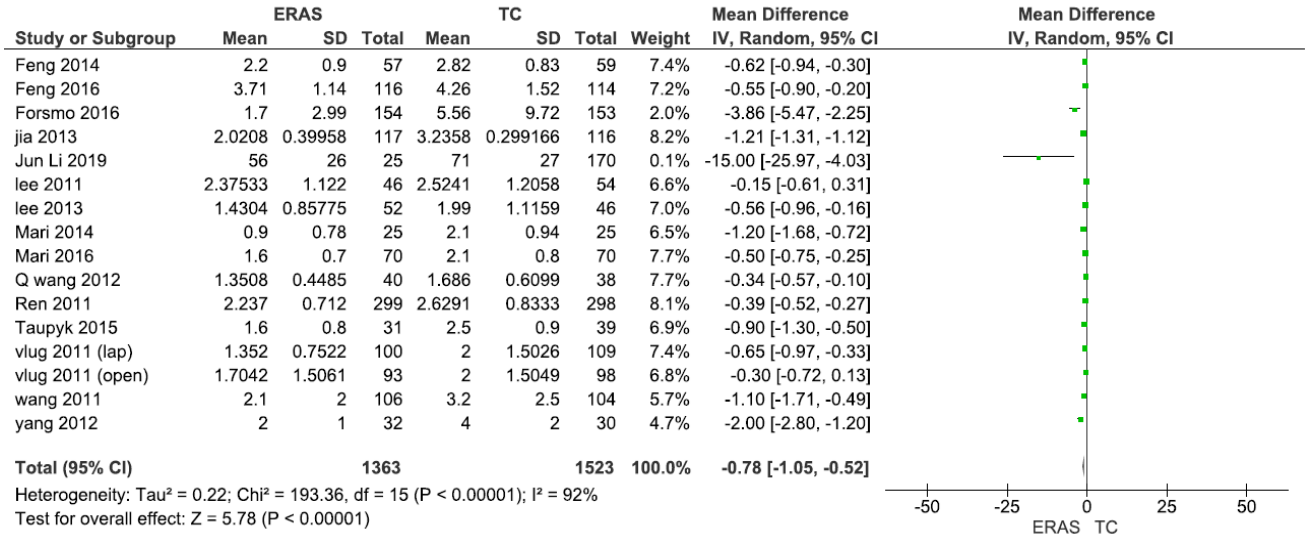
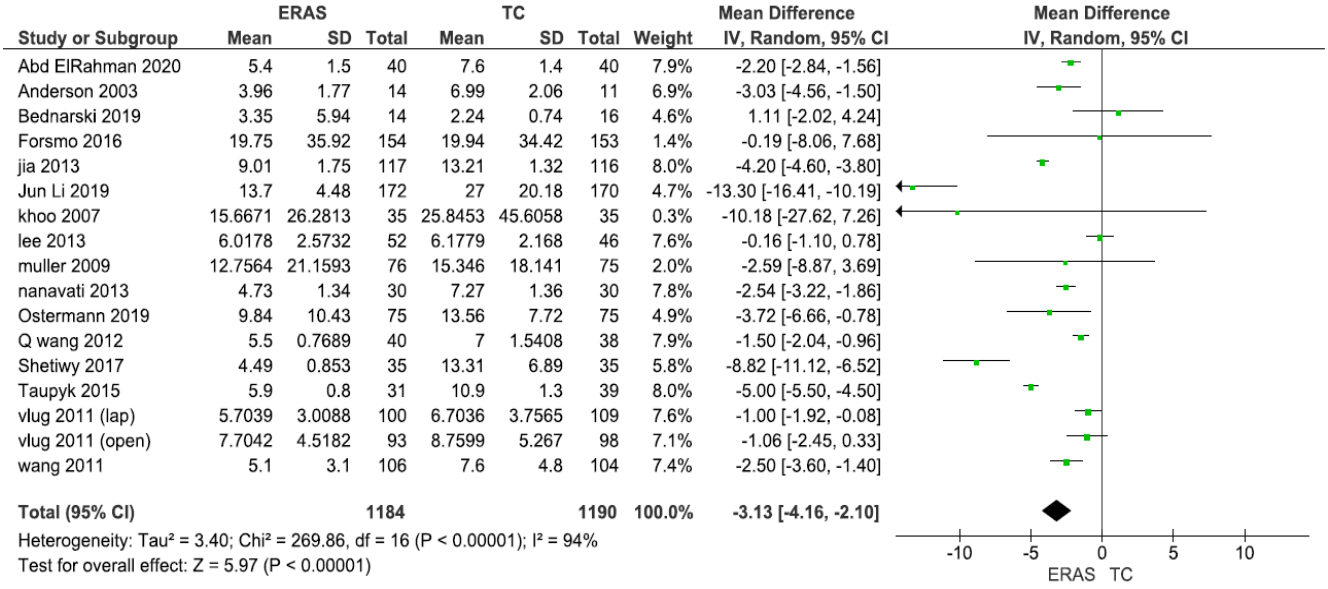


Figure 4: Forest Plot of Time to First Flatus in ERAS vs. Traditional Group with the pooled result of 0.78% (95%CI-1.05-0.52%)

The total length of Stay & Post-Operative Hospital Stay

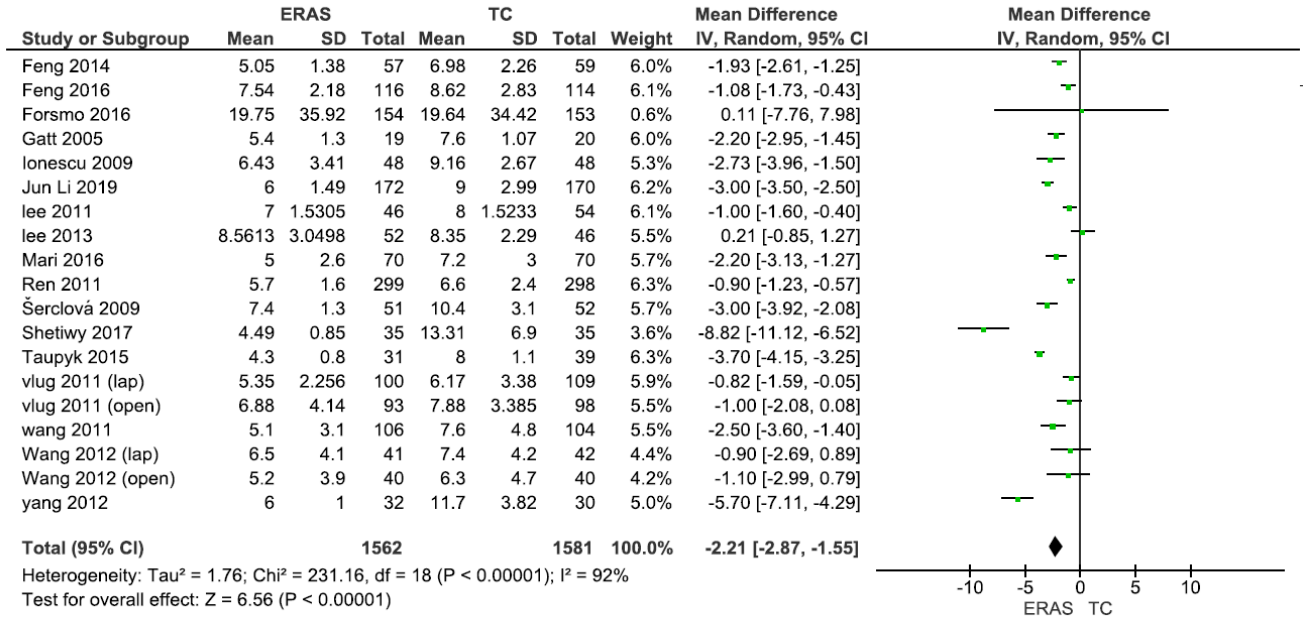
Sixteen RCTs mentioned the total length of stay. It included 1184 patients in the ERAS group and 1190 patients in the conventional care group. The outcome showed that the total length of stay was shorter in the ERAS group (Weighted Mean Difference: —3.13 days, 95% CI —4.16 to —2.10, p < 0.00001) than in the traditional care group. High heterogeneity of 94% was observed and a random effect model was used. PHS was reported in 17 RCTs with a total of 1562 patients in the ERAS group and 1581 in the traditional care group. The Postoperative Hospital Stay (PHS) also resulted as shorter in the ERAS care group (Weighted Mean Difference: —2.21 days, 95% CI —2.87 to —1.55, p < 0.00001) as compared to the conventional care group. Due to high heterogeneity, a random-effects model was used for analysis.



Study or Subgroup	ERAS Mean	ERAS SD	ERAS Total	TC Mean	TC SD	TC Total	Weight	Mean Difference IV, Random, 95% CI
Abd ElRahman 2020	5.4	1.5	40	7.6	1.4	40	7.9%	-2.20 [-2.84, -1.56]
Anderson 2003	3.96	1.77	14	6.99	2.06	11	6.9%	-3.03 [-4.56, -1.50]
Bednarski 2019	3.35	5.94	14	2.24	0.74	16	4.6%	1.11 [-2.02, 4.24]
Forsmo 2016	19.75	35.92	154	19.94	34.42	153	1.4%	-0.19 [-8.06, 7.68]
jia 2013	9.01	1.75	117	13.21	1.32	116	8.0%	-4.20 [-4.60, -3.80]
Jun Li 2019	13.7	4.48	172	27	20.18	170	4.7%	-13.30 [-16.41, -10.19]
khoo 2007	15.6671	26.2813	35	25.8453	45.6058	35	0.3%	-10.18 [-27.62, 7.26]
lee 2013	6.0178	2.5732	52	6.1779	2.168	46	7.6%	-0.16 [-1.10, 0.78]
muller 2009	12.7564	21.1593	76	15.346	18.141	75	2.0%	-2.59 [-8.87, 3.69]
nanavati 2013	4.73	1.34	30	7.27	1.36	30	7.8%	-2.54 [-3.22, -1.86]
Ostermann 2019	9.84	10.43	75	13.56	7.72	75	4.9%	-3.72 [-6.66, -0.78]
Q wang 2012	5.5	0.7689	40	7	1.5408	38	7.9%	-1.50 [-2.04, -0.96]
Shetiwy 2017	4.49	0.853	35	13.31	6.89	35	5.8%	-8.82 [-11.12, -6.52]
Taupyk 2015	5.9	0.8	31	10.9	1.3	39	8.0%	-5.00 [-5.50, -4.50]
vlug 2011 (lap)	5.7039	3.0088	100	6.7036	3.7565	109	7.6%	-1.00 [-1.92, -0.08]
vlug 2011 (open)	7.7042	4.5182	93	8.7599	5.267	98	7.1%	-1.06 [-2.45, 0.33]
wang 2011	5.1	3.1	106	7.6	4.8	104	7.4%	-2.50 [-3.60, -1.40]
Total (95% CI)			**1184**			**1190**	**100.0%**	**-3.13 [-4.16, -2.10]**

Heterogeneity: Tau² = 3.40; Chi² = 269.86, df = 16 (P < 0.00001); I² = 94%
Test for overall effect: Z = 5.97 (P < 0.00001)

Figure 5: Forest Plot showing total length of stay in ERAS vs. Traditional Group with the pooled result of 3.13% (95%CI-4.16-2.10%)



Study or Subgroup	ERAS Mean	ERAS SD	ERAS Total	TC Mean	TC SD	TC Total	Weight	Mean Difference IV, Random, 95% CI
Feng 2014	5.05	1.38	57	6.98	2.26	59	6.0%	-1.93 [-2.61, -1.25]
Feng 2016	7.54	2.18	116	8.62	2.83	114	6.1%	-1.08 [-1.73, -0.43]
Forsmo 2016	19.75	35.92	154	19.64	34.42	153	0.6%	0.11 [-7.76, 7.98]
Gatt 2005	5.4	1.3	19	7.6	1.07	20	6.0%	-2.20 [-2.95, -1.45]
Ionescu 2009	6.43	3.41	48	9.16	2.67	48	5.3%	-2.73 [-3.96, -1.50]
Jun Li 2019	6	1.49	172	9	2.99	170	6.2%	-3.00 [-3.50, -2.50]
lee 2011	7	1.5305	46	8	1.5233	54	6.1%	-1.00 [-1.60, -0.40]
lee 2013	8.5613	3.0498	52	8.35	2.29	46	5.5%	0.21 [-0.85, 1.27]
Mari 2016	5	2.6	70	7.2	3	70	5.7%	-2.20 [-3.13, -1.27]
Ren 2011	5.7	1.6	299	6.6	2.4	298	6.3%	-0.90 [-1.23, -0.57]
Šerclová 2009	7.4	1.3	51	10.4	3.1	52	5.7%	-3.00 [-3.92, -2.08]
Shetiwy 2017	4.49	0.85	35	13.31	6.9	35	3.6%	-8.82 [-11.12, -6.52]
Taupyk 2015	4.3	0.8	31	8	1.1	39	6.3%	-3.70 [-4.15, -3.25]
vlug 2011 (lap)	5.35	2.256	100	6.17	3.38	109	5.9%	-0.82 [-1.59, -0.05]
vlug 2011 (open)	6.88	4.14	93	7.88	3.385	98	5.5%	-1.00 [-2.08, 0.08]
wang 2011	5.1	3.1	106	7.6	4.8	104	5.5%	-2.50 [-3.60, -1.40]
Wang 2012 (lap)	6.5	4.1	41	7.4	4.2	42	4.4%	-0.90 [-2.69, 0.89]
Wang 2012 (open)	5.2	3.9	40	6.3	4.7	40	4.2%	-1.10 [-2.99, 0.79]
yang 2012	6	1	32	11.7	3.82	30	5.0%	-5.70 [-7.11, -4.29]
Total (95% CI)			**1562**			**1581**	**100.0%**	**-2.21 [-2.87, -1.55]**

Heterogeneity: Tau² = 1.76; Chi² = 231.16, df = 18 (P < 0.00001); I² = 92%
Test for overall effect: Z = 6.56 (P < 0.00001)

Figure 6: Forest Plot showing the postoperative length of stay in ERAS vs. Traditional Group with the pooled result of 2.21% (95%CI-2.87-1.55%)

Time to Mobilization of Patient

A total of 12 RCTs reported the time to mobilization in which 848 patients belonged to the ERAS group, while 839 patients in the traditional care group. Due to high heterogeneity, we used a random-effects model. The results showed that the time to the mobilization of patients was also shorter in ERAS patients (Weighted Mean Difference: —16.28 hours, 95% CI —22.04 to —10.53, p < 0.00001) than traditional care patients.

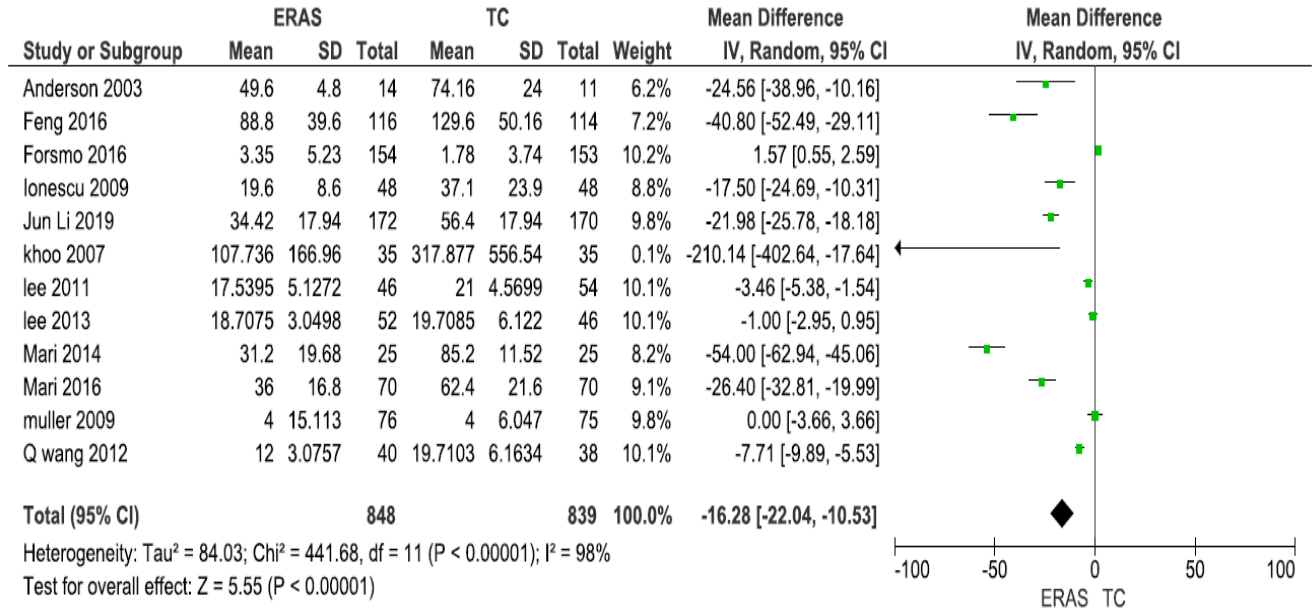


Figure 7: Forest Plot showing time to mobilization in ERAS vs. Traditional Group with the pooled result of 16.28% (95%CI-22.04-10.53%)

Time to First Fluid and Solid

Intake A total of 657 patients (ERAS) and 654 patients (traditional care) were added in 6 RCTs which mentioned the time to first fluid intake. The time was shorter in patients of the ERAS group (Weighted Mean Difference: —89.96 hours, 95% CI —119.89 to —60.03, p < 0.00001) than traditional care group. We used a random-effects model for quantitative analysis of time to fluid intake. Time for the development of tolerance to solid diet was mentioned in 14 studies with 870 patients (ERAS) and 887 in (traditional care). Using the random-effects model, results of the analysis showed that ERAS patients developed tolerance earlier (Weighted Mean Difference: —1.91, 95% CI —2.34 to —1.48, p < 0.00001) than patients receiving conventional care.

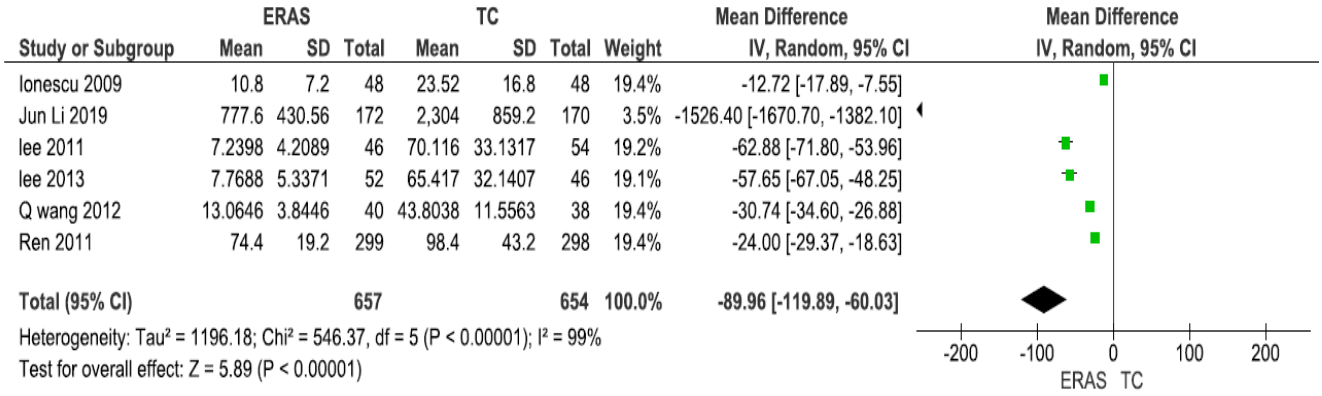


Figure 8: Forest Plot showing Time to first fluid in ERAS vs. Traditional Group with the pooled result of 89.96% (95%CI-119.89-60.03%)

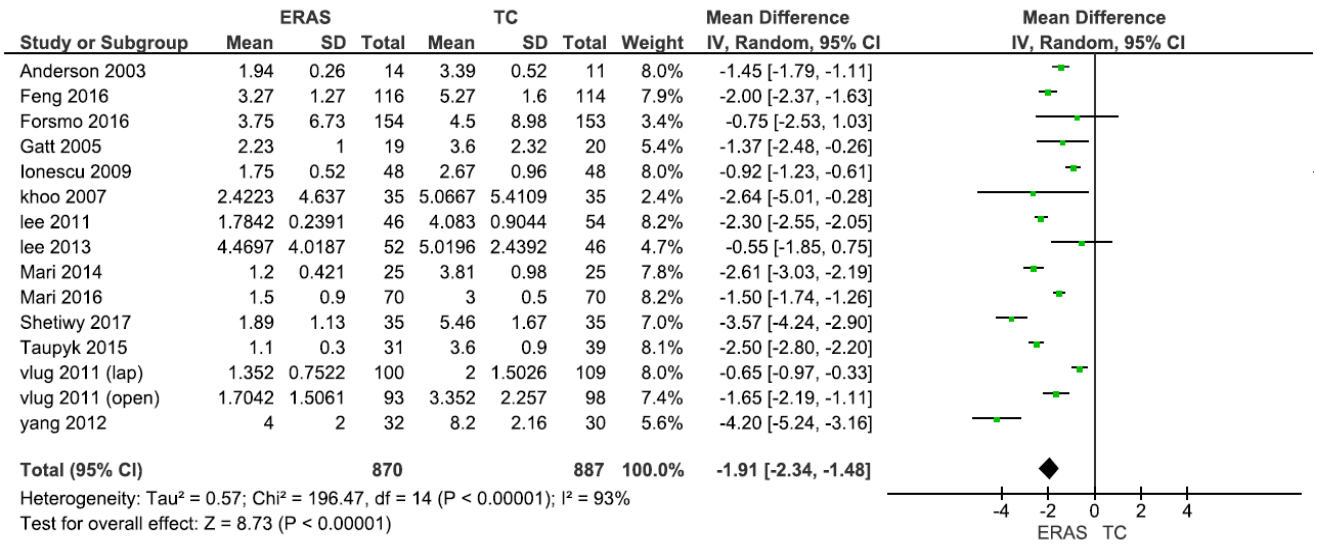


Figure 9: Forest Plot showing Time to first solid diet in ERAS vs. Traditional Group with the pooled result of 1.91% (95%CI-2.34-1.48%)

Readmissions Eleven RCTs reported the number of readmissions having a total of 990 patients (ERAS) and 1002 patients (traditional care). Dichotomous variables were used to assess the outcome of this parameter. Due to low heterogeneity, we used a fixed-effects model. The results showed that the traditional care group had a lesser number of readmissions with a total of 75 readmissions (7.4%) and the ERAS group had more number of readmissions with a total of 80 readmissions (8.08%). The forest plot also shows this variation (OR: 1.09, 95% CI 0.78 to 1.51, p = 0.74)

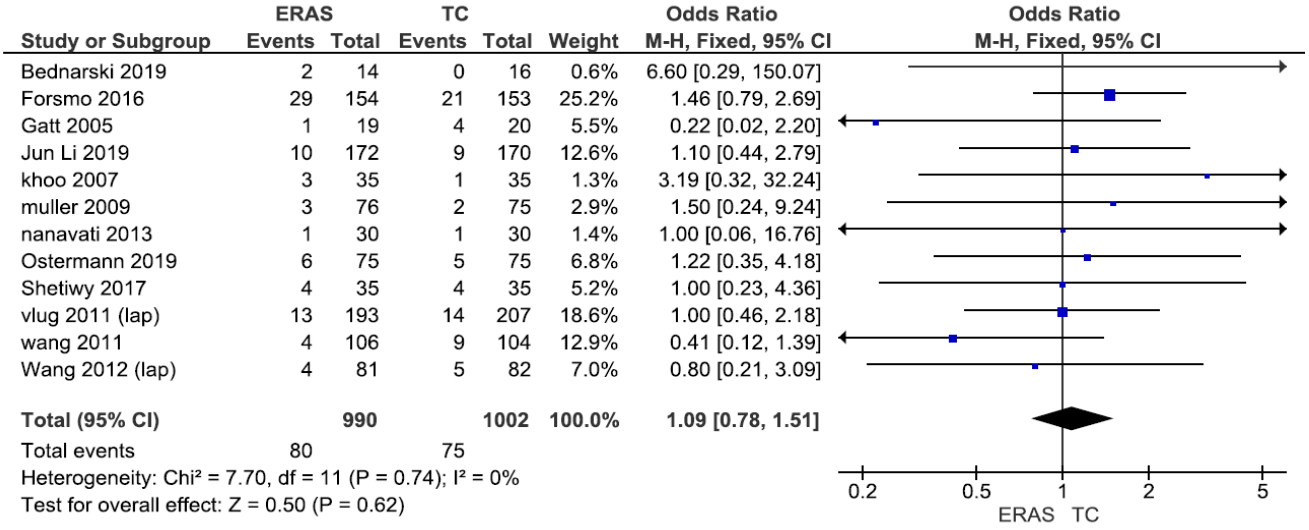


Figure 10: Forest Plot showing Readmission Rate in ERAS vs. Traditional Group with the pooled result of 1.09% (95%CI-0.78-1.51%)

Complications

Twenty-seven RCTs reported many complications, 20 RCTs mentioned anastomotic leaks, 9 RCTs mentioned intestinal obstructions, 15 articles reported the development of postoperative ileus, and 24 studies mentioned surgical site infections. Outcomes of all of these studies were assessed using dichotomous variables. There were a total of 404 complications (19.7%) in the ERAS group and 677 complications (32.7%) in the traditional care group (OR: 0.49, 95% CI 0.36 to 0.66, p = 0.0003). There was a lesser percentage of anastomotic leaks in the ERAS group (OR: 0.81, 95% CI 0.56 to 1.16, p = 0.52) than in the traditional care group. A total of 53 anastomotic leaks were observed in ERAS patients (2.94%) and 67 (3.68%) were observed in traditional care patients. A total of 17 patients (2.06%) developed an intestinal obstruction in the ERAS group while 25 patients (3.02%) suffered from intestinal obstruction in the traditional care

group (OR: 0.71, 95% CI 0.39 to 1.28, p=0.25). 54 patients (5.33%) in ERAS group developed postoperative ileus while 69 patients (6.68%) in traditional care developed postoperative ileus (OR: 0.76, 95% CI 0.52 to 1.11, p = 0.52). 4.89% patients (96 patients out of 1963 patients) suffered from surgical site infection in ERAS group and 7.19% patients (142 patients out of 1973 patients) suffered from surgical site infection in traditional care group (OR: 0.67, 95% CI 0.51 to 0.87, p = 0.51).

