

Archives of Surgical Research

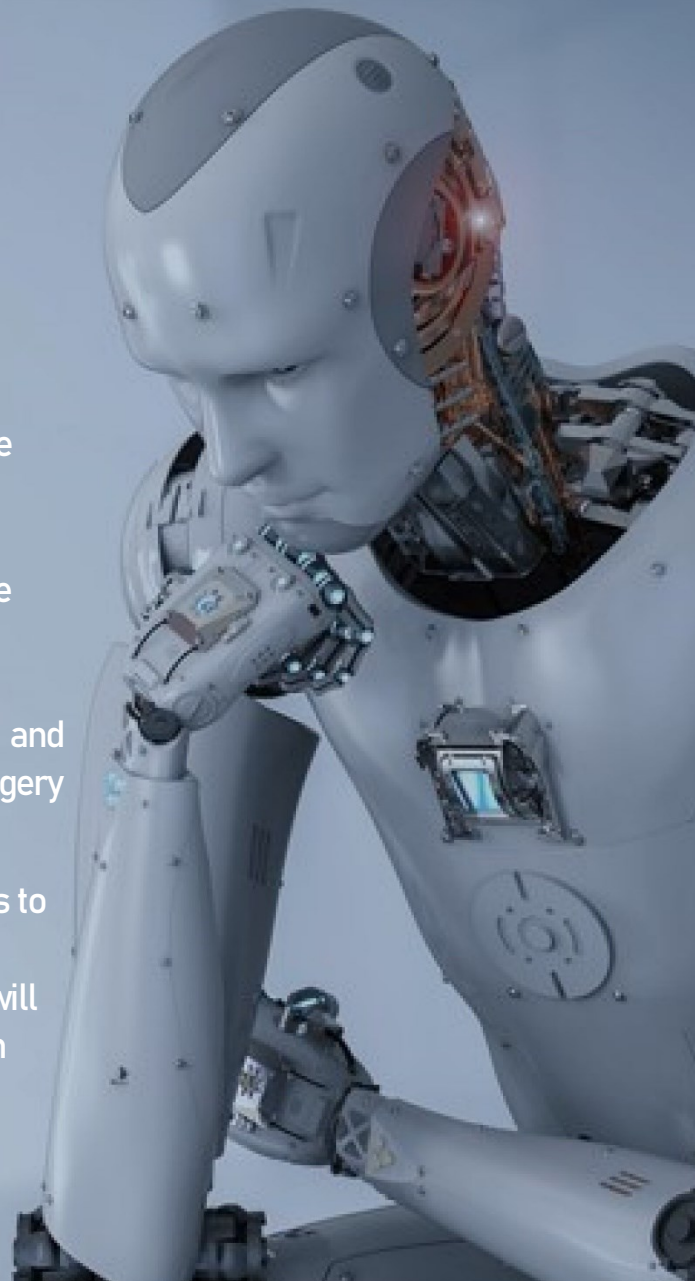
A Peer Reviewed Journal of
Surgical Research & Education

ArchSurgRes Volume 1, Issue 3
July-Sept, 2020

Editor in Chief: Prof Khwaja M Azim FRCS

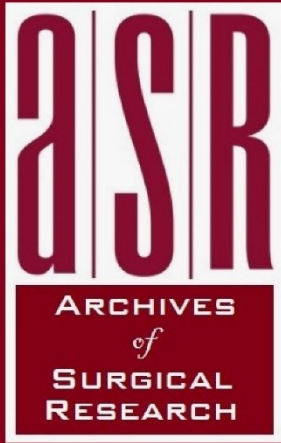
Archives of Surgical Research (ASR) is dedicated to the local, national, and global advancement of surgical research, education and clinical practice. It aims to promote continued development in surgery through the dissemination of knowledge, ideas and good practice across surgical specialties. ASR provides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

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.



Published by

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



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About Archives of Surgical Research

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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.

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Editor in Chief

KMA

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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



Role of Mentorship in Surgical Teaching and Learning - Past and Present

Syed Abul Hasan Kazmi

IMPORTANCE Mentoring goes back to times immemorial. Before delving into the subject of Mentoring in surgical practices and teaching, it is vital to find out its origins which may be quite interesting to the readers. This may be an officially agreed mentor or just mutually agreed person. There can be multiple mentors as well and they do not have to be in one place. Furthermore, with the advent of the modern technology, a mentor does not have to be in a nearby geographical location. This can help because we all learn from each other. It will expand and add a lot to the knowledge and training of the mentee. Various mentors can be of varying influence and strengths. This is also termed as mosaic mentoring. In Surgical training, like all other fields of life, there is almost always a mentor or perhaps, a role model in an overlapping form.

KEYWORDS Mentorship, surgery, teaching and learning, role modeling

HOW TO CITE Kazmi AH. Role of Mentorship in Surgical Teaching and Learning - Past and Present. *Archives of Surgical Research*. 2020;1(3):1-2. <https://doi.org/10.48111/2020.03.01>

Editorial

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Mentoring goes back to times immemorial. Before delving into the subject of Mentoring in surgical practices and teaching, it is vital to find out its origins which may be quite interesting to the readers.

There are many versions from the known history but amongst others, the most famous one is that the word mentor goes back to the character – Mentor, in Homer’s ‘*The Odyssey*’ - when Odysseus left for the 10 years’ long Trojan war, he asked Mentor, his elderly trusted friend, to serve as a counsellor to his son Telemachus¹. This is how the name has passed down as a senior wise person who is trusted and can impart knowledge and crafts to less experienced juniors^{1,2}.

There is another interesting version from ancient Africa; when a child was born, everyone in the village shared the responsibility for raising and educating that child. This practice still continues and is a mantra: “It takes a village to raise a child.” While the child had contact with everyone in the village, there was always an older person who would be assigned the sole responsibility to ask questions and listen to that younger child. In Swahili this was called, “Habari gani menta” which in English, means, the person who asks “What is happening?”³.

There are further examples of old French and Norwegian mythology too; so, Greeks were not the only ones who can claim the origin of mentoring³.

However, mentoring is not just a Western phenomenon, it is universal in various forms, shapes and practices. And very likely, since humans started on the planet Earth, mentorship

has always been in action in various forms in all fields of life in all cultures and places.

Mentorship is the voluntary relationship between a person with greater experience and one with lesser experience with mutual trust and respect.

On a slightly different note, a role model is someone who may not necessarily be physically present around where the trainee is and may even be a past historical figure which becomes an ideal for a person to follow in most respects.

A Mentor and Role Model can be the same person, or they can be different persons, and their place and influence are quite overlapping as shown in the table below:

Mentor	Common Factors	Role Model
<ul style="list-style-type: none"> • Direct • Knowledgeable • Good teacher • Caring • Trust worthy • Two-way Communication • Mutual Trust • Focus • Motivator 	<ul style="list-style-type: none"> • One or More Aspects of Life • Individuals • Passion • Integrity • Respect 	<ul style="list-style-type: none"> • Emulate • Historical or Present Day • Active or Passive

Table: 1. Adopted from A Venn diagram displaying the qualities of leaders, mentors, and role models⁴.

In Surgical training, like all other fields of life, there is almost always a mentor or perhaps, a role model in an overlapping form. This may be an officially agreed mentor or just mutually agreed person. There can be multiple Mentors as well and they do not have to be in one place. Furthermore,

with the advent of the modern technology, a mentor does not have to be in a nearby geographical location. This can help because we all learn from each other. It will expand and add a lot to the knowledge and training of the mentee. Various mentors can be of varying influence and strengths. This is also termed as mosaic mentoring.

It is not necessarily an older mentor and a younger mentee. It can be other way round as well with the advent of new technology such as modern Minimal Access and Robot Assisted techniques; because the younger persons can be more conversant with these new techniques and can teach their older colleagues. This brings the idea of tele-mentoring and remote mentoring where a mentor does not have to be physically around. It can be on a long term or brief and short-term basis.

In Surgery, the overlapping role of mentor and role model can be more obvious and important. The trainee surgeon can consciously or unconsciously become so influenced by a specific trainer that they can adopt the trainer's ways of work, habits, approaches and practices which are over and above the usual sphere of training modules.

Identification of positive role models in the Surgical field, particularly those with good relationships with patients and colleagues, can attract more junior doctors to this field.

There is a Halstead's apprenticeship model that relies on mentors to produce well trained surgeons. Over and above the professional training, they also impart the methods of clinical acumen and care, compassion, communication, professionalism and ethics. Surgical training differs from other spheres of life and even from those in other healthcare fields. There is added stress that emanates from the operating room environments. It is influenced by the Socratic method, which is a form of cooperative argumentative dialogue between individuals, based on asking and answering questions to stimulate critical thinking and to draw out ideas and underlying presuppositions⁵. Halstead's own mentee, Harvey Cushing, went on to develop the specialty of Neurosurgery, which is an example of good mentorship⁶.

In the past and still in many places, mentorship is an automatic and understood relationship between individuals, a senior and a junior. However, with modern systems and developments, it has become rather more

programmed and organized. Therefore, a senior faculty member or a senior student is assigned to support and guide their less experienced colleagues. Methods and approach change with time as with any procedure and custom but the basic principles never change and neither does the role of a mentor throughout the professional practices.

Having considered all this, there are barriers to mentorship such as cultural, generational, gender issues, scarcity of qualified mentors and time and availability constraints. But one can try to overcome these with proper management and an attitude of open mindedness and ensuring equal opportunities for all.

When I think about myself, I reflect on how various role models and mentors affected my career choices. My decision to embark into the Medical profession was influenced by my village doctor who I felt could cure almost everyone. Not only that but he was so kind to all and was the most respected person in the village. He was, indeed, a role model for me.

After entering Medical college, my choice of Surgery was borne out of my attitude towards human body engineering, what we call Anatomy. This attitude was cemented by the enthusiasm and guile, Professor GN Lasi displayed making the subject incredibly interesting for me. His magnetic personality not only as my teacher, but also as a person, was contagious, and he went on to become my mentor as well.

My progression through the field of surgery was largely inspired by my next choice as mentor: Professor Syed Zafar Haider. Despite the general feeling around that he was strict and tough, his moral integrity and excellent clinical acumen made me choose him for my training. As a mentor he proved to be quite the role model, as I ended up adopting, not only many of his surgical techniques, but also a lot of his every day habits. His guidance and direction are perhaps where the role model and mentor overlapped in many ways.

To conclude, it is not possible to train anyone in any craft, let alone Surgery, if the mentee is not willing. One cannot sow seeds and expect results from barren land. I feel that it is the inner aptitude and attitude of the mentee as well that leads them to a specific field, and then choose to go under the guidance of a certain mentor to train and advance further in that very profession.

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Archives of Surgical Research | Syed Zafar Haider Memorial Feature

Syed Zafar Haider: Custodian of a Tradition, A Class Act

Tehseen Ahmed Cheema

My association with Sayyed Zafar Haider spans almost half a century.

ذہریں بات کی برس چار دوہے، قصہ کا صدی نصف

I feel particularly fortunate that in all those years he enriched my life with his kindness, mentorship and role modeling. I was admitted in Nishtar Medical College in 1967. Coming from the backwaters of the remotest district of Punjab, Rahim Yar Khan, his influence has guided my professional and intellectual growth in many subtle and obvious ways. Shah Ji, as SZH was affectionately called by his disciples, has transformed lives of countless students and residents who were fortunate enough to be touched by him.

KEYWORDS Mentorship, surgery, teaching and learning, role modeling

HOW TO CITE Cheema TA. Syed Zafar Haider: Custodian of a Tradition, A Class Act. *Archives of Surgical Research*. 2020;1(3):3-5. <https://doi.org/10.48111/2020.03.02>

SZH Memorial Feature

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<https://doi.org/10.48111/2020.03.02>

Those were the watershed years in the history of Nishtar as well as for the country. The old traditions were crumbling and a new era of disorder was ushering in. The year was 1969. It was first ever student's strike in the history of Nishtar against the perceived strict rules being enforced in the hostels and the target was personality of the great incomparable teacher of physiology Prof. Gulzar Sahib who happened to be the hostel warden as well. Protesting students were gathered in the entry hall of the hospital and the mob was almost uncontrollable. No professor was ready to face the rebellious crowd. That was the first time we experienced the magic of great orator at a crucial moment. SZH, directly from operating room, clad in his operation room gown, descended from the stairs, and without any apprehension walked into the crowd and swayed them away from their violent course with his powerful and emotional appeal, invoking the tradition, history and values of Nishtar and the medical profession. For next couple of years whole country but especially Nishtar was gripped in the hysteria right/left politics, change of guard from Ayub to Yahya, rise of Bhutto cult, tragedy of East Pakistan and its aftermaths - a real time of chaos and change. To us Shah Ji provided a firm anchor of hope, steadfastness, and commitment to values with love of Pakistan above any other consideration. He was very opinionated about certain personalities but his faith in Pakistan, in Islam as its *raison d'être* was unshakable. Though he never interfered in student's politics directly, but his influence in upholding of tradition and in propriety in conduct, both for students and faculty was undeniable.



SZH was the chief guest and keynote speaker at the inaugural session of Pakistan Society for Surgery of the Hand in November 1993 at Bahawalpur but like a perpetual student, he listens to every presentation with utmost attention.



As the keynote speaker, he delivered the most memorable lecture on history of surgery in Pakistan.

As a teacher and a surgeon, his hard work and commitment was subject of folklore and stories students transmitted from generation to generation. His lectures were attended not just for their high level of scientific information but for oratory, drama and performance. He was master of eloquence in any language he chose to express himself – English, Urdu, or Punjabi with appropriately inserted verses of classical poets and quotes from icons of medical history. I haven't come across a more effective class room lecturer in medical field. It was not the era of video recording and I regret that those performances of SZH could not be saved for the progeny. However, the most feared part of his presence was unpredictability of his persona which could shift from father like kindness to a formidable disciplinarian, showing him visibly upset about something minor, sometimes without warning and a notice. Looking back, I recall that this created an unstated demand of excellence because no one wanted to disappoint Shah Ji. His ward was considered a showpiece of cleanliness, patient-centered care and high-quality teaching. Any delegates from outside who came to visit Nishtar, their first stop was Shah Ji's ward, and they were duly impressed by the standard of care patients were receiving.



My ward batch with SZH. Under his influence, this group produces two psychiatrists, two ENT surgeons, one Ophthalmologist, one Dermatologist, one Pediatrician, one Pulmonologist and an Orthopedic surgeon

In my final year, I had a serious injury to my foot (Lisfranc fracture-dislocation) in a student versus police clash. The way SZH protected me from the police and earned displeasure of the authorities, I can recall only with great gratitude. For him, his students were more precious than the goodwill of powerfults in the government. Those were the years when academic sessions were indeterminately prolonged due to unrest in the country and in the student community. Our final examination was postponed for six months. Shah Ji allowed few of us to become his house surgeons even before the examination and the final result. That turned out to be the fateful event for me and a surgical career became my destiny. Shah ji was the inspiring force to set me on this course and remained a guiding light for rest

of my career. Like a true mentor, he remained interested in my career, followed my professional trajectory and took a genuine pride in my success and achievements.

He visited me in 1979 during my chief year as orthopedic resident at New Jersey University of Medicine and Dentistry. On my request, he attended one of our grand-round conferences. The whole crowd fell under the spell of his graceful personality and eloquence. That elevated my stature in the eyes of my colleagues and program director by many notches.

In 1993, Pakistan Society for Surgery of the Hand (PSSH) was formed and I was elected its founding president. SZH was requested to be the chief guest and the keynote speaker at the inaugural session of the first meeting of PSSH. He delivered a most memorable lecture on history of surgery in Pakistan for which he had been a witness and an important protagonist in its forming years.

An essential part of my sojourns in Pakistan during all my years in US, was a pilgrimage stop at his residence to pay tribute, express gratitude and ask for his blessing and prayers. He always gave me gift of a book with his autographs and inspiring remark. Those are still my treasured collections. Once, one was able to penetrate outer crust of his persona, he was an unusually simple and kind man, seeking pleasures in small things of life like taking a walk or gardening. I actually saw him talking to the plants like his friends.



My truncated house job with SZH

On the fateful morning of February 18th, 2013, I was watching TV and braking news flashed that an eye surgeon in Lahore had been gunned down with his son in a sectarian target killing. My heart sank, as I knew the only eye surgeon in Lahore who could be target for such a heinous crime. Hoping it be false somehow, I called Dr. Shrafat Hussain Bhutta to confirm. The dread was confirmed and I was shattered with this most senseless act against a most noble person who was nothing but a benefactor of the humanity. For many days, I could not gather the courage to visit Shah Ji and share his grief. When finally, I had the

chance, I sat close to him on the ground. He embraced me and we both cried without uttering a word. The grief of losing the only son and a grandson was unbearable but SZH was still an example of grace and forbearance. I wondered how he was able to hold himself together in the face of such a tragedy. It dawned on me that he is and always has been custodian of a tradition – tradition of dignity of a teacher, tradition of duty of a healer, tradition of values, and as a last act custodian of the tradition of grace and patience under the most pressing circumstances like his forbearers. He always did this as a duty and always with a class act. May God bless his soul and reward him for the "sdaq i jaria" he left in the form of his students. He will remain a role model for generations of medical students as a teacher and as a human being. He is gone but long shadow lingers on.

لالہ جوں مری سے تربت گے نہ کل میں دل داغ

گے ہوں پ نہاں میں خاک جو نہ ہیں اخگر وہ یہ

TA Cheema

To Drain or Not to Drain in Thyroidectomy: A Meta-analysis of Outcomes

Safia Zahir Ahmed; Zaitoon Zafar; Talat Waseem; Faisal Rafiq

IMPORTANCE There is a traditional belief that a drain placed after thyroid surgery can prevent life-threatening hemorrhage and a hematoma from forming.

OBJECTIVE We conducted a meta-analysis to review the outcomes of a drain placement versus no drain placement following thyroid surgeries.

DESIGN This is a meta-analysis

DATA SOURCES Data was extracted using the Medical subject heading and key words "Drainage", "Thyroid", "Thyroidectomy", "subtotal thyroidectomy" "Goitre" and "Thyroid cancer" in PubMed Central, Embase, Pubmed, Cochrane library, Central Register of controlled Clinical Trials, ICTRP, CINAHL and Google Scholar. Further articles were identified by following the authors and references cited in the selected studies.

METHODS Randomized controlled trials and comparative studies monitoring patients who underwent thyroidectomy, subtotal thyroidectomy, and thyroidectomy with neck dissection for malignancy and lobectomy and isthmectomy for benign nodular goiter, with documentation of drain or no drain placement were included in the study. Single arm trials, cohort studies, retrospective studies, drains placed following parathyroid surgery were excluded. Qualitative studies of randomized controlled trials were reviewed using the Cochrane collaboration scheme on RevMan 5.4. Meta-analysis was assessed with odd ratio and standard mean difference using fixed effect model. The primary outcomes analyses were post-operative complications, re-operation rates, post-operative pain and length of hospital stay.

RESULTS We found 27 randomized controlled trials with 3297 patients, 1671 had drain placements and no drain was placed in 1626 patients. The odd ratio of wound infection was 2.9% (95% CI 1.6% to 5.3%), hematoma was 1% (95% CI 0.6% to 1.7%), seroma was 0.8% (95% CI 0.5% to 1.4%), hemorrhage was 1.5% (95% CI 0.7% to 3.4%), re-operation was 1.6% (95% CI 0.8% to 3.2%), hypocalcaemia was 1.7% (95% CI 1.2% to 2.5%), postoperative pain was 1.2% (95% CI 1% to 1.3%) and length of stay was 0.9% (95% CI 0.8% to 1%).

CONCLUSION There is significant difference in post-operative complications, incidence of post-operative pain and length of hospital stay in patients who have drain placement compared to those with no drain placement. However, seroma formation is observed more frequently in patients who have no drain placed after thyroid surgery.

KEYWORDS Drainage, Thyroidectomy, Subtotal thyroidectomy, Lobectomy, Goiter, Thyroid Cancer, Drain placement

HOW TO CITE Ahmed SZ, Zafar Z, Waseem T, Rafiq F. To Drain or Not to Drain in Thyroidectomy: A Meta-analysis of Outcomes. *Archives of Surgical Research*. 2020;1(3):6-17. <https://doi.org/10.48111/2020.03.03>

Meta-analysis

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Many controversies exist regarding drain placement following a thyroidectomy¹. Most believe that placing a drain after a thyroid surgery can prevent a life-threatening haemorrhage². Early detection of airway compromise can highlight an early bleed from the thyroid bed through drain output³. To conquer the fear of bleeding after thyroid surgery, surgeons take comfort with the routine placement of a drain^{4,5,6,7}. The incidence of bleeding after subtotal thyroidectomy is almost 0.3 % to 1% as there is vascularized tissue left behind after surgery which tends to bleed⁸⁻⁹. Although with good hemostasis the chances of bleeding are lowered.

The occurrence of a surgical wound following a thyroidectomy, and the resultant evacuation of the hematoma and seroma fluid collection from a confined space is another factor to be considered¹⁰. Authors have argued that a drain reduces the intensity of airway obstruction from a hematoma with the risk of a hematoma formation requiring a reoperation being around 0-2.6%^{8,11,12,13} and 0-1.5%^{2,14,15,16}. A hematoma occurs around 2-4 hours after surgery and can lead to potential life-threatening complications with 75% of complications occurring within 6 hours of surgery^{6,7,16,17}.

Some studies have shown that a drain can assist in recognition of hematoma to some extent but cannot prevent the risk of its development¹⁸. Most studies contradict this claim, stating that a drain could potentially get blocked by clotted blood and conceal the signaling of major bleeding, delaying surgical intervention¹⁹.

There is evidence in different surgical specialties regarding drain insertion which points to drain placements no longer being recommended^{20,21}. Some studies even claim drain placement increases the incidence misdiagnosed, but despite the clinical trials that have been undertaken over the years to show the lack of benefits of a drain placement after thyroid surgery, most surgeons still use routine drain placements after thyroid surgery^{22,23,24}.

One of the studies exploring a focused clinician group with discussions and conducting a thematic analysis found that a drain placement is owed more to the surgeon's apprehension and school of training rather than to evidence-based practice²⁵. Moreover, most studies have documented that a drain increases the likelihood of a wound infection, postoperative pain, discomfort, and even increases the length of stay and chances of a cosmetic scar²⁶. Tian et al. conducted a meta-analysis regarding the drain versus no drain debate following a thyroidectomy, but the study had limitations; increase heterogeneity in the length of hospital stay and differences in types of drains, diagnosis and general conditions of the patient. The outcomes of re-operations were not evaluated in patients who developed a hematoma²⁷.