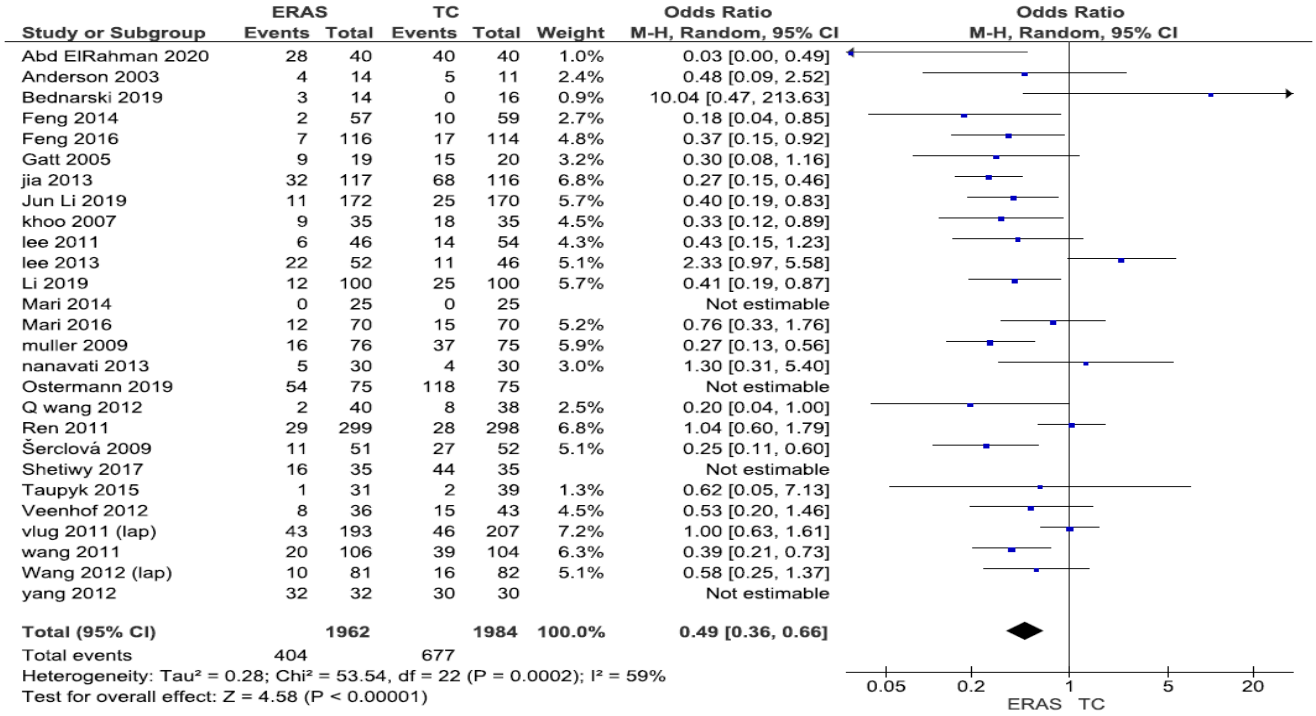


Figure 11: Forest Plot showing the total number of complications in ERAS vs. Traditional Group with the pooled result of 0.49% (95%CI-0.36-0.66%)

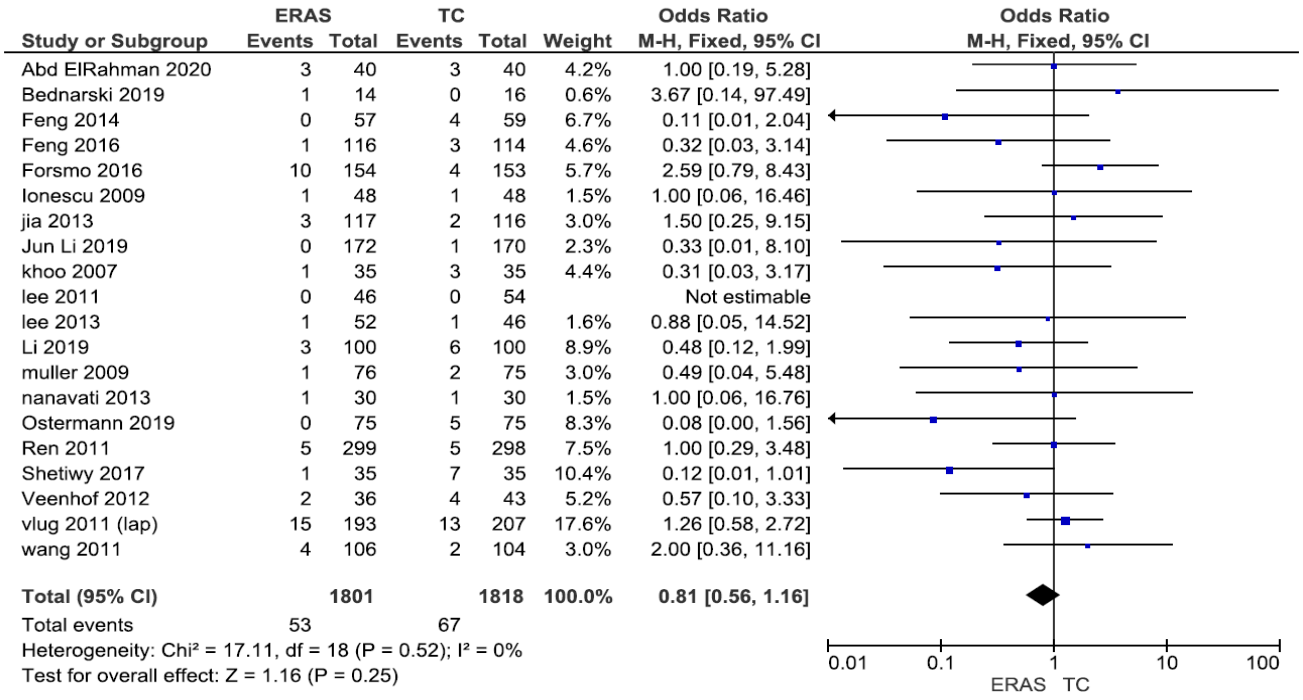


Figure 12: Forest Plot showing the total number of anastomotic leaks in ERAS vs. Traditional Group with the pooled result of 0.81% (95%CI-0.56-1.16%)

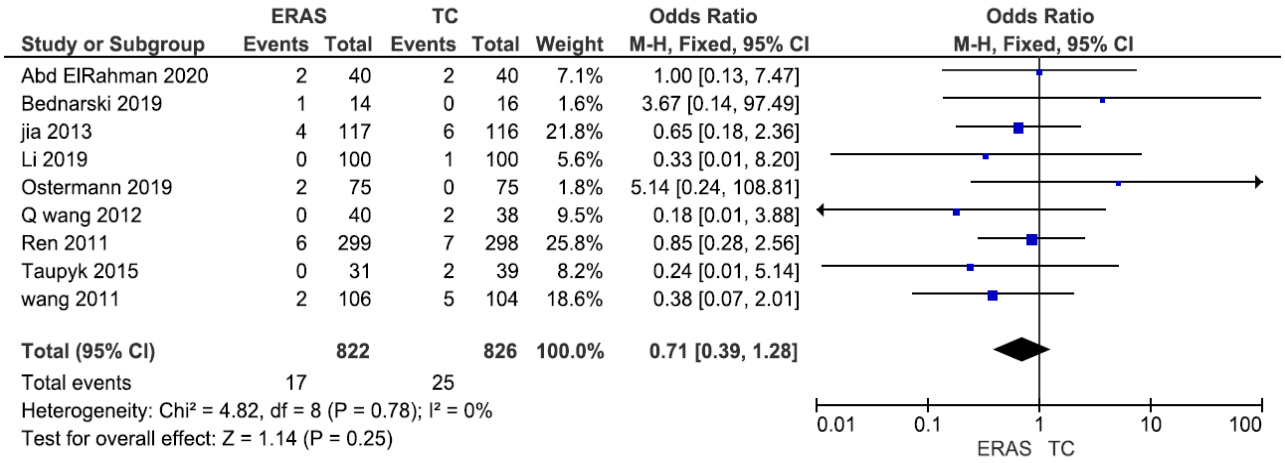


Figure 13: Forest Plot showing the total number of intestinal obstructions in ERAS vs. Traditional Group with the pooled result of 0.71% (95%CI-0.39-1.28%)

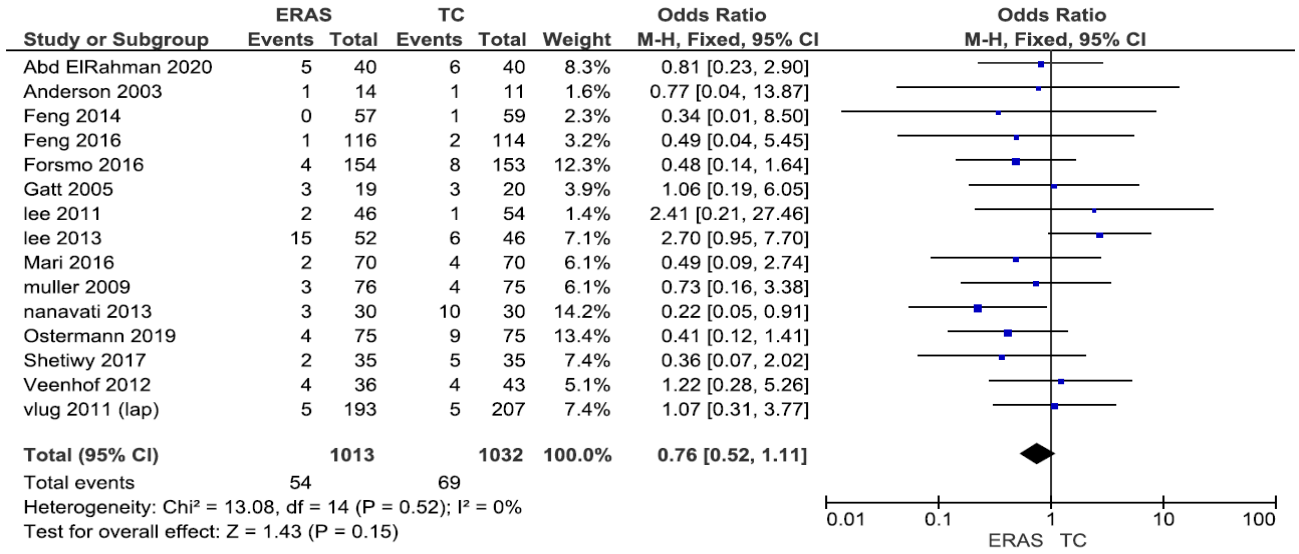


Figure 14: Forest Plot showing the total number of postoperative ileus in ERAS vs. Traditional Group with the pooled result of 0.76% (95%CI-0.52-1.11%)

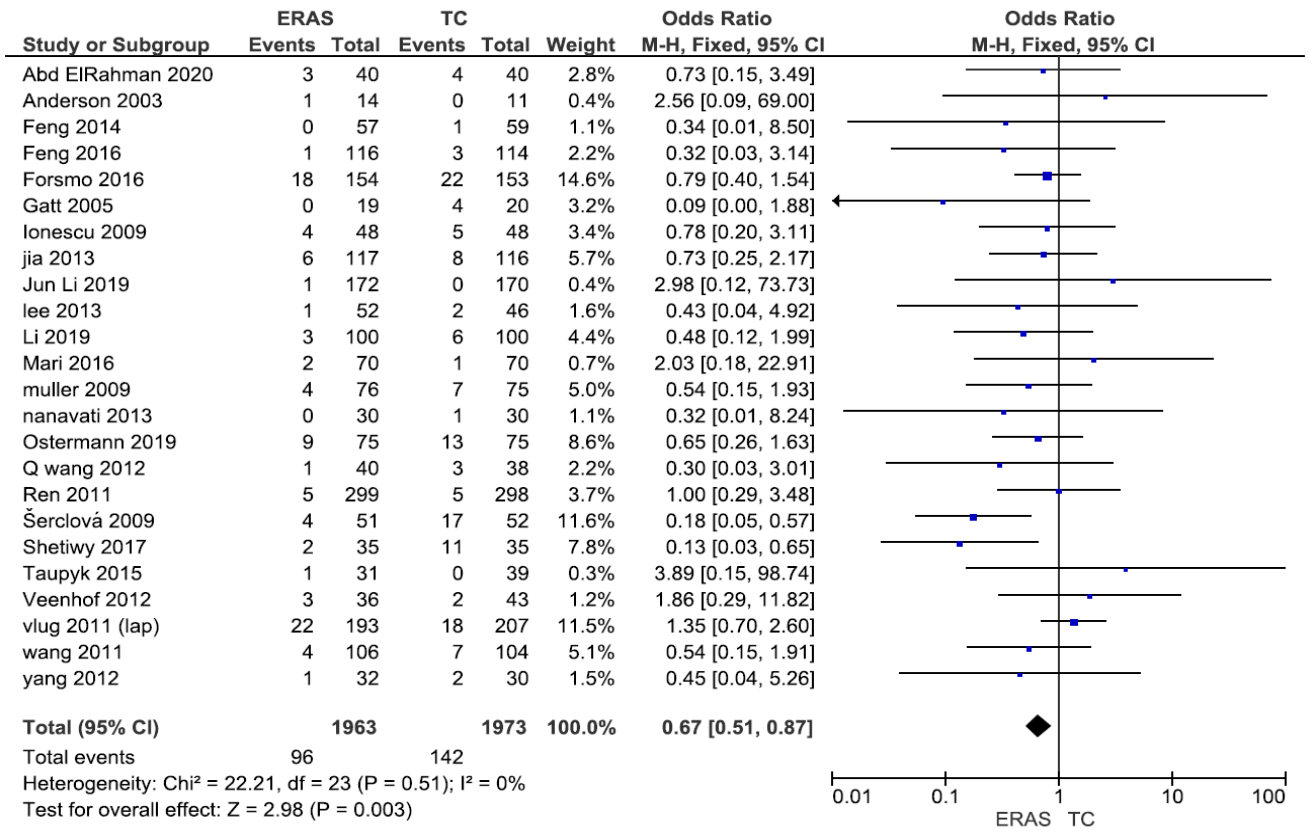


Figure 15: Forest Plot showing the total number of surgical site infections in ERAS vs. Traditional Group with the pooled result of 0.67% (95%CI-0.51-0.87%)

Sensitivity Analysis

We checked the sensitivity analysis of all the studies by excluding individually each study from the analysis of each outcome. The pooled results showed no significant difference in the exclusion of individual RCTs from the outcome analyses.

DISCUSSION

Major surgeries often pose a risk of intra- and postoperative stress in the form of prolonged hospital stay, late return of GI function, or higher rates of readmissions. The ERAS society developed its guidelines to revolutionize conventional surgical care practices in hospital settings. Unlike other surgeries, the ERAS program has been implemented vastly in the domain of colorectal surgery. Despite the growing popularity of the ERAS care program, many surgeons still exercise conventional measures in perioperative care. However, the ERAS society is earnestly working to implement this multidisciplinary evidence-based program[35].

In the past, a small number of meta-analyses have been performed to compare ERAS care versus traditional care in patients hospitalized for colorectal surgery. These included only a limited number of studies which were not sufficient to give satisfying results. More than a decade ago, Eskicioglu, Varadhan, and Lv et al conducted their meta-analyses with 4 and 6 studies, respectively[36, 37]. Later on, some meta-analyses were published with a large number of trials[38-41]. So far, our meta-analysis has included the greatest number of randomized studies (29 RCTs).

Recently, a meta-analysis included only those patients that underwent laparoscopic colorectal surgery[42], whereas our study did not disfavor any surgical approach. Some meta-analyses included both randomized and non-randomized trials[40, 42], whereas our study considered randomization essential as an inclusion criterion to screen for high-quality studies.

Other meta-analyses have studied the total length of stay and PHS as their primary outcomes along with postoperative morbidity, readmissions, and complications as their secondary outcomes[36-41, 43]. Ni et al have also included time to flatus and defecation, and inflammatory marker levels such as interleukin-6 and C-reactive protein. Their analysis included only the laparoscopically operated patients and only a small number of studies reported the outcomes of inflammatory markers[41]. Our analysis included time to first flatus, time to mobilization, time to first fluid intake, and solid

diet tolerance, in addition to the length of stay, PHS, readmissions, and complications.

We included early mobilization in our study outcomes as it is an integral element of ERAS recommendations. If not addressed appropriately, prolonged bed rest can lead to thromboembolism and muscle atrophy. Postoperative oral intake is also an important factor to monitor in patients, especially after major surgeries such as colorectal surgery[5]

Although our study has given significant results in favor of ERAS protocol, there were some limitations to it. Some of the outcomes we studied were missing in most of the RCTs. Most RCTs were non-masked and did not comply with the blinding of surgeons and participants. A few RCTs reasoned that blinding was not practicable because of the comparison of different perioperative care regimens[10, 33].

Here, we would also highlight the fact that most RCTs were conducted in European and East Asian countries. Countries from other geographical regions should also practice these protocols in colorectal surgery so that the compliance of ERAS protocol could be assessed on a global level.

CONCLUSION

Our meta-analysis shows a remarkably shorter length of stay in hospital and PHS, faster restoration of normal GI function, a shorter time to regain mobilization, and a reduced incidence of total complications in the ERAS care group in comparison to the traditional care group. The rate of readmissions in both groups was non-significant. We conclude that in light of our results, ERAS protocol provides safety, expeditious recovery, and rapid return of normal physiology.

ARTICLE INFORMATION Accepted for Publication: May 23, 2021, Published Online: Dec 25, 2021.
https://doi.org/10.48111/2021.04.04

Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest

REFERENCES

1. Melnyk M, Casey RG, Black P, Koupparis AJ. Enhanced recovery after surgery (ERAS) protocols: Time to change practice? *Can Urol Assoc J.* Published online October 1, 2011:342-348. doi:10.5489/cuaj.11002
2. Kehlet H, Mogensen T. Hospital stay of 2 days after open sigmoidectomy with a multimodal rehabilitation programme. *Br J Surg.* 2003;86(2):227-230. doi:10.1046/j.1365-2168.1999.01023.x
3. Fearon KCH, Ljungqvist O, Von Meyenfeldt M, et al. Enhanced recovery after surgery: A consensus review of clinical care for patients undergoing colonic resection. *Clin Nutr.* 2005;24(3):466-477. doi:10.1016/j.clnu.2005.02.002
4. Gustafsson UO, Scott MJ, Schwenk W, et al. Guidelines for Perioperative Care in Elective Colonic Surgery: Enhanced Recovery After Surgery (ERAS®) Society Recommendations. *World J Surg.* 2013;37(2):259-284. doi:10.1007/s00268-012-1772-0
5. Gustafsson UO, Scott MJ, Hubner M, et al. Guidelines for Perioperative Care in Elective Colorectal Surgery: Enhanced Recovery After Surgery (ERAS®) Society Recommendations: 2018. *World J Surg.* 2019;43(3):659-695. doi:10.1007/s00268-018-4844-y
6. Jia Y, Jin G, Guo S, et al. Fast-track surgery decreases the incidence of postoperative delirium and other complications in elderly patients with colorectal carcinoma. *Langenbecks Arch Surg.* 2014;399(1):77-84. doi:10.1007/s00423-013-1151-9
7. Khoo CK, Vickery CJ, Forsyth N, Vinall NS, Eyre-Brook IA. A Prospective Randomized Controlled Trial of Multimodal Perioperative Management Protocol in Patients Undergoing Elective Colorectal Resection for Cancer. *Ann Surg.* 2007;245(6):867-872. doi:10.1097/01.sla.0000259219.08209.36
8. Lee T-G, Kang S-B, Kim D-W, Hong S, Heo SC, Park KJ. Comparison of Early Mobilization and Diet Rehabilitation Program With Conventional Care After Laparoscopic Colon Surgery: A Prospective Randomized Controlled Trial. *Dis Colon Rectum.* 2011;54(1):21-28. doi:10.1007/DCR.0b013e3181fcdb3e
9. Lee S-M, Kang S-B, Jang J-H, et al. Early rehabilitation versus conventional care after laparoscopic rectal surgery: a prospective, randomized, controlled trial. *Surg Endosc.* 2013;27(10):3902-3909. doi:10.1007/s00464-013-3006-4
10. Muller S, Zalunardo MP, Hubner M, Clavien PA, Demartines N. A Fast-Track Program Reduces Complications and Length of Hospital Stay After Open Colonic Surgery. *Gastroenterology.* 2009;136(3):842-847.e1. doi:10.1053/j.gastro.2008.10.030
11. Nanavati AJ, Prabhakar S. A Comparative Study of 'Fast-Track' Versus Traditional Peri-Operative Care Protocols in Gastrointestinal Surgeries. *J Gastrointest Surg.* 2014;18(4):757-767. doi:10.1007/s11605-013-2403-2
12. Ren L, Zhu D, Wei Y, et al. Enhanced Recovery After Surgery (ERAS) Program Attenuates Stress and Accelerates Recovery in Patients After Radical Resection for Colorectal Cancer: A Prospective Randomized Controlled Trial. *World J Surg.* 2012;36(2):407-414. doi:10.1007/s00268-011-1348-4
13. Shetiwy M, Fady T, Shahatto F, Setit A. Standardizing the Protocols for Enhanced Recovery From Colorectal Cancer Surgery: Are We a Step Closer to Ideal Recovery? *Ann Coloproctology.* 2017;33(3):86-92. doi:10.3393/ac.2017.33.3.86
14. Taupyk Y, Cao X, Zhao Y, Wang C, Wang Q. Fast-track laparoscopic surgery: A better option for treating colorectal cancer than conventional laparoscopic surgery. *Oncol Lett.* Published online April 29, 2015. doi:10.3892/ol.2015.3166
15. Veenhof AAFA, Vlug MS, van der Pas MHGM, et al. Surgical Stress Response and Postoperative Immune Function After Laparoscopy or Open Surgery With Fast Track or Standard Perioperative Care: A Randomized Trial. *Ann Surg.* 2012;255(2):216-221. doi:10.1097/SLA.0b013e31824336e2
16. Vlug MS, Wind J, Hollmann MW, et al. Laparoscopy in Combination with Fast Track Multimodal Management is the Best Perioperative Strategy in Patients Undergoing Colonic Surgery: A Randomized Clinical Trial (LAFA-study). *Ann Surg.* 2011;254(6):868-875. doi:10.1097/SLA.0b013e31821fd1ce
17. Wang G. Fast-track rehabilitation program vs conventional care after colorectal resection: A randomized clinical trial. *World J Gastroenterol.* 2011;17(5):671. doi:10.3748/wjg.v17.i5.671
18. Wang G, Jiang Z, Zhao K, et al. Immunologic Response After Laparoscopic Colon Cancer Operation Within an Enhanced Recovery Program. *J Gastrointest Surg.* 2012;16(7):1379-1388. doi:10.1007/s11605-012-1880-z
19. Wang Q, Suo J, Jiang J, Wang C, Zhao Y-Q, Cao X. Effectiveness of fast-track rehabilitation vs conventional care in laparoscopic colorectal resection for elderly patients: a randomized trial: Fast-track rehabilitation vs conventional care. *Colorectal Dis.* 2012;14(8):1009-1013. doi:10.1111/j.1463-1318.2011.02855.x
20. Yang D, He W, Zhang S, Chen H, Zhang C, He Y. Fast-Track Surgery Improves Postoperative Clinical Recovery and Immunity After Elective Surgery for Colorectal Carcinoma: Randomized Controlled Clinical Trial. *World J Surg.* 2012;36(8):1874-1880. doi:10.1007/s00268-012-1606-0
21. Šerclová Z, Dytrych P, Marvan J, et al. Fast-track in open intestinal surgery: Prospective randomized study (Clinical Trials Gov Identifier no. NCT00123456). *Clin Nutr.* 2009;28(6):618-624. doi:10.1016/j.clnu.2009.05.009
22. Li Q, Du L, Lu L, et al. Clinical Application of Enhanced Recovery After Surgery in Perioperative Period of Laparoscopic Colorectal Cancer Surgery. J Laparoendosc Adv Surg Tech. 2019;29(2):178-183. doi:10.1089/lap.2018.0708
23. Li J, Kong X-X, Zhou J-J, et al. Fast-track

multidisciplinary treatment versus conventional treatment for colorectal cancer: a multicenter, open-label randomized controlled study. *BMC Cancer*. 2019;19(1):988. doi:10.1186/s12885-019-6188-x
24. Anderson ADG, McNaught CE, MacFie J, Tring I, Barker P, Mitchell CJ. Randomized clinical trial of multimodal optimization and standard perioperative surgical care. Br J Surg. 2003;90(12):1497-1504. doi:10.1002/bjs.4371
25. Bednarski BK, Nickerson TP, You YN, et al. Randomized clinical trial of accelerated enhanced recovery after minimally invasive colorectal cancer surgery (RecoverMI trial). *Br J Surg*. 2019;106(10):1311-1318. doi:10.1002/bjs.11223
26. Feng F, Li XH, Shi H, et al. Fast-track surgery combined with laparoscopy could improve postoperative recovery of low-risk rectal cancer patients: A randomized controlled clinical trial: FTS with laparoscopy in rectal cancer. *J Dig Dis*. 2014;15(6):306-313. doi:10.1111/1751-2980.12142
27. Feng J, Li K, Li L, et al. The effects of fast-track surgery on inflammation and immunity in patients undergoing colorectal surgery. *Int J Colorectal Dis*. 2016;31(10):1675-1682. doi:10.1007/s00384-016-2630-6
28. Forsmo HM, Pfeffer F, Rasdal A, et al. Compliance with enhanced recovery after surgery criteria and preoperative and postoperative counselling reduces length of hospital stay in colorectal surgery: results of a randomized controlled trial. *Colorectal Dis*. 2016;18(6):603-611. doi:10.1111/codi.13253
29. Gatt M, Anderson ADG, Reddy BS, Hayward-Sampson P, Tring IC, MacFie J. Randomized clinical trial of multimodal optimization of surgical care in patients undergoing major colonic resection. *Br J Surg*. 2005;92(11):1354-1362. doi:10.1002/bjs.5187
30. Ionescu D, Iancu C, Ion D, et al. Implementing Fast-Track Protocol for Colorectal Surgery: A Prospective Randomized Clinical Trial. *World J Surg*. 2009;33(11):2433-2438. doi:10.1007/s00268-009-0197-x
31. Mari GM, Costanzi A, Maggioni D, et al. Fast-Track Versus Standard Care in Laparoscopic High Anterior Resection: A Prospective Randomized-Controlled Trial. *Surg Laparosc Endosc Percutan Tech*. 2014;24(2):118-121. doi:10.1097/SLE.0b013e3182a50e3a
32. Mari G, Crippa J, Costanzi A, Mazzola M, Rossi M, Maggioni D. ERAS Protocol Reduces IL-6 Secretion in Colorectal Laparoscopic Surgery: Results From a Randomized Clinical Trial. *Surg Laparosc Endosc Percutan Tech*. 2016;26(6):444-448. doi:10.1097/SLE.0000000000000324
33. Ostermann S, Morel P, Chalé J-J, et al. Randomized Controlled Trial of Enhanced Recovery Program Dedicated to Elderly Patients After Colorectal Surgery. *Dis Colon Rectum*. 2019;62(9):1105-1116. doi:10.1097/DCR.0000000000001442
34. Abd ElRahman EM, Kharoub MS, Shora A, Emara NA, Balbaa MA. Early Outcome of Enhanced Recovery Programs Versus Conventional Perioperative Care in Elective Open Left Side Colonic Carcinoma Surgery: Analysis of 80 Cases. *Indian J Surg Oncol*. 2020;11(3):372-377. doi:10.1007/s13193-020-01074-x
35. Ljungqvist O, Scott M, Fearon KC. Enhanced Recovery After Surgery: A Review. *JAMA Surg*. 2017;152(3):292. doi:10.1001/jamasurg.2016.4952
36. Eskicioglu C, Forbes SS, Aarts M-A, Okrainec A, McLeod RS. Enhanced Recovery after Surgery (ERAS) Programs for Patients Having Colorectal Surgery: A Meta-analysis of Randomized Trials. *J Gastrointest Surg*. 2009;13(12):2321-2329. doi:10.1007/s11605-009-0927-2
37. Varadhan KK, Neal KR, Dejong CHC, Fearon KCH, Ljungqvist O, Lobo DN. The enhanced recovery after surgery (ERAS) pathway for patients undergoing major elective open colorectal surgery: A meta-analysis of randomized controlled trials. *Clin Nutr*. 2010;29(4):434-440. doi:10.1016/j.clnu.2010.01.004
38. Greco M, Capretti G, Beretta L, Gemma M, Pecorelli N, Braga M. Enhanced Recovery Program in Colorectal Surgery: A Meta-analysis of Randomized Controlled Trials. *World J Surg*. 2014;38(6):1531-1541. doi:10.1007/s00268-013-2416-8
39. Chemali ME, Eslick GD. A Meta-Analysis: Postoperative Pain Management in Colorectal Surgical Patients and the Effects on Length of Stay in an Enhanced Recovery After Surgery (ERAS) Setting. *Clin J Pain*. 2017;33(1):87-92. doi:10.1097/AJP.0000000000000370
40. Greer NL, Gunnar WP, Dahm P, et al. Enhanced Recovery Protocols for Adults Undergoing Colorectal Surgery: A Systematic Review and Meta-analysis. *Dis Colon Rectum*. 2018;61(9):1108-1118. doi:10.1097/DCR.0000000000001160
41. Ni X, Jia D, Chen Y, Wang L, Suo J. Is the Enhanced Recovery After Surgery (ERAS) Program Effective and Safe in Laparoscopic Colorectal Cancer Surgery? A Meta-Analysis of Randomized Controlled Trials. *J Gastrointest Surg*. 2019;23(7):1502-1512. doi:10.1007/s11605-019-04170-8
42. Zhao J, Sun J, Gao P, et al. Fast-track surgery versus traditional perioperative care in laparoscopic colorectal cancer surgery: a meta-analysis. *BMC Cancer*. 2014;14(1):607. doi:10.1186/1471-2407-14-607
43. Lv L, Shao Y, Zhou Y. The enhanced recovery after surgery (ERAS) pathway for patients undergoing colorectal surgery: an update of meta-analysis of randomized controlled trials. *Int J Colorectal Dis*. 2012;27(12):1549-1554. doi:10.1007/s00384-012-157

Archives of Surgical Research | Original Research Communication

Anatomic Variability And Distribution Of Facial Nerve Posing Surgical Challenge In Parotidectomy: Lesson Learnt From 106 Cases

Asif Maqbool, Hira Ashraf, Talat Waseem

IMPORTANCE Functional and anatomic preservation of facial nerve and its terminal branches is a major challenge faced by surgeons during parotid gland surgery. Extra-temporal segment of facial nerve can be injured due to trauma, laceration or iatrogenic causes. Surgical procedures of parotid gland, submandibular gland, temporomandibular joint and face lift are commonly associated with complication of facial nerve palsy. Since iatrogenic injury is quite common, knowledge about relation of facial nerve with parotid gland and facial muscles is essential for competent surgical approach. The rationale for conducting this retrospective study was to identify variations in the course of facial nerve which may lead to better understanding of the surgeon while dissecting it.

PATIENTS AND METHODS We have analyzed records of 106 patients undergoing parotid surgery. In this retrospective study special attention is paid to operative trunk distance, type of peripheral branching pattern and interconnections of facial nerve branches.

RESULTS Greatest variation is observed in upper division of the five-level branching pattern. The frequency of peripheral pattern of facial nerve was type I (31.1%), type II (17.9%), type III (21.6%), type IV (24.52%), type V (2.8%), and type VI (1.88%). This study shows that type I is the most common branching pattern, followed by type IV, type III and type II, respectively. Marginal mandibular branch was found below the mandibular border on live cervicofacial dissections in half of the included cases.

CONCLUSIONS The conclusions are confirmative that extra-temporal course of facial nerve is extremely variable. Distinct knowledge of anatomic variation and distribution of facial nerve is essential for surgeons to enable safe dissection particularly during parotid surgery.

KEYWORDS Facial nerve, Parotidectomy, Variations, Anatomy of Parotid Region

HOW TO CITE Maqbool et al. Anatomic Variability and Distribution of Facial Nerve Posing Surgical Challenge in Parotidectomy: Lesson Learnt from 106 Cases. *Archives of Surgical Research*. 2021, 2 (3):24-28. https://doi.org/10.48111/2021.04.05.

Original Research

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author:
Hafiz Muhammad Asif Maqbool
MBBS, FCPS
Department of Surgery, King Edward Medical University, Lahore, Pakistan

https://doi.org/10.48111/2021.04.05

Neoplastic lesions of parotid gland commonly require parotidectomy. Functional and anatomic preservation of facial nerve and its terminal branches is a major challenge faced by surgeons during parotidectomy [1]. Extra temporal segment of the facial nerve can be injured due to trauma, laceration or iatrogenic causes. Surgical procedures of parotid gland, submandibular gland, temporomandibular joint and face lift are commonly associated with complication of facial nerve palsy. Post-operative facial nerve deformity can cause legal issues for surgeons [2]. Hence, knowledge about distribution and anastomosis of facial nerve branches is crucial for surgeons.

Since terminal branches of facial nerve are closely related to parotid gland, preservation and protection of these branches is vital for successful parotidectomy. Terminal branches of facial nerve can be injured during parotidectomy, especially in deep lobe dissection [3]. Two commonly employed techniques used for preservation of the extratemporal part of the nerve are antegrade and retrograde approach. However, antegrade approach is the standard procedure [1]. It is used by trainees to avoid the commonest complication of parotidectomy. It involves use of tympanomastoid suture, tragal pointer or digastric muscles' posterior belly as landmarks for identification of facial nerve trunk [4]. Yet, the localization becomes a difficult task in obese patients. Since the advent of peri-operative nerve monitoring, preference of antegrade approach has increased among surgeons [5]. While, retrograde approach requires soft tissue landmarks. Facial nerve stimulator aids in identifying these landmarks [6].

Extracranial portion of facial nerve exits stylomastoid foramen and supplies stylohyoid, posterior belly of digastric and auricular muscles. Facial nerve runs ventrally lying 5cm deep to the skin, splitting in upper (temporofacial) and lower (cervicofacial) divisions at posterior edge of parotid gland [7]. It divides parotid gland in superficial and deep lobes. Several branches arise from these divisions and exit the gland in a plexiform fashion forming pes anserinus. Pes anserinus supplies the superficial muscles of head, face and

upper neck. Branching of these divisions have several variations [8]. However, temporofacial division usually gives off temporal, zygomatic and buccal branches, while, cervicofacial division gives off marginal mandibular and cervical branches [7]. Since iatrogenic injury is quite common, knowledge about relation of facial nerve with parotid gland and facial muscles is of key importance.

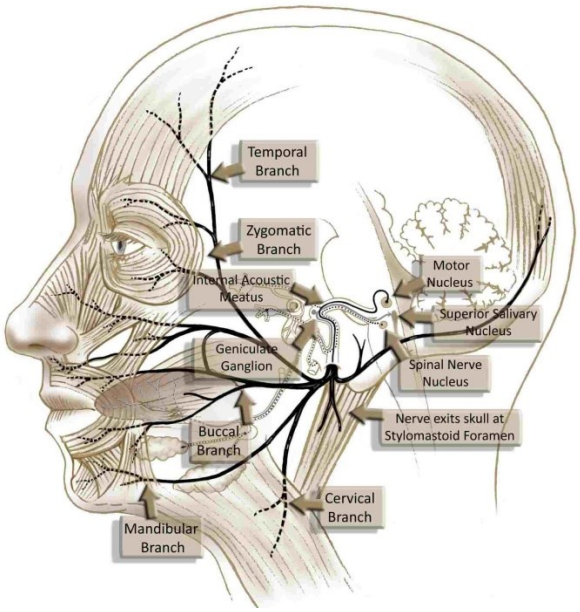


Figure 1: Facial nerve and its extra-temporal branches

Incidence of facial nerve injury during parotidectomy and rhytidectomy can be reduced by using anatomical landmarks. Facial nerve trunk passes superficial to retromandibular vein to enter substance of the gland and gives temporofacial and cervicofacial divisions [9]. Hence, retromandibular vein can be used for localization of facial nerve. Pre-operative localization of parotid gland tumors can reduce surgical complications. Retromandibular vein can be used as landmark in MRI, CT and sonography to localize the parotid tumors [10]. Course of retromandibular vein can be traced to localize the nerve trunk. Retromandibular vein and superficial temporal vein serve as landmarks in superficial parotidectomy and mandibular condyle fracture reduction. While, mastoid process, tragus, tympano-mastoid suture line and digastric muscles' posterior belly serve as important landmarks in intra-parotid facial nerve localization [10,11].

Injury to anastomosing terminal branches is less likely to cause permanent paralysis [12]. However, temporo-facial and mandibular branch of facial nerve rarely anastomose and are related to lesser subcutaneous tissue making these prone to injury in temporal flap and face lift procedures [2]. Thorough knowledge, good exposure, and reliability of surgical dissection can reduce the incidence of facial nerve injury. The rationale for conducting this retrospective study was to identify variations in the course of facial nerve which may lead to better understanding of the surgeon while dissecting it.

PATIENTS AND METHODS

Records of 106 patients undergoing parotidectomy are analyzed in this retrospective study. Special attention is paid to operative trunk distance, type of peripheral branching and interconnections. In all 106 cases antegrade approach is used. Antegrade approach is employed in all cases to identify facial nerve trunk using landmarks and then follow its course to identify the peripheral branching pattern. In addition, antegrade approach is also used in revision parotidectomy, limited superficial parotidectomy, traumatic nerve injury and obese patient. Parotidectomy of either side of the face is included. Both male and female patients are included in this study. All cases had regular follow-up for reporting post-operative facial nerve weakness.

RESULTS

A total of 106 cases of parotidectomy are included in this article. All cases had antegrade parotidectomy. In this study parotidectomy of either side of face is included. Difference in branching pattern is not seen to have any association with gender. Post-operative facial nerve weakness at one week and at 6 months is not reported in any of the case. Branching pattern categorized by Davis et al is used to classify the variations observed in all 106 cases [8]. Davis et al categorized patterns of facial nerve branching based on anastomosis amongst branches of each division and amongst divisions [8].

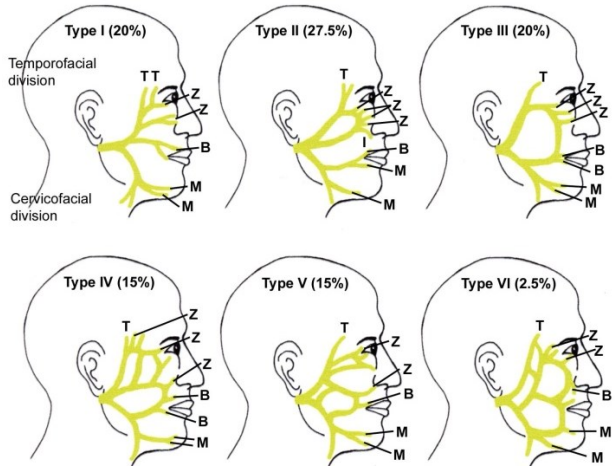


Figure 2: Various Branching Patterns previously classified by Davis et al[8] (Courtesy: Davis et al)

Type of branching	Anastomosis	Anastomosing branches
I	Absent	No anastomosis among temporo-facial and cervicofacial branches
II	Present	Among branches of temporo-facial division
III	Present (Single anastomosis)	Among branches of temporo-facial and cervicofacial division
IV	Present	It is a combination of type II and III
V	Present (Double anastomosis)	Among temporo-facial and cervicofacial division
IV	Present (Multiple anastomosis)	Among the two divisions. Buccal branch receives fibers from both, cervicofacial division and mandibular branch.

Table 1: Basic facial nerve branching pattern according to Davis et al[8] is given in Table 1 (Courtesy: Davis et al).

Antegrade approach is used in all cases owing to proficiency, decreased incidence of nerve morbidity, and technical ease. Nerve stimulator is not used intra-operatively in any of the case. Greatest variation is observed in upper division of the five-level branching pattern. Marginal mandibular branch was found below the mandibular border on live cervicofacial dissections in half of the included cases.

The frequency of peripheral pattern of facial nerve was type I (31.1%), type IV (24.52%), type III (21.6%), type II (17.9%), type V (2.8%), and type VI (1.88%). In every distinctive type subsequent subtype is also included.

Our study shows that type I is the most common branching pattern, followed by type IV, type III and type II, respectively. The least common branching types encountered are type V and type VI.

Branching type	Number of patients	Percentage
I	33	31.1 %
II	19	17.9 %
III	23	21.6 %
IV	26	24.52 %
V	3	2.8 %
VI	2	1.88 %

Table 2: Basic facial nerve branching patterns observed in this study.

Figure 3: Various representative Facial Nerve Variations observed during the study

Findings of our study are in contrast to the percentage reported by Davis et al [8]. Percentages reported by Davis et al[8] in their study are type III 28%, type IV 24%, type II 20%, type I 18%, type V 9%, and type VI 6%. Henceforth, the most common pattern reported by them was type III, followed by type IV, type II and type I. However, the least reported types by them were also type V and type VI.

In our study, marginal mandibular branch was found below mandibular border in half of the cases (53 cases). Several studies have shown that majority cases have this branch above the mandibular border [13–17]. However, our data implies that injury to this branch can be avoided by making incision below the mandibular border.

DISCUSSION

Facial nerve injury is a significant cause of morbidity associated with parotidectomy. Conventional approach used by majority surgeons for resection of parotid tumors is antegrade technique. Using this technique meticulous resection of the tumor is performed following identification of facial nerve trunk.

Parotidectomy is challenged by variation in peripheral branching pattern and distribution of facial nerve. Functional and anatomical knowledge about the peripheral branching pattern and distribution is hence vital for the operating surgeon. Peripheral branches are superficial and correlation between them and surgical interventions of this area require thorough description. A successful parotidectomy requires not only the removal of pathological tissue but also the functional and anatomical preservation of facial nerve. Surgical landmarks help in accurate localization of facial nerve trunk and peripheral branches, thereby reducing the incidence of nerve morbidity.

We studied the different presentations of facial nerve in order to protect and isolate the branches during parotidectomy. We employed antegrade approach in all cases owing to reduced incidence of nerve morbidity, proficiency and technical ease. However, some studies have shown no difference in incidence of nerve morbidity between antegrade and retrograde approach [18]. Nerve monitoring devices are not used in this study. Nerve monitoring has increased interest in retrograde approach and is also essential for this approach due to technical difficulties in localization and identification of peripheral branches [18–20]

Conventionally, complete superficial parotidectomy is performed for benign lesions. However, alternate techniques such as extracapsular dissection, limited superficial parotidectomy and selective deep lobe parotidectomy are encouraged in order to minimize iatrogenic facial nerve damage [1]. Antegrade approach is the standard technique practiced during training owing to reliable localization of the nerve using anatomical landmarks. However, the operative time is more than retrograde approach due to extensive resection. In United Kingdom 87% of the OMF and ENT surgeons use antegrade approach, while, 4% use retrograde approach [20]. Even though, antegrade approach is the standard approach, interest in retrograde technique is renewed due to its conservative approach and introduction of nerve monitoring devices [1].

In conclusion, the extra-temporal course of facial nerve is extremely variable. Knowledge about anatomic variation and distribution of the facial nerve is crucial for surgeons to avoid facial nerve injuries.

ARTICLE INFORMATION Accepted for Publication: August 18, 2021 Published Online: December 29, 2021.
https://doi.org/10.48111/2021.04.05

Author Affiliations: Department of Surgery, Mayo Hospital and Shalamar Medical & Dental College, Lahore, Pakistan

Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest.

REFERENCES

1. WL Adeyemo, OA Taiwo, OA Somefun, et al. A survey of facial nerve dissection techniques in benign parotid surgery among maxillofacial and ear, nose, and throat surgeons in Nigeria. *Nigerian journal of clinical practice*. 2011;14(1):83-86. doi:10.4103/1119-3077.79272
2. Myint K, Azian A, Khairul F. The clinical significance of the branching pattern of the facial nerve in Malaysian subjects. undefined. *Published online 1992*.
3. Cem K, Suat T, Selami Y, et al. Distribution of facial nerve in parotid gland: analysis of 50 cases. *Okajimas folia anatomica Japonica*. 1994;70(6):295-299. doi:10.2535/OFAJ1936.70.6_295
4. Neil B, Marc E R, Laverne D G. An objective assessment of the advantages of retrograde parotidectomy. Otolaryngology--head and neck surgery *: official journal of American Academy of Otolaryngology-Head and Neck Surgery*. 2004;131(4):392-396. doi:10.1016/J.OTOHNS.2004.03.012
5. SG Harner, JR Daube, CW Beatty, et al. Intraoperative monitoring of the facial nerve. *The Laryngoscope*. 1988;98(2):209-212. doi:10.1288/00005537-198802000-00018
6. DZ Wang, SJ Liu, RB Donoff, et al. A modified centripetal approach to parotidectomy. *Journal of oral and maxillofacial surgery : official journal of the American Association of Oral and Maxillofacial Surgeons*. 1985;43(1):14-19. doi:10.1016/S0278-2391(85)80007-0
7. De Castro Rodrigues A, Carlos Andreo J, de Freitas Menezes L, Pimentel Chinellato T, Marco Rosa Júnior RODRIGUES G. Anatomy of the Facial Nerve and its Implication in the Surgical Procedures Anatomía del Nervio Facial y sus Implicancias en los Procedimientos Quirúrgicos. *Int J Morphol*. 2009;27(1):183-186.

8. DAVIS RA, ANSON BJ, BUDINGER JM, KURTH LR. Surgical anatomy of the facial nerve and parotid gland based upon a study of 350 cervicofacial halves. *Surgery, gynecology & obstetrics*. 1956;102(4):385-412.
9. ASTIK RB, DAVE UH, GAJENDRA KS. Variant position of the facial nerve in parotid gland. *International Journal of Anatomical Variations*. 2011;4(1). Accessed July 28, 2021. https://www.pulsus.com/scholarly-articles/variant-position-of-the-facial-nerve-in-parotid-gland.html
10. M Piagkou, M Tzika, G Paraskevas, et al. Anatomic variability in the relation between the retromandibular vein and the facial nerve: a case report, literature review and classification. *Folia morphologica*. 2013;72(4):371-375. doi:10.5603/FM.2013.0062
11. Mehmet A B, Baran A, Emre G, et al. Anomalous relationship of the retromandibular vein to the facial nerve as a potential risk factor for facial nerve injury during parotidectomy. *The Journal of Craniofacial Surgery*. 2010;21(3):801-802. doi:10.1097/SCS.0B013E3181D84027
12. IY Park, ME Lee.. A morphological study of the parotid gland and the peripheral branches of the facial nerve in Koreans. *Yonsei medical journal*. 1977;18(1):45-51. doi:10.3349/YMJ.1977.18.1.45
13. Weerapant E, Bunaprasert T, Chokrungvaranont P, Chentanez V. Anatomy of the facial nerve branching patterns, the marginal mandibular branch and its extraparotid ramification in relation to the lateral palpebral line. *Published online 2010*. Accessed July 28, 2021. http://imsear.searo.who.int/handle/123456789/135111
14. RO Dingman, WC Grabb. Surgical anatomy of the mandibular ramus of the facial nerve based on the dissection of 100 facial halves. *Plastic and reconstructive surgery and the transplantation bulletin*. 1962;29(3):266-272. doi:10.1097/00006534-196203000-00005
15. TM Wang, CL Lin, KJ Kuo, et al. Surgical anatomy of the mandibular ramus of the facial nerve in Chinese adults. *Acta anatomica*. 1991;142(2):126-131. doi:10.1159/000147176
16. Marcus W, Ricardo de F, Emerson A S. Anatomosurgical study of the marginal mandibular branch of the facial nerve for submandibular surgical approach. *Brazilian dental journal*. 2006;17(1):71-74. doi:10.1590/S0103-64402006000100016
17. Canan S, Hulya U, Mustafa O, et al. Anatomic landmarks of the buccal branches of the facial nerve. *Surgical and radiologic anatomy* : *SRA*. 2006;28(5):462-467. doi:10.1007/S00276-006-0127-7
18. Neil B, Marc E R, Laverne D G. An objective assessment of the advantages of retrograde parotidectomy. Otolaryngology--head and neck surgery : *official journal of American Academy of Otolaryngology-Head and Neck Surgery*. 2004;131(4):392-396. doi:10.1016/J.OTOHNS.2004.03.012
19. Barry O, Girish B, Satwant B, et al. Facial nerve morbidity after retrograde nerve dissection in parotid surgery for benign disease: a 10-year prospective observational study of 136 cases. *The British journal of oral & maxillofacial surgery*. 2007;45(2):101-107. doi:10.1016/J.BJOMS.2006.03.009
20. Barry O, Girish B, Andrew E. Techniques for dissection of the facial nerve in benign parotid surgery: a cross specialty survey of oral and maxillofacial and ear nose and throat surgeons in the UK. *The British journal of oral & maxillofacial surgery*. 2008;46(7):564-566. doi:10.1016/J.BJOMS.2008.01.008

Archives of Surgical Research | Invited Commentary

How To Promote Transplantation In Pakistan And Establish Quality Centers

Muhammad Irfan Saeed

IMPORTANCE Chronic kidney disease is a rapidly growing health care concern in Pakistan with limited capacity to be addressed due to poorly organized medical services. According to United Nations Population and World Bank, the Pakistan population is more than 220 million. Transplant program development will require extensive commitment and sacrifice. The biggest challenge will be to start performing deceased donor transplants and standardizing the existing living donor transplantation programs to improve outcomes. It is a daunting task but can be achieved with proper leadership and responsibility. There will be hurdles, setbacks, and delays, but these can be overcome with perseverance, focus and hard work. Those who have been granted the opportunity to train at the highest levels abroad can participate and provide support in this noble cause.

KEYWORDS Transplant Centers; Quality Assurance; Transplant Centers; Logistics; Quality Protocols

HOW TO CITE Saeed MI. How To Promote Transplantation In Pakistan And Establish Quality Centers. *Archives of Surgical Research*. 2021, 2 (4):29-34. https://doi.org/10.48111/2021.04.06

Invited Commentary

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author:
Muhammad Irfan Saeed MD, FACS, General Surgery, Transplant Surgery Augusta University Medical center.
irfan_saeed_md@yahoo.com
+15737143235
https://doi.org/10.48111/2021.04.06

Chronic kidney disease is a rapidly growing health care concern in Pakistan with limited capacity to be addressed due to poorly organized medical services. According to United Nations Population and World Bank, the Pakistan population is more than 220 million[1,2]. The top three reasons for chronic kidney disease in Pakistan are diabetes mellitus, hypertension, and glomerulonephritis[3,4]. Patient diagnosed with chronic renal failure is increasing with an estimated annual incidence of > 100 cases of end stage renal disease (ESRD) per million population[5]. The average age of patients diagnosed ESRD are in their 40s[6]. Due to lack of national policies and systematic databases, most information comes from individual centers. Experts in the health care industry believe that the prevalence of chronic kidney disease and end stage renal disease is much higher than the available statistics[5].

A potential cause for the increasing incidence of ERSD is because chronic medical conditions are often not diagnosed in a timely manner or optimally managed. This leads to the need for ESRD treatment with dialysis much earlier compared to countries with greater resources[6]. When patients progress to dialysis the patient and family are left with difficult decisions. Most patients who start dialysis die because they stop treatments due to cost within the first three months or lack of available dialysis services close to home. Due to cost and lack of access, many families are told the only treatment choice is kidney transplant.

There is consensus the government and private sector need to work together to develop preventive programs for chronic diseases such as diabetes mellitus and hypertension and increase public awareness[6]. Another urgent question is how to help patients who have already developed end stage renal disease and are left to decide between dialysis versus transplantation. Kidney transplant is proven to improve quality and longevity of life compared to dialysis. However, most of this data comes from developed societies such as United States, Europe, and Japan[7].

The world is becoming a global village, and medical tourism has increased in the past several decades. Historically, wealthy people from Pakistan have travelled to England and United States for medical needs. This practice led to fundamental problems in our health system, as the privileged class were able to access care elsewhere and efforts were not implemented to develop the hospitals and institutions in Pakistan. In recent years, desperate families outside the privileged class have travelled to other countries and fallen victim to opportunist organizations with false advertising. By 2030, the number of patients receiving dialysis around the world is projected to increase to 5.4 million and most of this increase will be in the developing countries of Asia and Africa[8].

The Sindh Institute of Urology and Transplantation (SIUT) in Pakistan has been making efforts to overcome health disparities. They have done a phenomenal job in providing

complex care to people irrespective of their religious beliefs, ethnicity, and socio-economic status. However, access remains limited[9]. SIUT performs more than 1100 dialysis sessions per day and has performed more than 6000 transplants since 1980's, but alone they cannot keep up with need in Pakistan[9]. Other hospitals have started transplant programs in different parts of country due to increasing incidence of end stage renal disease. It has become evident with every passing day that an organized, sustainable, and financially sound transplant-specific hospital system is needed to provide the highest level of care to this underserved population in Pakistan.

There are certain questions that need to be answered before we take on this highly complex issue. We will also need to work on different issues simultaneously to achieve the target faster as we are trying to catch up right now.

SECTION I:

We will initially focus on how to promote transplantation followed by team building and how lessons learned during COVID-19 can help achieve those goals.

1. Ethics
2. Religious beliefs
3. Community beliefs
4. Pharmaceutical Support
5. Transplant Team
6. Regulatory compliance
7. Government Support
8. Access to transplant
9. Role of telemedicine
10. Importance of post-transplant care

Ethical Concerns: Transplant ethics deals with issues related both to the transplantation process and organ allocation. Access to transplant specifically for under privileged population and fair allocation of deceased donor organs are of utmost importance. The declaration of Istanbul strongly condemns organ trafficking, transplant tourism, and commercialism[10]. Pakistan passed a law "Transplantation of Human Organs and Tissue Ordinance 2007" to curb illegal transplant activity[11,12]. Also, there are separate issues related to living and deceased organ donation.

In living donation, the first rule is to protect the donor at all costs. There should be no coercion in living donation, unfortunately, family members are often pressured to donate in Pakistan. Living donation should also be based on compassion without financial gains. Paid donation and organ trading has scarred the field of transplantation especially in Indian sub-continent and middle east. The transplant center and physician have the utmost responsibility to protect living donors from family retribution if they elect not to donate. Living donor well-being is also extremely important, and donors should be able to resume their normal life, including work and other responsibilities, after donation. Special caution should be considered when assessing younger donors, specifically women. Every effort should be made to assess the donor's risk to develop potential complications in the future. If the work up reveals any potential risk, that risk should be clearly communicated to the donor first and then the rest of the family and recipient at the discretion of the donor. Donors should be highly encouraged to follow up with his or her chronic health care maintenance and practice preventive health measures to avoid the need for dialysis themselves in the future

Although deceased donation is non-existent in Pakistan, it could offer a lifesaving option for recipients who have no living donor available and to meet the anticipated increased demand for transplant in the future. However, it does raise its own ethical questions for both the donor and allocation to recipients.

Donor issues include controversies such as the definition of brain versus cardiac death, responsibility for the costs of laboratory and imaging tests, and how to obtain consent and an adequate past medical history from the family prior to donation. The family should always maintain the right to withdraw consent without any explanation. A systematic system must be in place for persons to register as an organ donor so their wishes can be known and respected after death. Dr. Schroff in his editorial comment talked about the challenges in setting up a deceased organ donation in South Asia and projected demand[13].

Organ allocation of deceased donor organs should be equitable, regardless of social, religious, or economic status. This process will only be successful if everyone believes it is fair and all recipients are treated equally. The development of governing bodies independent of government influence will be highly recommended to provide oversight of transplant programs.

Religious Beliefs: Religious beliefs are of the utmost importance and should be very carefully considered in Pakistan. Incorporating religious beliefs when providing transplantation support and promoting organ donation is crucial. There are numerous Islamic teachings discussing the rewards for saving humanity, yet cultural barriers often prohibit donation. In general, the Muslim community is viewed as being opposed to organ donation. However, it is the opinion of the author that this view is related to inadequate education and access to transplant to members of this religious group. Consistency among different sects in the Islamic world on this topic would be beneficial for promoting organ donation. Scholars from different sects should be invited to comment and open discussions should be encouraged to create harmony in the public opinion.

In addition to patient education, the views of different faiths should be incorporated into the donation process. Respect of the human body after death is practiced in all religions but minimizing trauma to the human body and early burial are particularly emphasized in the Islamic faith. The deceased donation process should guarantee adherence to these practices. Deceased donation from female donors can or will be a challenge in the beginning but with good practices in place and a dedicated team all those hurdles can be overcome. People from all faiths should be treated at the same level and their rights should be protected at all costs. There should be no discrimination based on religion in organ donation.

Community beliefs: The local community structures and cultural practices in Pakistan can be vastly different among provinces. Local traditions can be as influential as religious beliefs. Community leaders and other stake holders need to be educated regarding organ transplantation to promote organ donation in their respective areas. Community campaigns led by local community leaders and health care workers can address misbeliefs and fears related to transplant.

Pharmaceutical Support: Successful organ transplant requires lifelong immunosuppression, thus pharmaceutical support and access to medications is of the utmost importance. As evident from literature, one of the most common causes for graft failure is non-compliance with medications secondary to financial reasons. Coverage of end stage renal disease and post-transplant care under the health insurance system in Pakistan needs to be addressed. Patients are mostly responsible to pay for all costs out of pocket, which is not feasible for most patients. It is important to assure availability of induction and maintenance of immunosuppression at an affordable price. Support from government subsidies and pharmaceutical companies will be needed initially until a sustainable process is designed and implemented. SIUT is an example of an institution that has done an extraordinary job of providing immunosuppression free of cost in a sustainable manner based on philanthropic donations[14,15]. However, higher volumes in the future may require other funding sources. Another consideration is ensuring medications are obtained from reliable sources due to historical issues with counterfeit medications in Pakistan. The new Health card being introduced by the government should cover the cost of immunosuppressants. If charity funding is available, it can be utilized to help cover medication costs.

Transplant team: The transplant team is a multi-disciplinary team working together to optimize care over the course of time. Performing the transplant surgery is not solely the goal but rather maintaining the function of the graft over a long period of time is the marker of success. A successful kidney transplant team should include, but is not limited to these individuals:

- Surgeon
- Nephrologist
- Physician extenders, such as nurse practitioner or physician assistant
- ICU support staff
- Dialysis support staff
- Pharmacist
- Histocompatibility lab
- Radiologist
- Interventional radiologist
- Pathologist
- Transplant coordinators
- Social worker
- Nursing staff
- Dietitian
- Quality assurance staff
- Organ recovery team / donor management team

The transplant journey includes pre-transplant preparation, organ recovery, transplant surgery, post-operative care and long term follow up. Different organs such as kidney, liver, heart, and lung may have nuanced processes, but generally follow the same principles. Everyone on the team has a specific role, and they all come together to complete the picture. Team development will be discussed in the next section.

Regulatory Compliance: Regulatory compliance is vital to maintaining quality programs. Every effort should be made to standardize the process across the nation with some center-specific preferences allowed. A centralized regulatory body should be completely out of government influence and its board of directors should be held to the highest moral standards. Transplant programs should be audited on a scheduled basis and make every effort to stay in compliance. Centers should be given the opportunity to correct deficiencies that are identified, but persistent non-compliance should lead to prohibition of the program.

The regulatory body should also establish connections with the international transplant community with an intent to adapt practices in line with international standards.

Government Support: Robust legislation at national and provincial levels is required to setup a national transplantation program. Rizvi et al. published articles regarding successful government public sector cooperation and advancing transplantation[14,15]. Policy making at a national level with laws to protect living donors, recipients and transplant healthcare providers are necessary. In addition to living transplant, government support will be required to pave the path for deceased donation. A national database with help of NADRA (National Database and Registration Authority) like UNOS (United Network for Organ Sharing) in US can be introduced. Preventive measures implemented by the government to minimize the burden of chronic diseases on society will also help

facilitate transplantation, as there will be less mismatch in supply and demand. Collaboration with the World Health Organization (WHO) can help establish short- and long-term plans for chronic conditions. Additionally, American Society of Transplantation, American Society of Transplant Surgeons (ASTS), European and other societies have programs to facilitate and promote transplantation in underdeveloped countries.

Standardized data collection is another area requiring governmental assistance to establish quality programs. Accurate data collection, analysis and policy making based on this data are foundational steps regarding any project's success.

Pakistan spends less than one percent of its growth domestic product (GDP) on the health sector. A growing population and an increasing incidence of chronic diseases such as diabetes mellitus, hypertension, ischemic heart disease, chronic kidney disease and obesity will be a great challenge in the coming decades. Our health system is not equipped to take care of these patients and the government should encourage the private sector to invest in the health industry with appropriate laws and oversight.

Access to Transplantation: Access to transplantation is a large obstacle in developing countries. Researchers in Unites States have developed an Access to Transplantation Score which assesses health care disparities and chances to get a kidney transplant[16]. Factors that play a significant role in access to transplantation are individual and community related. Individual factors will include blood type, disease diagnosis, age of the patient, gender (women have already decreased access to health care), patient education status, and socio-economic status. Community factors include, but are not limited to, public sector education, health care professional education, internet access and transportation. Tools must be developed to reach those with decreased access to transplant. Web portals may facilitate access to materials related to transplantation to improve understanding for the general population. In the past, philanthropic efforts have proven to be successful in providing these types of services. Community awareness programs like public seminars, health care professionals' workshops, community awareness walks, free camps and social media advertisements could be introduced.

Role of Telemedicine: One of the major changes in healthcare during the COVID-19 pandemic is role of telemedicine. Many new telemedicine systems have been developed in a very short period, which has significantly opened new horizons in patient care and how patients with chronic diseases are managed. Internet access and band width can be limiting factors in certain settings. Underdeveloped countries can pursue strategies to implement telemedicine and help their population achieve better health and address health care disparities. Government and private sectors should collaborate to achieve this goal. Telemedicine can be used to perform pre-transplant evaluations and provide long term care when the patient is stable. This concept can be heavily utilized in management of other chronic disease states as well, such as diabetes mellitus, hypertension, chronic kidney disease and obesity.

Telemedicine platforms can also be used for patient education, health care professional training and conference attendance at regional, national, and international levels. This can allow collaboration among transplant professionals on difficult case managements.

Post-Transplant Care: Post-transplant care is one of the most important pillars to avoid complications and increase the longevity of the graft. Lifelong follow up should be provided to transplant patients[17]. Surgical success is meaningless if the patient is not compliant with post-transplant follow up. A well-trained transplant nephrologist needs to take the responsibility of long term follow up after a successful surgery. Due to the shortage of a reliable primary care system, the management of diabetes mellitus, hypertension, and hyperlipidemia will likely be the responsibility of the transplant team. Collaboration with specialized consultants can be obtained based on the complexity of issues.

Non-compliance with medications secondary to socio-economic reasons is a tragedy and should be avoided at every cost. Patients should be thoroughly educated regarding medication compliance with both transplant medications and other chronic disease state medications, as those disease processes will affect the new kidney if not properly controlled. If a patient has remained stable for a long period a decision regarding referral back to local nephrologist is purely on the managing team.

Early intervention to detect and prevent rejection helps improve long term graft survival. Acute rejection in the first year after transplant has a direct correlation with graft longevity, and late rejections are often difficult to treat. A high index of suspicion and development of a center-specific case discussion session can be helpful to identify and manage those issues.

The role of the multi-disciplinary team in pre- and long-term care cannot be over emphasized. Multiple providers discussing solutions to complex issues after initial work up can save valuable time and resources.

SECTION II

We will discuss the logistics of developing a transplant team and program.

Development of a transplant team and program is a time consuming and methodical process requiring patience, persistence, talent recruitment and financial resources. There have been success stories of transplant programs being established with limited resources in the Indian sub-continent. Every single person on the list mentioned are required to manage different aspects of the transplant course. Transplant team expertise depends on organ type, for example liver transplant team will require different expertise than a kidney transplant team. For example, a dedicated anesthesia team is necessary for liver transplant programs.

Competent surgeons, operating room technicians and nursing staff are extremely important for the transplant procedure. A surgeon's training, skill and experience are valuable assets. Minimizing re-operation and surgical complications play a significant role in this immunocompromised patient population. Close follow up in the early post-operative period by the surgical team is also beneficial. There are surgeons of Pakistani descent who have been trained in world's best institutions in the United States and England who can be approached and incentivized to establish transplant programs in Pakistan. To develop a sustainable work force, international-level fellowship training institutions must be developed in Pakistan. ASTS has developed a robust fellowship training program in the United States and aids international partners in other countries. Such collaboration can open elective opportunities or additional training options abroad with the intent to return to Pakistan for service. Aligning training standards, educational materials and curriculum will provide easier systems integration, which is important for a long-term partnership. Teleconferencing can provide options for training, collaboration, and attendance of conferences, particularly during the COVID-19 pandemic and with financial constraints. A market analysis for work force supply and demand should be carefully considered because an inability to find a desirable job will lead to demotivation and lack of interest for future candidates.

The same concepts apply to other members of the transplant team where advanced training is available, such as nephrologist, pathologist, histocompatibility laboratory staff, pharmacist, etc. A transplant nephrologist with dedicated fellowship in transplant or having good transplant exposure in nephrology fellowship is a key team member to help improve pre- and post-transplant outcomes. There are no dedicated transplant fellowships for intensive care, radiology, or interventional radiology, but some physicians have developed advanced skills in taking care of these complex patients. There are dedicated fellowship training programs for transplant pathologists. Other physicians who also play a significant role in program development are cardiologist and pulmonologist with special interest in end stage renal disease patients to provide a thorough cardiac/pulmonary assessment with a low threshold for invasive intervention. Transplant infectious disease consultant is a luxury to have. Transplant pharmacists are a quintessential team member, and no transplant is complete without one. After completion of pharmacy training, additional training is encouraged to work as an independent full-time transplant pharmacist.

Transplant nurse coordinators have multiple roles, which include but not limited to pre-transplant work up completion, ensuring regulatory compliance, and post-transplant patient care. Development of dedicated hospital floor nurses is ideal to take care of transplant recipients post-operatively, given the unique needs of these patients. Special dedication and motivation are required to go through the learning process for these providers.

Social workers are essential to assess patients' home conditions, social support, transportation options, coping skills, ability to manage transplant regimens, and advocating for the support they might, among other factors. They can help with patients struggling to afford their medications or dealing with other major life events that could impact compliance.