We aim to conduct this meta-analysis in order to compare the outcome of drain placement versus no drain placement after a thyroid surgery. We plan to achieve a well-founded conclusion by including high quality prospective clinical trials that have been conducted over the years, with a large population size, and review the post-operative outcomes along with the complications encountered, to enforce and compound the evidence provided in the previous meta-analyses available.

METHODS:

Search strategy and inclusion:

A Literature search was conducted using the Medical Subject Heading and Free Key words such as "Drainage", "Thyroid", "Subtotal thyroidectomy". "Thyroidectomy", "Goitre" and "Thyroid cancer" in the Pubmed, Pubmed Central, Embase, Cochrane Library, Central Register of Controlled Clinical Trials, ICTRP, CINAHL and Google Scholar database to identify studies and articles from January 1986 to July 2020. The data was further expanded from the authors and studies, references of the authors were followed and data was identified. Data was extracted using Boolean Operators method. Language barriers were overcome to include relevant data.

Eligibility:

Archives of Surgical Research

All randomized prospective clinical trials documenting drain or no drain placement following a thyroid surgery were included in the study. The studies in which total thyroidectomy, subtotal thyroidectomy, lobectomy and isthmectomy for benign disease and total thyroidectomy with neck dissection for thyroid cancers which reported quantitative variables were included. Single arm studies, cohort studies, studies on cumulative thyroid and parathyroid drainage, retrospective studies, editor letters, reviewers, case series, abstract without full articles identified were excluded from the studies.

Study Selection and Outcome:

After fulfilling the selection criteria of the studies, two arm prospective clinical trial were selected. Thyroid surgery due to benign and malignant thyroid disease were included. The primary outcomes measured were the postoperative complications, re-operation incidence, post-operative pain, and length of hospital stay. The post-operative complications reviewed were wound infection, hematoma, seroma, hemorrhage, and hypocalcaemia. The outcomes measured were quantitative variables.

Data Extraction:

The data selected and identified was reviewed in adherence with Preferred Reporting Items of Systematic Review and Meta-analysis (PRISMA) guidelines²⁸. Two authors reviewed the articles and screened the data after the comprehensive database search. Further data was explored by a third author for any discrepancy and further discussion was done. Abstract authors were contacted through email to retrieve full articles. Duplicate studies were excluded and excluded studies were reviewed by the third author and reconfirmed regarding the decision. Included studies were reviewed and in case of doubt, were further explored. The quality of the randomized controlled trials (RCTs) was reviewed using Cochrane collaboration risk of bias assessment tool²⁹. The selection bias was assessed with random sequence generation and allocation concealment, reporting bias with selective reporting, performance bias with blinding the participants and personnel, detection bias with blinding outcome and attrition bias with incomplete outcome data. Studies scoring five or above were considered high-quality.

Statistical Analysis:

Analysis was performed on all selected studies after review and discussion. The events of post-operative complication that included wound infection, seroma, hematoma, hemorrhage, hypocalcaemia, and re-operation were assessed using dichotomous variables of drain placement versus no drain placement after thyroid surgery. The Dichotomous variables was calculated using odd ratio with Mantel-Haenszel method with 95% confidence interval. The post-operative outcome of post-operative pain and length of hospital stay was calculated using continuous variable with 95% CI in drain versus no drain placement after thyroid

surgery and assessed with inverse variance method with effect measure of standard mean difference. Studies in which mean and standard deviations were, not found, mean and variances were calculated using the range, size and median of the study. Fixed effect method was used for the assessing the dichotomous and continuous variables and the heterogeneity of the population if less than 50% and if more than 50%, random effect model was selected for each outcome. The data was quantified and calculated using 2x2 chi square test in Rev Man 5.4 Software for the metanalysis.

The pooled results of the events of the intervention were shown in Forrest plot. The sensitive analysis of the study was individually analyzed by excluding the study to review its effect on the pooled results. Cochran Q test was used to assess the heterogeneity of the population and I2 test was used for statistical analysis for the assessment of heterogeneity across the studies. The heterogeneity of individual study and extent of the publication bias was assessed using funnel plot. The degree of heterogeneity was assessed as not important (0-40%), moderate (30-60%), substantial (50-90%) and considerable (75-100%).

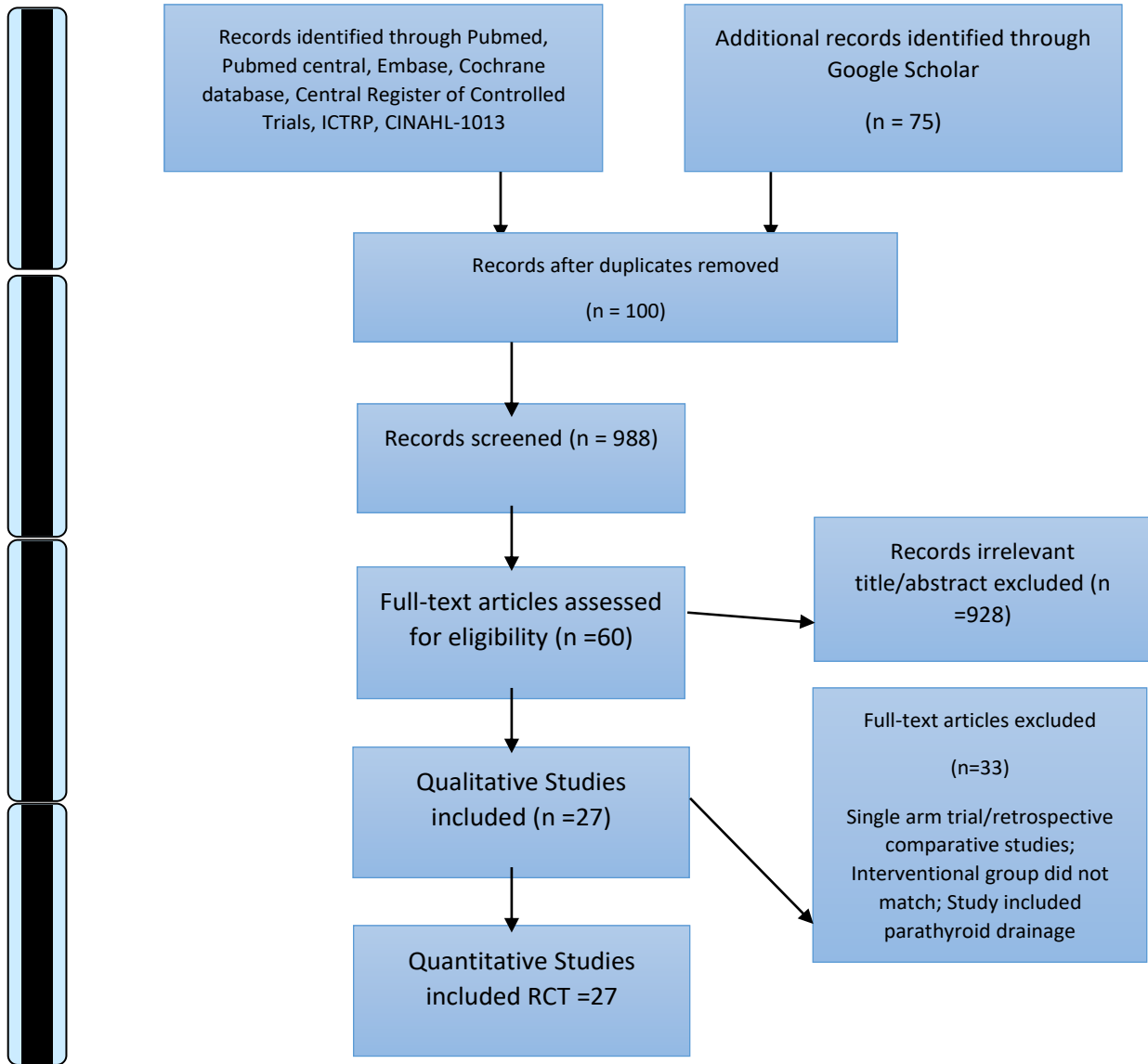


Fig 1. Flow chart showing a selection of studies using PRISMA diagram

RESULTS:

After extensive search with Boolean Operator method, 1088 studies were found and 60 were selected according to eligibility criteria, after excluding other irrelevant articles and full text articles were reviewed. 27 articles^{6,7,8, 15,23,25,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49} fulfilled the

inclusion criteria of the selection process after a detailed review. The PRISMA selection flow chart is shown in Fig 1. The articles excluded from the study were retrospective comparative study, included thyroid and parathyroid surgery to review the drainage, compared open and suction drainage and had no quantitative data of outcome. The 27 selected articles were randomized prospective controlled trials with characteristics of the study is shown in Fig 2. All the studies operated on benign and malignant

thyroid disease which required a total thyroidectomy, subtotal thyroidectomy, or lobectomy and isthmectomy. Thyroid cancer requiring extensive dissection and requiring neck dissection, huge toxic goiter and retrosternal goiter were excluded. In contrast, Lee et al. operated on total thyroidectomy with central neck dissection and Papavramidis et al. included patients with huge thyroid gland and total thyroidectomy and excluded small volume thyroid gland.

Authors	Drain Placement				No Drain Placement				
	No. of Pts	TT(%)	Type of Drain	Mean Age	No. Of Pts	TT(%)	Mean Age	Inclusion Criteria	Exclusion Criteria
Deveci 2013	200	86	Suction Drain	43	200	82	47	TT, TL for BD	SSE, ND, CD
Kalemera 2013	34	9	NA	45	34	0	44	All thyroid surgery	CD, Advanced TC,
Neary 2012	49	27	Open Drain	53	44	20	51	All thyroid surgery	Sternotomy, ND, CD
Musa 2010	35	100	Suction Drain	50	25	100	52	All thyroid surgery for BD	Intrathoracic extension, ND
Colak 2008	58	100	Suction Drain	45	58	100	47	All thyroid surgery for BD	ND, CD
Morrissey 2008	23	48	Suction Drain	NA	32	41	NA	TT, HT, CT	CD, ND, huge Goitre
Lee 2006	101	28	Suction Drain	50	97	19	45	All thyroid surgery, CND	SSE, GD, LND, CD
Suslu 2006	68	46	Suction Drain	47	67	43	47	All thyroid surgery	ME, CD, ND
Khanna 2005	51	NA	Suction Drain	35	51	NA	35	All thyroid surgery	CD, ND
Hurtado-Lopez 2000	100	8	Suction/Open	39	50	18	39	All thyroid surgery	ND
Debry 1999	43	42	Suction Drain	48	57	32	48	All thyroid surgery for BD	ND
Schoretsanitis 1998	100	84	Suction Drain	52	100	96	52	All thyroid surgery	NA
Wihlborg 1988	75	13	Suction Drain	48	75	15	48	All thyroid surgery	ND, Sternotomy
Peix 1992	48	NA	Suction Drain	NA	49	NA	NA	Cold Nodule, Euthyroid, TL	ND, Previous NS
Tubergen 2001	52	NA	Suction Drain	NA	48	NA	NA	All Euthyroid surgery	ND
Pezzullo 2001	30	NA	Suction Drain	NA	30	NA	NA	All thyroid surgery	Previous NS, Irradiation, ND
Dimov 2006	43	NA	Suction Drain	NA	57	NA	NA	All thyroid surgery	ND
Ishaq 2008	30	NA	Suction Drain	39.2	30	NA	39.2	All thyroid surgery	CD, GD, ND
Muthaa 2013	45	29	Suction Drain	44.6	45	25	40.7	TT, TL for BD	ND
Chalya 2011	32	NA	Suction Drain	48.5	30	NA	48.5	All thyroid surgery for BD	large goiter, CD, ND
Memon 2012	30	NA	Suction Drain	32.2	30	NA	31.2	TL	TT, STT, Previous NS, ND
Papavramidis 2014	50	50	Suction Drain	47	50	50	51	TT	GD, ND, CD, Previous NS
Waseem 2020	112	21	Suction Drain	49.3	100	13	47.3	All thyroid surgery	Large goitre, CD, ND, sternotomy
Jefferson 2014	32	20	Passive Drain	44.7	34	9	43.7	All thyroid Surgery	CD, Extensive TC, ND, ME
Abaszadeh 2017	90	NA	Closed Drain	41.3	90	NA	41.5	TT, STT, TL for BD and TC	CD, ND, SSE
Nawaz 2015	32	NA	Suction Drain	42.4	36	NA	42	All thyroid surgery	CD, ND, SSE, Advanced TC
Schietroma 2017	108	74	Suction Drain	47.2	107	76	48.3	All thyroid surgery	ND, ME

Fig 2: showing characteristics of the studies included in the studies. TT-Total Thyroidectomy, TL-Total Lobectomy, STT-Subtotal thyroidectomy, BD-Benign Disease, TC- Thyroid cancer, ND-Neck Dissection, SEE-Substernal extension, ME-Mediastinal Extension, CD-Coagulation Disorders, GD-Graves' Disease, NS- Neck surgery, LND-Lateral neck dissection, NA- Not applicable.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Abaszadeh et al 2017	+	+		+	+	+	
Chalya et al 2011	+	+		+	+	+	
Colak et al 2008	+	+		+	+	+	
Debry et al 1999	+	+		+	+	+	
Deveci et al 2013	+			+	+	+	
Dimov et al 2006				+	+	+	
Hurtado-Lopez et al 2000	+	+		+	+	+	
Ishaq et al 2008		+		+	+	+	
Jefferson et al 2014	+	+	+	+	+	+	
Kalemera et al 2013	+	+	-	-	+	+	
Khanna et al 2005	+	+		+	+	+	
Lee et al 2006	+			+	+	+	
Memon et al 2012	+	+		+	+	+	
Morrissey et al 2008	+	+	+	+	+	+	
Musa et al 2010				+	+	+	
Muthaa et al 2013	+	+	+	+	+	+	
Nawaz et al 2015	+	+	+	+	+	+	
Neary et al 2012	+	+	+	+	+	+	
Papavramidis et al 2014	+			+	+	+	
Peix et al 1992		+	+	+	+	+	
Pezzullo et al 2001		+		+	+	+	
Schietroma et al 2017	+	+	+	+	+	+	
Schoretsanitis et al 1998	+	+		+	+	+	
Suslu et al 2006				+	+	+	
Tubergen et al 2001	+	+		+	+	+	
Waseem et al 2020	+	+	+	+	+	+	
Wihlborg et al 1988				+	+	+	

Fig 3. Cochrane risk of Bias Assessment tool conducted on included studies of the meta-analysis.

The post-operative wound infection was monitored in all studies except for 7, seroma formation was not monitored in 10 studies, the presence of a hematoma was mentioned in all of the studies except for 7, and 10 studies did not mention whether the patients developed hemorrhage, and 3 studies did not mention whether the patients were taken back to theatres for re-operation. Hypocalcaemia was monitored in 14 studies. Post-operative pain score was not monitored in most of the studies except in 10 and only 3 studies failed to mention the length of the hospital stay post operatively.

The quality of the studies was reviewed using the Cochrane risk of bias assessment tool and found high quality studies with low risk of bias as shown in Fig 3. Most of the studies scored was 5 and above for each section.

A total of 3297 patients were included in the study, 1671 patients had drain in place while 1626 did not have any drain placed after thyroid surgery.

Post-operative wound infection was assessed in 20 RCT studies. Pooled results of odd ratio using Mantel Haenszel Fixed effect method was almost 3% in 2537 patients detected wound infection. It is noted that patients who had drain placed were prone to wound infection than no drain group. 40 patients out of 1267 developed wound infection in drain group in contrast 11 patient out of 1270 in no drain group with overall P value of 0.0003. There was no difference in heterogeneity of the individual study results when excluded individual studies.

Post-operative hematoma complication was observed in 2712 patient in 20 studies. In Drain group ,33 patient out of 1385 versus 29 patients in 1327 in non-drain group developed hematoma with pooled result of odd ratio of 1% (95% CI 0.6% to 1%). This showed there was no gross difference between both the groups and favoring more of no drain group.

Out of 1868 patients from 17 studies, post-operative hemorrhage occurred in 13 patients out of 933 having drain placement, compared to 7 out of 935 with a pooled result of odd ratio fixed effect of 1% favoring no drain group. Patients who were taken back to theatres due to a hemorrhage and/or hematoma were 28 out of 2837 from 24 RCT studies. 18 patients out of 1435 were from drain group compared to 10 patients out of 1402 who did not have any drain placement. The pooled results of odd ratio were 1% with P value 0.17 with no difference in heterogeneity in the studies.

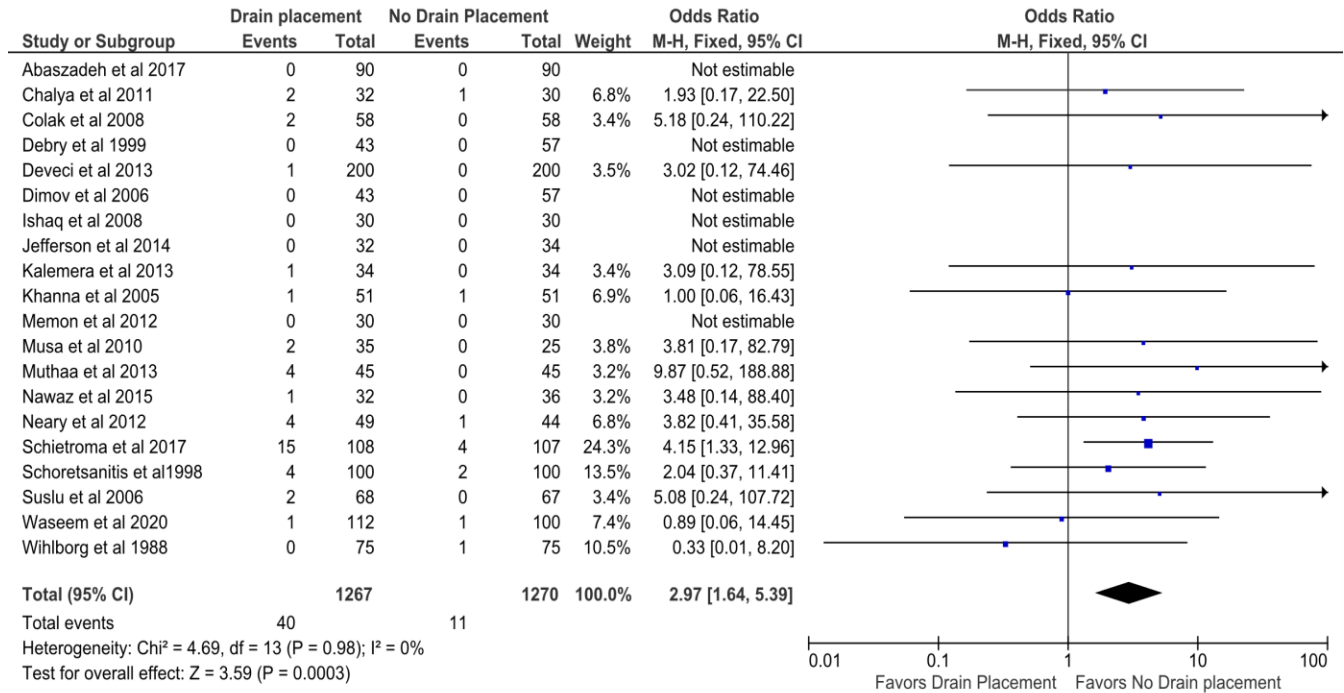


Fig 4: Forest plot showing wound infection in drain versus no drain placement with pool results of almost 3% (95% CI 1% to 5%) favoring no drain placement.

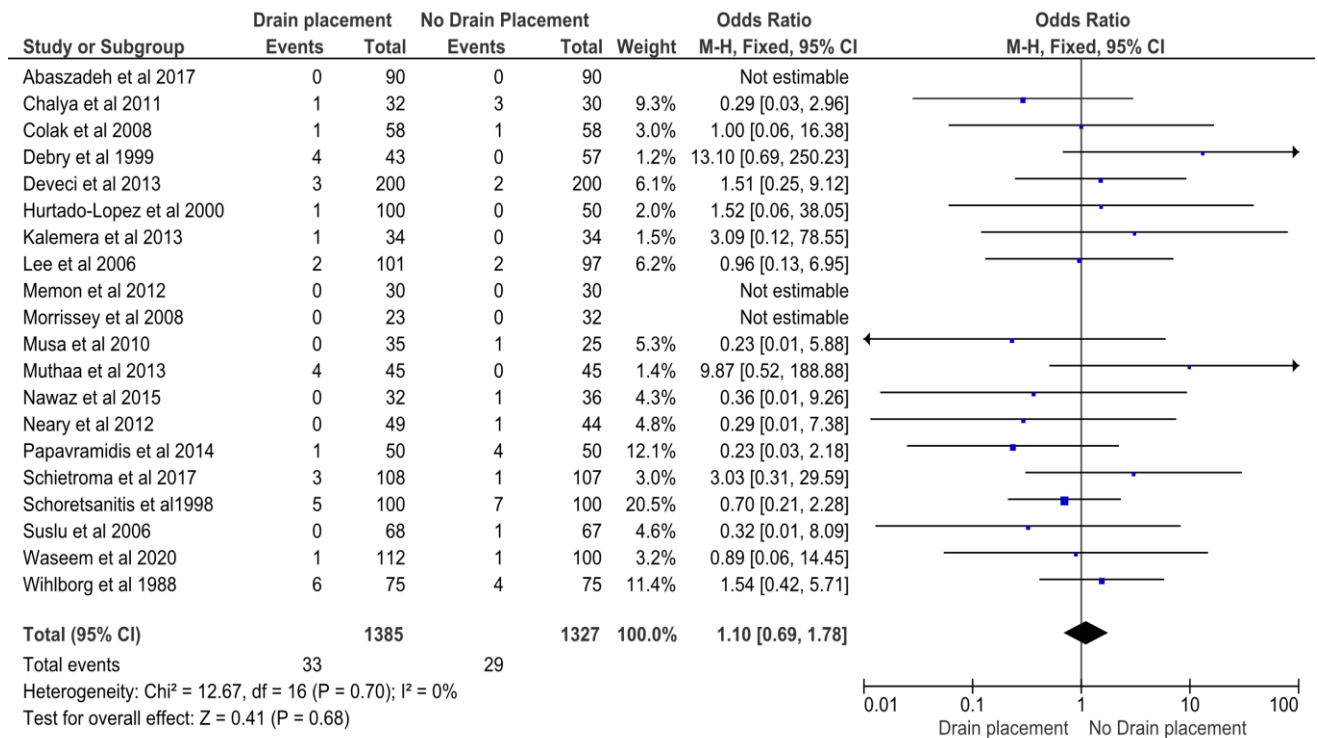


Fig 5: Forest Plot showing hematoma formation in drain versus no drain placement favoring more of no drain placement with a narrow angle.