Dieticians are important to optimize patients' dietary management in the pre- and post-transplant setting. They may assist with plans for obese patients to attain a goal weight or provide support for underweight patients to ensure adequate nutritional intake. Their role may differ depending on the organ, for example assisting with diabetic diet is a common need for kidney transplant recipients whereas addressing malnourishment in cirrhotic patients is more common in liver transplant.

The importance of the histocompatibility lab and its active role in solid organ transplant cannot be over emphasized. It plays a crucial role for pre-transplant for assessment of organ compatibility and final crossmatch before surgery. Special medical situations need particular attention before finalizing the crossmatch before surgery such as lupus, HIV, use of certain immunosuppressive medications, and patients who are highly sensitized. The HLA director and team must be thorough and meticulous. They also play a significant role post-transplant in patient management by analyzing antibody profiles for the presence of HLA and non-HLA antibodies that put the graft at risk. Again, team development will take time and collaboration with other institutions will help in achieving the goal.

Developing an organ recovery team and network is a time-consuming process and will require strategic planning and commitment. Highly specialized teams are mobilized when a deceased donor is identified. This process development can be revisited when deceased organ donation becomes a reality in Pakistan.

In addition to staff development there are certain processes that should be practiced meeting international standards. These processes include, but are not limited to:

1. Multi-disciplinary rounds
2. Multi-disciplinary selection committee
3. Multi-disciplinary living donor selection committee
4. Mortality & Morbidity conference (regarding immediate surgical complications)
5. Focused - Quality Assurance and Performance Improvement (QAPI) meeting
6. Physicians Group meeting

The frequency of these meetings can be determined based on program requirements.

CONCLUSION

Transplant program development will require extensive commitment and sacrifice. The biggest challenge will be to start performing deceased donor transplants and standardizing the existing living donor transplantation programs to improve outcomes. It is a daunting task but can be achieved with proper leadership and responsibility. There will be hurdles, setbacks, and delays, but these can be overcome with perseverance, focus and hard work. Those who have been granted the opportunity to train at the highest levels abroad can participate and provide support in this noble cause. An initial step can be to strengthen existing institutions already in place, to support physicians and leaders who are managing transplant programs with minimal resources. Then expanding the effort in starting new transplant programs throughout Pakistan. This is our human responsibility and debt to our nation.

Acknowledgments: Special thanks to Melissa Laub, Pharm D, Rachel Stephens Pharm D and Muhammad Omar Saleem, MD for editing and proof reading.

ARTICLE INFORMATION Accepted for Publication: November 10, 2021, Published Online: December 00, 2021. https://doi.org/10.48111/2021.04.06

Author Affiliations. General Surgery, Transplant Surgery Augusta University Medical center.

Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest

REFERENCES

1. Population: the numbers | Population Matters. Accessed November 10, 2021. https://populationmatters.org/population-numbers?gclid=Cj0KCQiA-K2MBhC-ARIsAMtLKRuaH0SZHb3PqVoF2aK4lfiJMH4sYRzH5bO8-9wtklX4v3TQqLtglQ4aAkD_EALw_wcB
2. World Bank Open Data | Data. Accessed November 10, 2021. https://data.worldbank.org/
3. Pakistan Renal Data System. Accessed November 10, 2021. https://pkrds.com/faq.php
4. Rizvi SA, Anwar Naqvi SA. Saudi Journal of Kidney Diseases and Transplantation. *Saudi J Kidney Dis Transplant*. 1996;7(4):404. Accessed November 10, 2021. https://www.sjkdt.org/article.asp?issn=1319-2442;year=1996;volume=7;issue=4;spage=404;epage=408;aulast=Rizvi
5. Rizvi SAH, Manzoor K. Saudi Journal of Kidney Diseases and Transplantation. *Saudi J Kidney Dis Transplant*. 2002;13(3):376. Accessed November 10, 2021. https://www.sjkdt.org/article.asp?issn=1319-2442;year=2002;volume=13;issue=3;spage=376;epage=379;aulast=Rizvi
6. Jafar TH. The growing burden of chronic kidney disease in Pakistan. *N Engl J Med*. 2006;354(10):995-997. doi:10.1056/NEJMP058319
7. Home | USRDS. Accessed November 10, 2021. https://www.usrds.org/
8. Garcia-Garcia G, Jha V. CKD in disadvantaged populations. *J Bras Nefrol*. 2015;37(1):14-18. doi:10.5935/0101-2800.20150003
9. Sindh Institute of Urology and Transplantation. Accessed November 10, 2021. https://siut.org/index.php
10. Steering Committee of the Istanbul Summit. Organ trafficking and transplant tourism and commercialism: the Declaration of Istanbul. *Lancet (London, England)*. 2008;372(9632):5-6. doi:10.1016/S0140-6736(08)60967-8
11. H Rizvi SA, Anwar Naqvi SA, Zafar MN, et al. Pakistan Abolishes Kidney Market and Ushers in a New Era of Ethical Transplantation. *Int J Organ Transplant Med*. 2010;1(4):193. Accessed November 10, 2021. /pmc/articles/PMC4089237/
12. Moazam F, Jafarey A. Pakistan's experience with kidney transplantation and trade: a call for international solidarity. *Indian J Med Ethics*. 2014;11(3):156-162. doi:10.20529/IJME.2014.042
13. Shroff S. Challenges in setting up of a deceased donor transplant program in South Asia. *Indian J Transplant*. 2018;12(3):161. doi:10.4103/IJOT.IJOT_34_18
14. Rizvi SAH, Naqvi SAA, Zafar MN, et al. A renal transplantation model for developing countries. *Am J Transplant*. 2011;11(11):2302-2307. doi:10.1111/J.1600-6143.2011.03712.X
15. Rizvi SAH, Naqvi SAA, Zafar MN, Akhtar SF. A kidney transplantation model in a low-resource country: an experience from Pakistan. *Kidney Int Suppl*. 2013;3(2):236. doi:10.1038/KISUP.2013.22
16. Your access to this site has been limited by the site owner. Accessed November 10, 2021. https://unos.org/
17. Rizvi SAH, Naqvi SAA, Zafar MN, et al. Living related renal transplants with lifelong follow-up. A model for the developing world. *Clin Nephrol*. 2010;74 Suppl 1(SUPPL.1). doi:10.5414/CNP74S142

Archives of Surgical Research | Invited Review

Colonic Polyps – What A Surgeon Needs To Know

Iftikhar Ahmed, Faisal Fayyaz, Syed Habib, Manuele Furnari

IMPORTANCE Colorectal polyps are protuberance of the tissue mass into the colonic lumen arising from the colonic mucosal layer. Although mostly benign, some types of colorectal polyps (especially adenoma) are considered to follow a histological pathway called adenoma-carcinoma transition sequence, which leads to the development of colorectal cancer. Up to 80% of colorectal cancers develop from initially benign adenomatous polyps that subsequently undergo such transition. Colonoscopy is considered to be an efficient method of detecting and removing the polyps, thus reducing the incidence of colorectal cancer. Several important characteristics of a polyp can be assessed during endoscopy such as the gross morphology, superficial glandular pattern, vascular pattern and appearance under chromoendoscopy, which help deciding the most suitable type of polypectomy technique and subsequent surveillance examination. This article reviews the histological characteristics and classifications of colorectal polyps, and discuss the traditional and modern endoscopic polypectomy techniques in light of recent scientific data.

KEYWORDS Polyp, Colonoscopy, Polypectomy, Adenoma, Endoscopic mucosal resection

ABBREVIATIONS CRC- colorectal cancer, HP– hyperplastic polyp, Adenoma carcinoma sequence ACS,

HOW TO CITE Ahmed I, Fayyaz F, Furnari M. Colonic Polyps – What a surgeon needs to know. *Archives of Surgical Research*. 2021, 2 (3):36-44. https://doi.org/10.48111/2021.04.07.

Invited Review

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author:
Dr Iftikhar Ahmed MRCPGI MD FRCP, Consultant Gastroenterologist & Associate Professor of Medicine
Sulaiman Al Habib Hospital Takhussusi, Riyadh, KSA
Al-Fasial University Riyadh KSA
University of Southampton, NHS Foundation Trust UK
Iftikhar.ahmed5@nhs.net
00966 546718235
https://doi.org/10.48111/2021.04.07

The word polyp, derived from a Greek word 'polypous' (meaning a morbid lump), describes a clump of tissue arising from the colonic mucosal layer protruding into the lumen of the colon. The incidences of colorectal polyps are on the rise worldwide[1] and where majority of these polyps are benign, only certain types are considered to be the precursor lesion of colorectal cancer (CRC), which is a leading cause of cancer related death in the western countries[2-4]. Although thought to be a rare disease in the Asian regions, rising trend in the incidence of CRC has been observed lately, which may be attributed to rapidly changing socio-economic demographics along with influence of the genetic and biological factors of the Asian population[5,6]. The advances in the endoscopic technology and molecular science have increased our knowledge about the transition of a benign polyp into a malignant one through a histological pathway called adenoma-carcinoma sequence (ACS)[7,8]. ACS is considered to be an integral concept to understand the pathophysiology of colorectal cancer (Figure 1) as up to 80% of colorectal cancer are caused by this transition pathway [9,10]. Majority of individuals with these adenomatous polyps are often asymptomatic hence growing emphasis on the need of screening colonoscopy to detect and remove these polyps to prevent their potential evolution to adenocarcinoma. It is widely accepted that removing adenomas in the early stages will reduces the incidence of colorectal cancer; and for that reason, screening colonoscopy to detect and remove colonic polyp is considered to be the most efficient method of CRC prevention[11,12].

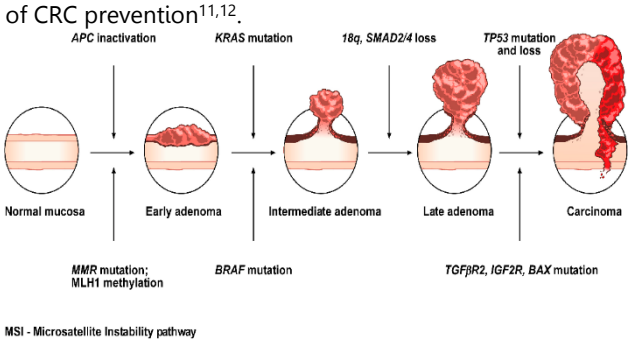


Figure 1: Diagrammatic Illustration of adenoma-carcinoma sequence Adapted from GI Atlas[10]

In the recent decades, the advancements in the endoscopic technologies coupled with growing expertise in the endoscopic skills has expanded the field of endoscopic diagnosis and therapies; subsequently endoscopic polypectomy techniques have also risen to another level. Better characterisation of colorectal polyps with advanced imaging has led to the formulation of robust classifications of colorectal polyps in term of their malignant potential. Additionally, development of new endoscopic therapeutic

tools has extended the possibilities of resecting bigger and complex polyps [13,14].

CLASSIFICATION OF COLONIC POLYPS

Certain characteristics of a polyp (such as mucosal surface and the vascular pattern) play a vital role in deciding the most appropriate polypectomy technique and further surveillance in order to prevent colorectal cancer[15]. Advanced endoscopic technology such as Narrow Band Imaging (NBI), enables to enhance certain distinguishing features of the polyp such as superficial mucosal pattern, colour and microvascular architecture [16]. Based on these particular characterisations, several classification protocols have been developed [17, 18].

According to these parameters, polyps can broadly be classified as benign and malignant polyps. Benign polys can be sub-divided into adenomatous and non-adenomatous polyps, the former with risk of evolution to carcinoma. Malignant polyps with invasion of the submucosal layer require therapies beyond endoscopic resection such as surgery or palliative treatment. Certain small polyp (<5mm-called diminutive polyps) are considered to be of very low risk where a "resect and disregard" approach can be safely adopted to save time and resources [19].

Benign Polyp			Malignant Polyp
Adenomatous	Non-Adenomatous Polyp		
	Mucosal Polyp	Submucosal Polyps	
Tubular adenoma	Hyperplastic polyp (including serrated polyps)	Colitis cystica profunda	Non-invasive carcinoma
Tubulovillous adenoma	Mucosal polyp (normal mucosa in a polypoid configuration)	Pneumatosis cystoids coli	Carcinoma in situ
Villous adenoma	Juvenile polyp (retention polyp)	Lymphoid polyps	Intramucosal carcinoma
	Peutz-Jeghers polyp	Lipoma	Invasive carcinoma (through muscularis mucosae)
	Inflammatory polyp	Carcinoid	Metastatic neoplasms
		Other rare lesions	

Table 1: Polyp Classification

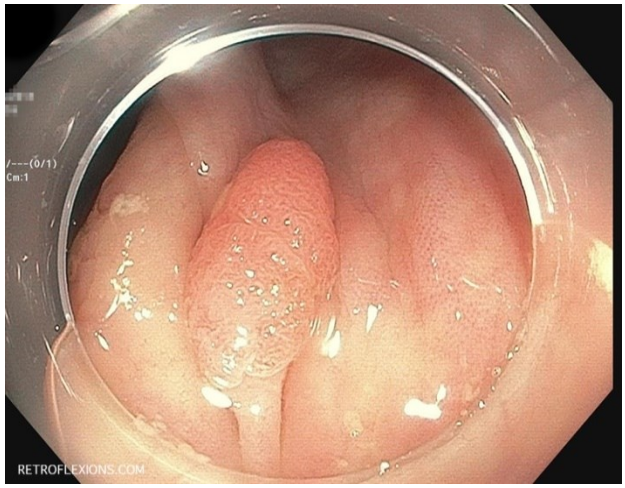
ADENOMATOUS POLYP

Adenomatous polyps are the commonly identified colonic polyps in general population and comprise approximately10-25% of all polyps [20]. Where approximately 90% of these adenomatous polyps are small (usually less than 1 cm in diameter) and carry a little potential for malignancy, the remaining 10% of larger adenomas (1cm or bigger) approach a 10% chance of containing invasive cancer [21]. Adenomatous polyps typically extend into the lumen of the colon and can be divided by histology into three types, namely Tubular Adenoma, Villous Adenoma and Tubulovillous Adenoma. There is a fourth category which is recently recognised as a separate entity called Serrated adenomatous Polyp.

Tubular adenomas: These are the most commonly occurring polyps in the rectal area although can be found anywhere in the colon. Tubular adenoma tends to be larger than the other two types, and are usually nonpedunculated, velvety, or cauliflowerlike in appearance [22].

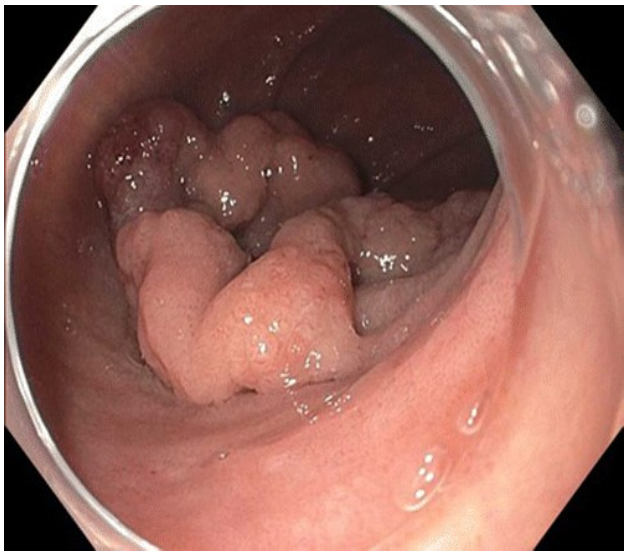
Villous adenomas: are considered to have the highest morbidity and mortality rates of all polyps. These are the villous adenoma which cause hypersecretory syndromes characterized by hypokalaemia and profuse mucousy diarrhoea and discharge and can harbour carcinoma in situ or invasive carcinoma more frequently than other adenomas [23].

A

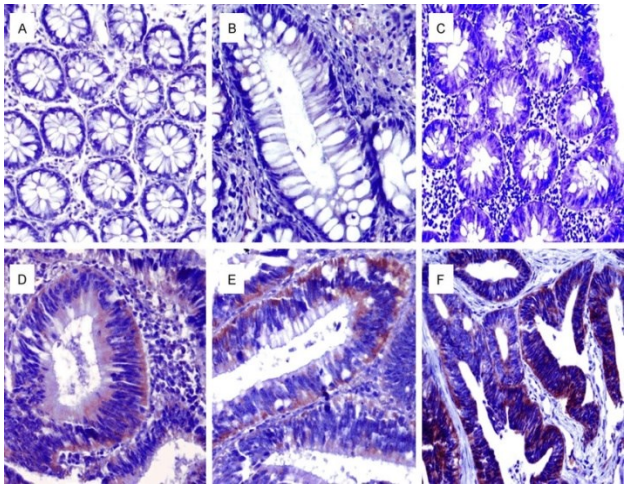


B

C



D



E

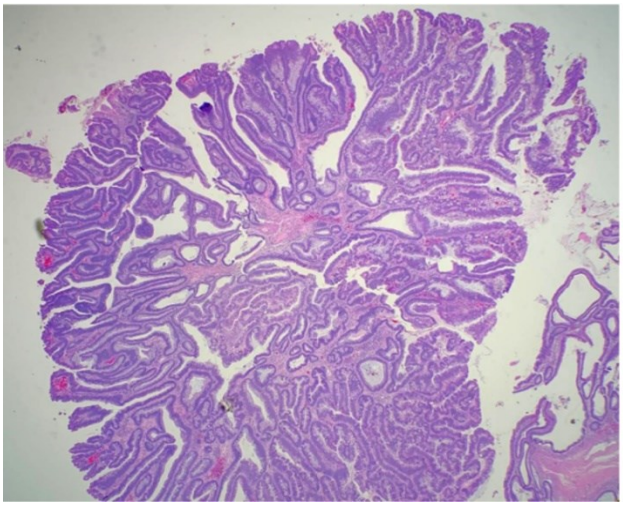


Figure 2: A- tubular adenoma B- Tubulovillous adenoma C-Villous adenoma D- Tubular and Tubulovillous adenoma histology E-Villous adenoma histology. Images adapted from Gastrointestinal Atlas (24)

Tubulovillous adenoma: show a histological pattern of a combination of tubular and villous architecture with villous component usually greater than 25%. The risk of progression to carcinoma is related to both the size and the histology of the adenoma. Adenomas that are greater than 1 cm, contain a substantial (>25%) villous component, or have high-grade dysplasia are commonly referred to as advanced adenoma and carry an increased cancer risks[24, 25].

NON-ADENOMATOUS POLYPS

Hyperplastic Polyps: Among the non-adenomatous benign polyps, hyperplastic polyps (HP) are the most commonly occurring polyps in the colon. These are small (few mm to as large as 5mm) polyps, and are considered to be formed when mature epithelial cell migrating to colonic crypts are failed to detach physiologically and continue to pile up leading to formation of a polyp [26]. Although previously thought to be completely benign, the larger HPs are now considered to have some malignant potential, in particular, larger HPs (>10 mm) were shown to be associated with increased risk of developing into advanced adenoma with some malignant potential [27].

Serrated Polyp: Previously considered to be a type of HPs, serrated polyps are more recently described as sessile serrated adenomas and recognised as a separate entity with a varying degree of malignant potential. These exhibit a mixture of adenomatous and hyperplastic features, with regions of saw-toothed, serrated-surface epithelium. However, in contrast to HPs, these polyps have certain differences, namely prominent nucleoli, goblet cell immaturity, and absence of a thickened basement membrane [28]

Other classifications were based on the visual parameter such as shape or gross structure of the polyp, which are also considered significant especially when it comes to the choice of polypectomy techniques. Those polyps which have a head and a stalk are called pedunculated polyps while the ones without a stalk are called sessile polyps. Based on these structural parameters, a robust and widely accepted classification, called Paris Classification, was developed by a working group including endoscopists, surgeons and gastroenterologists to standardise the nomenclature of the polyp in 2000 [29]. This classification is based on the morphology of the polyps as it appears during endoscopy assessment as described below in the table.

Paris classification	Characteristics	Description
0-Ip	Polypoid	Protruded, pedunculated
0-Is		Protruded, sessile
0-IIa	Nonpolypoid	Superficial, elevated
0-IIb		Flat
0-IIc		Superficial shallow depressed
0-III	Nonpolypoid and excavated	Excavated

Table 2: Paris classification of colonic polyps

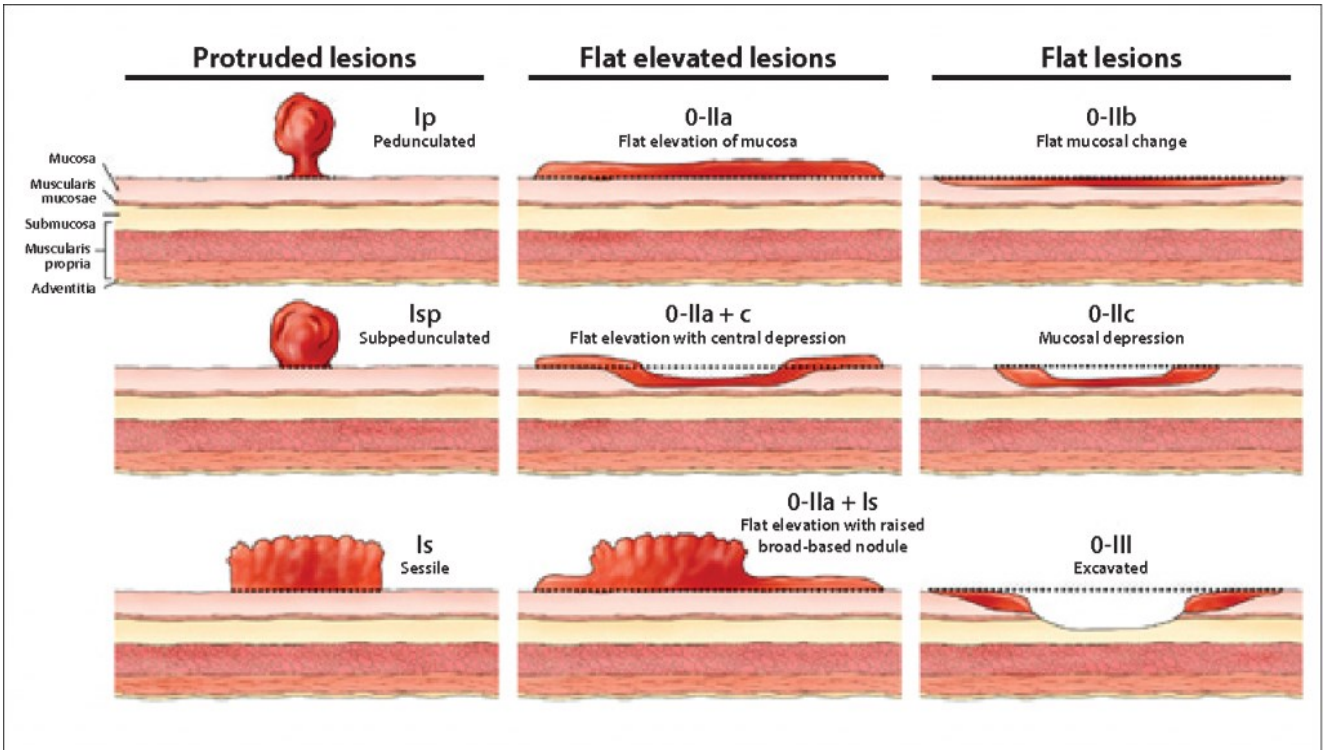


Figure-3: Paris classification, diagrammatic illustration. Adapted from GIE Journal [29]

In addition to the gross appearance of polyp, Pit Pattern (glandular pattern) and Vascular Pattern are two important features which require careful assessment during endoscopy. Regarding the observation of the glandular pattern, the pit pattern classification of colonic polyps, called Kudo Classification, is the most important and widely adopted [30].

Histology	Description	Pit pattern	Treatment selection
Nonneoplastic	Normal mucosa (normal round crypts, regular)	I	No treatment
	HP lesion (enlarged stellar crypts, regular)	II	
Neoplastic, adenomatous	Neoplastic lesion (elongated, sinuous crests)	IIIL	Endoscopic resection
	Neoplastic lesion (narrowed round pits, irregular)	IIIS	
	Neoplastic lesion (branched or gyrus-like crests)	IV	
Neoplastic, cancer	Malignant lesion (irregular surface)	Vi	Endoscopic resection
	Malignant lesion (amorphous surface)	VN	Surgery

Table 3: Kudo Classification based on pit patterns and associated histological features

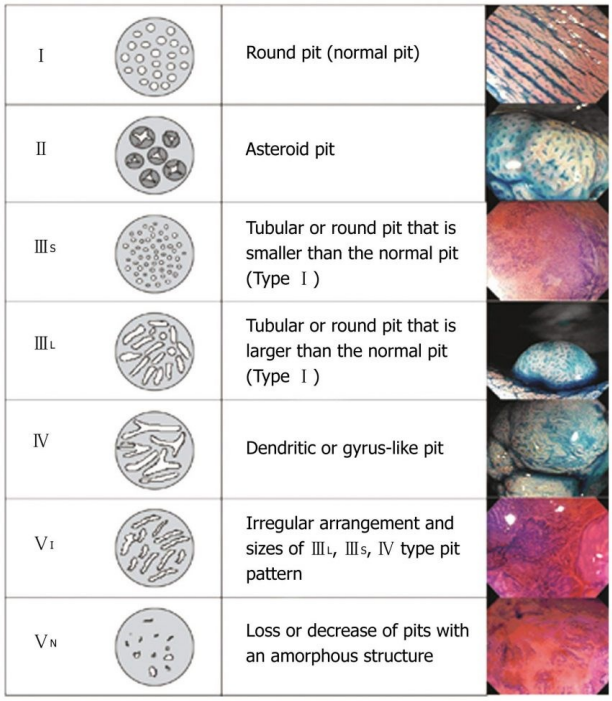


Figure 4: Diagrammatic illustration of Kudo classification. Adapted from Tanaka et al [30]

Several studies, majority of which were conducted by the Japanese authors, demonstrated that the visualisation of the superficial architecture of large bowel mucosa determined by the spatial disposition of glandular orifices is able to predict the histologic nature of the lesion and therefore be able to guide towards the appropriate therapeutic approach [31].

POLYPECTOMY TECHNIQUES

A wide variety of endoscopic techniques are available for polypectomy these days depending on the local expertise and hospital facilities. The choice of a preferred polypectomy technique is depended on the characteristics of the lesion such as optical diagnosis, size and morphology of the polyp. Several endotherapeutic techniques are included under this category; the simpler endoscopic polypectomy techniques which are commonly performed by almost all level of endoscopists usually encompasses the use of biopsy forceps and different types of polypectomy snares [32]. However, in the presence of a large, flat or locally advanced polyp, more advanced polypectomy techniques are required, i.e., endoscopic submucosal dissection, underwater mucosectomy and cup-assisted mucosectomy. Where these advanced endotherapeutic techniques offer curative options, these are also associated with higher risks of complications and, therefore, should only be restricted to be performed by a highly trained endoscopist. The goal of most appropriate polypectomy technique is to obtain a complete resection of the lesion with the best safety profile [33].

GASTROENTEROLOGIST VS SURGEON

When it comes to the advanced endoscopic polypectomy techniques, whether gastroenterologists or surgeons have better endoscopic skills remains a topic of much debate. A number of studies have shown a range of variability in the endoscopic skills among Surgeon and Gastroenterologists for detecting and characterising colon polyp, and endoscopic polypectomy expertise [34,35]. Such variabilities in skills might be due to non-uniform training curriculum and assessment parameters for endoscopy in Gastroenterology and Surgical training programs in different regions. With advancing endoscopy training and standardisation of colonoscopy practice, especially in the western countries, several quality parameters have been adopted to ensure the high quality of colonoscopy [36,37]. One of the most important measure of colonoscopy quality is adenoma detection rate (ADR). The higher degree of ADRs is directly proportionate to the quality of colonoscopy, and adoption of ADR as quality marker of colonoscopy has been considered to lower the risk of colorectal cancer [38].

Contrary to previous believes, recent studies have shown that Surgeons are as good as Gastroenterologist and advanced Endoscopist at detecting polyps through colonoscopy [39]. Despite this debate about the variability in endoscopic expertise of Gastroenterologist vs. Surgeon, it remains vitally important that an endoscopist is able to recognise and characterise the polyp accurately and understand his limitations of endoscopic skills before attempting polypectomy [40,41].

Simple Polypectomy techniques: Sessile and small pedunculated polyps of up to 1cm are expected to be removed safely and effectively by most endoscopists (whether gastroenterologist or surgeon). These are carried out by using forceps techniques in cases of small sessile polyps (<4mm) or snare polypectomy techniques in cases larger sessile polyps (>4mm) or pedunculated polyps[42].

Polypectomy for pedunculated polyp: Almost 30% of all polyps are pedunculated polyps which are usually large in size and are generally considered to be "easy" lesions to be resected by most endoscopist using snare. For successful resection of such polyps, the pedicle must be accurately evaluated in order to assess its full dimensions and its ability to be easily isolated and mobilized from the surrounding mucosa. The snare is then passed across the head of the polyp and is placed around the stalk. It is important to ensure that clear non-adenomatous tissue is visible between the snare and the head of the polyp, and then electrocautery is applied to completely resect the polyp from its stalk [43]. One of the main risks of stalked polypectomy using snare is bleeding which is proportionate

to the polyp dimension and thickness of the stalk containing feeding blood vessel. One way to avoid bleeding is by early application of energy and slow closure of the snare. There are other prophylactic measures which should be considered when the stalk diameter is more than 5 mm or the polyp head is more than 20 mm [44]. These prophylactic measures include application of detachable loops or clips on the stalk below the resection point which has been shown to effectively reduce bleeding rates. Additionally, Epinephrine injection (1:10,000 dilution) can be used to reduce the polyp size which enables less risks of bleeding using standard snare resection (epinephrine volume reduction; EVR) [45].

Polypectomy techniques for Sessile and Flat polyps: When it comes to the assessment and polypectomy of sessile polyps, these are of more concern than large pedunculated polyps, predominantly for two reasons. Firstly, the pathway for migration of invasive cells from the tumour into submucosal structures is shorter, and secondly, the complete endoscopic removal is more challenging and more difficult to ascertain. [46].
Depending upon the size and nature of sessile polyps, various polypectomy techniques are used as described below:

Polypectomy using biopsy forceps: Small sessile polyps (<4mm) can be safely removed using biopsy forceps which is by far the most easy and simple way of doing small polypectomy. Where the risks of perforation with cold forceps polypectomy are negligible, it poses a challenge of incomplete resection even in expert hands, particularly when minor initial bleeding occur with adenomatous tissue being present at the site of cold forceps [47]. For these reasons, cold snare resection is preferred over biopsy forceps polypectomy and the latter should be reserved only for diminutive polyps < 3 mm in size where a complete resection can be achieved [48].

Cold snare polypectomy: For effective resection of sessile polyps larger than 3mm but smaller than 10mm, the cold snare polypectomy technique is recommended, which is safe and effective, and can be performed by most endoscopist [49]. Snares are available in different sizes and types, which can be used depending upon the characteristics and size of sessile polyps to ensure effective polypectomy. Studies have shown a higher complete resection rate using cold snare polypectomy compared to forceps polypectomy, and according to recent data, polyps of over 1cm can also be safely removed using snare polypectomy with expert hands [50].

Hot snare polypectomy: Hot snare polypectomy is more or less similar to cold snaring technique with additional use of electrocautery, which is applied by providing energy to facilitate tissue cutting and coagulation to prevent bleeding. Although hot snare polypectomy is the widely practised technique for polyps between 7 and 9 mm, it is increasingly being replaced by cold snare polypectomy for removing polyps of up to 9 mm in size for better safety profile [51]. A variety of snares (oval, hexagonal, crescent, etc.) are available, each one with specific advantages. Currently there is no evidence that one device is superior to the others and the choice is usually made by endoscopist's preference [52].

ADVANCED POLYPECTOMY TECHNIQUES

Beyond the described polypectomy techniques, there are a number of advanced polypectomy techniques for larger and complex polyps which have been introduced lately and should only be carried out by advanced endoscopist who have special training and experience of dealing with such cases.

Endoscopic Mucosal Resection: Endoscopic mucosal resection (EMR) was first described in Japan in the early 1980s and is generally used to remove large sessile polyps or flat lesions up to 20 mm in size by appropriately trained and experienced endoscopists. In the current decade, EMR is widely practiced endoscopic modality to treat early colonic cancer limited to the mucosa [53]. During EMR, most advanced endoscopist also use a plastic cap mounted at the tip of colonoscope called cap-assisted EMR. The cap separates the endoscope tip from the colonic wall and assists in the appropriate and detailed visualization of a complex sessile polyp especially on the proximal side of a fold by stabilising the tip of colonoscope and keeping the lesion at an adequate distance. The polyp is aspirated in the cap with an inbuilt preloaded snare and saline solution is injected to separate it from underlying mucosa to minimize the risk of perforation. The polyp is then snared and pulled into the cap using the suction function of the endoscope and resected with electrocautery [54,55]. Another technique, which is called underwater endoscopic mucosal resection, offer advantage of enhanced visualisation of the superficial characteristics and margins of the polyp and does not require submucosal injection to create a fluid cushion between the mucosa and muscularis propria. Water immersion also maintains the adenomatous mucosal folds invaginated and not flattened against the muscularis propria and the lesion is resected by hot snare technique. The success rate of EMR for removing complex sessile polyp of 20mm or larger is reported to be up to 95% with limited complication and avoidance of surgery in 90% with significant reduction in mortality and cost [56]. These findings have also been replicated in other trials showing effective piecemeal removal of 90%–96% of colonic polyp larger than 20 mm in a single or multiple endoscopic session, and avoidance of surgery in more than 85% of patients with significant cost savings [57].

Endoscopic Submucosal Dissection: Endoscopic submucosal dissection (ESD) initially introduced in Japan for treating early gastric cancer, is used in expert centres now a days for removing complex colonic polyp especially those with suspicious of superficial malignancy, and require radical resection in order to decrease the risk of local tumour recurrence [58]. During ESD, the lesion is marked at the periphery using cautery, and a submucosal injection (indigo carmine) is used to create a long-lasting cushion between the lesion and the muscle layer. Using a transparent cap and under direct visualisation, the submucosal layer is then dissected using electrosurgical knives and the lesion is removed in one piece [59]. In expert hands, ESD offers more complete and accurate pathological assessment of the polyp with resection of residual adenomatous tissue with low local recurrence rates and the possibility to cure low-risk submucosal invasive cancer [60]

COMPLICATIONS OF POLYPECTOMY

Since colonic polyps are considered precursor lesion to develop colon cancer, the aim of colon polypectomy is to prevent the evolution of adenomas to carcinoma and advanced carcinoma. Although the natural history of unresected polyps and their evolution to colon cancer is not entirely known, there is now a growing body of evidence from observational studies and randomised clinical trials supporting the role of polypectomy in decreasing the incidence of colorectal cancer and reducing mortality [61]. Polypectomy procedures, on the other hands, are not risk free and even in the expert settings, are related to number of complications such as bleeding, colonic perforation and incomplete resection leading to reoccurrence of polyp and interval cancer. Munich Polypectomy Study, which is one of the largest prospective trial of colonic polypectomies, showed a positive correlation between polyp size (>10mm), type (non-pedunculated) and location (right colon) and the occurrence of postprocedural complications (i.e., bleeding rate of 25% for polyps>3cm) [62].

The most important complications of endoscopic polypectomy are bleeding and perforation. Several studies have suggested that polyp size (>1cm), morphology (sessile or thick stalk) and location (right side versus left side of the colon) are related to an increased risk of post-polypectomy complications [63].

GI bleeding: The most frequent procedure-related complication following polypectomy is GI bleeding, which can occur during polypectomy called immediate bleeding, or usually within one week of polypectomy procedure, called delayed bleeding. For small and diminutive polyps, the incidences of immediate bleeding are reported to be in the order of 0.5%–2.2%, while delayed bleeding is rarer, with overall incidence in range of 0.3%–0.6%. On the other hand, bleeding following large polyp resection is comparatively more common with an estimated incidence of 8.6% of all polypectomies [64]. Most cases of GI bleeding during polypectomy are self-limiting or can be managed successfully by endoscopic treatment alone such as with endoclips placement or adrenaline injection, whilst only a small proportion experience severe bleeding (1.6%), requiring blood transfusion or interventions other than endoscopic management (i.e. – surgery, interventional radiology).

Several techniques are used to minimise the risk of bleeding and perforation such as injection, clipping and endo-loop placement [65,66]. There is no consensus as to what technique is preferred over the other and endoscopists use a variety of measures to deal with this complication depending upon the available expertise. A recent survey of polypectomy practices has also shown a high degree of variability between endoscopist to manage the bleeding complications during or after polypectomy [67]. Some important precautions are mandatory particularly when dealing with patients on anticoagulant or antiplatelets therapy at the time of endoscopy. The current European Society of Gastrointestinal Endoscopy (ESGE) guideline stratifies post-polypectomy bleeding risk according to polyp size (< 1cm versus > 1cm) and type of antiplatelet therapy (aspirin versus thienopyridines) and recommends withholding thienopyridines whenever possible prior to polypectomy. More recently, a study has shown no increase in post-polypectomy bleeding rates with the use of prophylactic endoclips in patients with ongoing anticoagulants if the resected lesions were less than 1 cm in size [68]. The guidelines also recommend placement of a prophylactic endoloop to prevent bleeding in pedunculated polyps with a thick stalk, no recommendations are made concerning the use of endoclips or adrenaline injection. There is little data about the risk of bleeding and the safety of polypectomy in patient on oral anti-coagulant but it is generally accepted that oral anticoagulants should be withheld whenever possible [69].

Colonic perforation: Colonic perforation during colonoscopy or polypectomy is a rare but serious adverse event. For small polyp resection, the risks of perforation are practically none especially with the use of cold biopsy or cold snare resection, however, the use of electrocautery is most commonly related with colonic perforation. The data from the British Colorectal Cancer Screening Program reported approximately 0.90% incidence of colonic perforation associated with diagnostic colonoscopy [70]. Another large study of outpatient procedure showed a similar incidence of perforations after colonoscopy (0.85 per 1000 procedures), identifying an association between polypectomy and an increased risk of perforation (OR 2.96) [71]. A recent systematic review found an overall perforation rate of nearly 4% after an ESD procedure, with rates ranging from 1.5% to 10% in the literature [72]. Most cases of perforation following polypectomy can be successfully treated endoscopically using clip placement whilst only a small proportion requiring surgery. Most recently, use of

endoscopic suturing and over-the-scope clip have been introduced to manage the colonic perforation especially in high-risk complex polypectomy procedures such as ESD.

Post-polypectomy syndrome: This is a rare but recognised complication of colonic polypectomy procedure especially those which required electrocautery, and considered to be due to peritoneal irritation during prolonged polypectomy procedure. The syndrome is manifested as combination of symptoms such as fever, abdominal pain, feeling of being unwell with abnormal inflammatory markers. However, CT findings are usually within normal without any evidence of perforation. It is often self-limiting and can easily be managed with conservative and supportive treatment [73, 74].

Adenoma recurrence: One of the important complications of colonic polypectomy is incomplete resection of polyp leading to polyp reoccurrence especially adenoma, which is very important in light of cancer prevention programs and the risk of interval cancer. Incomplete resection of adenomatous tissue at the previous colonoscopy was found to be a probable cause of interval cancer in about 9% of the cases from a large British cohort, but rates of up to 26% have been cited [75]. Recent data has shown that larger lesions as well as flat or sessile lesions seem to carry risks of local recurrence as high as 27%. This is a relevant finding since advanced adenomas have a high rate of progression to invasive cancer, estimated at up to 5.6% for each additional year in some patient subgroups [76-77].

Although serious complications such as bleeding and perforation can occur after polypectomy, thirty-day mortality in these patients is extremely low in most series, suggesting that endoscopic resection is a very safe procedure in a vast majority of cases [78]. Cardiopulmonary complications arising during endoscopic procedures are usually related to sedation or anaesthesia and are not directly the result of polypectomy [79].

CONCLUSION

In conclusion, colorectal polyp, although predominantly benign, are the precursor lesion of colorectal cancer and early detection with colonoscopy and polypectomy has shown a remarkable success in preventing CRC. An effective approach to safe and efficient polypectomy would entail a thorough discussion with the patient about the benefits and risks of colonoscopy, polypectomy and related risks including those related to sedation. A detailed clinical history and review of medications, in particular, anti-coagulant treatment and appropriate assessment of the endoscopic features of colonic polyp in view of potential histology are of great importance in order to plan the proper therapeutic approach. For small polyps, cold snare polypectomy appears to be the most appropriate technique and should be preferred over hot biopsy forceps. Successful removal of large polyps either by EMR or ESD is now considered safe with high success rate with acceptably low complications. There are several suggestions from empiric experience as well as from scientific evidences that should be given thorough consideration whilst approaching a difficult and complex polypectomy, especially understanding one's limitations of skills, ability to manage complication and regular review of the expertise to perform advanced endoscopy.

ARTICLE INFORMATION Accepted for Publication: August 13, 2021 Published Online: December 29, 2021.
https://doi.org/10.48111/2021.04.07

Author Affiliations: Sulaiman Al-Habib Hospital, AlFaisal University Riyadh, KSA University of Southampton UK

Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest.

REFERENCES

1. Zauber AG, Winawer SJ, O'Brien MJ, et al. Colonoscopic polypectomy and long-term prevention of colorectal-cancer deaths. *N Engl J Med.* 2012;366(8):687-696. doi:10.1056/NEJMOA1100370
2. Jemal A, Bray F, Center MM, et al. Global cancer statistics. *CA Cancer J Clin.* 2011;61(2):69-90. doi:10.3322/CAAC.20107
3. Ferlay J, Pisni M PD. GLOBOCAN 2002: Cancer incidence, mortality and prevalence worldwide. IARC Cancer Base No.5 version 2.0 Lyon France: IARC press 2004*, American Cancer Society,Atlanta*. www.cancer.org.
4. Seeff L, Ahmed F, King JB, Coughlin SS. Colorectal cancer incidence in the United States, 1999-2004 : an updated analysis of data from the National Program of Cancer Registries and the Surveillance, Epidemiology, and End Results Program. *Cancer.* 2009;115(9):1967-1976. doi:10.1002/CNCR.24216
5. Sung JJ, Lau JY, Goh K, Leung W. Increasing incidence of colorectal cancer in Asia: implications for screening. *Lancet Oncol.* 2005;6(11):871-876. doi:10.1016/S1470-2045(05)70422-8
6. Pourhoseingholi MA. Increased burden of colorectal cancer in Asia. *World J Gastrointest Oncol.* 2012;4(4):68-70. doi:10.4251/WJGO.V4.I4.68
7. Cho KR, Vogelstein B. Genetic alterations in the adenoma--carcinoma sequence - PubMed. *Cancer.* 1992;70(6Suppl):1727-1731. Accessed September 3, 2021. https://pubmed.ncbi.nlm.nih.gov/1516027/
8. Cummings OW. Pathology of the adenoma-carcinoma sequence: from aberrant crypt focus to invasive carcinoma. *Semin Gastrointest Dis.* 2000;11(4):229-237.
9. Leslie A, Carey FA, Pratt NR, Steele RJ. The colorectal adenoma-carcinoma sequence. *Br J Surg.* 2002;89(7):845-860. doi:10.1046/J.1365-2168.2002.02120.X
10. Palma FD, D'Argenio D, Jonathan G, et al. The Molecular Hallmarks of the Serrated Pathway in Colorectal Cancer. *Cancers* (Basel). 2019;11(7):1017. doi:10.3390/CANCERS11071017
11. Thiis-Evensen E, Hoff GS, Sauar J, Langmark F, Majak BM VM. [Population-based surveillance by colonoscopy: effect on the incidence of colorectal cancer. Telemark Polyp Study I*J. Scand j Gastroenterol.* 1999;34(4):414-420. Accessed September 3, 2021. https://www.kreftregisteret.no/Forskning/Prosjekter/prosjektarkiv/NordICC/Publikasjoner/N

ordICC-publikasjoner/Population-based-surveillance-by-colonoscopy-effect-on-the-incidence-of-colorectal-cancer-Telemark-Polyp-Study-I/

12. Citarda F, Tomaselli G, Caposaccia R, Barcherini S, Crespi M. Efficacy in standard clinical practice of colonoscopic polypectomy in reducing colorectal cancer incidence. *Gut*. 2001;48(6):812-815. doi:10.1136/GUT.48.6.812

13. Mönkemüller K, Neumann H, Malfertheiner, Fry LC. Advanced colon polypectomy. *Clin Gastroenterol Hepatol*. 2009;7(6):641-652. doi:10.1016/J.CGH.2009.02.032

14. Bhatt A, Abe S, Kumaravel A, Vargo J, Saito Y. Indications and Techniques for Endoscopic Submucosal Dissection. *Am J Gastroenterol*. 2015;110(6):784-791. doi:10.1038/AJG.2014.425

15. Delavari A, Mardan F, Salimzadeh H, et al. Characteristics of Colorectal Polyps and Cancer; a Retrospective Review of Colonoscopy Data in Iran. *Middle East J Dig Dis*. 2014;6(3):144-150. Accessed September 3, 2021. /pmc/articles/PMC4119671/

16. Sano Y. Narrow Band Imaging (NBI). *Clin Gastroenterol*. 2009;24:47-52.

17. Rex DK, Kahi C, O'Brien M, et al. The American Society for Gastrointestinal Endoscopy PIVI (Preservation and Incorporation of Valuable Endoscopic Innovations) on real-time endoscopic assessment of the histology of diminutive colorectal polyps. *Gastrointest Endosc*. 2011;73(3):419-422. doi:10.1016/J.GIE.2011.01.023

18. Tanaka S, Sano Y. Aim to unify the narrow band imaging (NBI) magnifying classification for colorectal tumors: current status in Japan from a summary of the consensus symposium in the 79th Annual Meeting of the Japan Gastroenterological Endoscopy Society. *Dig Endosc*. 2011;23 Suppl 1(SUPPL. 1):131-139. doi:10.1111/J.1443-1661.2011.01106.X

19. Kandel P, Wallace MB. Should We Resect and Discard Low Risk Diminutive Colon Polyps. *Clin Endosc*. 2019;52(3):239-246. doi:10.5946/CE.2018.136

20. Liljegren A, Lindblom A, Rotstein S, Nilsson B, Rubio C, Jaramillo E. Prevalence and incidence of hyperplastic polyps and adenomas in familial colorectal cancer: correlation between the two types of colon polyps. *Gut*. 2003;52(8):1140-1147. doi:10.1136/GUT.52.8.1140

21. Shussman N, Wexner SD. Colorectal polyps and polyposis syndromes. *Gastroenterol Rep*. 2014;2(1):1-15. doi:10.1093/GASTRO/GOT041

22. Taherian M, Lotfollahzadeh S, Daneshpajouhnejad P, Arora K. Tubular Adenoma. Cutan Adnexal Neoplasms. *Published online* July 25, 2021:127-136. Accessed September 3, 2021. https://www.ncbi.nlm.nih.gov/books/NBK553180/

23. Myers DJ AK. Villous Adenoma - StatPearls - NCBI Bookshelf. *Stat Pearls Publishing*. Accessed September 3, 2021. https://www.ncbi.nlm.nih.gov/books/NBK470272/

24. Ferlitsch M, Reinhart K, Pramhas S, et al. Sex-Specific Prevalence of Adenomas, Advanced Adenomas, and Colorectal Cancer in Individuals Undergoing Screening Colonoscopy. *JAMA*. 2011;306(12):1352-1358. doi:10.1001/JAMA.2011.1362

25. Fairley KJ, Li J, Komar M, Steigerwalt N, Erlich P. Predicting the risk of recurrent adenoma and incident colorectal cancer based on findings of the baseline colonoscopy. *Clin Transl Gastroenterol*. 2014;5(12):64. doi:10.1038/CTG.2014.11

26. Hayashi T, Yatani R, Apostol J, Stemmermann GN. Pathogenesis of Hyperplastic Polyps of the Colon: A Hypothesis Based on Ultrastructure and in vitro Cell Kinetics. *Gastroenterology*. 1974;66(3):347-356. doi:10.1016/S0016-5085(74)80133-2

27. Nusko G, Mansmann U, Kirchner T, Hahn EG. Risk related surveillance following colorectal polypectomy. *Gut*. 2002;51(3):424. doi:10.1136/GUT.51.3.424

28. Rex DK. Serrated Polyps in the Colon. *Gastroenterol Hepatol (N Y)*. 2014;10(10):671. Accessed September 3, 2021. /pmc/articles/PMC4988225/

29. The Paris endoscopic classification of superficial neoplastic lesions: esophagus, stomach, and colon: November 30 to December 1, 2002. *Gastrointest Endosc*. 2003;58(6 Suppl). doi:10.1016/S0016-5107(03)02159-X

30. Kudo S, Rubio CA, Teixeira CR, Kashida H, Kogure E. Pit pattern in colorectal neoplasia: endoscopic magnifying view. *Endoscopy*. 2001;33(4):367-373. doi:10.1055/S-2004-826104

31. Kato S, Fujii T, Koba I, et al. Assessment of colorectal lesions using magnifying colonoscopy and mucosal dye spraying: Can significant lesions be distinguished? *Endoscopy*. 2001;33(4):306-310. doi:10.1055/S-2001-13700

32. Kang H, Thoufeeq MH. Size of colorectal polyps determines time taken to remove them endoscopically. *Endosc Int open*. 2018;6(5):E610-E615. doi:10.1055/A-0587-4681

33. Tolliver KA, Rex DK. Colonoscopic polypectomy. *Gastroenterol Clin North Am*. 2008;37(1):229-251. doi:10.1016/J.GTC.2007.12.009

34. Eberth JM, Josey MJ, Mobley LR, et al. Who Performs Colonoscopy? Workforce Trends Over Space and Time. *J Rural Health*. 2018;34(2):138-147. doi:10.1111/JRH.12286

35. Mehran A, Jaffe P, Efron J, Vernava A, Liberman MA. Colonoscopy: why are general surgeons being excluded? *Surg Endosc*. 2003;17(12):1971-1973. doi:10.1007/S00464-003-8806-5

36. Williams MR, Crossett JR, Cleveland EM, et al. Equivalence in colonoscopy results between gastroenterologists and general surgery residents following an endoscopy simulation curriculum. *J Surg Educ*. 2015;72(4):654-657. doi:10.1016/J.JSURG.2015.01.018

37. Patel NM, Terlizzi JP, Trooskin SZ. Gastrointestinal endoscopy training in general surgery residency: what has changed since 2009? *J Surg Educ*. 2014;71(6):846-850. doi:10.1016/J.JSURG.2014.05.014

38. Rex DK. Detection Measures for Colonoscopy: Considerations On the Adenoma Detection Rate, Recommended Detection Thresholds, Withdrawal Times, and Potential Updates to Measures. *J Clin Gastroenterol*. 2020;54(2):130-135. doi:10.1097/MCG.0000000000001301

39. Lee TJ, Rutter MD, Blanks RG, et al. Colonoscopy quality measures: experience from the NHS Bowel Cancer Screening Programme. *Gut*. 2012;61(7):1050-1057. doi:10.1136/GUTJNL-2011-300651

40. Pace D, Borgaonkar M, Evans B, et al. Annual colonoscopy volume and maintenance of competency for surgeons. *Surg Endosc*. 2017;31(6):2630-2635. doi:10.1007/S00464-016-5275-1

41. Petersen BT. Quality assurance for endoscopists. *Best Pract Res Clin Gastroenterol*. 2011;25(3):349-360. doi:10.1016/J.BPG.2011.05.003

42. Singh N, Harrison M, Rex DK. A survey of colonoscopic polypectomy practices among clinical gastroenterologists. *Gastrointest Endosc*. 2004;60(3):414-418. doi:10.1016/S0016-5107(04)01808-5

43. Tolliver KA, Rex DK. Colonoscopic polypectomy. *Gastroenterol Clin North Am*. 2008;37(1):229-251. doi:10.1016/J.GTC.2007.12.009

44. Di Giorgio P, De Luca L, Calcagno G, et al. Detachable snare versus epinephrine injection in the prevention of postpolypectomy bleeding: a randomized and controlled study. *Endoscopy*. 2004;36(10):860-863. doi:10.1055/S-2004-825801

45. Hogan RB, Hogan RB 3rd. Epinephrine volume reduction of giant colon polyps facilitates endoscopic assessment and removal. *Gastrointest Endosc*. 2007;66(5):1018-1022. doi:10.1016/J.GIE.2007.03.1078

46. Jung YS, Park JH, Kim HJ, et al. Complete biopsy resection of diminutive polyps. *Endoscopy*. 2013;45(12):1024-1029. doi:10.1055/S-0033-1344394

47. Peluso F, Goldner F. Follow-up of hot biopsy forceps treatment of diminutive colonic polyps. *Gastrointest Endosc*. 1991;37(6):604-606. doi:10.1016/S0016-5107(91)70863-8

48. Kim JS, Lee BI, Choi H, et al. Cold snare polypectomy versus cold forceps polypectomy for diminutive and small colorectal polyps: a randomized controlled trial. *Gastrointest Endosc*. 2015;81(3):741-747. doi:10.1016/J.GIE.2014.11.048

49. Repici A, Hassan C, Vitetta E, et al. Safety of cold polypectomy for. Endoscopy. 2012;44(1):27-31. doi:10.1055/S-0031-1291387

50. Muniraj T, Sahakian A, Ciarleglio MM, Deng Y, Aslanian HR. Cold snare polypectomy for

large sessile colonic polyps: a single-center experience. *Gastroenterol Res Pract.* 2015;20(15):175-959. doi:10.1155/2015/175959

51. Uraoka T, Ramberan H, Matsuda T, Fujii T, Yahagi N. Cold polypectomy techniques for diminutive polyps in the colorectum. *Dig Endosc.* 2014;26 Suppl 2:98-103. doi:10.1111/DEN.12252

52. Ichise Y, Horiuchi A, Nakayama Y, Tanaka N. Prospective randomized comparison of cold snare polypectomy and conventional polypectomy for small colorectal polyps. *Digestion.* 2011;84(1):78-81. doi:10.1159/000323959

53. Holt BA, Jayasekeran V, Sonson R, Bourke MJ. Topical submucosal chromoendoscopy defines the level of resection in colonic EMR and may improve procedural safety (with video). *Gastrointest Endosc.* 2013;77(6):949-953. doi:10.1016/J.GIE.2013.01.021

54. Iishi H, Tatsuta M, Iseki K, et al. Endoscopic piecemeal resection with submucosal saline injection of large sessile colorectal polyps. *Gastrointest Endosc.* 2000;51(6):697-700. doi:10.1067/MGE.2000.104652

55. Tamura S1, Nakajo K, Yokoyama Y, et al. Evaluation of endoscopic mucosal resection for laterally spreading rectal tumors. *Endoscopy.* 2004;36(4):306-312. doi:10.1055/S-2004-814204

56. Kaltenbach T, Soetikno R. Endoscopic resection of large colon polyps. *Gastrointest Endosc Clin N Am.* 2013;23(1):137-152. doi:10.1016/J.GIEC.2012.10.005

57. Kedia P, Waye JD. Colon polypectomy: a review of routine and advanced techniques. *J Clin Gastroenterol.* 2013;47(8):657-665. doi:10.1097/MCG.0B013E31829EBDA7

58. Larghi A, Waxman I. State of the art on endoscopic mucosal resection and endoscopic submucosal dissection. *Gastrointest Endosc Clin N Am.* 2007;17(3):441-469. doi:10.1016/J.GIEC.2007.05.012

59. Burgess NG, Bahin FF, Bourke MJ. Colonic polypectomy (with videos). *Gastrointest Endosc.* 2015;81(4):813-835. doi:10.1016/J.GIE.2014.12.027

60. Fujishiro M, Yahagi N, Kakushima N, et al. Successful nonsurgical management of perforation complicating endoscopic submucosal dissection of gastrointestinal epithelial neoplasms. *Endoscopy.* 2006;38(10):1001-1006. doi:10.1055/S-2006-944775

61. Zauber AG, Winawer SJ, O'Brien MJ, et al. Colonoscopic Polypectomy and Long-Term Prevention of Colorectal-Cancer Deaths. *N Engl J Med.* 2012;366(8):687. doi:10.1056/NEJMOA1100370

62. 62. Heldwein W, Dollhopf M, Rösch T, et al. The Munich Polypectomy Study (MUPS): prospective analysis of complications and risk factors in 4000 colonic snare polypectomies. *Endoscopy.* 2005;37(11):1116-1122. doi:10.1055/S-2005-870512

63. Rabeneck L, Paszat LF, Hilsden RJ, et al.. Bleeding and perforation after outpatient colonoscopy and their risk factors in usual clinical practice. *Gastroenterology.* 2008;135(6):1899-1906. doi:10.1053/J.GASTRO.2008.08.058

64. Watabe H, Yamaji Y, Okamoto M, et al.. Risk assessment for delayed hemorrhagic complication of colonic polypectomy: polyp-related factors and patient-related factors. *Gastrointest Endosc.* 2006;64(1):73-78. doi:10.1016/J.GIE.2006.02.054

65. Dobrowolski S, Dobosz M, Babicki A, Głowacki J, Nałecz A.. Blood supply of colorectal polyps correlates with risk of bleeding after colonoscopic polypectomy. *Gastrointest Endosc.* 2006;63(7):1004-1009. doi:10.1016/J.GIE.2005.11.063

66. Rabeneck L, Saskin R, Paszat LF. Onset and clinical course of bleeding and perforation after outpatient colonoscopy: a population-based study. *Gastrointest Endosc.* 2011;73(3):520-523. doi:10.1016/J.GIE.2010.10.034

67. Vormbrock K, Mönkemüller K. Difficult colon polypectomy. *World J Gastrointest Endosc.* 2012;4(7):269. doi:10.4253/WJGE.V4.I7.269

68. Boustière C, Veitch A, Vanbiervliet G, et al. Endoscopy and antiplatelet agents. European Society of Gastrointestinal Endoscopy (ESGE) Guideline. *Endoscopy.* 2011;43:445-458. doi:10.1055/s-0030-1256317

69. Hui AJ, Wong RM, Ching JY, et al.. Risk of colonoscopic polypectomy bleeding with anticoagulants and antiplatelet agents: analysis of 1657 cases. *Gastrointest Endosc.* 2004;59(1):44-48. doi:10.1016/S0016-5107(03)02307-1

70. Lee TJ, Rutter MD, Blanks RG, et al. Colonoscopy quality measures: experience from the NHS Bowel Cancer Screening Programme. *Gut.* 2012;61(7):1050-1057. doi:10.1136/GUTJNL-2011-300651

71. Stock C, Ihle P, Sieg A, et al. Adverse events requiring hospitalization within 30 days after outpatient screening and nonscreening colonoscopies. *Gastrointest Endosc.* 2013;77(3):419-429. doi:10.1016/J.GIE.2012.10.028

72. Benson BC, Myers JJ, Laczek JT. Postpolypectomy Electrocoagulation Syndrome: A Mimicker of Colonic Perforation. *Case Rep Emerg Med.* 2013;2013:1-3. doi:10.1155/2013/687931

73. Shin YJ, Kim YH, Lee KH, et al. CT findings of post-polypectomy coagulation syndrome and colonic perforation in patients who underwent colonoscopic polypectomy. *Clin Radiol.* 2016;71(10):1030-1036. doi:10.1016/J.CRAD.2016.03.010

74. Pohl H, et al. Incomplete polyp resection during colonoscopy-results of the complete adenoma resection (CARE) study. *Gastroenterology.* 2013;144(1):74-80. doi:10.1053/J.GASTRO.2012.09.043

75. Robertson DJ, Greenberg ER, Beach M, et al. Colorectal cancer in patients under close colonoscopic surveillance. *Gastroenterology.* 2005;129(1):34-41. doi:10.1053/J.GASTRO.2005.05.012

76. Buchner AM, Guarner-Argente C, Ginsberg GG. Outcomes of EMR of defiant colorectal lesions directed to an endoscopy referral center. *Gastrointest Endosc.* 2012;76(2):255-263. doi:10.1016/J.GIE.2012.02.060

77. Furnari M, Voiosu T, Ahmed I et al. Approaching polyps in the time of discrimination. *Rev Gastroenterol Hepatol Nutr.* 2015;2:28-38. doi:10.11138/RGHN/2015.2.1.028

78. Anderloni A, Jovani M, Hassan C, Repici A. Advances, problems, and complications of polypectomy. *Clin Exp Gastroenterol.* 2014;7(1):285-296. doi:10.2147/CEG.S43084

Archives of Surgical Research | Invited Commentary

Utilities of Teaching EPAs: Expanding the Scope of EPAs Beyond Clinical Context

Muhammad Zafar Iqbal[1], Mohamed M. Al-Eraky[2]

IMPORTANCE Recently, entrustable professional activities (EPAs) have been reported for teachers. Since it is a novel approach, the spectrum of their utilities has so far remained unexamined. Supported by the literature, this manuscript aims to propose some potential utilities of teaching EPAs. Teaching EPA frameworks can be used to design structured faculty development programs for specific teaching roles. EPA-based faculty development programs can then provide practice opportunities to the teachers to transfer the training to their teaching practices. Teaching EPAs can also be used to assess whether teachers are ready to independently perform the desired teaching tasks. Teaching EPA frameworks can serve as a learning guide for personal and professional development of the teachers. Finally, teaching EPAs can be used to credential the teachers and define their scope of teaching practice. Although EPAs hold multiple utilities for the teachers, program developers, and administrative bodies, their practical operationalization remains limited to date which could be attributed to their novelty.