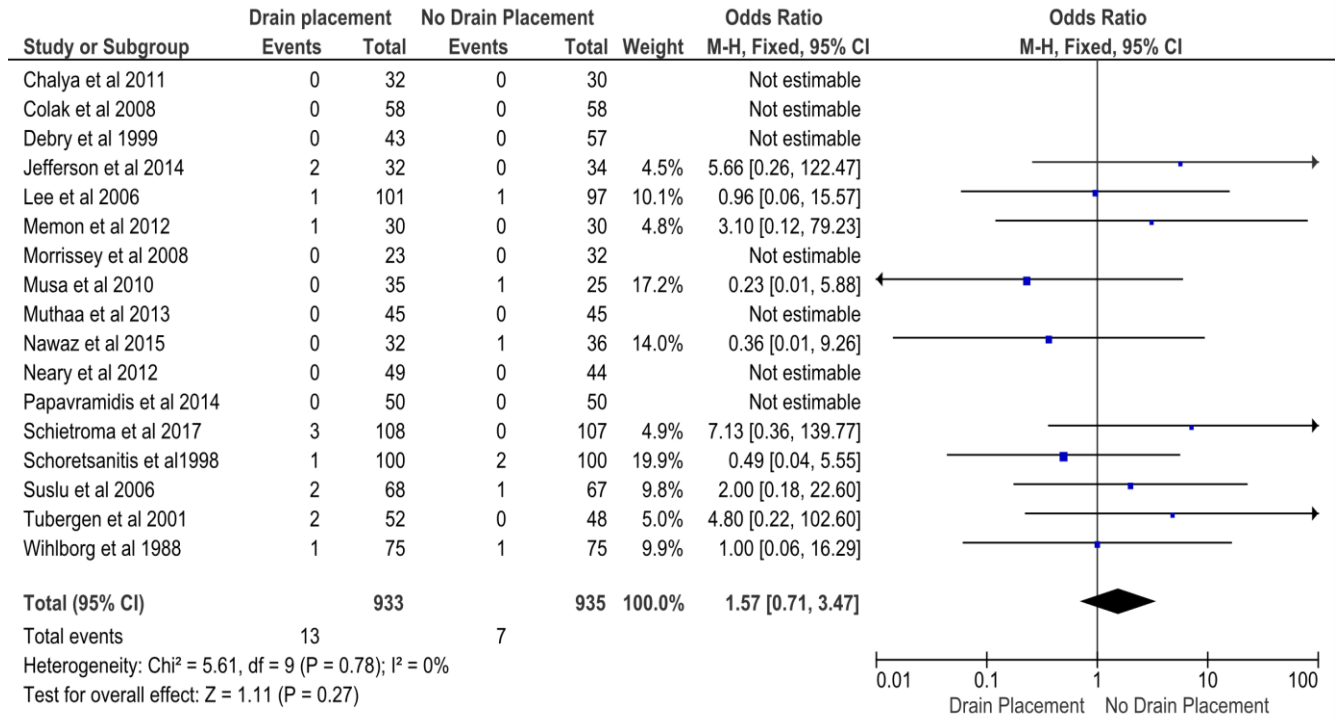


Fig 6: Forest Plot showing in Post-operative hemorrhage in drain placement compared to no drain placed with 1% pooled result (95%CI 0.7% to 3%)

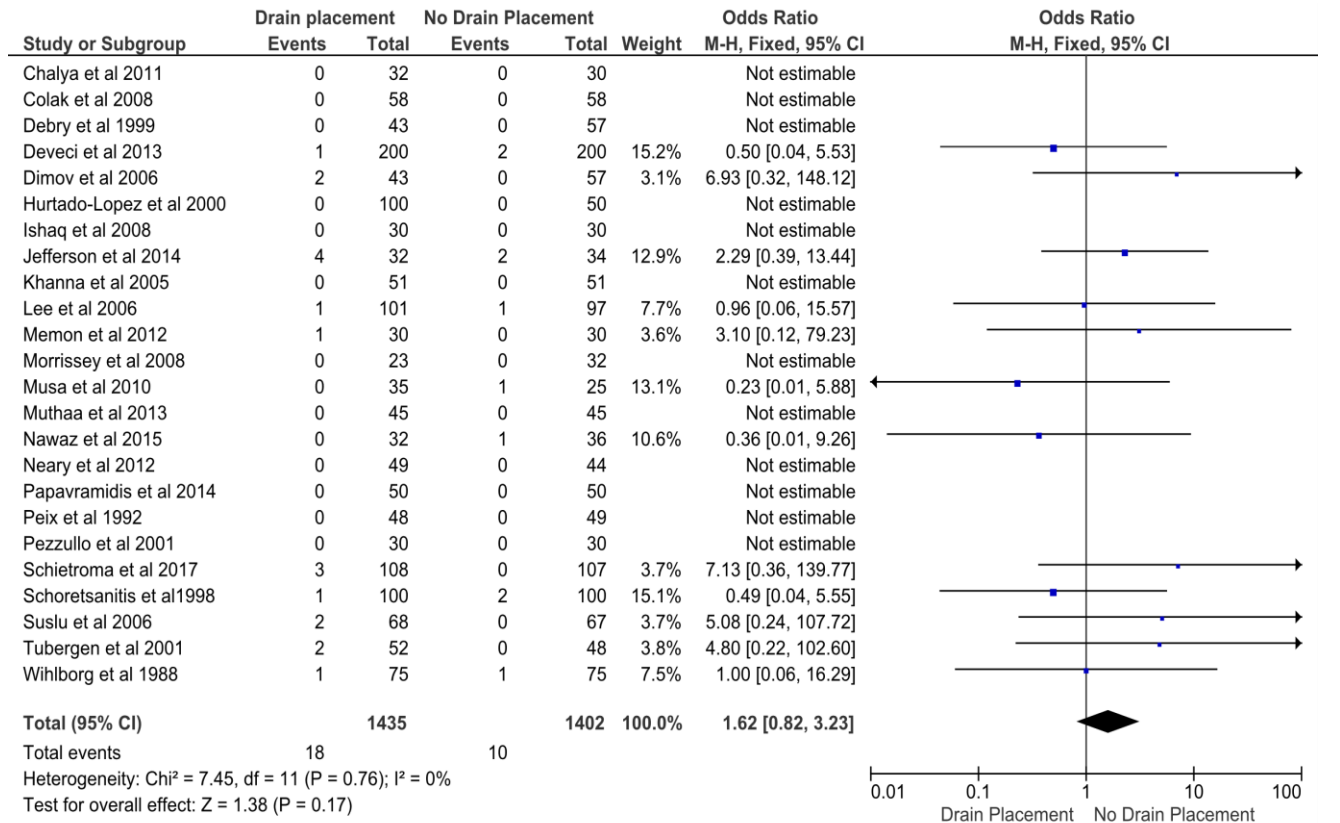


Fig 7. Forest Plot in patient who underwent re-operation in drain versus no drain placement showing 1% (0.8% to 3%) favoring no drain placement.

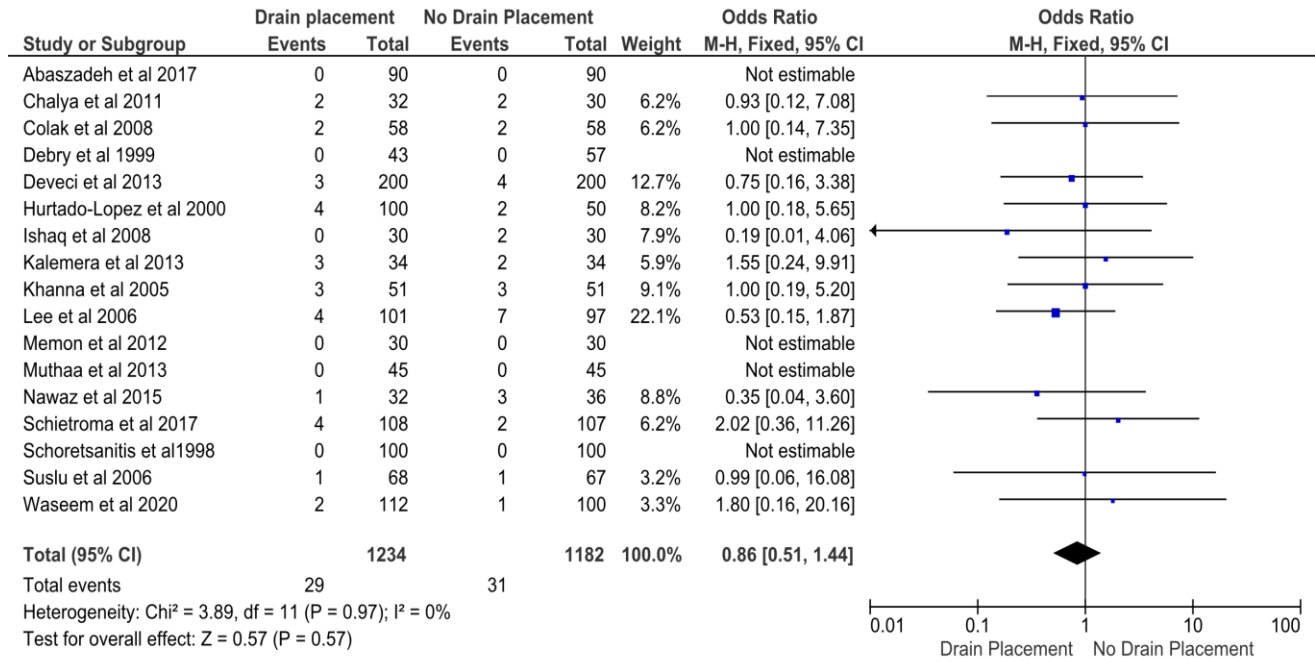


Fig 8: Forest Plot of seroma formation in drain placement group compared to no drain group showing 0.8% (95% CI 0.5% to 1%) favoring drain placement

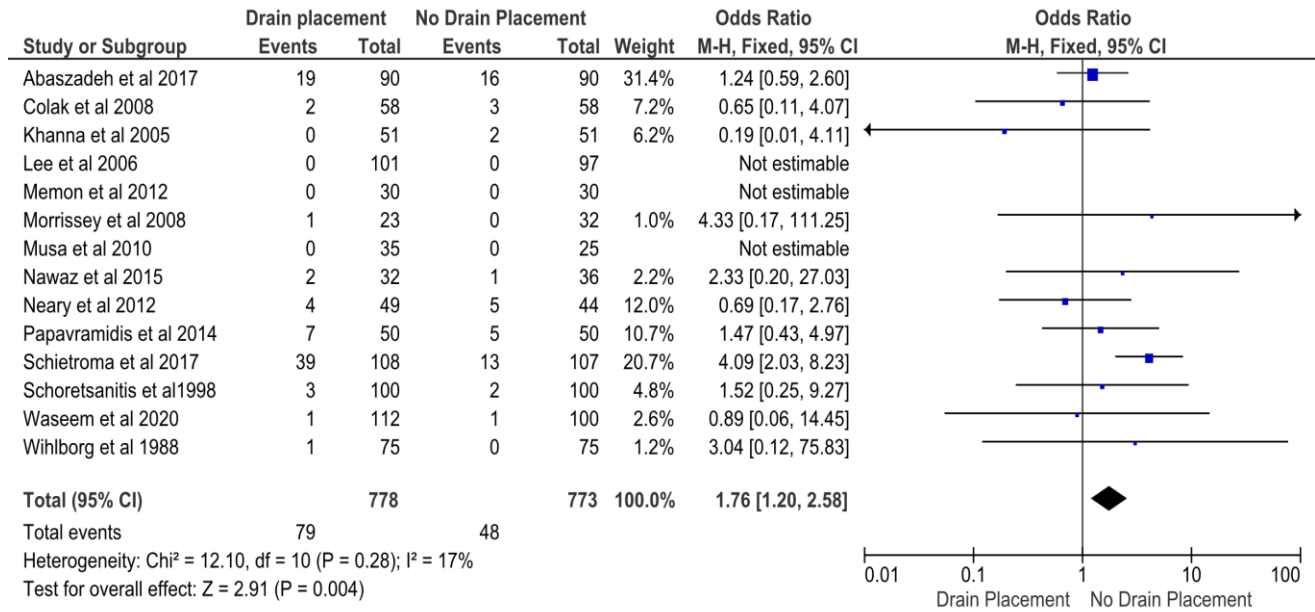


Fig 9: Forest plot of occurrence of hypocalcaemia in drain group compared to no drain placement with OR of 1% favoring no drain placement group

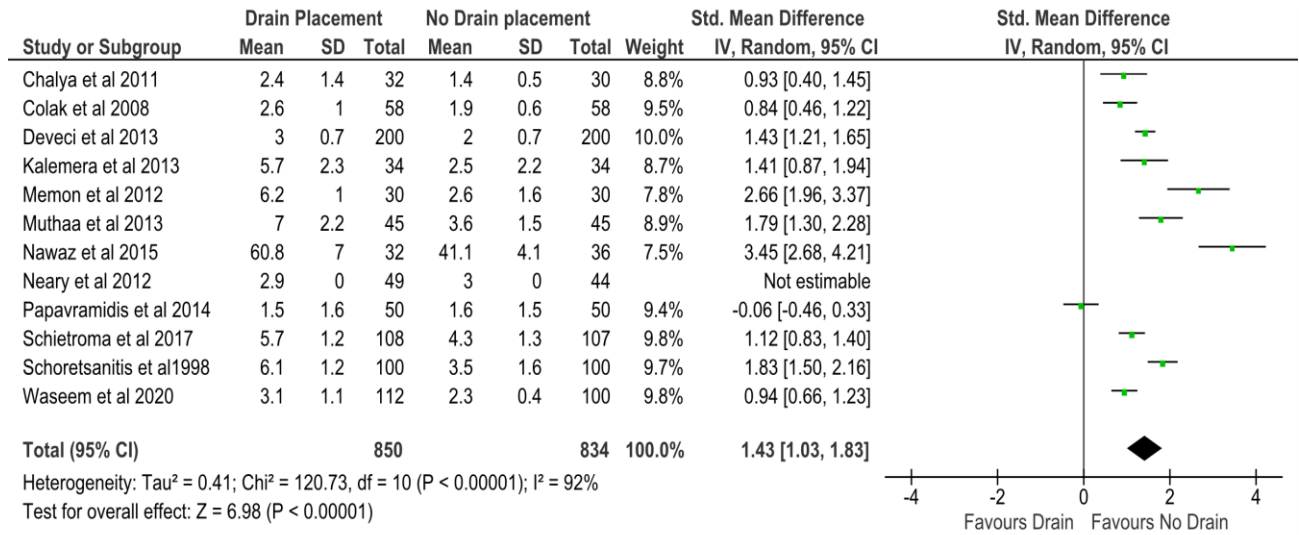


Fig 10: Forest Plot for postoperative pain in Drain placement group compared to no drain placement showing standard mean difference of inverse variance random effect pooled result of 1% (95% CI 1% to 1%).

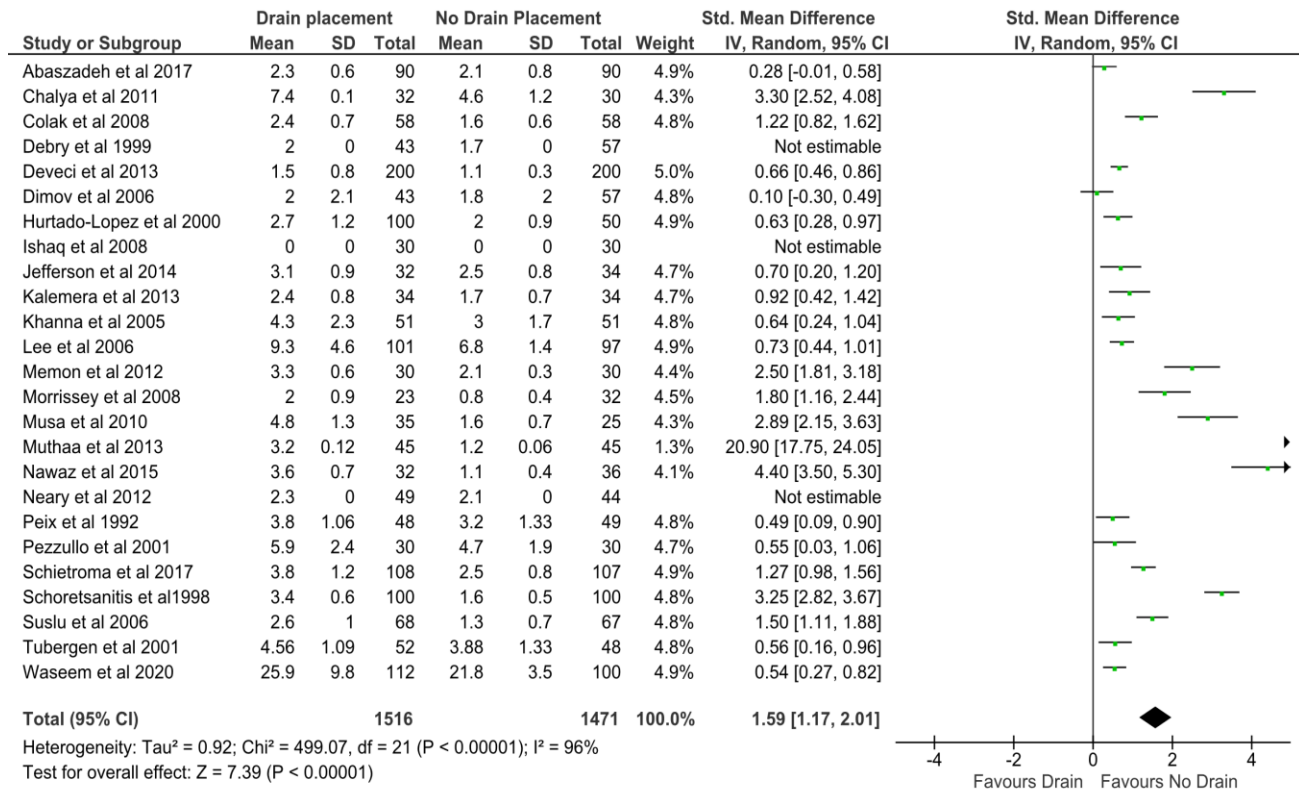


Fig11: Forest plot of length of stay in drain placement group compared to no drain placed showing pooled result of standard mean difference of random effect 1% (95% CI 1% to 2%) favoring no drain placement.

DISCUSSION:

It is an open debate whether routine drain placement has advantage after thyroid surgery. Endocrine surgeons argue that it can prevent from life threatening complications and airway obstruction. Evidence shows that a drain placed after Archives of Surgical Research

a thyroidectomy offers no benefit in a patient’s post-operative outcomes in uncomplicated cases. But still, surgeons hesitate to close the wound without placing a drain⁵⁰. Our meta-analysis directs towards no difference in both the groups with the exception of a longer length of hospital stay in drain placement groups²⁷. Due to a small sample size of the studies in the previous meta-analysis, we chose to conduct ours on a large population size to

overcome previous limitations. We evaluate postoperative outcomes and the efficacy of drain placements in postoperative period, pain management and length of hospital stay to see any difference from the previous reported results.

Our meta-analysis study excludes parathyroid surgery in contrast to previous meta-analyses to avoid bias, as there is less extensive dissection in parathyroid surgery. Recently, more compulsive hemostatic agents, surgical techniques and innovative technologies have pushed the practice of surgery toward a safer, more preventive approach with fewer postoperative complications. There was no difference noted in seroma and hematoma formation in both the groups but number of patients who underwent exploration in hematoma was higher in drain group than non-drain group. Out of 18 patients belonging placement drain group, underwent re-operation in which 5 cases developed hematoma while others experienced life-threatening hemorrhage. Moreover, 10 patients from no drain placement group had exploration done, out of which 3 had hematoma formation. This shows that in case of routine drainage, the practice remains ineffective in preventing hematoma formation, however it can prevent a seroma from forming and reduces the dead space of the wound. It still needs to be explored whether patients have re-operation in late or acute phase hematoma formation.

All the studies excluded neck dissection, toxic goiter and retrosternal dissection but Lee et al. conducted a study on 198 total thyroidectomy patients with central neck dissection and reviewed that no routine drain placement is a safe and effective approach with beneficial postoperative outcome and a reduction in hospital stay. However, central neck dissection along with total thyroidectomy, which is up to level VI lymph nodes and does not require extensive dissection or creation of large amount of dead space. Li and Chen¹³ did a meta-analysis on total thyroidectomy with neck dissection and proved no difference between the two groups but due to limited study the results remain uncertain. Similarly, Shaha et al² study proved that most patients developed hematoma in drain group which shows that regardless of a drain placement, postoperative outcomes cannot be prevented and routine drain placement adds no advantage to the recovery of the patient. As proved in this meta-analysis with no significant difference in the outcomes. Patients with drain placement were more prone to wound infection, hypocalcaemia, increased post-operative pain and increase in length of hospital stay and the study data favors no routine drainage after a thyroidectomy for better patient outcomes^{32,51}. Waseem et al. did a thematic analysis to explore the surgeon's belief and concerns regarding the routine drain placement and formulated a decision tree regarding their decisions. He found out that the operating surgeons placed the drain in for their own peace of mind rather than to avoid a hemorrhage. As it shows that drains cannot prevent an expanding hematoma, and the decision to explore the wound for immediate release is the only management²⁵.

Moreover, drain placement can increase the chances of bacteria translocation and in turn, a wound infection⁵². A few studies have compared a suction drain with an open passive drain to detect merits, but when analyzing the data there was no marked difference in the heterogeneity of postoperative wound infection in the drain groups¹⁰. As the fear of contamination in regards to hemorrhage is acceptable by the surgeons.

On the issue of practical expertise, most surgeons have practiced the same techniques and routine drain placement but the fear instilled in them forces them to place a routine drain in uncomplicated thyroidectomy rather than to follow evidence-based practise^{4,6,7}.