KEYWORDS entrustable professional activities; teaching competence; teaching EPAs

HOW TO CITE Iqbal MZ, Al-Eraky MM. Utilities of Teaching EPAs: Expanding the Scope of EPAs Beyond Clinical Context. *Archives of Surgical Research*. 2021, 2 (4):45-47. https://doi.org/10.48111/2021.04.08

Invited Commentary

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author:
Muhammad Zafar Iqbal, Postdoctoral Fellow at the School of Physical and Occupational Therapy, Faculty of Medicine and Health Sciences, McGill University, Montreal, Quebec, Canada.
drzafariqbal@live.com
+14389787550
https://doi.org/10.48111/2021.04.08

Many competency frameworks exist in theory to support the professionalization of teachers, yet they do not address how these competencies can be acquired and systematically assessed[1]. This is where the concept of entrustable professional activities (EPAs) finds its applicability as EPAs are known to translate the theoretical competencies into practice. EPAs are observable tasks of a professional domain that can be entrusted to a trainee once he/she demonstrates the necessary competence to perform this task unsupervised[2]. Originally proposed for competency-based postgraduate training, the concept of entrustment is now expanding to the teaching context where EPAs can be used to entrust the teachers to perform teaching tasks unsupervised[3]. Consequently, the scholarship on contextual EPAs for different teaching domains is gaining momentum. Since this is a novel development, the utilities of teaching EPAs have not been fully explored and discussed so far, which we aim to highlight in this manuscript.

Structuring Faculty Development: Faculty development programs are a vital source to support the teachers in the development of their teaching skillset. However, the effectiveness of these training programs in improving teaching practices remains debatable, primarily because of the lack of structure in training[4]. Similar to other clinical training programs, EPAs can be used to design structured faculty development programs. For instance, the comprehensive EPA frameworks available for specific teaching domains (i.e., bedside teaching, small group facilitation et cetera) can be used to design structured and focused faculty development programs for these specific teaching tasks[5,6].

Instigating Transfer of Training to Workplace: Teaching EPAs also have the potential to promote the transfer of training (faculty development) to workplace (teaching) setting[3]. In a traditional EPA-based training program, an informal practice at workplace is an essential component before entrustment evaluation. The informal practice period after formal faculty development can provide sufficient opportunity to the trainee teachers to apply the newly acquired skills to their teaching practices, thus instigating the training transfer to workplace.

Assessing Readiness to Teach: A long-standing issue in faculty development is to assess if teachers are ready to perform their teaching roles and responsibilities. This issue could be resolved through teaching EPAs and their associated entrustment process. EPAs are known to be useful in assessing the readiness of trainees before they are allowed to practice independently[7]. Understandably, health professionals pursuing a career in academia are by default licensed to teach in many educational institutes. However, we argue that without evidence, it cannot simply be assumed that teachers are ready and able to perform their teaching tasks effectively. EPAs provide means to assess teaching proficiency and generate evidence of whether or

not teachers can be entrusted to independently perform the teaching tasks. Upon demonstrating sufficient proficiency in the designated teaching task (i.e., bedside teaching, small group facilitation), the teachers can be entrusted, and a certificate of entrustment can be awarded.

Guiding Personal and Professional Development: Another utility of teaching EPAs is to serve as a personal learning and development guide for the teachers. As recommended by ten Cate and Taylor, a well-designed EPA should provide a detailed task description, its specifications and limitations, the relevant competencies and experiences required to perform the designated task, and information sources to assess task progress[7]. Comprehensive EPA frameworks, outlining the pre-clinical and clinical teaching tasks, can serve as a learning guide for personal and professional development of the teachers. The EPAs frameworks may help the teachers in identifying areas of strengths and deficiencies in their teaching practices and may also help them build their academic portfolios[8].

Credentialing and Privileging Teachers: Credentialing the clinicians is a norm in clinical context where clinicians are awarded practice privileges after demonstrating competence in a particular clinical domain. Credentialing is a valuable approach that defines the scope of practice of the clinicians by delineating the procedural boundaries for them within which they are allowed to perform. Similar to clinical practice, the credentialing concept can be used to define the scope of practice of teachers[9]. After each successful entrustment to perform a particular teaching task (for example, small group facilitation), the teacher can be credentialed as an entrusted small group facilitator. Moreover, incorporating an EPA-based credentialing system in institutional promotion regulations might help the leadership in regulating academic promotions of the faculty[10]. Including such a model in promotion criteria might also help the faculty to internalize the value of being an entrusted teacher.

CONCLUSION AND FUTURE RECOMMENDATIONS

Designing EPAs for teachers is a novel approach to streamline teacher education, training and evaluation. These EPAs hold multiple utilities for the teachers, program developers and administrative bodies. EPAs can be used for structuring faculty development, entrusting teachers, guiding promotions, ensuring transfer of training, and credentialing the teachers. They can also be used by the teachers as a guide for their personal development and for building their teaching portfolios. Despite multiple theoretical utilities of teaching EPAs, limited practical examples of their application are available in the literature. As a result, certain questions remain unanswered and are potential gaps for future researchers. These intuitive questions include: would the idea of being an entrusted teacher be acceptable to the teachers, especially in those contexts where teacher certification is not mandatory? What should be the eligibility criteria for someone to supervise and entrust other teachers? Considering senior teachers' existing workload and time constraints, would it possible to include other stakeholders in the entrustment decision-making process? These questions are essential to answer to fully operationalize teaching EPAs for teacher education, training and evaluation. Finally, through this paper, we encourage program developers and researchers to use the existing teaching EPA frameworks within their institutions so that valuable and practical lessons can be learned.

ARTICLE INFORMATION Accepted for Publication: October 18, 2021, Published Online: December 00, 2021. https://doi.org/10.48111/2021.04.08

Author Affiliations. Postdoctoral Fellow at the School of Physical and Occupational Therapy, Faculty of Medicine and Health Sciences, McGill University, Montreal, Quebec, Canada; Dr Mohamed M. Al-Eraky Assistant Professor and Head of Medical Education Department, Zagazig University, Zagazig, Egypt.

Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest

REFERENCES

1. Iqbal MZ, Al-Eraky MM. Common myths about entrustable professional activities. *Educ Med J* 2021;13(2):97–100. doi:10.21315/EIMJ2021.13.2.9
2. ten Cate O, Chen HC, Hoff RG, Peters H, Bok H, van der Schaaf M. Curriculum development for the workplace using Entrustable Professional Activities (EPAs): AMEE Guide No. 99. *Med Teach* 2015;37(11):983–1002. doi:10.3109/0142159X.2015.1060308
3. Iqbal MZ, M. Al-Eraky M. Using entrustable professional activities (EPAs) to assess teaching competence and transfer of training: A personal view. *Med Teach* 2019;41(1):107–8. doi:10.1080/0142159X.2018.1440074
4. Steinert Y, Mann K, Anderson B, Barnett BM, Centeno A, Naismith L, et al. A systematic review of faculty development initiatives designed to enhance teaching effectiveness: A 10-year update: BEME Guide No. 40. *Med Teach* 2016;38(8):769–86. doi:10.1080/0142159X.2016.1181851
5. van Dam M, Ramani S, ten Cate O. An EPA for better bedside teaching. *Clin Teach* 2021;18(4):398–403. doi:10.1111/tct.13346
6. Iqbal MZ, Könings KD, Al-Eraky MM, van Merriënboer JJG. Entrustable professional activities for small-group facilitation: A validation study using modified Delphi technique. *Teach Learn Med* 2021;In press:1–10. doi:10.1080/10401334.2021.1877714
7. Ten Cate O, Taylor DR. The recommended description of an entrustable professional activity: AMEE Guide No. 140. *Med Teach* 2020;0(in press):1–9. doi:10.1080/0142159X.2020.1838465
8. Antao V, Cavett T, Walsh A, Bethune C, Cameron S, Clavet D, et al. Leading from where you teach: Educational leader role within the Fundamental Teaching Activities Framework. *Can Fam Physician* 2017;63(10):808–12.
9. Valenza JA, George LA, O'Neill PN. A model for clinical credentialing of dental school faculty. *J Dent Educ* 2005;69(8):870–8.

10. Iqbal MZ, Könings KD, Al-Eraky M, AlSheikh MH, van Merrienboer JJG. Development of an entrustable professional activities (EPAs) framework for small group facilitators through a participatory design approach. *Med Educ Online* 2020;25(1):1694309. doi:10.1080/10872981.2019.1694309

Archives of Surgical Research | Original Research

Role Of Core Needle Biopsy in The Diagnosis of Thyroid Nodules: A Systematic Literature Review

Iqra Imtiaz, Ahmad Kaleem

IMPORTANCE With the rapidly increasing number of nodular goiter cases, advances are being made in diagnostic modalities. One of these is the Core Needle Biopsy (CNB) which gives a larger tissue specimen for diagnosis. This technique has its merits as well as demerits. The current article elaborates the characteristics of Core needle biopsy in comparison with the gold standard Fine Needle Aspiration Cytology (FNAC), as a diagnostic tool for thyroid nodules.

OBJECTIVE: This systematic review article aims to find out the role of Core needle biopsy in the diagnosis of thyroid nodules, both as a first-line technique and as a complementary method to fine-needle aspiration cytology (FNAC).

METHODS: A systematic review of full-text articles from the last 5 years, retrieved from PubMed, ProQuest, and Google Scholar, was performed. Out of 1032 articles retrieved, a detailed thematic analysis of records was used for screening out 12 relevant articles for final review.

RESULTS: It is argued that core needle or Tru-Cut biopsy (CNB/TCB) leads to a lower proportion of undiagnosed biopsy results because of adequate tissue sampling, at the cost of increased diagnoses of atypia of undetermined significance, and hence, leading to more diagnostic surgeries. Therefore, FNAC remains the first-line investigation in the majority of medical centers all over the world due to its higher negative predictive value, ease of use, lower pooled proportion of serious complications, and equal diagnostic surgeries performed in comparison with CNB.

CONCLUSION: CNB leads to a lower pooled population of nondiagnostic results as it provides a larger sample size with the availability of immunohistochemistry and histological architecture studies. Some disadvantages also need to be kept in mind such as the risk of more serious complications as it is a more invasive technique in comparison to FNAC.

KEYWORDS Core needle biopsy, Tru-Cut biopsy, Biopsy, Fine-Needle Aspiration cytology, Thyroid nodules

HOW TO CITE Imtiaz I, Kaleem A. Role Of Core Needle Biopsy in The Diagnosis of Thyroid Nodules: A Systematic Literature Review. *Archives of Surgical Research*. 2021, 2 (4):48-52. https://doi.org/10.48111/2021.04.09

Original Research

Author Affiliations: Author affiliations are listed at the end of this article.

Corresponding Author:
Ahmad Kaleem FCPS, MRCS Senior Registrar Shalamar Medical and Dental College,
ahmadkaleemklm@gmail.com
+92-320-4196900
https://doi.org/10.48111/2021.04.09

The thyroid gland lies in the neck in the infrahyoid visceral space. It produces Tri(T3) and tetraiodothyronine(T4) hormones which regulate growth and metabolism[1]. The most presented abnormality of the endocrine system is the presence of thyroid nodules[2]. They are clinically palpable in about 5% of the general population, whereas they can be found in up to 70% of the population with the help of diagnostic imaging techniques such as ultrasonography[3]. They are seen as lesions on ultrasonography that show differences from the surrounding parenchyma [4]. Approximately 10% of the thyroid nodules are at risk of being malignant[5].

The gold standard for evaluation of a thyroid nodule is ultrasonography-guided fine-needle aspiration (FNAC)[6]. FNAC specimens yield more inconclusive and indeterminate results as compared to core needle biopsies[7]. On the other hand, a drawback of core needle biopsy is that it has a higher rate of serious complications[8].

This review aims to determine the importance of Core needle biopsy for the assessment of thyroid nodules, as compared to more commonly used tools, and whether it can replace FNAC in becoming the first-line diagnostic tool in thyroid nodules.

METHODS:

This article has been designed according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to analyze the evidence available for comparing core needle biopsy with FNAC in diagnosing Thyroid nodules.

Search Strategy, Data Extraction, and Inclusion Criteria

A systematic review of full-text articles, published around the last 5 years retrieved from PubMed, ProQuest, and Google Scholar was performed. We searched the PubMed database using the terms: ((thyroid nodules) AND (core

needle biopsy)). A total of 125 records were identified. The ProQuest database was also searched to identify high-quality systematic reviews, studies, and meta-analyses, clinical trials, and reviews using the terms "Thyroid Nodules and core needle biopsy" that revealed 801 articles. In addition, Google Scholar search using the terms 'thyroid nodules and Tru cut biopsy' to retrieve 148 articles.

Pertinent articles were selected with an inclination toward recent publications, publications in the English language, and studies done on humans only. Detailed scrutiny was carried out by screening for records and thematic analysis to yield 12 articles for final review.

Exclusion Criteria: Exclusion criteria included duplicate papers, irrelevant titles, abstracts, themes, and papers not available in English.

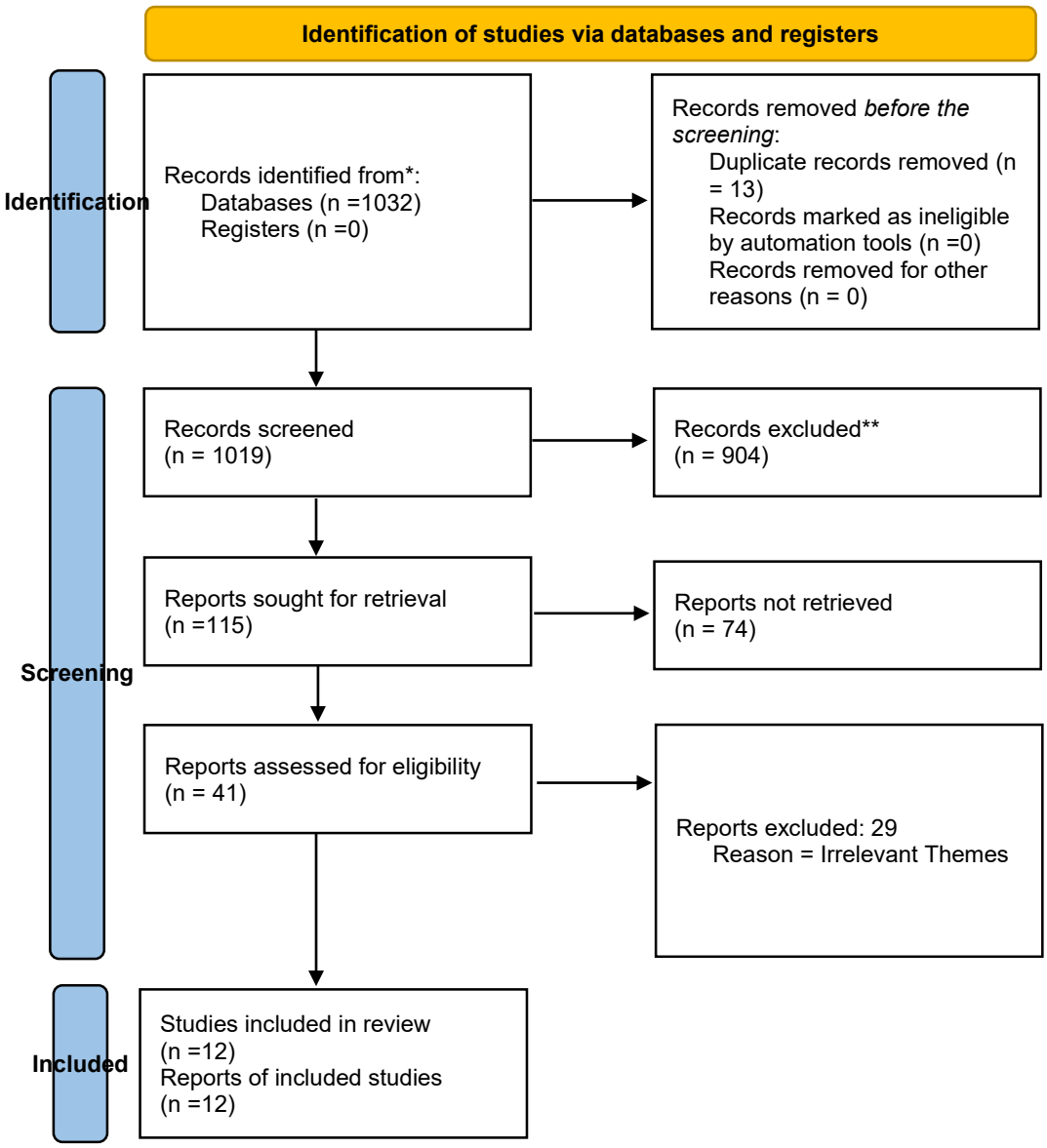


Diagram: Article selection process through computer literature search

Year	Author	Country	Research Method	Themes Identified
2021	Dupain (Dupain et al., 2021)	France	Biopsy samples were taken from the tumors of all enrolled patients in this study and compared	Both the biopsy methods show no significant differences in molecular profiling; core needle biopsy samples can be saved for further investigation
2021	Soon- Hyun Ahn (2021)	Korea	A meta-analysis of published data in Korea retrieved from Embase database	Although CNB has an advantage of reduced inconclusive results, it comes with the disadvantages of increased results of cellular atypia and follicular neoplasia
2020	Pantanowit (Pantanowitz et al., 2020)	USA	Review article comparing FNAC to TCB	Both FNAC and CNB have their own set of advantages and disadvantages, serving each other as complementary methods for thyroid nodule diagnosis.
2020	Reyaz (Reyaz et al., 2020)	Pakistan	Smears were made from aspirates of thyroid nodules using fine-needle cytology and studied	FNAC is an effective, cheap, and gold-standard biopsy method for thyroid nodules
2020	Hahn (Hahn et al., 2020)	Korea	Samples of patients who underwent either CNB or FNAC were studied retrospectively and compared to ultrasonographic findings	Non-diagnostic results were reduced whereas the conclusive rates increased with the use of CNB, the diagnostic performances were comparable for both methods.
2020	Lan (Lan, et al., 2020)	China	Data were retrieved from PubMed, Cochrane Library, and Embase databases and studied	CNB and FNAC show comparable results and are complementary to each other.
2019	Paja (Paja et al., 2019)	Spain	A retrospective study was done on all the CNB procedures done in the authors' institute in the last 11 years, in terms of performance, accuracy, and complications	CNB has a low proportion of non-diagnostic and inconclusive results and is an able replacement in situations where FNAC has a poor performance.
2018	Gupta (Gupta et al., 2018)	India	Overview of some of the already published data relating to biopsy methods of thyroid nodules as well as salivary glands	TCB is not the first-line investigation for biopsy of thyroid nodules; it is a complementary method to FNAC.
2018	Ha (Ha et al., 2018)	Korea	Major and minor complications were studied after CNB in patients.	Some complications did occur but none of them was serious enough to warrant CNB as an unsafe procedure.
2017	Rahman, (Rahman et al., 2017)	USA	A retrospective study was done of all thyroid TCBs and FNACs done in the authors' institute.	FNAC and CNB are valuable tools in diagnosing thyroid neoplasia and metastases, eradicating the need for invasive surgeries for such purposes.
2017	Chae (Chae et al., 2019)	Republic of Korea	Association between hematoma formation and clinical /ultrasonographic features was studied following biopsies	Hematoma formation and bleeding were more common after CNB as compared to FNAC.
2016	Wolinski (Wolinski et al., 2016)	Poland	Several databases were searched and retrieved, data were studied to compare FNAC and TCB.	CNB yielded a more pooled proportion of diagnostic results as compared to FNAC and more conclusive results after equivocal FNAC.

Table: Year of publication, author name, country, research method and Themes identified through analysis of 12 included papers. Important Terms: CNB: Core needle biopsy: Tru-cut biopsy. FNAC: Fine needle aspiration cytology

RESULTS

CNB and FNAC both have an important place in the diagnosis of thyroid nodules. FNAC is the investigation of choice, whereas CNB plays a complementary role. CNB also lacks a biopsy reporting system[11]. Data shows an equal number of diagnostic/therapeutic surgeries with CNB as compared to FNAC.

Current Noninvasive Biopsy Method For Thyroid Nodules -FNAC

It is a quick, simple, safe, tolerable, and specific method for obtaining a specimen for cytology[7,29]. Lower rates of inconclusive and false-negative results have been reported in retrospective studies as compared to clinical examination only. FNAC is also used to evaluate a breast lump; it is a part of the triple assessment. However, it fails to show important data such as the histopathology, grade, and receptors of the tumor[22].

Core Needle Biopsy/Tru-Cut Biopsy: This biopsy method yields tissue fragments by using larger bore needles and is based on the histological study[22]. It has been suggested as a complementary method to FNAC to overcome inconclusive results[7]. Some of the literature has established Tru-Cut biopsy as a safe, tolerable, and efficient method of obtaining a thyroid nodule specimen[6].

Advantages: An advantage of CNB is that it can sample greater amounts of tissue which leads to increased ease in assessing histological architecture and performing immunohistochemistry when required[23]. Immunohistochemical stains such as cytokeratin-19, galectin-3, BRAFV600E, or HBME-1 are used to diagnose thyroid malignancy in such cases[20].
However, the Tru-Cut biopsy technique is still not as popular as FNAC, one of the reasons being safety concerns[17].

Disadvantages: Two of the major complications of CNB include bleeding and recurrent laryngeal nerve injury[32]. Other common complications are hematoma, hemoptysis, parenchymal edema, infection, hoarseness, and dysphagia[18]. A rare complication of this biopsy technique is the development of a vasovagal reaction[25]. Nodules with heavy calcification may not be punctured[21]. Other limitations include relatively higher cost, technical requirements, and increased time consumption[16]. There are also no guidelines

on the potential use of Tru-cut biopsy as a first-line biopsy method[19].

CNB demonstrated a lower percentage of non-diagnostic and inconclusive results as compared to FNAC in two studies, one of them related to breast nodules[19,33] . It has been shown to decrease inconclusive results at the cost of increased results of cellular atypia, and in return increased diagnostic surgeries in nodular goiter[8]. In another study using core needle biopsy for diagnosis of breast lump, researchers have found that the results of CNB correlated with gold standard evaluation (1.9% error) whereas the post-surgical diagnosis following FNAC changed in up to 37% of the nodules. This study showed that FNAC led to more inadequate results as compared to TCB. In another study, the sensitivity and specificity of FNAC were 100% and 73.7%, whereas they were 100% and 94.7% for TCB. These data agree with the literature about female breast lesions[26].

However, one study has found that the negative predictive value was worse for TCB than FNAC when applying Criteria 1 and 2. The positive predictive value and specificity of FNAC when applying Criteria 3 were also higher than that of TCB irrespective of the size of the nodule. The diagnostic performance, when applying Criteria 4 and 5(for nodule size>2cm), did not vary in value. TCB did not demonstrate superior diagnostic performance to FNAC for thyroid nodule diagnosis in this study[6]. Conversely, in another study's results, in nodules categorized as intermediate in suspicion, the superiority of TCB was evident in nodules greater than 2 cm[7]. Some studies show that FNA and CNB are similar in terms of results and that FNAC is better as a first-line investigation in thyroid nodules[27,28,33].

The complication rates of FNAC and CNB are similar, although CNB has a greater proportion of major complications, which include bleeding and hematoma formation[19].

DISCUSSION

The Core needle biopsy is being used in many nodular diseases including breast cancer in men and women[9]. It provides tissue within the pathology, the nodule margin, and the normal thyroid tissue[10].

The investigation of choice for thyroid nodules is fine-needle aspiration cytology due to its low cost, minimal invasiveness, and ease of use[4]. The key limitations of this biopsy method are inconclusive results and non-diagnostic samples[11]. This is because of the monotonous cytological sample and scanty colloid[12]. These results are reported to be between 20 to 46%[13]. To combat these results, FNAC is repeated according to authority guidelines, although in as many as half of the cases, the results will be nondiagnostic again[11]. These results are generally followed by surveillance or diagnostic surgery, according to risk factors, ultrasound findings, and the choice of the patient. The false-negative rate of FNAC varies from 13.6 to 56.6[14].

On the other hand, even when CNB is used as a primary investigation, the results are good[13]. A major advantage of CNB is that its specificity according to a study is 96-100% [15,16]. The rate of nondiagnostic and inconclusive results is minimized with CNB[17]. There are rarely, if any, false-positive results with CNB[14]. The false-negative rates are higher in small nodules (less than 2 cm) whereas they are lower in larger nodules[16]. There are no remarkable differences in pain, minor complications, or tolerability between TCB and FNAC[18]. It allows the clinician to look for nuclear change, relationship to the adjacent healthy tissue as well as alterations in the follicular structure, important data which the FNAC technique simply does not provide[20]. It also differentiates between the follicular neoplasm and the nodule without neoplasia[10]. However, there are yet no definite authoritative guidelines on the use of TCB[19]. TCB is still not routinely used even though it has all these advantages because of limited data on efficacy and safety[15]. TCB is also not always feasible, especially when the nodule is present posteriorly or near the major vessels of the neck[21].

CONCLUSION

Hence, it is proven that both FNAC and CNB play an indispensable role in the diagnosis of thyroid nodules with the advent of technological advances in ultrasonography.[31] FNAC is the traditional investigation of choice and has made its place as a first-line biopsy method owing to the advantages of being fast, cheap, and readily available. As medical techniques have continued to get better and more sophisticated, Tru-cut biopsy has also emerged as another very important biopsy method due to the advantage of a greater tissue sample size that allows histological studies and immunohistochemistry as more tumor markers are being identified.

More studies need to be done to consider core needle biopsy as a first-line investigation as it yields less nondiagnostic or inconclusive results at the price of a greater pooled proportion of serious complications and an equal number of diagnostic surgeries.

ARTICLE INFORMATION Accepted for Publication: December 12, 2021,
Published Online: December 00, 2021.
https://doi.org/10.48111/2021.04.09

Author Affiliations. Department of surgery, Shalamar Medical & Dental College, Lahore, Pakistan

Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest

REFERENCES

1. Germano A, Schmitt W, Carvalho MR, Marques RM. Normal ultrasound anatomy and common anatomical variants of the thyroid gland plus adjacent structures — A pictorial review. Clin Imaging. 2019;58:114-128. doi:10.1016/J.CLINIMAG.2019.07.002
2. Paschou S, Vryonidou A, Goulis DG. Thyroid nodules: A guide to assessment, treatment, and follow-up. Maturitas. 2017;96:1-9. doi:10.1016/J.MATURITAS.2016.11.002
3. Wong R, Farrell SG, Grossmann M. Thyroid nodules: diagnosis and management. Med J Aust. 2018;209(2):92-98. doi:10.5694/MJA17.01204
4. Guler B, Kiran T, Dilek &, Arici S, Aysan E, Cavide Sonmez F. Should Core Needle Biopsy be Used in the Evaluation of Thyroid Nodules? doi:10.1007/s12022-016-9440-9
5. Durante C, Grani G, Lamartina L, Filetti S, Mandel SJ, Cooper DS. The diagnosis and management of thyroid nodules a review. JAMA - J Am Med Assoc. 2018;319(9):919-924. doi:10.1001/JAMA.2018.0898
6. Shin I, Kim E-K, Moon HJ, et al. Core-Needle Biopsy Does Not Show Superior Diagnostic Performance to Fine-Needle Aspiration for Diagnosing Thyroid Nodules. Yonsei Med J. 2020;61(2):161. doi:10.3349/YMJ.2020.61.2.161
7. Hahn SY, Shin JH, Oh YL, Park KW, Lim Y. Comparison Between Fine Needle Aspiration and Core Needle Biopsy for the Diagnosis of Thyroid Nodules: Effective Indications According to US Findings. Sci Rep. 2020;10(1). doi:10.1038/S41598-020-60872-Z
8. Ahn S-H. Usage and Diagnostic Yield of Fine-Needle Aspiration Cytology and Core Needle Biopsy in Thyroid Nodules: A Systematic Review and Meta-Analysis of Literature Published by Korean Authors. Clin Exp Otorhinolaryngol. 2021;14(1):116. doi:10.21053/CEO.2020.00199
9. Samantaray S, Panda N, Besra K, Pattanayak L, Samantara S, Dash S. Utility of Tru-Cut Biopsy of Breast Lesions - An Experience in a Regional Cancer Center of a Developing Country. J Clin Diagn Res. 2017;11(3):EC36. doi:10.7860/JCDR/2017/23572.9548
10. Ahn S, Jung S, Kim J-Y, Shin JH, Hahn SY, Oh YL. Evaluation of Modified Core-Needle Biopsy in the Diagnosis of Thyroid Nodules. Korean J Radiol. 2018;19(4):656. doi:10.3348/KJR.2018.19.4.656
11. Core-needle biopsy in thyroid nodules: performance, accuracy, and complications. European Radiology | 10.1007/s00330-019-06038-6.
12. Trimboli P, Giovanella L. Reliability of core needle biopsy as a second-line procedure in thyroid nodules with an indeterminate fine-needle aspiration report: a systematic review and meta-analysis. Ultrasonography. 2018;37(2):121. doi:10.14366/USG.17066
13. Comparison of core-needle biopsy and repeat fine-needle aspiration for thyroid nodules with inconclusive initial cytology. European Archives of Oto-Rhino-Laryngology | 10.1007/s00405-020-06473-y.
14. Chung SR, Baek JH, Choi YJ, et al. The Role of Core Needle Biopsy for the Evaluation of Thyroid Nodules with Suspicious Ultrasound Features. Korean J Radiol. 2019;20(1):158. doi:10.3348/KJR.2018.0101
15. Suh CH, Baek JH, Park C, Choi YJ, Lee JH. The Role of Core Needle Biopsy for Thyroid Nodules with Initially Indeterminate Results on Previous Fine-Needle Aspiration: A Systematic Review and Meta-Analysis. AJNR Am J Neuroradiol. 2017;38(7):1421. doi:10.3174/AJNR.A5182
16. Liu N, Meng Z, Jia Q, et al. Ultrasound-guided core needle biopsy for differential diagnosis of thyroid nodules: A systematic review and meta-analysis. Mol Clin Oncol. 2017;6(6):825. doi:10.3892/MCO.2017.1246
17. Diagnostic Efficacy and Safety of Core Needle Biopsy as a First-Line Diagnostic Method for Thyroid Nodules: A Prospective Cohort Study. Thyroid, 30(8), 1141–1149 | 10.1089/thy.2019.0444.
18. Jeong EJ, Chung SR, Baek JH, Choi YJ, Kim JK, Lee JH. A Comparison of Ultrasound-Guided Fine Needle Aspiration versus Core Needle Biopsy for Thyroid Nodules: Pain, Tolerability, and Complications. Endocrinol Metab. 2018;33(1):114. doi:10.3803/ENM.2018.33.1.114
19. Suh CH, Baek JH, Lee JH, et al. The role of core-needle biopsy in the diagnosis of thyroid malignancy in 4580 patients with 4746 thyroid nodules: a systematic review and meta-analysis. Endocrine. 2016;54(2):315-328. doi:10.1007/S12020-016-0991-9
20. Yim Y, Baek JH. Core needle biopsy in the management of thyroid nodules with an indeterminate fine-needle aspiration report. Gland Surg. 2019;8(Suppl 2):S77. doi:10.21037/GS.2018.09.07
21. Choe J, Hwan Baek J, Park HS, Choi YJ, Lee JH. Core needle biopsy of thyroid nodules: outcomes and safety from a large single-center single-operator study. doi:10.1177/0284185117741916
22. Garg P, Yadav P. ISSN 2347-954X (Print) Comparison between FNAC and Core Needle Biopsy in the Diagnosis of Palpable Breast Lesions. Sch J Appl Med Sci (SJAMS. 2017;5(11A):4366-4370. doi:10.21276/sjams.2017.5.11.12
23. Is thyroid core needle biopsy a valid compliment to fine needle aspiration? Journal of the American Society of Cytopathology | 10.1016/j.jasc.2020.06.003.
24. Suh CH, Hwan Baek J, Jeong •, et al. The role of core-needle biopsy in the diagnosis of thyroid malignancy in 4580 patients with 4746 thyroid nodules: a systematic review and meta-analysis. Endocrine. Published online 2020. doi:10.1007/s12020-016-0991-9
25. Suh CH, Baek JH, Choi YJ, et al. Efficacy and safety of core-needle biopsy in initially detected thyroid nodules via propensity score analysis. Sci Rep. 2017;7(1). doi:10.1038/S41598-017-07924-Z
26. PISTOLESE CA, PERRETTA T, CLARONI G, et al. A Prospective Evaluation of Tru-Cut Biopsy and Fine-needle Aspiration Cytology in Male Breast Cancer Detection. In Vivo (Brooklyn). 2020;34(6):3431. doi:10.21873/INVIVO.12182
27. Lan L, Luo Y, Zhou M, et al. Comparison of Diagnostic Accuracy of Thyroid Cancer With Ultrasound-Guided Fine-Needle Aspiration and Core-Needle Biopsy: A Systematic Review and Meta-Analysis. Front Endocrinol (Lausanne). 2020;11:44. doi:10.3389/FENDO.2020.00044
28. Dupain C, Masliah-Planchon J, Gu C, et al. Fine-needle aspiration as an alternative to core needle biopsy for tumour molecular profiling in precision oncology: prospective comparative study of next-generation sequencing in cancer patients included in the SHIVA02 trial. Mol Oncol. 2021;15(1):104-115. doi:10.1002/1878-0261.12776
29. Reyaz N, Baloch MB, Butt ME, Siddique S, Malik SH, Noor J. Comparative Study of Fine Needle Aspiration Cytology (F.N.A.C) Vs Tissue Biopsy in Thyroid Glands: Following Bethesda System Med Forum 2020;31(9):136-140
30. Chae IH, Kim E-K, Moon HJ, Jung •, Yoon H, Park VY, et al. Ultrasound-guided fine needle aspiration versus core needle biopsy: comparison of post-biopsy hematoma rates and risk factors. 2020;
31. Rahman M, Okada A, Guan K, Tauchi-Nishi P. Metastatic neoplasms to the thyroid diagnosed by fine-needle aspiration/core needle biopsy: Clinicopathologic and cytomorphologic correlation. Cytojournal [Internet]. 2017 [cited 2021 Dec 30];14(1). Available from: https://pubmed.ncbi.nlm.nih.gov/28694837/
32. Ha EJ, Suh CH, Baek JH. Complications following ultrasound-guided core needle biopsy of thyroid nodules: a systematic review and meta-analysis. [cited 2021 Dec 30]; Available from: https://doi.org/10.1007/s00330-018-5367-5
33. Gupta N, Gupta P, Rajwanshi A. Trucut/Core Biopsy versus FNAC: Who Wins the Match? Thyroid Lesions and Salivary Gland Lesions: An Overview. J Cytol [Internet]. 2018 Jul 1 [cited 2021 Dec 30];35(3):173. Available from: /pmc/articles/PMC6060581/.
33. Wolinski K, Stangierski A, Ruchala M. Comparison of diagnostic yield of core-needle and fine-needle aspiration biopsies of thyroid lesions: Systematic review and meta-analysis. Eur Radiol. 2017;27(1):431. doi:10.1007/S00330-016-4356-9

Archives of Surgical Research | Case Report

Colonic Interposition For Concomitant Corrosive Esophageal And Gastric Esophageal Stricturing

Jahangeer Ahmed; M. Hasham Ashraf; Talat Waseem

IMPORTANCE The stomach, jejunum, and colon (right, left, or transverse) have all been proposed as potential conduits as a replacement of the esophagus after esophagectomy. We report a case of concomitant esophageal and gastric stricture in which a part of the colon was used for this purpose.