Tian et al. did a meta-analysis on 14 studies and found the post-operative wound infection and length of stay was greater in drain placement group with no significant difference in hematoma or seroma formation. Our study comprises of 27 prospective trials with 3297 participants with 1671 in drain group and 1627 in non-drain group showing that postoperative outcomes are better in no drain group when compared. There was no difference in the seroma formation between the group although the hemorrhage in 17 studies and hematoma development in 20 studies results reviewed were more inclined towards no drain procedure in uncomplicated surgery with less incidence rate of complication.

The sensitive analysis of the study proves that the results are reliable and comparable with the proven literature. This study aids surgeons in their decision making and in changing the trend of practice as there is no additional advantage of a drain placement.

Few authors advocate that draining the thyroidectomy with extensive dissection such as huge goiter, combination of neck dissection and in retrosternal goiter or patients on anticoagulant as they are more vascular and tend to bleed but there is no evidence that drains can prevent the torrential bleed. It may aid in detecting early major arterial bleed which can be managed in a timely fashion^{12,13,53}. Although our study advocates no drain placement in uncomplicated thyroidectomies but the study has its limitations. As our study shows, wound infection is associated with drain placement but it needs to be further explored and open versus closed suction drains need to be compared. There were limited studies in which open drains were used so the results remain ambiguous and any change in the result is uncertain. To achieve a comparable study a larger sample size study is required in open passive drain to reach a conclusion. Further study needs to be explored regarding the thyroid surgery if drains are beneficial in lateral neck dissections, grave's disease, huge goiter, or thyroid cancers involving the strap muscles.

CONCLUSION:

Based on our meta-analysis, our results are comparable with the existing literature and updated evidence provide similar

results that placing drain does not make a difference in postoperative outcomes yet increases the chances of wound infection, postoperative pain and length of hospital stay and no change in decision making of re-exploration of the wound after thyroid surgery. The practice of drain placement is based purely on a surgeon's experience, training, and

comfort level rather than on evidence-based practice with no additional benefit and a change in practice should be encouraged.

ARTICLE INFORMATION

Accepted for Publication: April 26, 2020. Published Online: Sept 30, 2020. <https://doi.org/10.48111/2020.03.03>

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Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest

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Archives of Surgical Research | Invited Commentary

Surgical Training in Pakistan: Challenges & Directions

Zaitoon Zafar, Hammad Naeem Rana

IMPORTANCE With arrival of the age of technology, surgical training in Pakistan should not fall behind, it must co-opt numerous technological measures into its century's old techniques. In a field that allows no room for mistakes, e-learning, simulation training, and virtual reality are gifts from beyond for students to make mistakes to learn from. These technological ventures have proven to be beneficial in postgraduate training and we must try our best to allocate funds to make it possible for the students of Pakistan as well.

KEYWORDS Mentorship, surgery, teaching and learning, role modeling

HOW TO CITE Zafar Z, Rana HN. Surgical Training in Pakistan: Challenges & Directions. *Archives of Surgical Research*. 2020;1(3):18-19. <https://doi.org/10.48111/2020.03.01>

Invited Commentary

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<https://doi.org/10.48111/2020.03.04>

Surgery by nature requires infallibility, there is no room for mistakes. Thus, as an extension of its nature, it attracts the most ambitious and hardy personalities, making it the most competitive field in medicine. It is also a field which is expectedly quick and regular in its evolution.

A mistake in surgery is a very probable permanent alteration to a patient's life, and hence, the training provided to a surgeon is of utmost importance and should be held to the highest standards. Surgical training began with apprenticeships in the 16th century, which usually began around teenage and lasted a rough 6-7 years. Structured programs for surgical training began in present-day Germany in the 1880s, which was imported to the USA by a William S. Halsted within a decade¹.

Dr. Halsted, being impressed upon by the formal training regimens of German surgeons, produced the Halstedian model of surgical training; which emphasized on the need for mentorship, patient communication and a training which gradually became more complex, with increased responsibility and independence. The Halstedian model soon became the foundation for surgical learning in the 20th century¹.

This model and new found direction in the field of surgery attracted numerous great surgeons. The 21st century has seen an even greater expanse in surgical professionals, with more and more female medical students also opting for the specialty².

Medical students in Pakistan go through a rigorous program of 5 years in medical college, followed by a year of house job. Students then have to clear the FCPS (Fellowship of the College of Physicians and Surgeons) exam in order to pursue their field of specialization. The training narrows down from a general, broad based study to a choosing of a subspecialty.

This rigorous training is conducted in order to give students a broad view of the options available to them in addition to sifting out the most hard-working and passionate. Students then enter their postgraduate training which, in surgery, comprises of supervised apprenticeship. According to a special report compiled by Prof. John SG Biggs, postgraduate trainees face a special set of difficulties, ranging from inadequate supervision to a lack of prospective careers³.

The future of the wellbeing of the country rests in surgical training. To test the quality of such a program, there are various established instruments;

- the OPRS⁴, (Operative Performance Rating System), consists of 10-item procedure-specific rating instruments, including technical skills rating, operative decision making, and general items (each scaled from 1 to 5)
- the O-SCORE⁵, (Ottawa Surgical Competency Operating Room Evaluation) consists of 11 items (8 items rated on the five-point competency scale, 1 yes/no question about competency to perform the procedure independently, and 2 open-ended questions for feedback) and the attending who evaluates the resident after finishing the surgical procedure
- the "Zwisch" scale⁶, a scale that was originally designed by Dr. Joseph Zwischenberger, which analyzes the attendings' and residents' behavior during the operation. It consists of four levels of supervision: show and tell, smart help, dumb help, and no help.

In the setting of Pakistan, all 3 aforementioned scales can be used. We must use the assistance of such scales to gauge the quality of teaching we provide, in addition to postoperative feedback, involving discussions and surveys.

Moving on to the time required to become a surgeon; in the UK, a 5-6-year medical school course is followed by 2 years of foundation training after which a doctor may opt to specialize in surgery, upon which they will be admitted to 2 years of core surgical training followed by approximately 6 years of specialty training. In the USA, a student must first obtain a BSc, then graduate from medical school within the next 4 years, after which they can enter their surgery training which taken around 3-7 years, depending on the specialty. In Pakistan, however, students complete their 5 years of MBBS, 1 year of house-job, and then can enter surgical training, which lasts 5-7 years, after passing their FCPS with satisfactory marks.

Pakistan has one of the shortest time-routes to becoming a surgeon; in recent studies conducted to analyze the shortcomings of postgraduate training programs of

surgeons, advisors in the UK did not recommend shortening the length of postgraduate training⁷. In another study carried out in the USA⁸, 71% of respondents believed broad training was superior to a short tracking system. This study also determined that role models and mentors played the biggest part in attracting medical students to the surgical specialty.

With the arrival of the age of technology, surgical training in Pakistan should not fall behind, it must co-opt numerous technological measures into its century's old techniques. In a field that allows no room for mistakes, e-learning, simulation training, and virtual reality are gifts from beyond for students to make mistakes to learn from. These technological ventures have proven to be beneficial in postgraduate training⁹ and we must try our best to allocate funds to make it possible for the students of Pakistan as well.

ARTICLE INFORMATION

Accepted for Publication: September 20, 2020. Published Online: Sept 30, 2020.

<https://doi.org/10.48111/2020.03.04>

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Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest

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Archives of Surgical Research | Original Research Communication

Impact of Personal Protective Equipment on Surgeon's Performance during COVID-19 Crisis: Qualitative Exploration of Challenges and Solutions

Aiza Saeed¹, Maira Dastgir Nousherwani¹, Talat Waseem¹, Zaitoon Zafar¹, Zabish Mehmood¹, Javeria Usman²

IMPORTANCE The pandemic caused by the Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has exposed surgeons to hazardous working conditions, imposing the need for personal protective equipment (PPEs) use during surgery. The use of such equipment may affect their technical and non-technical skills, augment fatigue and affect their overall operative performance.

OBJECTIVE This study aimed to assess the perceptions of surgeons in regards to the impact of wearing PPEs during emergency surgery, in tertiary care settings, throughout the pandemic and to explore the solutions recommended to cope with emerging issues.

DESIGN This is a Mixed Method Qualitative Study

METHODS A cross sectional survey having both qualitative and quantitative components was administered through an online form which was circulated around the world through emails and social media among surgical communities. Purposive sampling with "snow-balling" was used in order to obtain quality input. Surgeons and surgical trainees who were performing emergency and elective surgeries during the pandemic were included to obtain a meaningful input.

RESULTS Responses to the survey (n=28) were received from surgeons from all over the world. The vast majority (99%) were males. Despite wearing PPEs, only 50% individuals felt safe suggesting high level of anxiety and unpredictability among surgeons. Most of the surgeons (67.9%) felt adversely affected by PPEs in terms of their surgical performance. The four most common problems encountered were problems related to vision (82.1%), breathing and temperature (67.8% each). Mobility and comfort were the 4th most affected factors (60.7%). Common suggestions included prioritizing emergency surgeries over elective procedures (46.42%), performing procedures 4 hours or shorter (42%), taking frequent breaks (32.1%) along with the use of alternative forms of PPEs to suit infection control and surgical performance both. 42% percent responses showed that provision of training for proper usage of PPEs can minimize most problems associated with PPE use. Few suggested avoiding use of PPEs if prior screening for coronavirus turned out negative; however majority were still inclined to observe protective measures. Other suggestions included selection of individualized PPEs suited to various surgeons, adequate training to use them and counseling of peers (10.7%) to curb anxiety in the operation theatre.

CONCLUSION PPEs, although necessary for surgeon and staff safety, have adversely affected the operative performance of surgeons and surgical teams during the pandemic. The use of better suited PPEs, appropriate training and following necessary protocols for infection control advised by various surgical societies can be helpful adjuncts to prevent surgeon fatigue and improve their operative performance.

KEYWORDS Personal protective equipment; non-technical skills; operative performance; vision, fatigue;

HOW TO CITE Saeed A, Nousherwani MD, Waseem T, Zafar Z, Mehmood Z, Usman J. Impact of Personal Protective Equipment on Surgeon's Performance during COVID-19 Crisis: Qualitative Exploration of Challenges and Solutions. *Archives of Surgical Research*. 2020;1(3):20-27. <https://doi.org/10.48111/2020.03.05>

Original Investigation

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<https://doi.org/10.48111/2020.02.05>

On 31st December 2019, the World Health Organization (WHO) was formally notified about a cluster of cases of pneumonia in Wuhan City, home to 11 million people and the cultural and economic hub of central China. The cause of the severe acute respiratory syndrome that became known as COVID-19 was a novel coronavirus, SARS-CoV-2. SARS-CoV-2 is transmitted via droplets in respiratory aerosol, contact with surfaces and possibly via fecal-oral contact. Worldwide, about a million people have died as of this writing, and a total of 28.6 million infected with the virus. Both surgeons and the patients undergoing surgery are at higher risk of developing COVID related morbidity and mortality.

The SARS-CoV-2 pandemic has exposed surgeons to hazardous working conditions, imposing the need for personal protective equipment (PPEs) use during surgery. They require proper donning and doffing of airborne infection control PPEs for optimal safety during surgical procedures. The use of such equipment may affect a surgeon's technical and non-technical skills, augment fatigue, and affect their overall operative performance¹⁻⁹. Exploring the impact of PPE on the performance of surgeons (technical and non-technical both) and to extrapolate possible solutions for these issues are of highest research priority. Non-technical skills include communication, decision making, situational awareness, and anxiety and fatigue control. The use of PPEs during surgery has also raised concerns about their impact on surgical performance through worsening of quality of vision, temperature regulation, level of anxiety, breathing problems/exhaustion, mobility, decision making, quality of dissection, energy in theatre, research, ability to perform longer operations, quality of assistance and feelings of safety. The purpose of this study was to assess surgeons' perceptions in relation to the impact of wearing PPEs during surgery throughout the

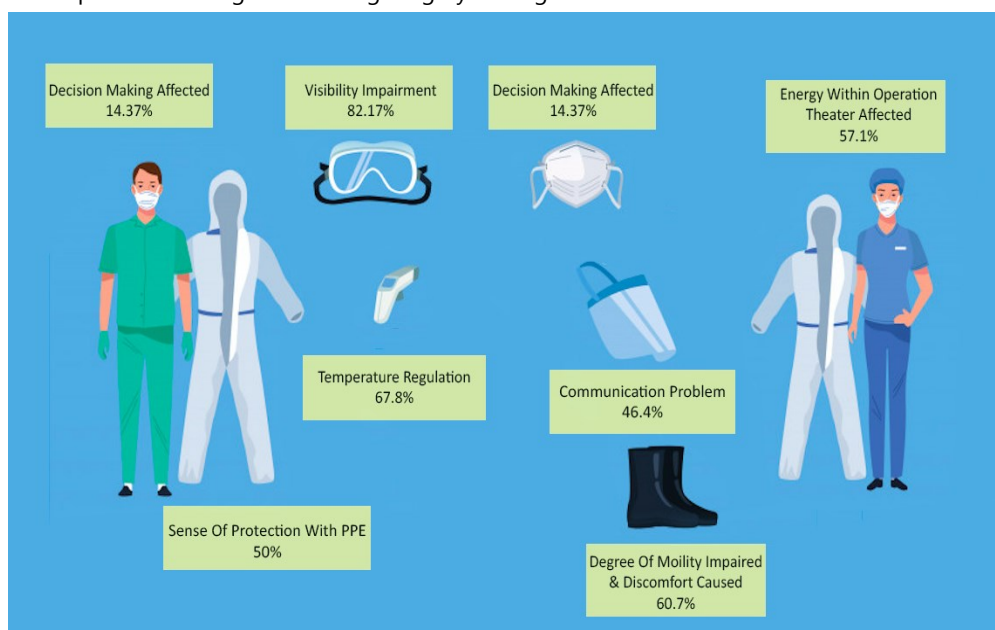
pandemic, in tertiary care settings and to find solutions for these problems.

METHODS:

A detailed literature review was done under expert supervision and potential impacts of PPEs were identified and summarized. This literature review was used to form the basis of the questionnaire. The questionnaire items were expert validated through 8 experts and then were distributed among the participants for data collection. The questionnaire containing 22 items was uploaded on Google Forms and issued internationally as an online survey. A draft of the questionnaire which was designed can be found at: https://docs.google.com/forms/d/e/1FAIpQLSereQBID9UNobHwLoqrSdOEmWLB4_-joo8v_mb9HxsYxzjg/viewform.

It was a cross sectional survey having both qualitative and quantitative components. Purposive sampling with "snow-balling" was used in order to obtain quality input. Data was collected from surgeons of different tertiary hospitals from around the world. The sample size consisted of approximately 28 surgeons considering more dominant components of qualitative data which was eventually subjected to thematic analysis. Surgeons and surgical trainees who were performing emergency and elective surgeries during the pandemic were included to obtain a meaningful input. Those surgeons and their trainees who were not performing surgeries, either because they are quarantined or because of any other issue or those who declined to participate were excluded. The vast majority of participating surgeons were specialized in general, plastic, neurosurgery, and orthopedic surgery. The survey collected demographic data (age, gender, specialty, qualification, institutional affiliation, city and country of clinical practice)

along with the surgeons self-impressions of PPE usage and the feeling of safety, visual impairment, temperature regulation, level of anxiety, breathing problems/exhaustion, mobility, decision making, quality of dissection, energy in theatre, research, ability to perform longer operations, quality of assistance and surgical performance during the COVID-19 pandemic. The questions were formulated so that respondents could give their responses in detail. Frequencies and percentages were calculated



from the collected quantitative data as appropriate.

RESULTS:

A total of 28 surgeons took part in the study. This study population consisted of 9 general surgeons, 2 neurosurgeons, 2 urologists, 2 hepatobiliary and pancreatic surgeons, 2 orthopedic surgeons and 11 plastic surgeons (total=28). Male surgeons were 27 in number and the study population consisted of 1 female surgeon. 6 out of the total fell into the age group of 20-30 years, 12 were of the ages in between 30-40 years, while 10 were aged between 40-50 years. 25 of 28 participants felt that PPEs have significantly affected their ability to perform adequately within the operation theater for various reasons. Moreover, 5 out of 28 did not feel safe enough to perform surgery even after wearing the PPEs. Figure 1 and Table 1 highlight the most common problems encountered along with their percentages according to our study.

Table 1: Which of the aspects listed below have been adversely affected by wearing personal protective equipment in operating room?

Problems	Percentage of surgeons encountering them
Wearing n95 mask for longer periods	67.8%
Permissible length of surgical procedure	50.0%
Energy within operation theatre	57.1%
Degree of mobility and discomfort	60.7%
Quality of visualization	82.1%
Quality of dissection	32.1%
Quality of assistance	32.1%
Quality of communication	46.4%
Preoperative decision-making process	14.3%
Temperature regulation	67.8%
Level of anxiety	28.6%
Sense of protection	25.0%
Financial compromise	17.8%
Surgical training practices affected?	35.7%
Surgical education practices	35.7%
Surgical research practices	21.4%

Among general surgeons as well as specialty surgeons, the top three most encountered problems at an individual level were a decrease in the quality of vision (82.1%), problems with temperature regulation (67.8%) and breathing issues with wearing N95 masks for a prolonged period of time (67.8%) (Table 1). Other problems that seemed to affect the majority consisted of PPEs causing restricted mobility and discomfort (60.7%), energy within operation theatre (57.1%) while financial compromise and preoperative decision-making process were the least frequent problems encountered by the surgeon (17.5% and 14.3% respectively). An important observation regarding PPEs was noted about

how much our study population felt safe with the usage of PPEs.

Summary of solutions as suggested by the participants (Quantitative)

Top 3 most commonly provided solutions were: prioritizing emergency surgeries over elective procedures (46.42%), performing procedures 4 hours or shorter (42%), taking frequent breaks (32.1%) along with the use of alternatives to PPEs. 42% results also showed that training for proper usage of PPEs can minimize most of the problems associated with its use. Solutions to all of the physical problems revolved around frequent changing and/or cleaning the gear i.e. the goggles to prevent fogging, and getting better quality equipment with antifog mechanism and respirators was suggested. Methods to curb anxiety in the operation theatre included taking frequent breaks (32.1%), dividing teams into multiple smaller sections to complete longer surgeries and counseling peers (10.7%) was thought to provide help to reduce the stress levels. 28.7% suggested avoiding use of PPEs if prior screening turned out to be negative. For all the complaints relating to increased room and body temperatures, it was unanimously suggested that thermostats to air conditioners be adjusted accordingly and surgeons be placed in the most ventilated part of the room. Along with extra pedestal fans being a favorite to resolving heat problems (21.4%).

QUALITATIVE FINDINGS

Challenges encountered by the Surgeon as an individual with Solutions

Most of the general surgeons suggest that their visibility during operating procedures was compromised due to their goggles getting fogged by their own breath or sweat. For example, one respondent quoted, "my visibility is reduced because vapors are condensed in the goggles" –while other surgeons did not seem to have much of a problem and in fact stated, "our vision gets clearer with goggles". To curb these visibility problems, one expert said "we clean goggles every few minutes" while another suggested, "we can use [Jupiter] hoods instead". Similarly, surgeons faced severe anxiety as the PPEs posed an adaptability challenge. One expert was of the view, "it elevated the level of [my] anxiety of getting infected with Covid19." While another thought, "I did not feel anxious while wearing them". However, majority of the younger experts unanimously answered that "adaptability was not very problematic in my age group but was for older surgeons" and "with age, wearing PPEs is more challenging especially in surgeons with high BMI and comorbidities". A few also claimed "Age has no role whatsoever." Suggestions that followed these problems were worded as, "Screening before the surgery provides a sense of relief". A second expert suggested, "Strong nerves and faith after taking precautions played a significant role (in curbing anxiety)".

In the same way, general surgeons reported no change in their decision-making abilities with the addition of PPEs to their routines. They said, "I found no difficulty in timely decision making with PPEs". Some disagreed by saying, "being visually affected delays judgment in identifying structures, securing hemostasis [and can negatively impact your operative performance]". Suggestions included, "Establishing effective two-way communication between

assistants and primary surgeons can help overcome this barrier". It was vastly reported that no change in their quality of dissection was observed; an expert said "we can dissect as well as before" For those encountering problems they suggested, "I have noticed changing masks often can help with maintaining focus and quality dissection" while another expert tipped, "We can take breaks in between operations."

Table 2: Challenges encountered by the Surgeon as an Individual		Coping strategies suggested
	Responses by Surgeons	Responses by Surgeons
Quality of vision	Most affected - "My visibility is reduced because vapors are condensed in the goggles." - "They are difficult to wear with spectacles" - "they have no effect." - "our vision gets clearer with goggles"	"we should Get better quality shields and goggles" "we can Clean goggles every few minutes" "we can use hoods instead"
Temperature regulation	Mostly affected - "PPEs cause increased Sweating leading to irritation" - "You get sweaty within half an hour, you feel hot, palpitations, dizziness, the heat of it starts killing you."	"Standing in well ventilated parts of the theatre" "Installing extra pedestal fans and lowering thermostat of A/C can help cool down."
Level of anxiety	Mostly unaffected. - "I am not affected at all" - "I Did not feel anxious" - "It elevated the level of anxiety due to having the risk of getting infected with covid-19."	"Avoid wearing PPEs when patient is Covid Negative" "Screening before the surgery provides sense of relief" "Peer counseling helps a lot" "Wearing PPEs provides sense of relief"
Breathing Problems/exhaustion	Mostly affected "Feeling of shortness of breath during long procedures." "N-95 mask is very tough as it makes rashes on the face, especially on the nose, it was much irritating" "We have stopped performing long procedures because of n95 masks" - "It caused shortness of breath during operation, which in return caused decreased energy."	"by Changing masks every hour, we are able to solve this problem" "Using Green 3M Masks as they are less suffocating" "Using Surgical Masks only without n95 masks" "By resting after every surgery"
Mobility	Mixed responses - " Surgeons don't have to move this much that PPEs have this effect" - "it restricts my mobility significantly"	"Getting patients screened prior so we don't have to wear PPEs" "Wearing surgical gowns instead of PPEs can curb this problem" "Keeping less number of assistants and number of other staff in OR" "Getting good size and quality of PPEs" "Limiting no. of patients in one day"
Decision making	Unaffected - "My Decisions are not much affected" - "Visuals affecting your senses and delays the judgments in identifying structures, securing hemostasis". - "our focus is lost." - "I found no difficulty in timely decision making with PPEs"	"Establishing effective two-way communication between assistants and primary surgeons can help overcome this barrier," "by Taking frequent breaks our team can handle the decisions better."
Quality of dissection	Mostly unaffected - "They don't have any effect" - "We Can dissect as good as before" - "Free movement cannot be done" - "Restricts Fine movement so difficult to perform quality dissection"	"We can Take breaks in between operations." "By paying more attention to surgical practice." "I have noticed changing masks often can help with maintaining focus and quality dissection" "we should always adapt to changing environments"
Age and the adaptability to wearing PPEs have some role to play?	Mixed responses - "Maybe these are interrelated." - "Age has no role whatsoever" - "I don't think so" - "It's not a that much problematic in my age group than older surgeons" - "With age, wearing PPEs is more challenging"	"By motivating peers and fellows to provide a safe environment for everyone" "Strong nerves and faith after taking precautions played significant role"

	especially in surgeons with high BMI and comorbidities.. "	
Covid 19 has affected hugely in terms of research practices?	Mixed responses - "It's badly affected as no surgeries, so no data of patients for research" - "I Have ample time to gather data from ER and do our research" - "Research work is very much slowed due to limited work" - " Stopped research because of it" - " Absolutely, in my personal research, patients for my sample of study were not available. And so research paper is delayed. " - "Completed previous research papers in the free time available during Covid, wrote two more new papers, one related to Covid"	"We can still conduct research by Connecting with patients online" "we can Keep electronic record of data" "We should focus on Completing past researches" "we should be a part of webinars"
Energy in theatre	Mostly affected "Yes, unable to perform longer surgeries now" "It has increased the level of depression and stress among surgeons." "They cause a lot of Exhaustion" "They have not affected me to a great deal"	"I Spitted my team in small groups to perform long surgeries in steps..." "Good hydration before starting operation & control of room temp. while doing surgery helps energy levels." "By only wearing surgical gowns with masks and not wearing PPEs" "By sitting on stools and performing surgeries"
Psychologically Affected?	Mostly Affected	"Encourage Exercise at home" "everyone should Get good amount of sleep" "By keeping 1-2 cases on list everyday" "Spend more time with family and minimizing exposure to patients to keep safe from Covid"

Every participant was significantly affected by the rising temperatures from wearing PPEs and reported, "You get sweaty within half an hour, you feel hot, palpitations, dizziness, and the heat of it starts killing you..." One participant said, "N-95 mask is very tough as it makes breathing difficult and gives rashes on the face, especially on the nose. It is very irritating". The surgeons were agitated so much by N95 masks that they ended up performing fewer surgeries, "we have stopped performing long procedures because of N95 masks". suggestions included, "Installing extra pedestal fans and lowering thermostat of A/C can help cool down." Along with two others saying, "by changing masks every hour, we are able to solve this problem" and "Using Green 3M Masks as they are less suffocating".

Have research practices been affected?

In an online discussion on whether COVID-19 affected research activities, out of a total 98 responses a clear majority of answers discussed how research practices have been negatively affected due to lack of data etc.10 Among our study population, 60.7% subjects claimed that their research practice did not get affected by the pandemic and instead one expert said, "I have ample time to gather data from ER and do our research". It was also suggested that COVID-19 has provided opportunity for newer research topics.... "during COVID, wrote two more new papers, one related to COVID". Only 39.3% subjects reported that their

practice had suffered in the pandemic. They said, "It's badly affected as no surgeries, so no data of patients for research". Suggestions on fixing this problem included, "We can still conduct research by connecting with patients online". Another participant said, "We should focus on completing past researches" with a unique suggestion of "we can keep electronic record of data".

Challenges encountered as a team

The ability to perform longer operations was by far the most common challenge that our subjects faced (50%). One response said, "Yes, as long time stay in OR increases exposure" while another explained, "Operative stamina is decreased". As a result of which they suggested, "Avoid[ing] longer procedures for the time being" and "...Take frequent breaks in between procedures". 46.7% of the subjects claimed their communication between the team during surgeries got affected. One stated "PPEs caused muffling of voices so we are unable to hear voices", another countered "I don't think it is a problem". It was proposed "by talking loudly it helps a little." along with "manage all staff talks before surgery so I don't need to rush during case fixes the worry" (10.7%). Surgical training and educational practices were the third most common problem faced because of bringing PPEs into surgical practice as 82.1% subjects thought due to lesser opportunities in theatre, "online classes have covered a lot, though not 100%". To overcome

this one answered, "encouraging everyone to attend webinars both national and international" and another suggested "recording surgeries and sharing with staff later; conduct Zoom meetings"

Rest of the results are tabulated in table 2.

DISCUSSION:

In this study we analyzed the impact of PPEs use on surgeons performing surgeries and identified the common problems they faced in the setting of an operation theatre. Current PPE recommendations for operating room staff consist of protection of droplet, contact, and airborne routes¹¹. This includes the use of N95 respirators, eye protectors, face shields, gloves, surgical gowns and shoe covers¹². Since there is little literature available scrutinizing the consequences of PPE usage for surgeons, exploring their impact on performance of the surgeon (technical and non-technical both) and to explore possible solutions for those issues should be of interest and a need of the time.

Results are classified as 'mostly affected' for challenges encountered the most, 'mixed responses' where the answers of the study population were divided between the proposed challenge causing problems to some and no problems to the rest, 'mostly unaffected' for those where participants did not feel challenged by a certain issue.

The answers revealed that 67.9% of the respondents asserted that their physical performance was significantly impaired as they found themselves avoiding procedures that take longer than 4 hours. Even so, when they performed, they were forced to take frequent breaks due to PPEs causing visual compromise, breathing impairment, limited mobility, affected communication, overall discomfort and the energy within operating theatre being decreased. The use of full body suits and double gloving, in addition to the use of N95 masks disturbed temperature regulation of the body and resulted in extreme sweating, early exhaustion, and increased anxiety levels.

N95 masks are proven to be the best at blocking viral particles but they can also reduce the amount of available oxygen by up to 20%¹³. This corresponds to the claims made by majority of our subjects who reported breathing problems and suggested the use of simple surgical masks instead of these respirators. Infectious disease expert Amesh A. Adalja, MD senior scholar at the Johns Hopkins Center for Health Security in Maryland claimed, "someone wearing an N95 mask for a prolonged period of time may have alterations in their blood chemistry that could lead to changes in the level of consciousness if severe"¹⁴. Thus, for those facing severe exhaustion and headaches after prolonged use of such masks need to be provided with safety measures to mitigate health risks. There is good evidence that improved access and use of PPEs vastly reduced healthcare worker infections in both Italy and China.¹⁵ However, as important as they may be for the protection of individuals and the entire hospital setting, they

pose difficulties for surgeons. Suggestive alternate for N95 masks was the use of Powered Air-Purifying Respirator (PAPR) by the study subjects. As explained in an article about worker's safety by 3M, a powered air purifying respirator uses a blower to force the ambient air through air-purifying elements to the inlet covering. A PAPR system typically includes a motor/blower, filter/cartridge, battery, headgear and a breathing tube.¹⁶ It is proven that these respirators are more effective in protecting the user from breathing contaminated air when compared with N95 masks and their use causes less breathing problems making them competent alternatives to N95 masks.¹⁷ There is, however, a need for proper training when donning PAPR, as the greater protection provided by these over N95 masks is reduced if one self contaminates with a disease that is transmitted via contact¹⁷, a point which has also been emphasized by our study results (42% suggested providing training for usage of PPEs).

Research by Bryce and colleagues (2008) found that even though healthcare personnel may use appropriate PPEs, they often do so incorrectly or incompletely.¹⁸ So when our study population was inquired if age and adaptability to wearing PPEs was a challenge, subjects in the age group 40-50 years reported that age did not have any effect on adaptability and usage of PPEs and disregarded this as a concern. On the other hand, subjects in the age groups of 20-40 years old reported how they themselves were not encountering any issues but believed their colleagues senior in terms of age to them do face a great deal of challenges.

According to our conducted survey, only 50% individuals felt safe wearing PPEs. This lack of confidence could be explained by the extreme working conditions which more than half our study population faced owing to working in operating facilities with infrastructure not equitable with the rest of the world's. The responses of our subjects working in local government hospitals in Pakistan is testament to the fact that difficult working conditions pose a bigger threat to the surgeons as compared to the pandemic itself. However, provision of appropriate PPE and training does protect doctors treating COVID-19 patients from exposure to the infection¹⁹ and no matter how difficult working conditions are, 60.7% of our subject population suggested PPEs cannot be avoided; instead alternatives should be used to minimize the stress caused by it.

We also found that PPE use under the given circumstances also affects a team's performance as communication and mobility is hampered by way of muffled voices, fogging of goggles, crowding of the operating rooms causing surgeons to take additional measures to make their surgeries successful. Measures like improving ventilation by way of adding extra fans, reducing number of assistants and even talking loudly to make their instructions heard help yet also add to the already difficult working conditions. Adequate judgment in surgical practice is established as the capacity to make accurate decisions with the available information.²⁰ This decision-making capacity was one of the least affected aspects of PPE usage.

Additionally, as mentioned earlier it was reported by our subjects that the usage of goggles impaired their visual capabilities by way of fogging. This resulted in subjects frequently cleaning their goggles or avoiding their use altogether if prior PCR screening of the patient turned out to be negative (28.6%). However, it is an established fact that 90% of the 2000 daily workplace eye injuries could be prevented if the victim had been wearing protective eyewear, such as safety glasses or goggles,²¹ making it an important part of PPE. So, if a high-performance antifog is not a part of your organization's planning for safety in the workplace, one could be putting workers in significant danger²¹.

Engelmann et al. suggests taking short intermittent breaks to help maintain excellent performance, lower error rates, and increase the surgeon's well-being²² 32.1% of our subject population suggested likewise and 3 subjects (10.7%) further suggested of splitting their teams into 2 shorter teams for longer procedures. This would help keep up the energy levels within the operating rooms as declining energy is a frequent complaint. Hence the use of such equipment in the surgeons' working environment generates biochemical stress resulting in fatigue and exhaustion.¹ According to the results of our survey, it is felt that more focus needs to be given on making guidelines for the usage of PPEs rather than only focusing on donning and doffing them. Particular attention is also needed to improve the infrastructure of operating theatres of local hospitals so surgeons feel safer while performing lifesaving procedures. Solutions to problems caused by PPEs need more attention as their need has increased exponentially in the past months.

ARTICLE INFORMATION

Accepted for Publication: April 26, 2020. Published Online: Sept 30, 2020.
<https://doi.org/10.48111/2020.03.05>

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Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest

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Adrenal Incidentalomas: When to operate and when not to operate!

Asif Hussain; Jawaria Avais

IMPORTANCE Adrenal incidental mass lesions are commonly detected during abdominal and chest imaging and pose lot of burden for its diagnostic possibilities with a special focus on its potential to be a malignant lesion and/or hyperfunctioning with endocrinal complications. Biochemical testing for hormones, and a dedicated CT with adrenal protocol can detect many but not all of these incidentalomas. Therefore, further testing with MRI, FDG-PET and rarely with biopsy and/or adrenal venous sampling is also needed in cases where CT is equivocal. Diagnostic certainty is needed to choose between management options of surgical resection, monitoring or no follow up. This invited review aimed at elaboration of diagnostic and management options which best suits for various clinical scenarios.

KEYWORDS Adrenal Incidentaloma, Adrenal Adenoma, Adrenocortical Carcinoma, Pheochromocytoma

HOW TO CITE Hussain A, Avais J. Adrenal Incidentalomas: When to operate and when not to operate! *Archives of Surgical Research*. 2020;1(3):28-32. <https://doi.org/10.48111/2020.03.06>

Invited Review

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<https://doi.org/10.48111/2020.03.06>

Due to increased utilization of advanced radiological imaging, incidental findings are commonly noted in adrenal glands. Generally, 5-10% of these are malignant ¹, 10% are functional, 5% subclinical Cushing's syndrome, 5% pheochromocytoma, and 1% have hyperaldosteronism. It's essential to work out these lesions for hormone production and, even more importantly, for the risk of being malignant. As the adrenal carcinoma is often aggressive with high mortality, hence early detection is important ².

Functioning lesions can produce cortisol, aldosterone, adrenal androgens, or catecholamines. Hormone secreting masses may be adenoma, carcinoma, pheochromocytoma, congenital adrenal hyperplasia (CAH), massive macronodular hyperplasia or a nodular variant of Cushing's syndrome. The masses which don't produce hormones include adenoma, myelolipoma, neuroblastoma, ganglioneuroma, hemangioma, carcinoma, metastasis, cysts, hemorrhage, granuloma, amyloid deposit or an infiltrative disease ³.

The aim of this review is to summaries the management strategies for these lesions, which often are tricky and need work up.

DIAGNOSTIC STRATEGIES

Three basic questions which need answers are: 1): is it a benign or a malignant lesion, 2): is the mass hormone secreting or non-functioning lesion, & 3): does it need to be treated or followed up. These questions are answered by a

detailed clinical assessment for endocrinal complications (Cushing's syndrome, Pheochromocytoma, Conn's syndrome or Virilization) by history, examination, hormonal evaluation, non-invasive radiological imaging modalities for features suggesting benign or malignant lesions, and rarely by invasive testing such as adrenal venous sampling or biopsy of the lesion [Table 1]. Children, adolescents, pregnant females, and adults <40 years of age should be evaluated urgently due to the high risk of malignancies, and MRI is preferred due to no radiation risk. Old frail patients or those with short life expectancy should be assessed proportionate to clinical benefit ⁴.

Clinical assessment: Personal or family history of adrenal malignancy or multiple endocrinal neoplasia (MEN) III syndrome makes it highly likely to be malignant. Androgenic features usually are seen in adrenal carcinoma or congenital adrenal hyperplasia. Carcinoma can often cause biochemical and metabolic complications more than morphological features of Cushing's syndrome due to rapid growth ⁵. Pheochromocytoma can present with features of sympathetic overactivity, anxiety, resistant/secondary hypertension or rarely hypotension.

Conn's syndrome can also present with secondary hypertension, muscle weakness and electrolyte imbalance (hypernatremia, hypokalemia, and metabolic alkalosis). Cushing's syndrome can present with insulin resistance, hyperglycemia, diabetes, central obesity with cushingoid

appearance, proximal myopathy, osteoporosis, hypertension, immunosuppression, infections, hypercoagulopathy, lymphopenia, eosinopenia, neutrophilia, polycythemia and thrombocytosis. Adrenal androgens can

cause precocious puberty (male child), heterosexual precocious puberty (female child), virilization (adult females), and hypogonadism with the maintenance of

secondary sex features in an adult male. Hence a detailed clinical and laboratory assessment may be needed depending on the clinical presentation ⁶.

Table 1: Pros & cons of various diagnostic modalities.

Modality	Pros & Cons	When to use?
CT Adrenal protocol	Easily available & convenient Risk of radiations & contrast. Uses lipid content or contrast washout.	Usually First line (unless contra-indicated).
MRI Adrenal	Not commonly available, Costly, and more time required. Rely on drop out signals, tissue densities on T1, T2 images, and contrast.	Second-line if CT is equivocal. First-line for pregnant patients, young patients, and patients with renal disease or contrast allergy.
FDG-PET/CT	Not commonly available. Radiations risk. Uses FD-Glucose uptake in metabolically active lesions	The first choice when there is a confirmed or suspected metastatic malignancy or for patients with known malignancy.
FNAC	Invasive and can't differentiate adrenal adenoma from carcinoma. Risk for complications. Needs an expert histopathologist to assess the cytology.	Used when a non-adrenal malignancy or an infection such as TB/Fungal is suspected, which can change the management.
24-hour UFC and DST	Measures pathological hypercortisolism	Every patient needs to be tested including those who are asymptomatic.
Urinary and serum metanephrines and catecholamines	Detect any functioning pheochromocytoma	Hypertension, hypotension, adrenergic symptoms, or extra-adrenal tumors. Also, before FNAC or surgery to exclude asymptomatic pheochromocytoma.
Renin-aldosterone ratio	Detects Conn's syndrome Stop ACE inhibitor, ARBs, Spironolactone, and Beta-blockers before doing the test.	Hypertensive patients, hypokalemic or alkalotic patients.

Abbreviations used in the Table 1: FDG-Fluorodeoxyglucose, FNAC: Fine needle aspiration cytology, UFC: Urinary free cortisol, DST: Dexamethasone suppression test.

RADIOLOGICAL ASSESSMENT

Size of the lesion: The size of the lesion is directly proportional to the chances of being malignant. Lesions above 4cm in size have a 20% chance of being malignant. That's why surgical resection is often recommended for lesions 4cm or bigger in size. However, size alone is not a criterion for being benign or malignant as some benign lesions can also be large in size ⁷. Malignancy is more likely if the size is larger than 6cm, especially when there are other clues such as irregular borders, inhomogeneity, calcification, or less than 40% washout go contrast after 15 minutes ⁸.

CT features of the lesion: Often, CT abdomen done for some other presentation finds incidental lesions in the adrenal glands. CT is the most common modality used to assess adrenal lesions. CT with 2-3 mm slices should be performed, including pre-contrast and delayed contrast phase unless contraindicated, and radiographic attenuation is assessed by Hounsfield unit (HU) values ³. Lipid rich lesions such as adenoma (<10HU) or myelolipoma (<30HU) have low attenuation on CT before contrast. As 70% of adenoma has fat, CT is very sensitive for these lipid-rich adenomas. Lipid-poor adenomas have high attenuation, so the sensitivity of HU assessment for such adenomatous lesions is low. Therefore, contrast washout is used especially for lipid poor adenoma, as all adenomas (irrespective of the lipid content) wash out rapidly in comparison to other lesions. Using a 15 minutes delay for washout calculations and demonstration of at least 60% absolute percentage or 40%

relative percentage washout is almost diagnostic of adenoma irrespective of its lipid contents ⁹.

However, vascular metastasis, such as renal cell carcinoma (RCC) or hepatocellular carcinoma (HCC), can also show similar washout (Shetty AS). If attenuation is >120 on portal venous phase, it's likely a hypervascular metastasis or pheochromocytoma rather than a lipid poor adenoma. CT features having irregular borders, nonhomogeneous density, density more than ten Hounsfield unit (HU), increasing size on interval scans, local invasion, etc. all favor malignancy more than benign lesions and should be assessed for surgical resection. Non-adenoma lesions often have high attenuation ¹⁰. Lesions with attenuation >20 are unlikely to be adenoma on chemical shift MRI and dynamic contrast CT is better imaging ¹¹.

MRI: When CT is equivocal, MRI chemical shift imaging can help. MRI demonstrates signal drop out on opposed phase images in the majority of adenoma and >16.5% or more drop in the signal intensity is diagnostic of adenoma. The liver should not be used as a reference as it can change signals depending on iron content or fat in liver cells. MRI is useful if CT attenuation of the lesions is less than 30HU. The sensitivity and specificity of the signal drop out on out of phase (OOP) imaging are 100% if CT attenuation is 10-20 HU and are 89% & 100% respectively if CT attenuation is 20-30 HU. Fat containing metastasis, such as RCC or HCC, can also demonstrate changes similar to adenoma. Restricted diffusion on MRI favors malignant lesions ^{11,12}.

Pheochromocytoma has a low density on T1, high intensity on T2, and avid enhancement on T1 with gadolinium. However, lack of hyperintensity on T2 doesn't exclude pheochromocytoma, and similarly, a few metastases can have high intensity on T2 images¹³. Adrenal carcinoma is heterogeneous with an area of high signal intensity on both T1 & T2 images due to blood products & necrosis. Also, gadolinium enhancement is nonhomogeneous in carcinomatous lesions. Carcinoma, due to its origin from the adrenal cortex, may have fat and may lose intensity like adenoma¹⁴. Metastasis is often bilateral, low signal intensity on T1, high intensity on T2, and progressive contrast enhancement. However, they lack a signal drop off on OOP images, hence differentiating from lipid-rich adenoma¹⁵. Myelolipoma is made up of fat and bone marrow, hence have fat attenuation of -150 to -30 HU on CT and parallel the signals of retroperitoneal fat on MRI, but have low uptake on FDG-PET. Adrenal cysts have low density (<20) close to that of water with no enhancement on contrast, and MRI will show homogenous high intensity on T2¹⁶.

FDG-PET: If CT or MRI are equivocal, the next non-invasive option can be FDG-PET. Metabolically active lesions such as carcinoma, metastasis, or pheochromocytoma usually have a high uptake of FD Glucose, whereas lesions such as adenoma, cyst, or myelolipoma with low metabolic activity have low FDG uptake. It becomes an investigation of choice, especially in those who have malignancy elsewhere with an adrenal lesion suspected as metastatic vs. benign finding. However, false-negative FDG uptake can be seen in carcinomas with necrosis, previous chemotherapy causing low growth of tumors, mucinous tumor cells, or small size lesions^{17,18}. Patients known to have extra-adrenal malignancy preferred imaging is FDG-PET⁴.

FNA-Cytology: Image-guided FNA-cytology (preferably CT guided) is an option when non-invasive imaging techniques fail to establish diagnosis confidently. However, as cytology can't differentiate adenoma from carcinoma, FNA is recommended mainly when non-adrenal cancer or an infection is suspected, and it is expected that the treatment plan will change by the cytology. However, it's an invasive test with risks such as bleeding, pain, pneumothorax, pancreatitis, infection, or recurrence of cancer along the track. For these reasons, FNAC is rarely used to establish a diagnosis for adrenal incidentaloma¹⁹.

Hormonal Assessment: A detailed history should be asked about symptoms of hormone excess like hypercortisolism (Cushing's Syndrome), virilization due to androgens, hypertension with weakness, and electrolyte imbalance (Conn's Syndrome) or those of pheochromocytoma. Almost 90% of the incidentalomas are non-functioning. Rarely adrenal damage may also cause Addison's disease. Hormonal assessment is needed both in symptomatic and asymptomatic cases; the latter is important to exclude subclinical functioning cases. Pheochromocytoma

assessment is especially important for anyone with hypertension or those who are planned for any intervention such as FNAC or surgical resection to avoid any complication due to adrenergic storm. Patients known to have extra-adrenal malignancy should be assessed for pheochromocytoma as well⁶.

24-hour urine free cortisol (UFC) & low dose Dexamethasone suppression test (DST) is helpful to exclude hypercortisolism. Plasma and urinary metanephrine and catecholamines are screening tests to exclude functioning pheochromocytoma. Adrenal androgens such as DHEA-S for androgenic secreting lesions is important in patients with virilization. Early morning testing for the renin-aldosterone ratio by more than one paired sample obtained at an interval of 30 minutes in the supine position is used to exclude hyperaldosteronism (Conn's Syndrome) in cases with hypertension. Drugs that can affect renin-aldosterone, such

as Beta-blockers, ACE inhibitors, ARBs, or spironolactone, should be stopped before checking for the test. If needed, blood pressure should be controlled by vasodilators such as Prazosin, which doesn't affect renin-aldosterone. For bilateral lesions, adrenal venous sampling is often needed to assess the source of the hormone^{4,6}.