CASE PRESENTATION A 26-year-old female with a history of corrosive intake presented with progressive dysphagia. On barium swallow and endoscopy, concomitant esophageal and gastric stricture was diagnosed. Transhiatal esophagectomy followed by right colonic interposition was performed successfully with excellent post-op outcomes.

DISCUSSION Considering the technical complexity of interpositional procedures, the published rates of morbidity and mortality are highly variable. In experienced hands, construction of colon and jejunal conduits can be performed with good short-term and long-term results.

KEYWORDS Esophageal stricture; Dysphagia; Corrosive Intake; Esophagectomy; Roux en Y Gastric Advancement; Esophagectomy; Gastric Stricturing

HOW TO CITE Ahmed J, Waseem T, Ashraf MH. Colonic Interposition For Concomitant Esophageal And Gastric Esophageal Stricture. *Archives of Surgical Research*. 2021, 2 (4):53-55. https://doi.org/10.48111/2021.04.10.

Case Report

Author Affiliations: Author affiliations are listed at the end of this article.
Corresponding Author: Mr. Talat Waseem FRCS Eng, FACS, Consultant Surgeon
Shalamar Medical & Dental College, Lahore
twaseem@gmail.com
092-333-8078705
https://doi.org/10.48111/2021.04.10

Replacement of the native esophagus after esophagectomy is a problem that has challenged surgeons for over a century. Not only must the conduit be long enough to bridge the distance between the cervical esophagus and the abdomen, but it must also have a reliable vascular supply and be sufficiently functional to allow for deglutition.

Multiple structures have been proposed to serve as a conduit but the stomach has gained favor for its length, reliable vascular supply, and need for only a single anastomosis. However, there are times when the stomach is unavailable. It is in these instances that an esophageal surgeon must have an alternative option in their armamentarium.

Colonic interposition has been used for esophageal reconstruction since the early 1900s.[1] Either the left or right colon may be utilized and in either case, the transverse colon is always required. Proponents of colonic interposition recommend this option in many cases for its substantial length. The length of the right colon interposition for example closely simulates that of the native esophagus.

Another benefit of the colon is its resistance to acid and the right colonic interposition includes the valve of Bauhim which may further decrease reflux.[2] Disadvantages of the colonic interposition include; the colon may have or can develop native pathology and that loss of absorptive capacity of the colon may result in diarrhea.[3] The colon conduit may also lengthen over time leading to redundancy that may require surgical revision. [4]

CASE PRESENTATION

A 26 years old female, with a history of corrosive intake, presented to us with progressive dysphagia which was initially for solid food only but she now presented with complaints of difficulty for intake of liquids as well.

Past medical history revealed no previous comorbid conditions or any other associated traditional risk factors. On clinical examination, the patient was pale and emaciated.

Barium swallow and upper GI endoscopy confirmed the diagnosis of concomitant esophageal and gastric stricture. Baseline workup was done and the patient was prepared for transmittal esophagectomy followed by esophageal reconstruction with colonic interposition. The right and middle colon were mobilized; ileocolic and cologastric anastomosis was constructed.

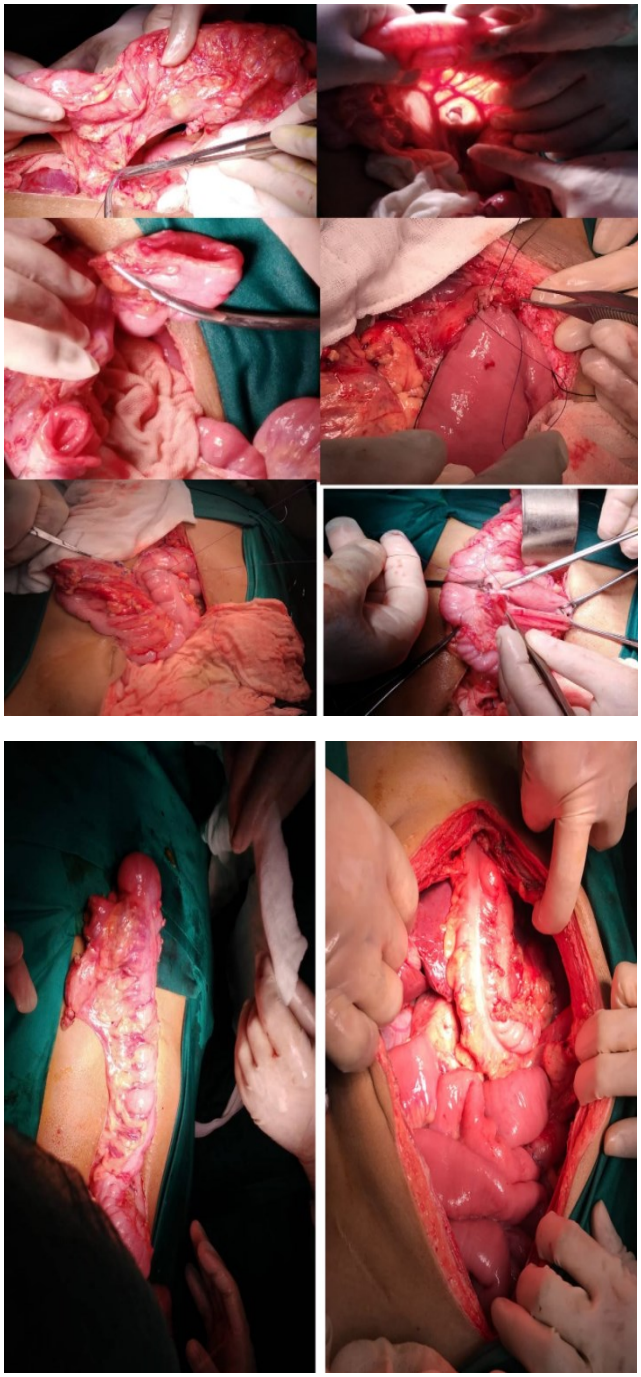


Fig 1&2: These pictures demonstrate the mobilized colon and the colon in situ in the retrosternal position following mobilization and the cologastric anastomosis.

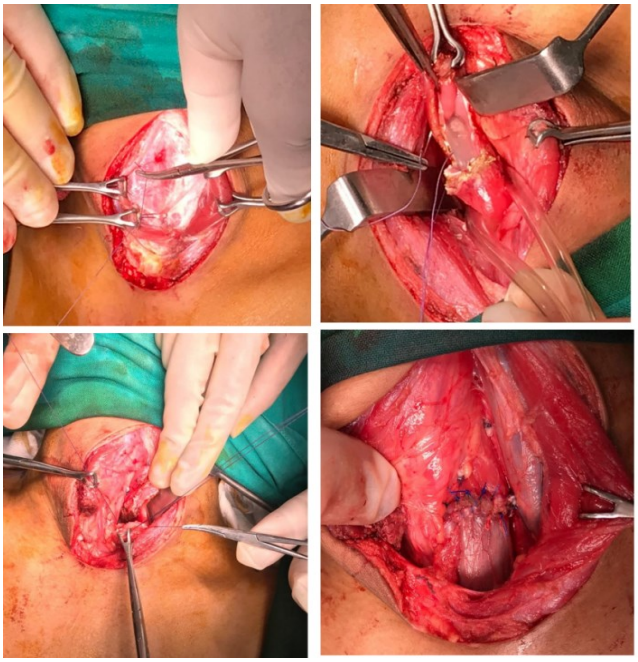


Figure 3: Mobilized esophagus and the esophagocolic anastomosis can be seen in these pictures

DISCUSSION

Colonic interposition is one of the standard conduits available for construction. Rates of reported graft loss were 0–14%. In the larger case series, this range decreases to 0–2%. The reported anastomotic leak rate was 0–50% and in larger case series, this rate decreases to 0–12.6%. Mortality ranged from 0–16.7% and in centers with higher case volume, this rate was 0–7%. The long-term stricture rate was 0 to 32%. The re-operative rate was 0–32% and reasons for re-operation included graft necrosis, graft redundancy, and anastomotic leaks. The most commonly reported medical complication was aspiration and pneumonia which had a rate of 0–32%. Resumption of oral intake has been reported between 75% and 100%. The use of non-gastric conduits after esophagectomy is often a salvage procedure and interpretation of the results of series describing outcomes following colon and jejunal interpositions should consider this. Though the interpositional procedures are quite complex and the morbidity and mortality rates are high, as published in the literature, we advocate that the construction of colon and jejunal conduits if performed by experienced surgeons have an excellent prognosis. When the gastric conduit is not available we prefer to use an iso-peristaltic right colon interposition, the reason being its sufficient length, robust blood supply, and non-dependence on a microvascular anastomosis.

ARTICLE INFORMATION Accepted for Publication: March 14, 2021, Published Online: Dec 30, 2021. https://doi.org/10.48111/2021.04.10

Author Affiliations: Department of Surgery, Shalamar Medical College & Dental College, Lahore, Pakistan

Declaration of Consent: The authors certify that they have obtained all appropriate consent required from the patient.

Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest.

REFERENCES

1. Boukerrouche A. Isoperistaltic left colic graft interposition via a retrosternal approach for esophageal reconstruction in patients with a caustic stricture: mortality, morbidity, and functional results. *Surg Today* 2014;44:827-33
2. Yasuda T, Shiozaki H. Esophageal reconstruction with colon tissue. *Surg Today* . 2011;41:745-53
3. DeMeester SR. Colonic Interposition for Benign Disease. *Oper Tech Thorac Cardiovasc Surg* 2006;11:232-49.
4. Strauss DC, Forshaw MJ, Tandon RC, et al. Surgical management of colonic redundancy following esophageal replacement. *Dis Esophagus* 2008;21:E1-5
5. Korst RJ, Sukumar M, Burt ME, et al. Atraumatic gastric transposition after transhiatal esophagectomy. *Ann Thorac Surg* 1997;64:867-9.
6. Saeki H, Morita M, Harada N, et al. Esophageal replacement by colon interposition with microvascular surgery for patients with thoracic esophageal cancer: the utility of superdrainage. *Dis Esophagus* 2013;26:50-6

Author Guidelines

Archives of Surgical Research (ASR) ASR ISSN: 2709-684X (Print), 2709-6858 (Online) is dedicated to the local, national, and global advancement of surgical research, education and clinical practice. It aims to promote continued development in surgery through the dissemination of knowledge, ideas and good practice across surgical specialties. ASR provides readers with critically peer-reviewed, carefully selected and edited, and up-to-date publications about advancements in all surgery specialties.

The journal aims to uphold the highest standards at the cutting-edge of research, provide a focus for evidence-based medicine through the publication of review articles and special issues, and give the findings context through the publication of editorials, commentaries and letters from the surgical community. We encourage enforcement of reporting guidelines and encourage the registration of all research involving human participants in a publicly accessible research registry.

As a journal covering all surgical specialties, ASR aims to facilitate the transfer of important ideas and thought systems between and across specialties. Hence, ASR will help prevent the trend of increasing sub-specialization which leads to 'tunnel-vision' and the unfortunate concealment of important surgical advances within specific specialties.

The journal is ICMJE, DOAJ and COPE compliant and follows the guidelines and policies instituted by these bodies. Manuscripts which have been published as copyrighted material elsewhere cannot be submitted. In addition, manuscripts under review by the journal should not be resubmitted to copyrighted publications. However, by submitting a manuscript, the author(s) retain the rights to the published material. In case of publication they permit the use of their work under a CC-BY license [http://creativecommons.org/licenses/by/4.0/], which allows others to copy, distribute and transmit the work as well as to adapt the work but not to make commercial use of it.

1. DOWNLOADABLE DOCUMENTS AND FORMS (FROM THE JOURNAL WEBSITE)

- ASR-Letter of Undertaking (WORD FORMAT) (PDF FORMAT)
- ASR-Ethical Compliance Undertaking (WORD FORMAT) (PDF FORMAT)
- ASR-Reviewer Suggestion Form (WORD FORMAT) (PDF FORMAT)
- ASR-Consent Form of Case Reports (WORD FORMAT) (PDF FORMAT)
- ASR-Peer Reviewer Proforma (WORD FORMAT) (PDF FORMAT)
- ASR-Manuscript Submission Checklist (WORD FORMAT) (PDF FORMAT)
- ASR-Disclosure Form (WORD FORMAT) (PDF FORMAT)
- ASR-Title Page Sample (WORD FORMAT)

Authors are required to follow ICMJE Guidelines for reporting research work. Before submitting, kindly ensure that the following aspects are present. Please also review journal policies listed below in website especially about Ethical Publishing, Professional Misconduct about Scientific Reporting, Plagiarism, and Peer Review Process etc. before writing a manuscript.

For the correspondence author:

- E-mail address
- House address

Manuscript: The Manuscript files should be prepared in a manner to facilitate double blind peer review process. The title page containing author and institutional information should be submitted separately from the body of the manuscript. The manuscript should include:

- Cover Letter
- Title Page
- Article Body Text
- All figures (with relevant captions)
- All tables (including titles, description, references)
- Ensure all figure and table citations in the text match the files provided
- Supplemental files, if applicable
- Letter of Undertaking
- Ethical Compliance Undertaking
- Reviewer Suggestion Form (One Reviewer should preferably from outside Pakistan)
- Plagiarism Check Report (Optional)
- Relevant Consent Forms
- IRB Approval Letter
- Disclosure Form
- Proof of Submission of Article Processing Charges (APC) Contact Support Person

2. SUBMISSION CHECKLIST

(HIGH LEVEL OF COMPLIANCE IS REQUIRED; THE ARTICLES NOT IN COMPLIANCE WOULD BE RETURNED)

The authors must comply with these important checklist items prior to submitting their manuscript for publication as the non-compliant manuscripts would be returned without review: -

1. Manuscripts should be prepared following Uniform requirements for manuscripts submitted to Biomedical Journals as approved by the International Committee of Medical Journal Editors (www.icmje.org). The manuscript handling is done through Committee on Publication Ethics (COPE) guidelines.
2. The submission file is in Open Office, Microsoft Word, or RTF document file format. The text is single-spaced; uses a 12-point font; employs italics, rather than underlining (except with URL addresses); and all illustrations, figures, and tables are placed within the text at the appropriate points, rather than at the end.
3. All original manuscripts should have Abstract in structured format up to 350 words. It should mention Objective, Methodology, Results, Conclusions and appropriate Key Words.
4. Please strictly follow the author guidelines for writing your manuscript. Non-compliant manuscripts would be returned without review without any exception. Referencing should be done through Mendeley, Endnote or any other such referencing software. In text citation should be in form superscript. The manuscripts with improper citation would be retuned without review. A sample manuscript submission file may be downloaded from this website.
5. The submission files should have a. Cover Letter describing the value of research work being submitted, b. Title Page containing the Manuscript Title, Authors, affiliations, contributions—an example of title page can be downloaded from this website, c. Article Text File having body of the main manuscript, d. Images and Tables, e. IRB approval Letter, f. Signed Letter of Undertaking, g. Consent Form for Case Report h. Article Processing Charges Submission Proof, i. Ethical Undertaking. Make sure that quality of Images is according to specifications provided in author guidelines. j. Reviewer Suggestion Form. k, Disclosure Form
6. Title page should contain title of the write-up, Name of the author/co-authors, their qualifications, designation & institutions they are affiliated with and mailing address for future correspondence, E-mail address, Phone, Cell Phone number besides a short running title of the manuscript. Don't type the name of the author/s on other pages in the manuscript except the title page to ensure the double blinding of the review process.
7. Prior to submission the manuscript should be checked for plagiarism preferably through Turnitin or some other medium and the similarity index should exceed 19%.
8. You have the proof in PDF/ JPEG form of submission of Article Processing Charges (APC).
9. All submissions are received through online portal through www.archivessr.com.
10. All randomized control trials should be prepared according to CONSORT Guidelines. All Clinical Trials submitted for publication must be registered in a registry e.g. https://clinicaltrials.gov/. Provide registration number.
11. Disclosure regarding source of funding and conflict of interest if any besides approval of the study from respective Ethics Committee/Institution Review Board.
12. Manuscript must be submitted along with IRB/Ethics Committee Approval letter.
13. Case Reports should be submitted along with Consent Form wherever applicable.

Corresponding Author Name_____ Sig. _____

Date _____

Manuscript Title: _____

_____

Further Considerations:

- Manuscript has been checked for correct spelling and grammar
- All Reporting Guidelines have been met
- All references mentioned in the Reference List are cited in the text, and vice versa
- All figures and tables are cited in text
- Permission for use of copyrighted material from other sources has been obtained
- A conflict of interest statement is provided, even if the authors have no conflicting interests to declare
- All research and clinical trials are registered in a public registry
- Journal policies detailed in this guide have been reviewed
- Referees and reviewers suggested by author(s) comply with journal policies as well.

3. BEFORE INITIATING SUBMISSION PROCEDURE

Ethical Confines

The work detailed in the manuscript must be approved by the appropriate ethical committees related to the institution(s) in which it was performed, including verification that all subjects involved gave informed consent. Records of written consent must be kept by the author. Studies involving experiments with animals must follow institution guidelines for the care of animal subjects. Any identification markers of patients and volunteers – including names, initials, and hospital numbers – must NOT be used.

Declaration of Interest

All authors must disclose financial and personal relationships with individuals or organizations that could potentially introduce bias to their article. Examples of possible conflicting interests include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications or registrations, and grants or other funding. If there are no interests to declare, then please: 'Declaration of interest: none'. This summary statement will be published if the article is accepted.

Submission Declaration and Verification

Verify that the work described has not been published previously (except in the form of an abstract, a published lecture or academic thesis), that it is not being considered for publication anywhere else, that its publication is approved by all authors, and by the responsible authorities/institutions where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form without the written consent of the copyright-holder. Verify that the work is original – all manuscripts are checked for plagiarism, and if found to be plagiarized above a certain degree, the author is liable to be blacklisted.

Use of Impartial and Inclusive Language

Inclusive language acknowledges diversity, conveys respect, is sensitive to differences, and promotes equality of opportunity. Content must not imply that one individual is superior to another on the basis of age, gender, race, ethnicity, culture, sexual orientation, disability or health condition. Authors should ensure that writing is free from bias, stereotypes, slang, and references to dominant culture. Avoid using markers of identification – including age, gender, race, ethnicity, culture, sexual orientation, disability or health when referring to subjects unless absolutely necessary. Always use the gender-neutral 'they' when referring to singular subjects unless the gender of the subject has particular influence on the research matter.

Authorship and Author Rights

Manuscripts by multiple authors must be signed by all the authors and contain details of contribution of every individual author. All authors must fulfill criteria for authorship. Authorship credit should be based on:

- Significant contribution to formation or design of study, procurement of data, or analysis and interpretation of data (Acquisition of funding, collection of data, or general supervision of the research group alone does not justify authorship)
- Drafting the article or revising it analytically
- Final approval of the version to be published
- Agreement to be responsible for all aspects of the work, and ensuring that the accuracy or integrity of any part of the work is maintained.

If a large, multi-center group has conducted the work, the group should identify the individuals who accept responsibility for the manuscript. These individuals should fully meet the criteria for authorship defined above and complete journal-specific author and conflict of interest disclosures. When submitting a group author manuscript, the corresponding author should clearly indicate the preferred citation and should clearly identify all individual authors as well as the group name. Other members of the group should be listed in the acknowledgements. In case of suspicion of gift authorship the journal may refuse further processing of the manuscript. Manuscripts with more than *Eight* authors will not be accepted for further processing and will be rejected. An author (or employer or institution) has certain rights to reuse work that this journal will not infringe upon.

Registration of Research and Clinical Trials

All types of research studies and clinical trials involving human participants should be preferably registered prior to submission, and proof of registration must be provided. Unregistered trials and studies may not be published.

Role of Funding Source

The funding source must be disclosed along with their degree of involvement with the research matter, if any, in the design, collection, analysis or interpretation of data; in the writing of the article, or in the decision to submit the article for publication. If the funding source had no involvement, then this should be stated. Any authors found guilty of scientific misconduct will be blacklisted from future publications.

4. PREPARATION

Reviewing Process

This journal is reviewed using a *double blind* method through OJS. The following categories the journal will accept, out of guest editorials, original articles, review articles, case reports, clinical updates, short communications, book reviews, case studies, clinical notes, Continuation of Medical Education (CME), obituaries , letters, Knowledge-Attitude-Practice (KAP) studies, routine surveys and cross sectional studies. The authors are required to suggest potential refrees for the review process. The journal however would have to discretion to get the article reviewed by the suggested faculty or not.

Reporting Guidelines

Compliance with the relevant reporting guideline is mandatory for submission of the following guidelines:

1. Submit a completed checklist, indicating the page numbers where compliance to the guidelines was ensured.
2. Mention in the 'Methods' section that the research is being reported in line with the relevant guideline, which should be named and cited.

Randomized Controlled Trials

All randomized controlled trials submitted for publication in Archives of Surgical Research must include a completed

Consolidated Standards of Reporting Trials (CONSORT) flow-chart and ensure that all features of the CONSORT checklist are present. A copy of the CONSORT checklist must be uploaded in supplemental material. Refer to the CONSORT statement website here.

Systematic Reviews

Systematic reviews are to be reported in accordance to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) Guidelines and must include the flow-chart as a figure and the checklist as a supplemental material. Please download a PRISMA Flowchart and a PRISMA Checklist here. To aid and improve the methodological quality of your article, include an AMSTAR 2 checklist as well, which is available here.

Cohort, Case-control and Cross-sectional studies

Cohort, Case-control and Cross-sectional studies must be compliant with the STROCSS criteria (Strengthening the reporting of cohort studies in surgery), which is available here. Cite the following paper: Agha RA, Abdall-Razak A, Crossley E, Dowlut N, Iosifidis C, Mathew G, for the STROCSS Group. STROCSS 2019 Guideline: Strengthening The Reporting Of Cohort Studies in Surgery. Each study type has its own checklist which must be uploaded as supplemental material.

Diagnostic, Quality Improvement and Qualitative studies

Diagnostic studies should be reported according to the STARD statement criteria (Standards for the Reporting of Diagnostic Accuracy studies). The flow-chart should be a figure and checklist should be uploaded as supplementary material. Quality Improvement studies must comply with the Standards for Quality Improvement Reporting Excellence (SQUIRE) criteria, which is available here. Qualitative studies require the Consolidated criteria for Reporting Qualitative Research (COREQ) checklist, available here.

Health Economic Evaluation

Health Economic Evaluation studies should conform to the CHEERS statement, available here.

Tumour Marker Prognostic Study

Tumor Marker Prognostic studies should be reported according to the REMARK criteria.

Before and After Studies

Before and After studies measure specific characteristics of a population or group of individuals after an event or intervention, compare them with those characteristics before the event or intervention, then measure the effects of the event or intervention. These studies should conform to the STROCSS statement.

Experimental Animal Studies

Animal studies must be reported according to the ARRIVE guidelines (Animals in Research: Reporting In Vivo Experiments) and must include the checklist as supplemental material. An example of a completed checklist can be found here. The institutional protocol number must be included at the end of the abstract.

Qualitative Surveys

Qualitative Surveys should be reported according to the criteria detailed in the SRQR Guidelines. Guidelines for synthesis of qualitative research can be found here. Guidelines for interviews and focus groups are available here.

Case Series

Ensure that the case series is compliant with the PROCESS Guidelines and submit a completed PROCESS checklist. State that the work has been reported in line with the PROCESS criteria and cite the following paper: Riaz A. Agha, Mimi R.Borrelli, Reem Farwana, Kiron Koshy, Alex Fowler, Dennis P. Orgill, for the PROCESS Group. The PROCESS 2018 Statement: Updating Consensus Preferred Reporting Of CasE Series in Surgery (PROCESS) Guidelines.

Article Structure

Title Page

The title page should give the title in capital letters and a shorter running title. Avoid abbreviations and formulae if possible. In addition, the title page should also include:

- Correctly spelled names of all authors, and their affiliation addresses where the actual work was done. Include the e-mail address of each author.
- Signpost clearly the correspondence author who will maintain contact at all steps of reviewing and publication, and post-publication, and answer any questions about the research. All information must be updated in case of any changes.
- Present/permanent address of every author.
- The source of funding of the research.
- The number of figures and tables, the total word count and the total number of pages of the manuscript.
- A sample Title Page has been uploaded on this page above.

Abstract

All original articles must accompany a structured abstract of up *to 250-350* words. It should state aims of the study, methodology and materials used, results obtained, and conclusions reached. Specify how the sample selection of study subjects or experimental animals was carried out, specify the observational and analytical methods, and give specific data and its statistical significance, where possible. Highlight novel and significant aspects of the study. Avoid references, but if necessary, cite the author(s) and year(s). Avoid non-standard or uncommon abbreviations, but if necessary they must be defined at their first mention in the abstract. This page should constitute of the abstract and keywords only.

Keywords

Right after the abstract, provide a maximum of *6* keywords, using British spelling. Avoid general and plural terms and

multiple concepts (avoid, for example, 'and', 'of'). Only abbreviations firmly established in the field may be appropriate. These keywords will be used to aid the indexing process of the journal.

Introduction

Outline the aims of the work and provide sufficient background information, avoiding a lengthy literature review or a summary of the results.

Methodology

Provide adequate details to allow the research to be reproduced by an independent researcher. If experimental apparatus is used, the manufacturer's name and address should be included in parentheses. Methods that have previously been published should be summarized, and signposted by a reference. If quoting directly from a previously published method, use quotation marks and cite the source. Any alterations to existing methods should also be described. If a drug is used, its common name, dose and route of administration must be included. For patients, age and sex with mean age ± standard deviation must be given where relevant to the data. Statistical methods employed for comparisons of data sets must be mentioned and any computer programs used for calculations must be specified.

Results

Results should be clear and succinct. They must be presented in the form of text, tables and illustrations. The content of the tables should not be repeated in the text; the tables should be numbered and identified and referenced to as their number. A conclusion that either supports or negates the hypothesis should be included. If the data is inconclusive, that should also be noted.

Discussions

This should emphasize present findings of the research, and the differences and similarities with prior work done in the field by other researchers. Data must not be repeated in the discussion, and lengthy citations and reviews must be avoided. Highlight the original and central aspects of the study and the conclusions that they lead to.

References

Please make sure that Mendley or some other software is used for referencing. The articles without compliance in this area would be sent back. **American Medical Association (AMA Referencing Style) should be used.** References should be typed in sequential numbers in superscript for in-text citations, and numbered sequentially in the Reference List provided at the end. Maximum references for original article should not exceed 40; they should not exceed 10 for case reports, and 80 for reviews. Authors should ensure that locally published studies are given precedence. Add DOI number of documents where it is available.

References from books should include author, title, publisher, and year of publication. Example:

Das JC. *Power System Harmonics and Passive Filter Designs*. John Wiley & Sons, Inc; 2015.

For articles in journals, the authors, title of article, name of journal, year of publication, and an article identifier and page range (where available) must be included. See the following example:

Zhu Z, Hoffman JE. Condensed-matter physics: Catching relativistic electrons. *Nature.* 2014;513(7518):319-320.