TREATMENT:

When not to operate?

Surgery is not recommended for asymptomatic non-functioning unilateral adrenal mass with obvious benign features on imaging (especially the lesions less than 10HU, regular borders, homogenous density, washout >50%, size less than 3cm), and are followed up by imaging and hormone testing at regular intervals of 1-2 years. Mild biochemical Cushing's syndrome without clinical symptoms should be evaluated annually and surgery is recommended in worsening of symptoms. However, if opted for non-operative treatment for indeterminate lesions, 3-12 monthly re-evaluation is needed³. If imaging confidently points toward other causes such as myelolipoma, cyst, TB, or hematoma, or other non-malignant causes, in an asymptomatic patient, then it can be managed non-operatively. Conservative approach is also recommended for a non-functioning mass in an old person²⁰.

When to operate:

Hyperfunctioning lesions should be controlled by the medications to prepare them for operative treatment when possible. When surgery is needed, it's prudent to exclude Pheochromocytoma to avoid intra-operative and post-operative complications. Non-functioning adrenal mass >4 cm, indeterminate/suspicious lesions, malignant lesions or hyperfunctioning lesions (even if they are benign) should be considered for surgical resection. Laparoscopic surgery for unilateral mass with suspicious imaging findings for

malignancy (and local invasion or diameter of <6cm without local invasion) is preferred ²¹.

Follow up:

For those who don't need operative treatment, follow up with hormone assays isn't recommended if hormone level is normal at first assessment unless they develop symptoms of hormone excess. Similarly, repeat imaging isn't recommended for those who benign mass of <4cm size. For indeterminate lesions, repeat CT/MRI 6-12 months is needed to see any increase in size, which would suggest surgical treatment if growth is 20% (or repeat scans in 6-12 months if size increase is less than 20%). Benign adrenal lesions in patients known to have an extra-adrenal malignancy don't need treatment, but indeterminate lesions are followed up at the same interval as for the underlying tumor ⁴. Post-op follows up for recurrence of the malignant disease,

hormonal excess, or Addison's disease is important. Those having bilateral adrenalectomy will also need to follow up for Nelson's syndrome. Cortisol replacement is important in post-operative cases with bilateral adrenalectomy (lifelong requirement along with aldosterone replacement) or for a variable period of 6-12 months for unilateral hyperfunctioning lesions ²².

DISCUSSION

Incidental lesions are commonly found on routine imaging, and a collaborative assessment, including clinical,

biochemical, and radiological, often helps classify them as benign or malignant with a rare need for biopsy. CT is often the first modality to characterize the lesions based on HU and contrast washout. Often MRI may complement CT, if the latter is equivocal. FDG-PET is mainly used with systemic malignancy in a known or suspected case of cancer, with possible metastatic adrenal disease.

Lipid rich lesions such as the majority of the adenoma (70%), or rarely some tumors like RCC and HCC or cortical adrenal carcinoma have low attenuation (HU) on CT. Lipid poor adenoma is the one that has high attenuation and is difficult to differentiate from other causes, but contrast washout CT findings or signal drop out on opposed phase MRI chemical shift imaging can reliably differentiate adenoma from malignancies. Vascular lesions such as carcinoma, pheochromocytoma, or metastasis have a high uptake of the contrast (unlike benign adenoma with a rapid washout at 15 minutes). Metabolically active lesions such as carcinoma, pheochromocytoma or metastasis also have high FDG uptake on FDG-PET. Adrenal carcinoma can mimic many radiological patterns due to a variable combination of tumor necrosis, high vascularity, blood products, variable growth rate, and metabolism in different parts of the tumors; and it can also have lipid due to its origin from the adrenal cortex. Non-functioning, benign and small lesions don't require surgery. Hyperfunctioning, indeterminate, or lesions with possible malignant features are managed operatively. Follow up for conservatively managed cases or post-operative cases is important.

ARTICLE INFORMATION

Accepted for Publication: July 26, 2020.

Published Online: Sept 30, 2020.

<https://doi.org/10.48111/2020.03.06>

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Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest

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Archives of Surgical Research | Invited Commentary

"Rules of Thumb" for Research Ethics

Fatima Aslam

IMPORTANCE Research ethics provide guidelines for responsible conduct of research and educate and monitor scientists', conducting research to ensure a high ethical standard. Research ethics are significantly important for a number of reasons. They promote the aims of research, such as expanding knowledge and support the values required for collaborative work like mutual respect and equity. These pillars make a foundation of important social, moral values, and the principle of doing no harm to others. Ethics in research are associated with the ethical principles of social responsibility. Usually, research envelops a vast framework of working with people and researchers put up with this endeavor to gain trust in the respondents' eyes, to be able to collect authentic reliable data, and also to ensure the transparency of the scientific work.

KEYWORDS Research Ethics, Beneficence, Informed Consent, Patient Safety

HOW TO CITE Aslam F. Adrenal Incidentalomas: "Rules of Thumb" for Research Ethics *Archives of Surgical Research*. 2020;1(3):33-34. <https://doi.org/10.48111/2020.03.07>

Invited Commentary

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Research ethics provides ground rules to researchers on how to conduct research in an effective manner while maintaining high ethical standard. These ethical principles matter a great deal for a number of reasons like enhancing knowledge and cultivating mutual regard and integrity for collaborative work among the researchers. These pillars make a foundation of significant moral and societal standards, and the principle of preventing harm to others and are associated with the ethical principles of social responsibility. Usually, research envelops a vast framework of working with people. Researchers put up with this endeavor to achieve trust in the respondents' eyes, to be able to collect authentic reliable data, and also to ensure the transparency of the scientific work.

There are a few principles in ethics that should be followed while conducting a research study. The word autonomy has been originated from ancient Greek, meaning 'self-legislation' or 'self-governance. In other words, it is the individual's capacity to act in accordance with their own values and interests. It is based on respect for individual and value of person as an end in itself thus enabling or empowering patients to make their own decisions about their health care interventions. In order to treat an individual as autonomous, he must be provided with complete information about the research project and given a choice to participate or refuse. The participants of research study should be informed about their right to decline the intervention at any point of time during the ongoing research. It has been observed that it is the highly overlooked ethical concern while conducting a research.

Individuals with diminished autonomy and mental proficiency, psychosocial stressors and developmental disabilities are the vulnerable populations who should not be excluded from research, as if done so, it will restrict knowledge development in those domains where these population may get benefitted by an authentic research work. Under special circumstances, the consent can be obtained from family, legal guardian, or a custodian.

Beneficence is balancing the gains of treatment in opposition to the expenditure and risks associated with that particular mode of therapy, whereas non-maleficence means avoiding the causation of harm. For example, it may be an essential treatment but is not considered to prevent a more serious health issue in future. The purpose of research is to help the society by exploring contemporary and safer treatment modalities. To some extent, participants may get exposed to discomfort, harms, and risks during the research process and it is the responsibility and moral duty of investigator to reduce the harm and augment the welfare. Research integrity refers to active observance of ethical principles and professional norms that are essential for effective research practice. It does not mean taking it as a directive by law makers but following it as a part of personal belief system. The integral component of research process is integrity because it builds up trust and confidence. The individuals involved in research should respect and acknowledge each other's work, and "they must also be trusted by society since they provide scientific expertise that may impact people's lives". Confidentiality is an ethical practice used to build up trust and rapport with the

participants involved in the study by protecting their privacy thus maintaining the moral standards and dignity of research process. Protecting and respecting patient confidentiality is mandatory to build a relationship on the basis of trust and respect.

Informed Consent is a voluntary agreement to participate in research and this choice is based on the fundamental principle of altruism i.e., to benefit others in society. It can be on the expense of potential disclosure of their personal information, so it is the duty of researcher to protect the participants. It is not merely a form that is signed but is an important procedure, in which the subject is provided with adequate knowledge about the research, making sure that he/she understands the benefit to risk ratio, that helps in making an informed, voluntary, and rational decision to participate. This also includes information on their right to decline or withdraw.

Ensuring justice in research commences with selecting subjects based on research requirements rather than expediency. Inclusion and exclusion criteria should be explicitly mentioned in the study design and followed so that every participant can have an equal opportunity to

participate in the research. It is the ideal distribution of risks and benefits when scientists are recruiting volunteers, to participate in clinical trials. In randomized trials, the investigator is in charge to establish an independent group of experts in a Data and safety monitoring board to monitor the level of risks associated with experimental treatment and study procedures, in order to ensure the safety of participants. Conflicts of interest implies those situations when professional decisions related to a major interest (e.g., the responsibilities of a medical researcher) may be at risk of being shadowed by a subsequent interest (e.g., monetary benefit or career growth). The investigators can achieve mitigation of conflict of interest, by complying with the institutional and governmental regulations, adhering to the prerequisites for recognizing, disclosing, and managing conflicts of interest, and circumventing and minimizing conflict.

Research ethics are comprehensive from developing to usage and applying knowledge. It is the primary obligation of investigators to devise safe strategies for all participants to take part in the research process in a fully informed and ethical way despite their literacy level or physical or intellectual capacity.

ARTICLE INFORMATION Accepted for Publication: September 20, 2020.
Published Online: September 30, 2020.
<https://doi.org/10.48111/2020.03.07>
Open Access: This is an open access article distributed under the terms of the CC-BY License. © 2020 Aslam ASR.

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Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest

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Archives of Surgical Research | Invited Comment

Managing Cognitive Retention of Surgical Graduate with Improved Techniques: Lessons from Cognitive Psychology

Saleem Arif, Talha Asad

IMPORTANCE As the base of scientific knowledge expands, it is becoming harder for the today's medical student to have a lasting grip on it. It is timely and very much the need of hour to incorporate modern learning techniques in our lessons and educate medical students about them so that they can remember most of material, manage the cognitive load more effectively and enhance their germane loads to compete the pace of ever-increasing body of medical knowledge. It remains imperative to understand the process of information processing and cognition, the problems associated with it before embarking on identifying and suggesting the strategies to overcome associated issues. This article would focus on first, the process of information processing and memorizing and in the later half would focus on identifying associated problems and the strategies in light of modern theories and recommendations to rectify them.

KEYWORDS Cognitive retention; Techniques; Surgical education

HOW TO CITE Arif S, Asad T. Managing Cognitive Retention of Surgical Graduate with Improved Techniques: Lessons from Cognitive Psychology. *Archives of Surgical Research*. 2020;1(3):35-38. <https://doi.org/10.48111/2020.03.08>

Invited Comment

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<https://doi.org/10.48111/2020.03.08>

Many of the students find it difficult to learn and retain long and lengthy material to secure good grades in exam¹. Though we need to work on many areas to improve educational outcomes such as student counseling, remedial classes, teacher training to use advanced techniques and minimizing the number of students to facilitate individual attention; however, this article specifically pertains to understanding the reasons for lower cognitive retention and strategies to deal with them. Fortunately, there are thoroughly investigated strategies that have been developed by cognitive and educational psychologists that are helpful for student dealing with lengthy learning materials^{2,3}. These techniques are easy to use and generalizable to great set of students. In this assignment we will first analyze the problem of the index student, then would define the reasons for his lower cognitive retention and then learn techniques to handle cognitive load and cognitive retention.

ANALYSIS OF THE PROBLEM

The problem of low cognitive retention and forgetfulness faced by the student can be at either at the end of the teacher or the student himself. For example the poor teaching techniques used by the teacher would certainly reflect on the students in form of lower achievement of the

STATEMENT OF PROBLEM

A final year student in your medical college has complained that it is difficult for him to remember what he studies. He has asked for advice from you so that he can grasp long reading material and learn it to pass the exam. Suggest strategies on the basis of the principles and approaches of cognitive psychology, how he can remember most of information.

educational goals³. Interference, retroactive inhibition, proactive facilitation, differential resistance to interference and lack of enactment and automaticity are the most important factors which a teacher has to control to impart lesson effectively with better cognitive retention³. The details regarding these factors can be found elsewhere³. Apart from role of the teachers and quality of lessons, learning environment, emotional stability of the student, low self-esteem and level of motivation play significant role in cognitive retention.

On the student side there can be many problems but the most common problem that students often face is to manage the cognitive retention effectively. There are many techniques that are quite popular among the students for remembering the lengthy materials but they are not effective enough and hence the students eventually suffer⁴.

As a medical educationist it is our primary responsibility to teach our students these techniques for better handling of the long reading materials. Dunlosky et al have extensively

worked on defining roles of these strategies⁴. Table 1 here gives a list of few commonly used techniques:

Technique	Description
1. Elaborative interrogation	Generating an explanation for why an explicitly stated fact or concept is true
2. Self-explanation	Explaining how new information is related to known information, or explaining steps taken during problem solving
3. Summarization	Writing summaries (of various lengths) of to-be-learned texts
4. Highlighting/underlining	Marking potentially important portions of to-be-learned materials while reading
5. Keyword mnemonic	Using keywords and mental imagery to associate verbal materials
6. Imagery for text	Attempting to form mental images of text materials while reading or listening
7. Rereading	Restudying text material again after an initial reading
8. Practice testing	Self-testing or taking practice tests over to-be-learned material
9. Distributed practice	Implementing a schedule of practice that spreads out study activities over time
10. Interleaved practice	Implementing a schedule of practice that mixes different kinds of problems, or a schedule of study that mixes different kinds of material, within a single study session

Table 1: Learning Techniques (Courtesy: John Dunlosky 2013)

The traditional techniques such as highlighting, re-reading and summarization have been frequently used in past by the students with some benefit. However, newer techniques have emerged recently which are far more effective and can enhance cognitive retention massively. Here at this juncture it has become to understand these new techniques for better cognitive retention and to teach to our students for optimal educational outcomes.

Modern Learning Techniques:

The selection of appropriate technique for learning by the student is of utmost importance. Dunlosky et al have extensively worked to map the beneficial role of various learning techniques and have divided the techniques into high, moderate and low utility technique⁴. The most commonly used techniques by the students include re-reading, highlighting, note taking, summarization, writing to learn etc have all been interestingly estimated to be low utility techniques. Others popular newer techniques such as concept mapping, PQ4R method, keyword mnemonics, imagery and elaborative interrogation have been found to be moderately effective. In stark contrast, practice testing, distributed and interleaved practice have been found to be highly effective techniques with exceptional overall educational outcomes in terms of cognitive retention and reproduction.

Here we evaluate the differential usefulness of the techniques and we stress for the student to adopt the technique according to the type of educational content and

goals. Appropriate selection and right use of these techniques would produce quite effective results.

- 1. Practice Testing:** Practice testing enhances learning and retention⁵. Even Edward Thondike (1906) found that active recall of a fact from within is as a rule better than its impression from without⁶. The technique has brought generalizability. It enhances retention by triggering elaborative retrieval processes. The practice testing increases the likelihood that the related information is activated and encoded along with the target during learning process.
- 2. Distributed Practice:** This popular cramming strategy is very effective that is helpful in learning overtime either in one session or across sessions⁷. Distributed practice offers beneficial long-term retention of the information being processed by the student. The term distributed practice encompasses both spacing effect (advantage of spaced over massed practice) and lag effect (advantage of spacing with longer lags, over spacing with shorter lags)⁴. Researchers have shown that technique has high utility and very effective in educational setting.
- 3. Interleaved Practice:** This technique facilitates organizational processing and specific processing by comparing different kind of problems. For example, it gives the students opportunity to identify which solution method can be used for a given problem. It helps to discriminate between different kinds of problems so that the students can select and use specific method or strategy to solve each of them one by one (Dunlosky, Rawson, et al., 2013).

- 4. Elaborative Interrogation:** Elaborative interrogation and explanatory questioning can be harnessed to promote learning. The students learn the material and complex concepts by asking questions and answering them⁸. In their earliest systematic studies of elaborative interrogation found that this technique enhances learning by supporting the integration of new information with the existing prior knowledge. Learners activate their schemata to organize new information that facilitates retrieval⁹.
- 5. Group Study:** This technique can be quite effective for better retention. Small groups running on the basis of PBL, CBL, communities of practice are good examples of group study where interaction plays an important role in improving cognitive retention.
- 6. Self-Explanation:** It is effective in learning content material within task as well as across several task domains. As this technique requires little or no training so it can be easily practiced by the students. But they need teacher assistance to explain the task or give brief introduction to the learning material¹⁰. The quality of explaining the material affects directly on the learning outcome. It has broad applicability. For example, the students perform better when they were provided minimal explanation about problem solving than who were not.
- 7. PQ4R Method:** This is the most popular strategy in which student preview, question, read, reflect, recite and review the information. The teacher during the lecture stops at various points and asks students to reflect their understanding of the concept, can ask short questions in order to engage the students in active learning instead of passive listening (Slavin, 2017).
- 8. Outlining and Concept Mapping:** This is comparatively new strategy but can be very effective to learn large amount of information. Outlining is to identify the main points in hierarchical format¹¹. In this way the long topic can be organized in few important points that would be easy to learn. Concept mapping is to identify the main ideas and diagram the connections between them¹². Although the research is limited in this area but the technique can be very useful to learn lengthy materials.
- 9. Summarization:** When students are required to learning huge amount of information, summarization can be very helpful learning strategy¹³. The teacher can ask the students to summarize the 40 minutes lecture in 10 minutes. This technique would improve the student ability identify the main ideas if the lengthy lecture and sum up it in few points. It is important to keep this in mind that summaries can be of single word, sentences, paragraphs are written or spoken whatever works for the students. The teacher can facilitate the technique by guiding students, how to write better summaries by emphasizing the main points¹².
- 10. Imagery:** Imagery is to form mental images to remember. Researches show that it boosts comprehension and effect positively on learning abilities¹⁴. Imagery can be very helpful in memorizing complex scientific content. Visualizing and making mental images can enhance mental organization or integration of information in the text. However, this technique is limited to use where the content is imagery friendly.
- 11. Keyword Mnemonics:** the use of mnemonics can enhance learning and comprehension for a wide variety of material and students with various abilities¹⁵. For example student in a literature class can grasp the motives of the main character by visualizing the whole scene in mind's eye¹². Evaluation of class room application of mnemonics show mixed results and there are questions about long term retention of the material learned through techniques.
- 12. Highlighting an Underlining:** This technique is frequently used by the students when they are going through text books and reading materials². It is frequently used because it is easy to practice. This technique relies on cognitive phenomenon, isolation effect in which semantically or phonologically unique item or phrase is much better remembered than its less distinctive counterparts. Research shows that students are more likely to remember highlighted text¹².
- 13. Note Taking:** Note taking is another commonly used technique. The students paraphrase the information focusing the main ideas. When the students dealing with lengthy materials, the teacher can provide them with some partial notes to direct student's note taking and avoiding unnecessary details.
- 14. Writing to Learn:** This is a useful strategy in which the students read the material and then write it. It involves high level of information processing as the student thinks about the material and then paraphrases it. The student writes about the cardiac cycle and better retains it.
- 15. Rereading:** students use this technique frequently than the other techniques as it is self-regulated and requires no assistance, so it is very popular among students. Dunlosky in 2012 conducted a survey where university students average SAT scores above 1400. The students reported that 84% of them used re-reading in their list of learning strategies¹².

COMMENT:

Learning strategies discussed in this assignment are not the only things that would facilitate learning and clearly motivation plays a central role in this process. The students need to differentially evaluate the learning material and

adopt the appropriate learning technique for prolonged and reusable retention. The students should rely on the high utility techniques instead of the low utility old but more popular techniques for better outcomes. Differential use of these learning techniques can be quite helpful for varying

tasks; even blending of the techniques may work for certain tasks. The teacher has immense responsibility to ensure that students can differentially understand the utility of various techniques and their application in a comprehensive way.

ARTICLE INFORMATION Accepted for Publication: September 20, 2020. Published Online: September 30, 2020.

<https://doi.org/10.48111/2020.03.08>

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INTEREST DISCLOSURES: Author disclosed have no financial or personal relationships with individuals or organizations that could inappropriately influence (bias) their work.

Financial Support and Sponsorship: Nil.

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Artificial Intelligence in Surgical Education and Training: A Systematic Literature Review

Hamza Azhar, Talat Waseem, Hira Ashraf

INTRODUCTION Traditional method of surgical training is centered on apprenticeship and shadowing. Assessment of technical skills is subjective and largely dependent on mentors, merely reflecting trainee's expertise. Certain aspects of this method hinder technical training of the trainees. However, artificial intelligence (AI) can help us revolutionize surgical education and training. Artificial intelligence (AI) is defined as capability of a computer to perform actions analogous to actions performed by human brain. It can be used to objectively evaluate the surgical skills of a training surgeon.

OBJECTIVE of this study was to give a comprehensive outline of impact of artificial intelligence on surgical training and education.

METHODS A systematic computerized search was done on 7 February 2021 in PubMed. Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines were followed to carry out this systematic review. Keywords used for search were ("Artificial intelligence") AND ("Surgical education" OR "Surgical training"). All the articles published from 2019-3-1 to 2021-2-25, which met our inclusion criteria were added. Only articles in English were added. Following PRISMA guidelines 700 articles were identified, out of which 83 articles were selected after reading the title. 30 articles were selected after reading the abstract and 16 articles were finally selected for thematic analysis and literature review after reading the full text paper.

DISCUSSION & CONCLUSION AI can revolutionize surgical education and training. It can be used for Surgical Skill Assessment and optimizing the training of surgeons. It can help in objective assessment of the trainees. AI is extensively used in the field of ophthalmology, plastic surgery and vascular surgery. It has also found its application in radiology and diagnostics.

KEYWORDS Artificial Intelligence, AI, Machine Learning, Neural Networks, Surgical education, Surgical training

HOW TO CITE: Azhar H, Waseem T, Ashraf H. Artificial Intelligence in Surgical Education and Training: A Systematic Literature Review *Archives of Surgical Research*. 2020;1(3):39-46. <https://doi.org/10.48111/2020.03.09>

Systematic Literature Review

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Dr. Halstead is esteemed as one of the most innovative surgeons in the history of surgical training. His greatest contribution was the integration of teaching basic sciences and clinical skills in training of young surgeons. His method of training mainly focused on training full time teachers. However, this traditional method of surgical training has several drawbacks. It is mostly centered on apprenticeship and shadowing. Assessment of technical skills is dependent largely on mentor. Active feedback from mentors is subjective and merely a reflection of trainee's work. Different surgical procedures have variable patient volume which becomes a hindrance in the technical training of a surgeon. Moreover, cadavers are expensive and often inaccessible in several countries. Passive learning from classroom is necessary for building foundational knowledge, however, it

requires translation of 2D images and textbooks in practical dimension for teaching essential technical skills.

John McCarthy first used the term artificial intelligence (AI) in 1956¹. Artificial intelligence (AI) is defined as capability of a computer to perform actions analogous to actions performed by human brain. It can be used to evaluate a surgeon's surgical skills. Deep learning and machine learning are two important branches of AI. Machine learning deals with development of computer programs that improve with experience automatically while deep learning is concerned with development and application of artificial neural networks (ANNs). AI can be incorporated into surgical training and education to provide an objective method for assessment of surgical skills of a trainee, through its application in robotic surgery, virtual reality based surgical training and post-op analysis of surgical videos.

This systematic literature review will provide an outline of the tools available within ML for surgical training, and their efficacy in different fields such as ophthalmology, neurosurgery, cardiac surgery, laparoscopic surgery, and endoscopy. In addition, effectiveness in objective skill assessment and calculating accurate learning curves are also reviewed in this article.

METHODS

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

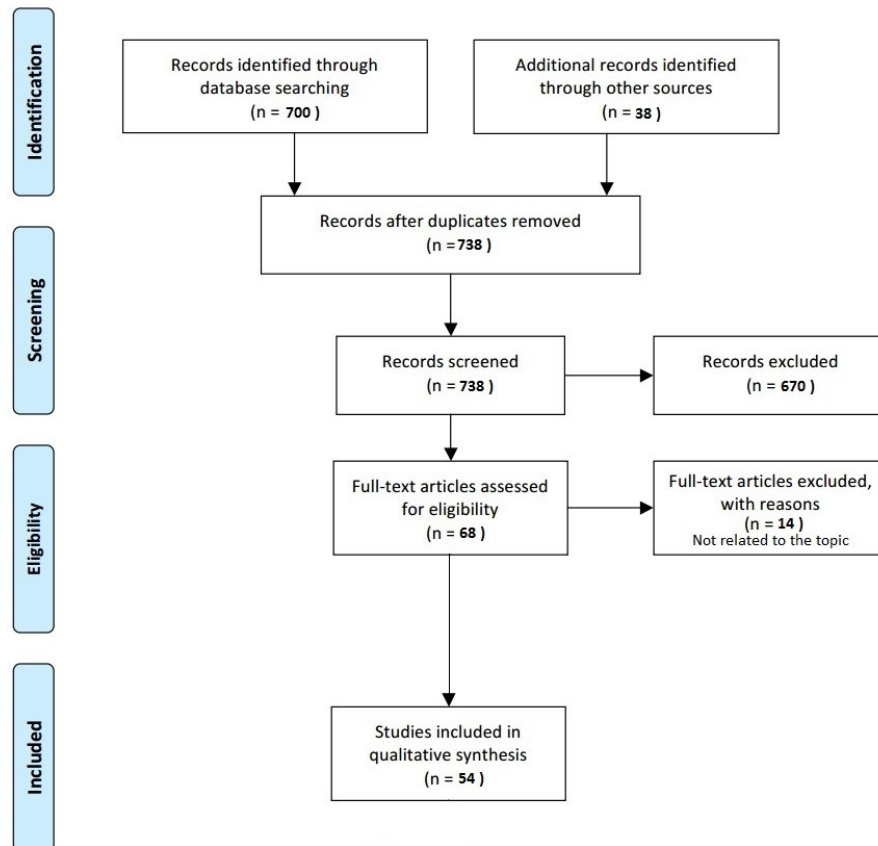
2.1. Literature Search Process: Following PRISMA guidelines, a systematic literature search was done in database of PubMed using search terms (“Artificial intelligence”) AND

(“Surgical education” OR “Surgical training”). All papers published from 2019-3-1 to 2021-2-25 were filtered out. Additionally, the reference research papers were also included in the review.

2.2. Inclusion of Articles & Data Synthesis: Following PRISMA guidelines 700 articles were identified. No paper was excluded for duplication. 83 articles were selected after reading the title. 30 articles were selected after reading the abstract and 16 articles were finally selected for thematic analysis and literature review after reading the full text paper. Only Full-text English language papers were selected. Studies that were not related to the topic were not included. Selection process is presented in a flow diagram in figure 1.

A thematic analysis of each paper included in the study was done. The themes identified through the analysis is described in the table given in the end.

Figure 1: PRISMA Flowchart- Article selection process through computer literature search and analysis:



RESULTS & DISCUSSION

3.1. Artificial Intelligence Based Surgical Skill Assessment

Evaluation of surgical skill is usually done by reviewers who watch the video of surgical videos postoperatively. Now AI can be used to identify different steps of procedure in the

surgical video which can be helpful for the evaluation of the surgical skill.^{2,3} The surgical action can be detected using AI. One study used deep learning model which could detect the surgical action with mean recall of 94% and a mean precision of 91% and. It was also able to tell the surgical skill level of the operator with the mean recall of 78% and a mean precision of 77%.⁴ This type of systems can be used in the surgical training for optimizing the training of surgeons. Several studies show that there is a relation between hand motion of an individual and their skill level in surgery^{5,6}. This information can be used to evaluate the surgical skill level of a surgeon. A deep neural network algorithm was developed and trained using data collected with wearable inertial measurement unit sensors attached to the surgeon. The system achieved an accuracy of 98.2% in telling the skill level of the surgeon⁷. Assessment of surgical skill with AI requires a lot of expensive equipment. One study tried to solve this problem by using data in form of videos collected from JIGSAW database. 3D Convolutional neural network (CNN) was trained with that dataset which was able to classify participants based on their skill level with an accuracy of 95.1% to 100%⁸. Robotic surgery has given us an opportunity to gather the kinematic data from the surgical procedures performed by the robot. This data can be used for the assessment of surgical skill by using artificial intelligence. Early studies used kinematic data to extract GMFs (Global Movement Features) such as smoothness of motion, task speed, task completion time etc. but results of those models depend on quality of extracted features⁹. Recent studies do not use GMFs, instead surgical task is broken down into surgical gestures before training phase and then evaluation of the skill of surgeon is done by their performance during the gesture. This technique require manual segmentation into gestures which is an expensive and time consuming process¹⁰. A recent study used only kinematic data collected from JIGSAW database of surgeons with different surgical skills which was used to train a Convolutional neural network which was able to categorize the surgical skill. Using this approach the amount of expense required for the process can be minimized¹¹. Video commentary is another way of evaluation of surgical expertise of a surgeon. In this technique surgeons are shown videos of surgical procedures and they are asked to say all the anatomical landmarks, instruments, and steps of procedure shown in the videos. They are then scored on the basis of video commentary. Machine learning can be used to increase the productivity of this technique. In a study the relation between the PGY level of the surgeon and their individual video commentary (VC) score was investigated. The results of that study demonstrated that a correlation was present between them. However, there are some limitations like ML based system overestimates the skill of PGY1s and underestimates the skill of PGY3s and PGY4s. Selection of video for video commentary (VC) was also a hurdle because selection of video affects the result. The sample size selected for that study was also very small¹². AI can also be used to optimize

the surgical training by its capability to foretell the surgical learning curve of the trainee. A supervised machine learning model was trained by learning curves data taken from virtual basic laparoscopic skill trainer and physical FLS trainer box. This model had the ability to predict surgical learning curve from data collected from first few trials of the trainee. This prediction can help us build a personalized training program designed to train surgeons based on their varying surgical learning curves. Unsupervised machine learning approach was also used which was able to classify surgical trainees in accordance with their different surgical learning curves. Results of that study showed that data from only a few trials is sufficient enough to foretell the total number of trials needed to become proficient. It was also capable of predicting the final skill level of the trainee after the 40th trial¹³. This data can help us model an objective surgical training system where number of surgical procedures each trainee needs to do to achieve proficiency will be assessed by machine learning algorithms. This approach can save time and money of the trainees and trainers.

3.2. Artificial Intelligence in Radiology and Diagnostics

We can train algorithms to detect patterns in the data. This ability can be used in the field of radiology and diagnostics where we can use artificial intelligence to train algorithms to detect pattern in radiological findings. AI has been used to interpret the finding of CT, MRI and PET images¹⁴. Table 1 shows all the FDA approved AI systems used in different clinical indications¹⁵. AI can also help in identification of malignancy which can help the surgeon to decide whether a growth is malignant or benign^{16,17}. AI can also help in diagnosis of different medical conditions like appendicitis^{18,19}.

Manufacturing Company	Date of approval by FDA	Indication
Apple	Sep 2018	Detection of Atrial Fibrillation
iCAD	Aug 2018	Breast Density via mammography
Aidoc	Aug 2018	Brain hemorrhage diagnosis on CT
Neural Analytics	May 2018	Diagnosis of stroke
IDx	Apr 2018	Diabetic retinopathy diagnosis
Zebra Medical	Jul 2018	Scoring of coronary calcium
Bay Labs	Jun 2018	Determination of Ejection Fraction on Echocardiogram
Viz.ai	Feb 2018	Diagnosis of stroke on CT
Arterys	Jan 2017	Interpretation of MRI heart
Alivacor	Nov 2017	Watch
MaxQ-AI	Jan 2018	Brain hemorrhage diagnosis on CT

3.3. Artificial Intelligence and Robotics

Surgical Skill Assessment:

With the advances in robotic surgery it is possible to get data from the robot in many forms. It can be in form of video data or in form of kinematic data. Processing this vast amount of data is an expensive and time taking task but with the use of machine learning it is doable. Initial studies used kinematic data for skill assessment. For AI based surgical skill evaluation, kinematic data using global movement metrics i.e. depth perception, task completion time, smoothness of motion, length of path, velocity, curvature etc. have been used²⁰. Similarly the surgeon's movement style can also be used to assess the surgical skill. This can be done by using electromagnetic sensors attached on the shoulders, wrists and hands of the surgeon²¹. Robots like Da Vinci can collect data like motion of camera and surgical instrument which can be classified by machine learning according to the surgical skill of trainee^[22]. Tool based metrics and cognitive based metrics have also been applied to classify expert and non-expert surgical trainees by machine learning^{23, 24}.

Haptic Feedback:

Modality of touch is very important in surgical training. Robotics have made it possible to gauge the tactile force being applied by the surgeon. Machine learning has been applied to develop a system which gives warning of suture breakage when the tactile force is strong enough to break the suture. This ML based system was successful in decreasing the rate of suture break^{25,26}.

Autonomous Robots:

Even though robotics is still very primitive still surgical automation is not so far²⁷. Primary focus of Initial efforts have been on deconstruction of the task and carrying out of simple tasks like suturing. Now AI based robot can perform superior bowel anastomoses in porcine tissue^{28,29}.

3.4. Artificial Intelligence and Surgical Logistics

AI can be used to minimize the cost of procedures and save the precious time. The cost of surgical procedures can be reduced by accurate prediction of operating time³⁰. Machine learning can be used for this purpose. A machine learning system has been developed which can predict the operating time with 16.8% accuracy³¹.

3.5. Application of AI in the Surgical Procedure

AI can help us detect the important anatomical landmarks in a surgical procedure. A survey involving surgeons was carried out and 40.5% respondents of the survey said that the injury of bile duct they faced during laparoscopic cholecystectomy was due to misidentification of anatomical landmarks^{32,33}. An object detection algorithm called YOLOv3 was trained with short videos to detect 4 anatomical

landmarks i.e., cystic duct, Lower edge of left medial segment, common bile duct and Rouviere's sulcus. Although, for each landmark average precision was not good but YOLOv3 model detected important landmarks to avoid bile duct injury in 22 of 23 videos³⁴. The surgical instrument detection during laparoscopic procedures using AI is also possible which can help us in surgical training. A system using neural network was developed and trained which was able to decipher surgical instruments manipulation in recordings of laparoscopic gastrectomies with an accuracy of 87% and a recall of 83%³⁵.

3.6. Artificial Intelligence and Virtual Reality (VR)

Virtual Reality can be used as a tool for the surgical training. The data gathered from the procedures done in the VR is sufficient enough to assess the surgical skill of the trainee. In a study, a support vector machine algorithm was used on the data gathered from the hemi-laminectomy done on VR by different surgeons of varying surgical skills. It achieved 97.6% accuracy³⁶.

AI based VR training has also been used in neurosurgery. Using 4 metrics of safety of safety and movement a framework called virtual operative assistant was created. This provides a metric wise assessment based on weight of each metric. This can be applied to evaluate the skill level of the trainees³⁷. Another AI aided VR study was carried out for neurosurgical tumor resection skill assessment. Using machine learning participants were classified into 4 levels based on their skill level with an accuracy of 90%³⁸. Similarly VR simulated anterior cervical discectomy was done in which 21 individuals participated. Using 16 metrics neural network was trained which classified the participants according to their skill levels with testing accuracy of 83.3% and training accuracy of 100%³⁹.

AI based VR systems are very useful for surgical training but it is very difficult to develop them and the inter specialty communication is not good. MLASE (Machine Learning to Assess Surgical Expertise) checklist was designed to bridge the gap between different specialties. The checklist includes 4 sections i.e. quality of discussion, design of the Study, Structure of Data and Supervised Machine Learning which are further divided into subsections which are given certain points. This checklist provides a scoring system to assess the AI based VR system capable of assessing the surgical expertise.

A systematic literature review was done and each selected paper was scored according to the MLASE checklist. Results showed that score of medical articles were lowest in structure of data and supervised machine learning and it was highest in quality of discussion. Engineering papers showed lowest scores in quality of discussion and highest in study design and supervised machine learning⁴⁰. An interdisciplinary communication is necessary to bridge the gap.

Year	Article	Author(s)	Research method	Themes Identified
2020	Video Commentary & Machine Learning: Tell Me What You See, I Tell You Who You Are	Mohamed S Baloul , Vicky J-H Yeh , Fareeda Mukhtar	Secondary Analysis Study	Using AI to find a Correlation between Individual's skill and Video commentary score
2020	Machine Learning and Artificial Intelligence in Surgical Fields	Melissa Egert , James E Steward , Chandru P Sundaram	Literature review	A review of use of ML and AI in different surgical fields
2019	Artificial intelligence and robotics: a combination that is changing the operating room	Iulia Andras , Elio Mazzone , Fjfs W B van Leeuwen	Narrative literature review	Application of Artificial intelligence in robotics
2020	Development of an artificial intelligence system using deep learning to indicate anatomical landmarks during laparoscopic cholecystectomy	Tatsushi Tokuyasu , Yukio Iwashita , Yusuke Matsunobu	Prospective study	AI assisted detection of anatomical structures; Application of AI in procedures
2019	Artificial Intelligence in Medical Education: Best Practices Using Machine Learning to Assess Surgical Expertise in Virtual Reality Simulation	Alexander Winkler-Schwartz , Vincent Bissonnette , Nykan Mirchi	Prospective study	AI based skill assessment in Virtual Reality (VR) and Simulations
2020	The era of artificial intelligence and virtual reality: transforming surgical education in ophthalmology	Shaunak K Bakshi , Shawn R Lin , Daniel Shu Wei Ting	Review article	Use of AI in ophthalmology
2020	The digital surgeon: How big data, automation, and artificial intelligence will change surgical practice	James Wall , Thomas Krummel	Review article	Artificial intelligence shaping the future of surgery
2020	VR and machine learning: novel pathways in surgical hands-on training	Domenico Veneziano , Giovanni Cacciamani , Juan Gomez Rivas	Systematic Review	AI based skill assessment in Virtual Reality (VR) and Simulations
2019	Machine Learning Identification of Surgical and Operative Factors Associated With Surgical Expertise in Virtual Reality Simulation	Alexander Winkler-Schwartz , Recai Yilmaz , Nykan Mirchi	Prospective study	AI based skill assessment in Virtual Reality (VR) and Simulations
2020	Evaluation of Deep Learning Models for Identifying Surgical Actions and Measuring Performance	Shuja Khalid , Mitchell Goldenberg , Teodor Grantcharov	Prospective study	AI based surgical skill assessment
2019	Surgical skill levels: Classification and analysis using deep neural network model and motion signals	Xuan Anh Nguyen , Damir Ljuhar , Maurizio Pacilli	Prospective study	AI based surgical skill assessment
2019	Video-based surgical skill assessment using 3D convolutional neural networks	Isabel Funke , Sören Torge Mees , Jürgen Weitz	Prospective study	AI based surgical skill assessment
2020	A machine learning approach to predict surgical learning curves	Yuanyuan Gao , Uwe Kruger , Xavier Intes	Prospective study	AI based prediction of surgical learning curves
2019	Accurate and interpretable evaluation of surgical skills from kinematic data using fully convolutional neural networks	Hassan Ismail Fawaz , Germain Forestier , Jonathan Weber	Prospective study	AI based skill differentiation from kinematic data
2020	Automated Surgical Instrument Detection from Laparoscopic Gastrectomy Video Images Using an Open Source Convolutional Neural Network Platform	Yuta Yamazaki , Shingo Kanaji , Takeru Matsuda	Prospective study	AI based detection of surgical instrument manipulation in video recording
2020	Artificial Neural Networks to Assess Virtual Reality Anterior Cervical Discectomy Performance	Nykan Mirchi , Vincent Bissonnette , Nicole Ledwos	Prospective study	AI based skill assessment in Virtual Reality (VR) and Simulations

Table describing the overview of studies included in the literature review.

3.7. Artificial Intelligence in Surgical Education in Ophthalmology

A vast amount of literature has been written on the recent boom of application of AI in ophthalmology. FDA has approved a diagnostic system for the diagnosis of diabetic retinopathy^{41,42}. The surgical performance of trainees can be assessed using machine learning. Convolution neural networks (CNNs) have been developed which are capable of detecting surgical tools which gives means of identifying context and stage of the procedure^{43,44,45}. This can be used for post op evaluation and assessment of resident's surgical performance. CNNs have also been used to evaluate the trainees' skills in capsulorhexis using cataract surgery videos⁴⁶. Intraoperative guidance and feedback based on AI can be a possibility. One study showed phase recognition in 23 cataract surgeries using inception V3 network. Detection of instrument position and orientation by tool tracking system can also help the surgeon to orient themselves⁴⁷. AI can also predict surgical outcomes. It is already possible to predict endophthalmitis rates after cataract surgery^{48,49}.

3.8. Role of Artificial Intelligence in Plastic Surgery

Artificial intelligence is being applied in burn surgery, microsurgery, craniofacial surgery, hand and peripheral nerve surgery, and aesthetics. Surgical skill assessment by artificial intelligence is getting accepted in the realm of plastic surgery. The post op outcome is very important when it comes to plastic surgery. AI can help to identify individual technique being applied during the procedure that leads to a particular outcome. Recognizing this relation between the technique and its post op outcome can help the residents to minimize the post op complications⁵⁰. AI is also being applied in the field of aesthetics. AI has been applied to detect what people regard as aesthetic and their emotional reaction to procedures related to cosmetics which can help us in deciding the surgical plan of action and it can also be used in the personalized counselling of the patient^{51,52,53}.

3.9. Role of Artificial Intelligence in Vascular Surgical Education

With the very fast paced increase in medical literature it is very difficult to stay updated with the recent literature. AI can help in literature search and management of big datasets which can help in the medical research^{54,55}. Laparoscopic training is very important in vascular surgery. Now a laparoscopic training system capable of surgical skill is created by artificial neural network (ANN). With the use of that system an increase in the surgical dexterity and learning curve was observed⁵⁶. Electronic medical records can be used for predictive analysis by AI for the betterment of

medical education. To standardize the clinical training AI can be used to predict least number of procedures a trainee should perform to get the desired results^{57,58,59}

LIMITATIONS

Not enough literature is available in this area. We need more research done in this aspect to incorporate artificial intelligence in surgical training and education.

ETHICAL CONSIDERATIONS

Existing code of ethics do not consider the use of interactive artificial intelligent agents in our healthcare system. A comprehensive discussion is needed to tackle with the ethical issues of trust, privacy, and safety of the patient.

FUTURE PROSPECTS:

Artificial intelligence is being used in preoperative planning, intraoperative guidance and robotics. Diagnostics is one of the most important field in which AI will play an integral role. Radiomics is a method which uses radiographic imaging and machine learning algorithms to enhance diagnostic accuracy. It has found its application in the field of oncology. It can diagnose different types of cancers with great accuracy^{60,62}. Recently radiomics has been used for detection of Covid-19⁶³. Radiomics can help the future medical practitioners in making the correct diagnoses. In future clinical decision making will be a major application of artificial intelligence. Bayesian networks are already able to help us determine if patients with arterial injuries due to limb trauma would benefit from revascularization⁶⁴. This ability of AI to help us in clinical decision is going to improve with time. Another field which has been strongly influence by AI is robotics. Autonomous robots can be utilized in the future to perform surgical procedures all alone without the assistance of specialists.

CONCLUSIONS

Artificial intelligence is still in its primitive stages but a lot of research is focused on the development of this field. Incorporation of AI can revolutionize the surgical training and education. Efforts should be focused on educating the medical professionals about artificial intelligence and bridging the interdisciplinary gap between different fields interested in implementing machine learning in medical training and education.

ARTICLE INFORMATION Accepted for Publication: September 14, 2020
Published Online: September 30,

2020.
<https://doi.org/10.48111/2020.03.09>
Open Access: This is an open access

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Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest

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Archives of Surgical Research | Perspective Review**Quality Improvement Initiatives In Surgery: Challenges And The Way Forward**

Muhammad Arsalan, Imran Siddiq, Fatima Javaid, M. Waleed

IMPORTANCE According to Abdul Latif Shaikh, President of Pakistan Society of Health-System Pharmacists (PSHP), at a press conference in Karachi Press Club in 2017, over half a million people die each year due to medication errors. More than 200 million surgeries are performed each year globally, and recent studies demonstrated a high rate of adverse events despite certain patient safety initiatives in the recent past.

Surgical errors include errors that occur before and after any surgical intervention and during perioperative care rather than a technical surgical mistake. These include but are not limited to, lack of communication amongst the surgical team, healthcare providers, patients, and their families, delay in diagnosis or failure to diagnose, and delay in treatment or failure to treat. Thus, we need to formulate processes that implement multiple layers of defense (Swiss Cheese Model) for surgical care, to ensure a proper defense mechanism against the potential harm that can be caused by an error. Errors within the system are like an opportunistic pathogen in the body. As the immune system of the body gets weaker, the pathogen wins. Similarly, as the processes of the organization lack its defense, the error wins.