Websites that are blogs and subject to changes by the author must be used as sparingly as possible, and when included, the author's name, the title, the name of website, date of publication, date on which the website was accessed, and a link to the website must all be included. Example:

Andrew E. After Years Of Conflict, Huge Project Could Help Scientists Decipher The Brain. IFLScience. Published June 18, 2015. Accessed October 30, 2018. https://www.iflscience.com/brain/after-years-conflict-huge-project-could-help-scientists-decipher-brain/

For government reports, technical reports, and scientific reports, if the report number is unavailable, then cite the report as a book. For reports it is usually not individual people that are credited as authors, but a governmental department or agency. Include the name of the agency, the title of the report, the publisher, and the year of publication. An example is as follows:

Government Accountability Office. *The Manager, the Government, and the Accounting Profession*. U.S. Government Printing Office; 1968.

References to Ph.D. dissertations, Master's theses or Bachelor theses follow the format outlined below, and must include author, title, publication detail if applicable, and year of publication.

Campbell AJ. History transformed: Sengoku Daimyo in Japanese popular media. Published online 2012.

For newspaper articles, citation must include the author, title, name of newspaper, full date and page number. The example is as follows:

Kinsley M. Paid Leave Counts as Progress. *New York Times*. May 27, 2017:SR3

Avoid referencing personal communications and unpublished observations, but they must be presented in parentheses in the text if included, and not in the list of references in the appendix. A research article may not be cited as "Under Publication" or "In Press" unless it has been accepted for publication. In such a case, the name of the journal must be given.

Acknowledgements

All contributors who do not meet the criteria for authorship should be credited in this section. It should include persons who provided technical help, writing assistance and general support or supervision. Financial and material assistance must also be credited. Persons who have added to the material but do not justify authorship can be listed as "clinical investigators", "participating investigators", "scientific advisors", "reviewers', or "data collectors."

5. FURTHER CONSIDERATIONS

World Limits

Maximum length of the original manuscript should not exceed *4000* words including title page, table and references. For review articles, the maximum word count is *3500,* however considering the demand of the subject it can be up to 8000 words. Maximum number of tables & illustrations should not exceed 5. Short reports of cases, clinical experience, drug trials and their adverse effects can be submitted. Maximum length of these case reports should not exceed *800* words, *5* maximum number of references, and *2* table or illustrations. For letters, maximum words are *600* with *5* references. Extra charges will be applicable for lengthy manuscripts.

Units, Abbreviations and Formulae

Système Internationale (SI) units should be used, with the traditional equivalent in parentheses where appropriate. Avoid non-standard or uncommon abbreviations, but if necessary they must be defined at their first mention. Submit math equations as editable text. Add simple formulae in line with normal text where possible and use the solidus (/) instead of a horizontal line for small fractional terms, e.g., X/Y. Variables are to be written in italics. Powers of e should be denoted by exp. Any equations that have been presented separately from the text (if referred to explicitly) must be numbered consecutively.

Artwork

Make sure to use uniform lettering and sizing of original artwork. For original illustrations, use Arial, Courier, Times New Roman, Symbol, or a font that looks similar. Number the illustrations according to their order in the text with a logical naming convention for the artwork files. Provide captions to illustrations separately. Size the illustrations close to the desired dimensions of the published version, avoiding any files that are disproportionately large. Submit each illustration as a separate file. If the electronic artwork is created in a Microsoft Office application (Word, PowerPoint, Excel) then please supply in the native document format without alterations or conversions. If the application used is not part of Microsoft Office, convert the images to one of the following formats (note the resolution requirements for line drawings, halftones, and line/halftone combinations given below):

- EPS (or PDF): Vector drawings, make sure to embed fonts.
- TIFF (or JPEG): Color or gray-scale photographs (halftones); ensure a minimum of 300 dpi.
- TIFF (or JPEG): Bitmapped (pure black & white pixels) line drawings; ensure a minimum of 1000 dpi.
- TIFF (or JPEG): For combinations of bitmapped line/half-tone (color or gray-scale), ensure a minimum of 500 dpi.

Do not supply files that are optimized for screen use (e.g., GIF, BMP, PICT, WPG); these typically have a low number of pixels and limited set of colors. Do not supply files that are too low in resolution. Ensure that each illustration has a separate caption that is not attached to the figure. A caption should comprise of a short title and a brief description of the illustration. Avoid text in the illustrations themselves but explain the symbols and abbreviations used.

Tables

Submit tables as editable text and not as images. Tables can be placed either next to the relevant text in the article, or separately at the end in an appendix. Number tables consecutively according to their sequence in the text and present any table notes below the table body. Keep the use of tables to a minimum and ensure that the data included in them is not repeated in results described elsewhere in the article. Avoid using vertical rules and shading in table cells.

Supplementary Material, Research Data, and Video

Supplementary material such as applications, images, and sound clips, can be published with the article to enhance it. Submitted supplementary items are published exactly as they are received (Excel or PowerPoint files will appear as such online). Submit this material with the manuscript and supply a concise, descriptive caption for each file. If you want share data that supports your research publication, where appropriate, interlink the data with the article. Research data refers to the results of experimentation that validate research results. To enable reproducibility and data reuse, share the software, code, models, algorithms, protocols, methods and other useful materials related to the project. If you have made your research data available in a public data repository, link the dataset directly into your article. To enable transparency, we require you to state the availability of data in your submission if your data is unavailable to access or unsuitable to post. Authors who wish to submit video files with their article are encouraged to include links to these within the body of the article. This can be done in the same way as a figure or table by referring to the video or animation content and noting in the body text where it should be placed, or separately at the end. Keep the file in one of the recommended file formats with a preferred maximum size of 150 MB per file, 1 GB in total.

6. AFTER COMPLETION

Proofreading

Final version of the article is sent to corresponding author for proof reading before publication. In case of changes, corrections should be sent to the editor by email.

Processing & Publication Charges

This is open access journal and journal charges Article Processing Charges (APC) of Rs 5000/- for local manuscripts and $US 100 for foreign manuscripts. Article Processing Charges are deposited at the time of submission and are non-refundable. Moreover, please also note that once accepted minimum publication charges for articles, manuscripts are Rs.4,000/- per page (in case of overseas US$ 50/- per page; Overseas US$ 50/- per page). Charges for photograph, films and illustrations are additional. Publication charges are payable in advance once the manuscript has been accepted for publication.

A fast track review system is in place upon deposition of additional processing fee (Rs. 20,000), however we do not encourage such route and should be employed only in significant circumstances. Moreover, this does not ensure that manuscript if accepted would be published on priority.

Above-mentioned charges have been waived till further notice. A small amount may be charged at the time publication during this interim period.

Waiver Request

Those who cannot pay for processing and publication can apply for waiver at the time of the submission of their article.

Ethics Committee Approval

All manuscripts involving human subjects must be accompanied with certificate of approval by the relevant institutional review body or ethics committee.

Informed Consent

While the actual signed consent forms need not be sent to the journal, all manuscripts reporting the results of experiments involving human subjects should include a statement confirming that informed consent was obtained from each subject or subject's guardian, after the experimental protocol is approved by relevant institutional body or ethics committee.

Letter of Undertaking

Manuscripts must be accompanied by letter of undertaking signed by all the authors

Printed Copy

One printed copy will be sent to the correspondence author. Authors can order additional copies at the rate of *cost*. Payment for additional copies should be sent in with the publication charges.

Submission

All manuscripts must be Word documents.

Ombudsperson

The journal's managing Editor can be contacted by authors and other personnel in case any grievances should arise by e-mail.

7. PRIVACY POLICY

Archives of Surgical Research is committed to the protection of your personal information. The privacy policy outlined here applies only to information collected by Archives of Surgical Research through the http://www.archivessr.com/.

Information We Collect

We will request personal data from you to ascertain your individual user profile that may support all online activities allotted as an author, editorial member, or other connected role. Data like your name, postal address, e-mail address, telephone number and geographic locale are used as identifiers to permit access to certain content or to a secure website. All personal information is treated by Archives of Surgical Research as strictly personal and confidential. Archives of Surgical Research won't disclose any personal information to third parties without your permission, unless required by law

Cookies

Cookies and log files are automatically recorded when you visit our site. These data includes some of the following information: IP address, host name, domain name, browser version and platform, date and time of requests, and downloaded or viewed files. This information is used to measure and analyze traffic and usage of the www.archivessr.com website and our digital products.

Making Changes to Your Information

When you have created an account on the http://archivessr.com, you can update your private information at any time through your account settings.

This statement may be periodically updated.

If you are concerned about how your information is stored, please contact us by email at editor@archivessr.com

8. PUBLISHING ETHICS

Archives of Surgical Research follows the COPE Core Practices and ICMJE's *Recommendations to conduct, report, edit and publish Scholarly Work in Medical Journals*, and expected an ethical behavior from authors, reviewers and editors to follow guidelines. We also follow the Principles of Transparency circulated through WAME.

Allegations of Misconduct

Archives of Surgical Research (ASR) defines research & publication misconduct as follows:

- Plagiarism: the practice of taking someone else's work or ideas and passing them off as one's own.
- Citation manipulation: a problem when references do not contribute to the scholarly content of the article, and are included solely to increase citations.
- Data falsification/fabrication : intentional misrepresentation of research results
- Conflict of interest: a conflict of interest exists when a manuscript's or journal's author, editor, reviewer have a financial or personal relationship that may influence their intentions or bias.
- Redundant publication : when a published work (or substantial sections from a published work) is/are published more than once (in the same or another language) without adequate acknowledgment of the source/cross-referencing/justification (https://publicationethics.org/category/keywords/redundant-publication)

Any allegations of misconduct brought to the journal's attention will be dealt with immediately and seriously. ASR

will not accept articles that violate research & publication ethics, any manuscript not in compliance will be rejected.

ASR utilizes Turnitin to assess all submitted manuscripts, a plagiarism percentage upwards of 24% is unacceptable and articles not in accordance with this rule will be rejected.

In cases of citation manipulation, relevant COPE guidelines will be followed.

In case of suspected data falsification/fabrication, respective authors will be asked to clarify and explain their methods. Failure to do so will result in:

1. rejection of their submitted manuscript
2. communication of the authors' misconduct will be made to relevant institutions and regulatory bodies
3. black-listing of the authors from ASR for all future submissions

This is in accordance with COPE guidelines.

We follow the COPE Guidelines for sharing information regarding any misconduct with other journals. We also follow the COPE Retraction Guideline. We as a journal have policy to refer such cases to COPE if required.

In case of suspicion of image manipulation in a manuscript, COPE flowchart will be followed.

In cases of redundant publications, COPE flowchart will be followed.

Disclosures

All authors are required to submit a Disclosure of Interest form, which can be found here: http://www.icmje.org/disclosure-of-interest/. In case of an undisclosed conflict of interest, COPE guidelines will be followed.

Authorship

Archives of Surgical Research (ASR) follows the COPE flowchart to recognize potential authorship problems. Ghost, guest, and gifted authorship will result in rejection of submitted manuscript, in accordance with COPE guidelines.

ASR implements ICJME recommendations for what constitutes authorship of a manuscript.

ICMJE Authorship Criteria

As per ICMJE guidelines the authorship should be based on the following criteria:

1. Substantial contributions to conception & design, or acquisition of data, or analysis & interpretation of data.
2. We do not allow ghost, guest and gift authorships and if found so we follow COPE guidelines to handle such cases.
3. Drafting the article or revising it critically for important intellectual content.
4. Final approval of the version to be published. All those who meet the above three conditions are eligible to be included as Authors in the manuscript
5. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.
6. When a large multicenter group has conducted the work, the group should identify the individuals who accept direct responsibility for the manuscript. These individuals should fully meet the criteria for authorship defined above. Acquisition of funding, collection of data, general supervision of the research group does not qualify any one to be an author. All contributors who do not meet the criteria for authorship should be listed in the acknowledgment section. Those who provide technical support, writing assistance, or department chair who provided just general support should also be mentioned in acknowledgment. It is also important that all those whose names appear in acknowledgement must have given permission to be acknowledged.

ICMJE http://www.icmje.org

If a contributor does not fulfill the authorship criteria, ASR encourages listing them in the acknowledgements section. **All** authors are required to submit a Disclosure of Interest form, which can be found here: http://www.icmje.org/disclosure-of-interest/. In addition to submitting a disclosure of interest form, the manuscript must outline the specific contribution of each author. ASR Authors are also encouraged to link their ORCiD profiles.

Authorship disputes should be brought to light via email to relevant editors. They are handled through COPE Guidelines.

Complaints and Appeals

Archives of Surgical Research (ASR) follows COPE guidelines in case of appeals to the journal's editor's decisions and complaints about ASR's journal management of the peer review process.

If authors wish to file a complaint or appeal against an editorial decision, they are encouraged to email: editorial@archivessr.com, with the subject heading mentioning "COMPLAINT" or "APPEAL". We have dedicated Ombudsperson for handling such appeals.

Furthermore, Archives of Surgical Research (ASR) consults COPE guidelines if a reviewer is suspected of appropriating or mismanaging author material and may refer such cases to COPE if required.

Data and reproducibility

Archives of Surgical Research (ASR) follows ICMJE data sharing guidelines.

In case of suspected data falsification/fabrication, respective authors will be asked to clarify and explain their methods.

To Improve transparency, we encourage use of and link to international standard reporting guidelines such as those listed in the EQUATOR Network. We encourage pre-registration of clinical trials (and other study designs) in an online clinical study database before data are collected (eg, ClinicalTrials.gov). We encourage journal pre-registration and peer review of study protocols before data are collected (eg, as promoted by the Center for Open Science).

We have system of scruitiny to find such data manipulations, if found may result in:

1. Rejection of their submitted manuscript
2. Communication of the authors' misconduct will be made to relevant institutions and regulatory bodies
3. Black-listing of the authors from ASR for all future submissions

This is in accordance with COPE guidelines.

In case of suspicion of image manipulation in a manuscript, COPE flowchart will be followed.

Ethical Oversight

Archives of Surgical Research (ASR) follows COPE guidelines for ethical oversight, wherever applicable. ASR has it's own consent form for case reports, which is mandatory along with the submission of the manuscript. The consent form is adapted from BMJ Case Reports and is in line with COPE guidelines. To determine whether a study requires ethical approval or not, ASR looks to COPE guidelines.

Furthermore, ASR requires a transparency declaration from the lead author of an original study guaranteeing honesty and accuracy (as published & implemented by the BMJ and endorsed by the EQUATOR network).

Post-publication Review and Audit

If authors whose work has been accepted and/or published wish to retract/correct/revise their articles, please email: editorial@archivessr.com, with the subject heading mentioning "RETRACTION" or "CORRECTION" or "REVISION".

Conflict of Interest Policy

Adopted from Conflict of Interest in Peer-Reviewed Medical Journals which is prepared by WAME Editorial Policy and Publication Ethics Committees.

Articles would be published with statements or supporting documents declaring:

Authors' conflicts of interest

Sources of support for the work, including sponsor names along with explanations of the role of those sources if any in study design; collection, analysis, and interpretation of data; writing of the report; the decision to submit the report for publication; or a statement declaring that the supporting source had no such involvement; and Whether the authors had access to the study data, with an explanation of the nature and extent of access, including whether access is on-going.

To support the above statements, editors may request that authors of a study sponsored by a funder with a proprietary or financial interest in the outcome sign a statement, such as "I had full access to all of the data in this study and I take complete responsibility for the integrity of the data and the accuracy of the data analysis."

Disclosure form is available from the website, which has been adapted from ICMJE Disclosure Form and should be filled at the time of acceptance of manuscript. Disclosures are also obtained whenever deemed necessary at the time of review and editorial tasks.

9. EDITORIAL POLICIES

Principles of Transparency and Best Practice in Scholarly Publishing are followed as per ICMJE guidelines. This Journal strives to adhere to the ***Principles of Transparency and Best Practice in Scholarly Publishing*** which could be found in the **DOAJ** Web site completely,

This Journal has established a guideline for editorial independence as delineated below. The guideline generally follows that created by the World Association of Medical Editors.

1. This Journal is operated by Pakistan Endocrine & Thyroid Surgeons Association (PETSA), which is publishing organization.
2. The Chief Editor is responsible for independent leadership of This Journal editorial operations. The General Publishing Editor reports to the Editor-in-Chief for all editorial matters.
3. The Editor-in-Chief has full authority over the content of this Journal and its related offerings. This includes summaries and comments on recent medical advances, opinions, blogs and news.
4. Content-related decisions are based on quality, importance, and value to the users of this Journal. Contributing authors, editors, This Journal staff are free to express responsible positions -even if these views are not in agreement with interests, policies or published research, editorial or commentary of PETSA.
5. This Journal actively seeks input regarding editorial matters from the physician Editors-in-Chief in an advisory capacity, as well as from the other editorial board members, internal editorial staff, and readers.
6. Editors-in-Chief of this Journal is empowered to create content and commentary free of commercial and organizational influence. All authors and editors operate without conflict of interest and all potential conflicts are disclosed (please also see Conflict of Interest Policy).

10. PEER REVIEW POLICY

We follow ICMJE recommendations on the manuscript handling. The practice of peer review is to ensure that only good science is published. It is an objective process at the heart of good scholarly publishing and is carried out by all reputable scientific journals. Our referees play a vital role in maintaining the high standards Review Policy and all manuscripts are peer reviewed following the procedure outlined below:

Initial manuscript evaluation

The Editor first evaluates all manuscripts. It is rare, but it is possible for an exceptional manuscript to be accepted at this stage. Manuscripts rejected at this stage are insufficiently original, have serious scientific flaws, have poor grammar or English language, or are outside the aims and scope of the journal. Those that meet the minimum criteria are normally passed on to at least 2 experts for review. Most of the submitted manuscripts are reviewed except few invited or editorial content.

Type of Peer Review

Policy employs double blind reviewing, where both the referee and author remain anonymous throughout the process.

How the Referee is selected

Whenever possible, referees are matched to the paper according to their expertise and our database is constantly being updated. The referee is selected both from the editorial team and outside and depending on the author suggestions.

Referee Reports

Referees are asked to evaluate whether the manuscript: - Is original - Is methodologically sound - Follows appropriate ethical guidelines - Has results which are clearly presented and support the conclusions - Correctly references previous relevant work. This is a systematic process and works on the well-designed Peer Review Proforma. The confidentiality of the peer review is ensured. Reviewers are encouraged to report conflict of interest, ethical misconduct etc.

Language correction is not part of the peer review process, but referees may, if so wish, suggest corrections to the manuscript.

How long does the review process take?

The time required for the review process is dependent on the response of the referees. Should the referee's reports contradict one another or a report is unnecessarily delayed, a further expert opinion will be sought. The Editor's decision will be sent to the author with recommendations made by the referees, which usually includes verbatim comments by the referees. Revised manuscripts might be returned to the initial referees who may then request another revision of a manuscript.

Final Report

A final decision to accept or reject the manuscript will be sent to the author along with any recommendations made by the referees, and may include verbatim comments by the referees.

Editor's Decision is Final

Referees advise the editor, who is responsible for the final decision to accept or reject the article.

Conflict of Interest

All reviewers and editors have to declare any potential conflicts of interest if any. We follow COPE and ICMJE guidelines in this regard.

Editorial and Peer Review Processes Generally Follow these Steps:

We follow and request from authors, reviewers and editors the "ICJME Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals". Editorial reviewer policy is independent of any financial, academic or any other interest.

- When an article is submitted to Archives of Surgical Research, Editor makes the first check of submitted articles (structure, plagiarism, scientific quality).
- Article may be rejected, sent back for structural revision, or sent to at least two reviewers for peer review.
- After peer review process, articles may be rejected, sent back for revision requested by reviewers or accepted for publication.
- Revised articles by authors may be accepted, resent to reviewers, resent to authors for additional corrections/revision or rejected.
- Authors could not see reviewers' information. Editor may make authors' information available to reviewers or not.
- Accepted articles are forwarded to publishing process.
- Editor(s) may require additional materials or changes from authors during copy editing, composing, grammatical editing and/or proof reading steps.
- A fast track review system is in place upon deposition of additional processing fee (Rs. 20,000), however we do not encourage such route and should be employed only in significant circumstances. Moreover, this does not ensure that manuscript if accepted would be published on priority.
- Post-publication review and peer review is encouraged and is managed through letter to the editors.

11. STATEMENT OF INFORMED CONSENT

We follow ICMJE and COPE Guidelines for appropriate consenting. Patient's privacy should not be breached without taking consent. In written descriptions there should not be any specifications regarding patients including names, hospital numbers, photographs or pedigrees unless the information is needed for scientific purposes and the patient allows for publication with written informed consent. It should be disclosed by authors to the patients that any identifiable material could be available on the Internet or in printed form after publication. Patient consent ought to be written and archived with the journal, the authors, or both, as settled by local rules and regulations. Applicable laws vary from territory to territory, and journals should make their own policies with legal guidance. Since a journal that archives the consent will be aware of patient identity, some journals may decide that patient confidentiality is better guarded by having the author archive the consent and instead providing the journal with a written statement that attests that they have received and archived written patient consent.

Nonessential identifying details should be omitted. Informed consent should be obtained if there is any doubt that anonymity can be maintained. For example, masking the eye region in photographs of patients is inadequate protection of anonymity. If identifying characteristics are de-identified, authors should provide assurance, and editors should so note, that such changes do not distort scientific meaning.

The requirement for informed consent should be included in the journal's instructions for authors. When informed consent has been obtained, it should be indicated in the published article.

- International Committee of Medical Journal Editors ("Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly Work in Medical Journals")

12. GUIDELINE FOR REVIEWERS

Peer review in all its forms plays an important role in ensuring the integrity of the scholarly record. The process depends to a large extent on trust, and requires that everyone involved behaves responsibly and ethically. Peer reviewers play a central and critical part in the peer-review process, but too often come to the role without any guidance and unaware of their ethical obligations.

Archives of Surgical Research follows COPE Guidelines for educating the reviewers for the review process.

13. ETHICAL EDITING FOR EDITORS

Becoming an editor of Archives of Surgical Research is an exciting but daunting task, especially if you are working alone without day to day contact with editorial colleagues. This short guide aims to summarize key issues and to provide links to relevant pages of the COPE website as well as those of other organizations. We encourage the editorial team to consult COPE and ICMJE resources frequently for their training and handling of the manuscript and various editorial issues.

14. GUIDELINES FOR JOURNAL MANAGEMENT

We believe that Archives of Surgical Research serves as an important part of the scientific literature. Hence, its management should be of the highest quality and ethically sound. We follow COPE Guidelines to manage the top hierarchy in terms of conflicts of interest and ethical considerations. We also following COPE Guidelines for maintaining relationship of journal management to the Pakistan Endocrine & Thyroid Surgeons Association to ensure editorial independence. The journal editorial teams meets periodically at least biannually. The editorial team is independent of the society and is managed by a transparent process two yearly as per the ethical confines suggested by COPE, ICMJE and local guidelines.

15. SELF-ARCHIVING POLICIES

All articles printed on the Archives of Surgical Research website square measure protected by copyright command by Archives of Surgical Research (or its subsidiaries). The data is archived through Cross-Ref and other indexing agencies.

As author of a journal article, you keep the rights careful within the following:

The Digital Object Identifier (DOI) of your article are often found on the relevant webpage of Archives of Surgical Research.

The above permissions apply to authors whose articles are to be printed by Archives of Surgical Research *and authors who have purchased a replica or received a complimentary copy of their printed article.*

This policy doesn't apply to pay-per-view customers and subscribers, who ought to adhere to their individual agreement policies

1. *The publisher-created version can solely be posted wherever a gold access fee has been paid and also the article contains an associate Open Access mark.*

2. *You post the preprint any place at any time, provided it's in the middle of the subsequent acknowledgement:*

3. Preprint of an article submitted for thoughts in *Archives of Surgical Research* © [Year] [copyright *Archives of Surgical Research*] [www.archivessr.com]

4. Preprint of an article printed in [Journal, Volume, Issue, Year, Pages] [Article DOI] © [copyright *Archives of Surgical Research*] [*archivessr.com*]

5. After publication in website, you can post the accepted author manuscript on your personal website, your institutional or subject repositories of your own alternative or as stipulated by the Funding Agency. Please provide the subsequent acknowledgement:

6. Electronic version of an article printed as [Journal, Volume, Issue, Year, Pages] [Article DOI] © [copyright *Archives of Surgical Research*] [Journal URL]

Definitions:

- *"preprint" - a version of an article created prior to peer review*

- *"accepted author manuscript" - an author-created version of the final journal article (to reflect changes made in peer review and editing)*

"publisher-created version" - the definitive final record of published research that appears in the journal and embodies all value-adding publisher activities including copy-editing, formatting and pagination.

16. LICENSE INFORMATION

We support green open access and accepted manuscripts can be self-archived following our sharing guidelines and are required to attach a CC-BY-NC-ND license.

Main Features of CC BY-NC-ND 4.0

Read, print and download --> Yes
Redistribute the article (e.g. display in a repository) --> Yes
Translate the article --> Yes (For private use only and not for distribution)ss
Download for data mining purposes --> Yes
Reuse portions or extracts from the article in other works --> Yes
Sell or re-use for commercial purposes --> No

17. PRIVACY POLICY

Archives of Surgical Research is committed to the protection of your personal information. The privacy policy outlined here applies only to information collected by Archives of Surgical Research through the http://www.archivessr.com/.

Information We Collect

We will request personal data from you to ascertain your individual user profile that may support all online activities allotted as an author, editorial member, or other connected role. Data like your name, postal address, e-mail address, telephone number and geographic locale are used as identifiers to permit access to certain content or to a secure website. All personal information is treated by Archives of Surgical Research as strictly personal and confidential. Archives of Surgical Research won't disclose any personal information to third parties without your permission, unless required by law

Cookies

Cookies and log files are automatically recorded when you visit our site. These data includes some of the following information: IP address, host name, domain name, browser version and platform, date and time of requests, and downloaded or viewed files. This information is used to measure and analyze traffic and usage of the www.archivessr.com website and our digital products.

Making Changes to Your Information

When you have created an account on the http://archivessr.com, you can update your private information at any time through your account settings.

This statement may be periodically updated.

If you are concerned about how your information is stored, please contact us by email at editor@archivessr.com

18. ADVERTISING POLICY

Archives of Surgical Research accepts advertising for their hard copies, web sites and related e-mail services (e-mail alerts) according to the following principles:

- Advertisement must be separate from content. Content may not be altered, added, or deleted to accommodate advertisement. Advertisers have no input regarding any of our editorial decisions or advertising policies. The advertising sales representatives have neither control over, nor prior knowledge of, specific editorial content before it is published.
- Archives of Surgical Research reserves the right to decline or cancel any advertisement at any time.
- Third-party 

advertisements may not use Archives of Surgical Research name, logo, or title on their web pages or email alerts.

19. TERMS OF USE

General

These Terms of Use rule your access to and use of digital products and services owned by the Archives of Surgical Research and its subsidiaries, but not limited to the www.archivessr.com website, unless other terms and conditions apply.

Copyright

To gain access worldwide to scientific information and research, Archives of Surgical Research gives copyrights of all online published papers (except where otherwise noted) for free use of readers, scientists, and institutions (like link to the content or permission for its download, distribution, printing, copying, and reproduction in any medium, without any changing), under the terms of CC BY-NC-ND 4.0 License, provided the original work is cited. Please contact the publisher for getting permission to publish.

All printed materials (including illustrations, tables and images in the document) would be copyrighted by the Archives of Surgical Research.

Hence, "Acknowledgement of Authorship and Transfer of Copyright Agreement" to be evaluated is requested in addition to document. Remittance or charges are not applied for document or manuscript under the name of copyright announced for publishing in the journal and no printing cost is charged; however, reprints would be at authors' fee.

COPYRIGHT OWNERSHIP AND PERMITTED USE

The content will be available through the Archives of Surgical Research services is protected by copyright and may be used only in accordance with the Creative Commons Attribution-Noncommercial License and other applicable laws. Content available through the Archives of Surgical Research services is approved only for your personal noncommercial use. Archives of Surgical Research reserves the right to limit, terminate your approach to the Archives of Surgical Research sites at any time without notice.

Trademark Ownership

Journal logos and name design are trademarks of the Archives of Surgical Research. Any use of Archives of Surgical Research trademarks in connection with the sale, offering for sale, distribution or advertising of any goods or services, which is likely to cause confusion which can cause a mistake is prohibited.

Disclaimer of Warranties and Liability

Content would be available through the Archives of Surgical Research services is that the result of analysis and research done by people or organizations. The Archives of Surgical Research is not accountable for or endorses the accountability of any information or conclusions reported in such content. All contents are supposed for guidance and reference purposes solely.

The Archives of Surgical Research sites and your access to them are provided on an "as is" and "as available basis" while no warranty of any kind, either categorical or inexplicit, not restricted to the implied warranties of state, fitness for a selected purpose, and noninfringement. In no event will the Archives of Surgical Research, its workers, officers, members, or licensors be answerable for any special, incidental, indirect, or damages of any kind, or any damages resulting from the inability to use or the use of the services, whether or not suggestive of the chances of damages, or on any theory of responsibility arising out of or in connection with the use or performance of the services

User-Submitted Content

The subsequent distribution apply to all article submitters to the Archives of Surgical Research in connection with its documents and other related work. By submitting content you agree to the following provisions, which may be excluded periodically:

1. Agreement is made that you are responsible for the content that you submit and you will not post any content that disobeys or encourages the violation of any applicable local, state, national or international laws.
2. The editors of Archives of Surgical Research, in their sole discretion have the right to reject, edit, remove or change any content submitted for any reason.
3. Once your submission is published, you will not have the right to remove or edit it.

Login Security

Sharing login information for the Archives of Surgical Research services is prohibited.

International Use

Users are responsible for compliance with all local applicable laws, rules and regulations regarding online conduct and data usage of the country you reside in or access from.

Privacy

You confirm that you have read and accept our Privacy Policy.

Modifications of Terms of Use

Archives of Surgical Research reserves the right to modify these Terms of Use at any time. The continued use of the Archives of Surgical Research services after any such posting shall constitute acceptance of the Terms of Use as modified.

Service Update and Website Availability

The Archives of Surgical Research reserves the right to modify, suspend, discontinue or restrict access to all or any part of the services and website at any time.

Archives of Surgical Research (ASR) is a double blind peer-reviewed quarterly ICMJE and COPE compliant journal dedicated to the local, national, and global advancement of surgical research, education and clinical practice. It aims to promote continued development in surgery through the dissemination of knowledge, ideas and good practice across surgical specialties. ASR provides readers with critically peer-reviewed, carefully selected and edited, and up-to-date publications about advancements in all surgery specialties.

Archives of Surgical Research
A Peer Reviewed Surgical Journal

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INTERNATIONAL CENTRE

COPE

ICMJE INTERNATIONAL COMMITTEE of MEDICAL JOURNAL EDITORS

DRJI Directory of Research Journal Indexing

doi

Member of Crossref

creative commons BY NC SA

PKP PUBLIC KNOWLEDGE PROJECT

Archives of Surgical Research
A Peer Reviewed Surgical Journal

Pakistan Endocrine & Thyroid Surgeons Association (PETSA), 537-S, Imperial Garden Homes, Paragon City, Lahore, Pakistan.