Based on the number of research articles and as working Quality Professionals, we would suggest that the government, under the public and private partnership, develop a separate department for Surgical Improvement in Pakistan. This department will focus on developing key surgical measures, analyzing and sharing data on positive outcomes procedure, consultant and hospital-wise, and issue them for the public to choose from the best possible care available to them.

KEYWORDS Quality Initiatives, Surgical challenges, Way forward, Medical Errors, Failures, Donabedian Model

HOW TO CITE: Arsalan M, Siddiq I, Javaid F, Waleed M. Quality Improvement Initiatives In Surgery: Challenges And The Way Forward. *Archives of Surgical Research*. 2020;1(3):47-51. <https://doi.org/10.48111/2020.03.10>

Perspective Review

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<https://doi.org/10.48111/2020.03.10>

Organizations with higher safety standards include the Aviation industry, Boeing, Airbus, Amusement Parks, Oil Industries, Nuclear plants, etc. These are organizations attributable to higher safety and quality standards because one error can lead to hundredths and thousands of deaths. One loophole may end up costing people their lives. These are high-risk organizations. Unfortunately, healthcare industries were very late to understand the gravity of their outcome on patients and are still a very high-risk organization. An indicator from the Source: Joint Commission's presentation in HMA 2004 at Bangkok, Thailand, shows the Deaths/100 Million Hours¹.

Medical errors play a considerable role in justifying the need to adopt a robust health system that can prevent avoidable

deaths and incidents that lead to temporary or permanent loss of limb of a patient.

Joseph King, a 3-year-old child, died due to dehydration caused by a medication error in one of America's best hospital care centers. Betsy Lehman, a health reporter, died from an overdose of chemo. Willie King had become a victim of the wrong site procedure and got the wrong leg amputated. Eight years old Kolb died during surgery due to the wrong medication². In 2009, Imanae Malik, a 3-year-old child, came in an emergency with a minor hand burn and died due to an overdose of a high alert medication. Nashwa, a 9-month-old infant, died due to an accidental overdose.

Deaths/100 Million Hours

▪ Being pregnant	1
▪ Traveling by train	5
▪ Working at home	8
▪ Working in agriculture	10
▪ Being in traffic	50
▪ Working in construction	67
▪ Commercial flying	100
▪ Being hospitalized	2000

Source: Joint Commission's presentation in HMA 2004 at Bangkok, Thailand

All these cases are just the tip of an iceberg. Especially in the Lower Middle-Income Countries (LMIC), where no reporting culture exists, lie within the iceberg's submerged part, over half a million people who die each year due to medication errors. While in the west, a significant study was published in 1999 by the Institute of Medicine, called 'To Err is Human-Building a Safer Healthcare System,' which suggested that 45000 to 98000 people die each year due to preventable medical errors. According to this report, medical errors were the 8th leading cause of death at that time².

The study also cited that 2 out of every 100 admissions had become a victim to the preventable adverse events, which increased the in-patient hospital cost to about \$2 billion for the nation as a whole in America. However, these incidents can be avoided by developing systems and taking initiatives that prevent caregivers from making inadvertent errors and encourage them to follow the processes diligently².

CHALLENGES:

The Harvard practice study group defines error and mistake, used interchangeably, in surgical practice as an adverse event or an unintended injury caused by surgical management rather than by the disease process resulting in death, disability, re-admission, or an increased length of hospital stay. A cognitive psychologist, James Reason, started research based on an incident that occurred during his everyday routine. One day he was making tea for himself and ended up pouring cat food in the tea instead of milk as his cat was clamoring around him. This absent-mindedness incident developed his interest in researching, in the late 1980 and early 1990s, with his team, where they analyzed 21 surgeons conducting multiple surgeries that took them to the edge of their abilities. He was surprised to discover that every procedure had an adverse event of one kind or another. Hence, he deduced that surgical excellence is different from what he imagined, not free of error after all. However, according to him, the most accomplished surgeons expected and detected the errors and compensated for them. They could be flexible and remained optimistic, which distinguished them from the less adaptive surgeons with had tunnel vision⁴.

More than 200 million surgeries are performed each year globally, and recent studies demonstrated a high rate of

adverse events despite certain patient safety initiatives in the recent past. These include the '100,000 Lives Campaign' (2005/2006) and subsequently '5 Million Lives Campaign' (2007/2008) by the Institute for Healthcare Improvement (IHI), the 'Surgical Care Improvement Project' (2006), and 'Universal Protocol' (2009) by the Joint Commission, and the WHO 'Safe Surgery Saves Lives' campaign accompanied by the global implementation of the WHO surgical safety checklist (2009). However surgical errors include errors that occur before and after any surgical intervention and during perioperative care rather than a technical surgical mistake. These include lack of communication amongst the surgical team, healthcare providers, patients, patients and their families, delay in diagnosis or failure to diagnose, and delay in treatment or failure to treat⁵.

QUALITY IMPROVEMENT INITIATIVES:

"Every hospital should follow every patient it treats, long enough to determine whether or not the treatment has been successful, and then to inquire, 'if not, why not' to prevent similar failure in future." —Ernest Codman⁶.

Quality Improvement Initiatives have had more than 100-year history, starting from a Hungarian Obstetrician named Dr. Ignaz Semmelweis, who prevented the spread of disease and other nosocomial infection through hand hygiene. Based on his research, today, hand hygiene is the single most effective technique to prevent Healthcare-Associated Infections, as declared by WHO.

Ernest A. Codman, an American surgeon, in 1910 -1913 proposed the "end result" system of hospital standardization and founded the American College of Surgeon – Hospital Standardization Program to maintain minimum quality standards during the surgical procedure and also gave the concept of mortality and morbidity review in the organization. Later in 1917 and 1918, the American College of Surgeon published their first Minimum Hospital Standards and started Hospital inspections for its implementation. In 1953, ACS officially transferred its Hospital Standardization Program to the Joint Commission on Accreditation of Hospital, which began providing accreditations to hospitals in the United States^{6,7}.

In 1966, Dr. Avedis Donabedian developed a model. This framework still has a remarkable implication during the modern healthcare quality: what we call a Donabedian Model, that lays out three key components for monitoring, analyzing, and improving the Quality of care outcomes; the structure, process, and outcomes. Each of these components helps the organizations to measure its intended outcome based on the processes it develops and the resources it provided. Hence, structures are the resources required to implement the processes for the desired outcomes⁸.

The further initiative includes the National Surgical Quality Improvement Program (NSQIP), the use of selective referral

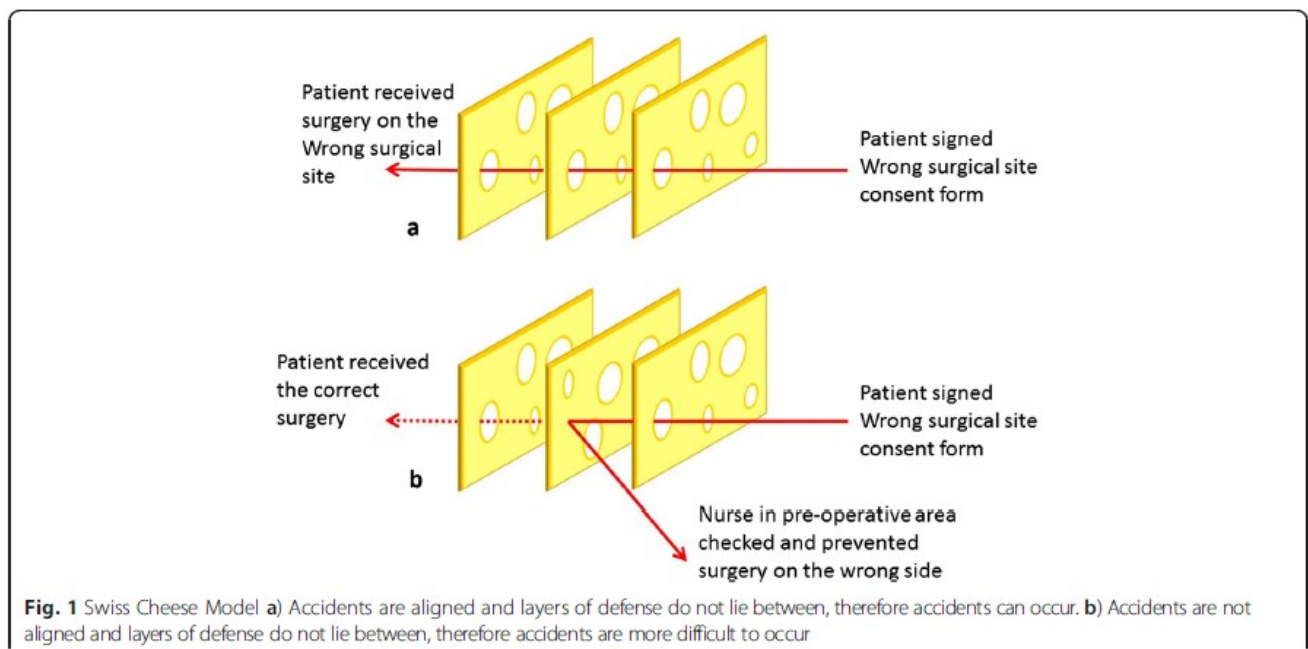
and centers of excellence, the Surgical Care Improvement Project, and the World Health Organization Surgical Safety Checklist⁹.

American College of Surgeon's NSQIP is one of the most widely recognized programs developed by the Department of Veterans Affairs health system. This program was based on a Quality measurement system for non-cardiac surgeries and its core purpose is to enhance the quality of surgical care by focusing on the core processes and structure of care at the subspecialty level of surgical care and services rather than focusing on bad surgeons. The program works on the Donabedian framework of Structure, Process, and Outcome. Department of Veteran Affairs witnessed a 27% decrease in postoperative mortality and a 45% decline in postoperative morbidity, along with a decreased length of stay and a positive increase in patient satisfaction scores⁹.

There is insufficient research in Pakistan to establish the challenges and medical errors affecting patient care outcomes during hospitalization apart from medical errors. Despite being a lack of research and reporting culture, medical errors in Pakistan are as high as half a million in a year. Recent studies showed that 134 million adverse events occur every year due to a lack of safe care in hospitals in Lower-Middle Income Countries (LMIC), which leads to 2.6 million deaths each year¹⁰. These statistics reveal that LMICs are way behind the developed countries in ensuring safe care in hospitals. For instance, ACS published its first "Minimum Standards" back in 1917. In Pakistan, the first of its kind, Minimum Service Delivery Standards for Hospitals, was published in 2013 and was only done in one province of Pakistan, i.e., Punjab. Before this, there were no such healthcare-related standards that focused on holistic care. However, these minimum service delivery standards still lack

the framework required to implement these standards in true letter and spirit. As we have already discussed above, the actual surgical errors were the ones that occurred during pre- and post-operative surgical care. These include inadequate communication amongst the surgical team, healthcare providers, patients, and their families, delay in diagnosis or failure to diagnose, and delay in treatment or failure to treat⁵. One report from Joint Commission revealed that 80% of the medical error is caused by the lack of communication of one kind or another between care transitions¹¹. Lack of an integrated approach between departments, inappropriate System Thinking, and the lack of a Donabedian approach also has a critical role in not achieving high-quality care. Due to a lack of education, training, and human resource development, the staff is rarely bothered to implement these standards. Some common failures that impede the Quality of care are listed but not limited to, the following:

1. Not prioritizing the Quality Improvement Activities as the first point agenda in Top Management Meetings.
2. Lack of emphasis in Documentation Control.
3. Improperly informed consent may cause miscommunication.
4. Improper Handoff communication between caregivers including doctors.
5. Transfer within the Hospital facility mostly undermines in many hospitals.
6. Improper Preoperative assessment.
7. Lack of follow up on specimen pathology after surgery.
8. Site marking and Time Out Process knowledge and implementation.



9. Lack of preparation beforehand before elective cases.
10. Lack of implementation understanding of the Safe Surgery Checklist and its importance.
11. Improper monitoring of quality measures.
12. Proper Monitoring of Anesthesia Care.
13. Lack of labeled medications administered in Operating Rooms
14. Breach of Operating Room space by staff again and again during the procedure.
15. Ensuring the CSSD indicator before using the surgical instrument.
16. Proper Sign Out with swab and instrument count, etc.

In this overall scenario, it is imperative to understand that human beings may make errors. And errors are unavoidable, but having a well-established system for developing processes, keeping the outcomes in focus, and providing the right structure can prevent errors. This is illustrated in the Swiss Cheese Model, formally propounded by Dane Olandella and James R. Reason, where each hole, dispersed at random, denotes a varying degree of failure at every step and the slice represents the defense layer in the process. The alignment of the holes results in the patient being harmed.

Each layer in the process acts as a defense against the potential error, as depicted in figure below⁵:

Thus, we need to formulate surgical care processes with multiple layers of defense to ensure a proper defense mechanism against the potential harm caused by an error.

THE WAY FORWARD:

Given the various research articles and as working Quality Professionals, there is a dire need to develop a system under the public and private partnership i-e The Department for Surgical Improvement in Pakistan. This department's focus will be to conduct research and recommend improvements in General Surgery across Pakistan. The department will also focus on developing critical surgical measures, analyzing and sharing data on positive outcomes procedure, consultant and hospital-wise, and issue them for the public to choose from the best possible care available to them. These measures will also be available for national and international benchmarking. This will create a surge in the Surgeons and the Hospitals to measure, analyze, and improve their performance, as things which are not measured cannot be improved.

At the end but not least, the Avedis Donabedian Model should be utilized for the minimum service delivery standard's basic framework. As the outcomes cannot be achieved in the absence of processes, and implementation of processes cannot be achieved without a proper structure.

ARTICLE INFORMATION Accepted for Publication: September 14, 2020
Published Online: September 30, 2020.
<https://doi.org/10.48111/2020.03.10>
Open Access: This is an open access article distributed under the terms of the CC-BY License. © 2020 Arsalan et al ASR.

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Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest

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Coronavirus Pandemic Experience of a "Specialized Surgical Service"

Moazzam Nazeer Tarar; Maryam Riaz Tarar

PERSPECTIVE

The COVID-19 pandemic has had its greatest impact on provision of healthcare services in both public and private sector hospitals, on a global scale. The disruption that resulted as the pandemic gained momentum after March 2020, affected the working of specialized tertiary care units like Burn and Plastic Surgery services. We wish to share the experience of handling the services amidst this pandemic.

KEYWORDS Covid-19 Pandemic, Specialized Surgical Service, Corona, Operating Theater

HOW TO CITE: Tarar MN, Tarar MR. Coronavirus Pandemic Experience of a "Specialized Surgical Service". *Archives of Surgical Research*. 2020;1(3):52-54. <https://doi.org/10.48111/2020.03.11>

Perspective

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The COVID-19 pandemic has had its greatest impact on provision of healthcare services in both public and private sector hospitals, on a global scale. The disruption that resulted as the pandemic gained momentum after March 2020, affected the working of specialized tertiary care units like Burn and Plastic Surgery services. We wish to share the experience of handling the services amidst this pandemic. Jinnah Burn & Reconstructive Surgery Centre (JB&RSC) is an autonomous entity inside Allama Iqbal Medical College / Jinnah Hospital complex in Lahore, Pakistan. It became fully functional in 2014, being one of the largest, state of the art institution providing acute burn care, post burn and trauma reconstruction including replant services. The elective work carried out in the center include head and neck cancer surgery, post mastectomy breast reconstruction and whole range of genital deformities. It can house serious burn patients in independently catered 10 HEPA filtered suites and has a capacity to have 78 in-patients. It has Burn ICU, HDU for post-surgical patients and 8 operating theatre suites with modular design and laminar airflow. This unit has 541 employees including 68 medical staff and 90 nurses and the rest of support and ministerial staff.

1. "Crisis before the disaster":

At start of the pandemic authorities` response was to allocate and reserve space and beds, in different hospitals for treating COVID-19 patients. Before the actual Corona pandemic lockdown was enforced in later half of March 2020, we had to face existential threat by the health managers planning the response strategy for the pandemic. We were about to fall victim to our own success having earned a reputation of being well-designed and well-

managed facility. Our isolated and self-contained premises seemed attractive enough for the purpose by expeditious officials. Little did they know that sophisticated closed air-handling system with no immediate solution to make it an open one, foiled the attempt and proved to be our savior. Our additional argument of providing essential service for burn and trauma patients would have fallen on deaf ears.

2. The Fear & Preparations:

The lockdown resulted in closure of outdoor services which meant that the unit's routine function came to a halt. We cater for more than 30,000 patients in our outdoor clinics, annually. Routine admissions and surgeries were all stopped but we kept admitting acute burn, trauma patients and active cancer related cases. Initially, there was a fear of the unknown created by media frenzy in the minds of front-line staff despite low prevalence of the infection at that time. Personal Protective Equipment (PPE) shortage compounded panic amongst the concerned personnel. We set about to arrange PPEs on self-help basis. Disposable gloves and sanitizers were procured partly through our regular funds and donations. The administrator office at JB&RSC was converted into a make-shift `factory` for preparing face shields (Fig 1). We sought the help of some technically savvy philanthropists who provided 3-D printed scaffolds on which protective face shields were fabricated for all staff. Doctors, nurses, paramedics and ministerial staff all worked tirelessly to produce these face shields. Approximately 700 pieces were prepared by our staff in a short span of time, out of which 250 were donated to the Corona unit at Jinnah Hospital. As disposable gowns were in short supply at this time as well, we activated our links with our surgical linen suppliers and helped them to design re-sterilizable water-

proof protected clothing. Their testing and alteration kept us all busy for a few days. Thermal scanners were procured and it was made mandatory for every visitor to have the temperature checked with no exception (Fig 2). It was decided that JB&RSC being one of its kind tertiary care center providing facilities for patients with complex problems, shutting our doors completely for non-emergency patients would not be justifiable. Therefore, we devised a strategy to provide essential OPD services, all be it scaled down. A triage area was established in an open space where patients to be seen, were filtered and ushered into waiting area, in small numbers so to maintain social distancing (Fig 3). Their single accompanying relative were only allowed if necessary.

Fig 1: Face-shield Factory – Staff at work



Fig 2: Temperature Monitoring at JB&RSC Entrance



Fig 3: Social Distancing Arrangement in OPD Waiting Area of JB&RSC

3. Disruption of Services:

A waiting list is maintained for elective admissions for surgery at JB&RSC. Some of the patients requiring non-essential elective procedures may have to wait for over a year. Due to lockdown and suspensions of routine services, all such patients missed their turn and now had to be adjusted in future operation lists. They will be competing with not only emergencies and urgent patients but also those routine patients who were supposed to be admitted on future dates. This will be a difficult juggling act and we had to grapple with this mayhem for foreseeable future.

Those lucky ones who managed to get their foot in the door after crossing all those hurdles of lockdown then had to undergo COVID-19 PCR screening before being operated upon. That further catapulted management of the operating time allocation.

4. Coping with the "New Reality":

Burn and reconstructive surgeries are demanding and there is a need for maintaining high ambient temperature in theaters to prevent hypothermia. This presented a big challenge for surgical teams as we had to shut down our air conditioning system and additional protective clothing made life intolerable for those working in these circumstances. Long reconstructive procedures like limb

replantation became physically demanding. Multiple teams had to be deputed to relieve each other during these arduously long procedures.

5. COVID-19 Positive staff: Amidst all this, we had to manage 67 health care workers out of 541, who tested positive for COVID-19 in post Eid-ul-fitr spike in June 2020. Altogether, 10 doctors, 8 nurses, 3 admin staff and 49 paramedical staff were found positive. As there is no tradition of "Occupational Health Service" in any institution in our set up, we had to nominate a hurriedly formulated task force for this purpose. The composition of this team was made up of members of infection control team, pharmacy, housekeeping and security staff. The focal person for coordination of activities was Assistant Professor, Dr Ahsan Riaz. This task force was responsible for all matters related to COVID-19. This comprised entry control, enforcement of SOPs, surveillance, staff testing of suspected cases, contact tracing, their management and provision of replacement staff. We had our staff trained to obtain nasopharyngeal swab samples for PCR testing for COVID-19. The samples were transported to

Jinnah Hospital PCR lab for testing and timely reporting. The same team was also keeping the inventory for PPEs up to date.

As for majority of the staff who came down with infection, had one thing in common; they were all "moonlighting" in Corona centers of private hospitals clandestinely. They subsequently infected their contacts in our center (unpublished observations). Fortunately, no fatality was reported in any staff or patients and no transmission in patients was traced to be originating from any infected staff of JB&RSC.

Conclusions:

This was an unprecedented health emergency situation requiring extraordinary planning, execution and participation by all and sundry. The staff must stay vigilant and avoid complacency in using appropriate PPEs we are not out of the woods yet. No elective surgery should be carried out without first screening for COVID-19 by PCR.

ARTICLE INFORMATION

Accepted for Publication: September 5, 2020. Published Online: September 30, 2020.

<https://doi.org/10.48111/2020.03.11>

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Financial Support and Sponsorship: Nil.

Conflicts of Interest: There are no conflicts of interest

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.

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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: -

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- A conflict of interest statement is provided, even if the authors have no conflicting interests to declare
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- Journal policies detailed in this guide have been reviewed
- Referees and reviewers suggested by author(s) comply with journal policies as well.

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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 referees for the review process. The journal however would have to discretion to get the article reviewed by the suggested faculty or not.

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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](#).

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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](#).

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Cohort, Case-control and Cross-sectional studies must be compliant with the STROCCS 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, Losifidis C, Mathew G, for the STROCCS Group. STROCCS 2019 Guideline: Strengthening The Reporting Of Cohort Studies in Surgery. Each study type has its own checklist which must be uploaded as supplemental material.

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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](#).

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Health Economic Evaluation studies should conform to the CHEERS statement, available [here](#).

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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 [STROCCS](#) statement.

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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:

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- Present/permanent address of every author.
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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

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Introduction

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

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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.

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Acknowledgements

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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](#).

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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](#).

ICMJE Authorship Criteria

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

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3. Drafting the article or revising it critically for important intellectual content.
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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 scrutiny](#) 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 its 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 ongoing.

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 (PETSAs), 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.
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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 "ICMJE 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 follow [COPE Guidelines](#) for maintaining relationship of journal management to the Pakistan Endocrine & Thyroid Surgeons Association to

ensure editorial independence. The journal editorial teams meet 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.

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