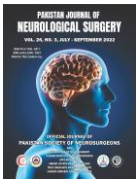

PAKISTAN JOURNAL OF NEUROLOGICAL SURGERY (QUARTERLY) – OFFICIAL JOURNAL OF PAKISTAN SOCIETY OF NEUROSURGEONS

Audit

Surgical Audit of Ruptured Intracranial Anterior Circulation Aneurysm Clipping in Neurosurgery Unit II, Punjab Institute of Neurosciences, Lahore

Mubashir Malik, Shehzad Safdar, Fauzia Sajjad, Abdul Ghafoor, Usama Mansoor, Amir Aziz, Muhammad Anwar

Department of Neurosurgery Unit-II, Punjab Institute of Neurological Sciences (PINS), Lahore – Pakistan

ABSTRACT

Objective: To review and document the rates of morbidity and mortality after surgical clipping for ruptured intracranial anterior circulation aneurysms in the department of Neurosurgery Unit II at Punjab Institute of Neurosciences, Lahore.

Material and Methods: A retrospective observational study was conducted at the Department of neurosurgery unit –II PINS, Lahore. A retrospective analysis of Doctors' and nurses' preoperative, intraoperative, and postoperative notes along with post-operative progress reports was done. Radiology was also reviewed to analyze the outcome of patients after microsurgical clipping.

Results: 180 patients were included with a mean age of 44 years. Fisher grading: Grade I – 89.4%, Grade II – 6.7%, and Grade III – 3.9%. WFNS grading: Grade I- 83.9%, Grade II – 11.1%, Grade III – 1.7%, and Grade IV – 3.3%. Hunt and Hess grading: Grade I – 47.4%, Grade II-25%, and Grade III – 0.6%. Anterior Communicating Artery aneurysms were 47.22%, Middle Cerebral Artery aneurysms 28.3%, Internal Cerebral Artery aneurysms 8.9%, Distal Anterior Cerebral Artery aneurysms 8.3%, and Posterior Communication Artery aneurysms 7.2%. A temporary clip was applied during surgery in 13.3% only. The results showed the incidence of these outcomes: acute new onset neurological deterioration/deficit was documented in 6.1%, rebleeding in 3.3%, vasospasm in 5.0%, revision surgery in 6.1%, and mortality in 8.3%.

Conclusion: The outcome of patients who underwent surgical clipping of ruptured anterior circulation aneurysms in the PINS, Lahore, is comparable to the results of the studies and trials in the published literature and can be quoted in the national and international literature for the same region and ethnicity and can be taken as reference.

Keywords: Anterior circulation aneurysm, Ruptured aneurysms, Surgical clipping.

Corresponding Author: Mubashir Malik
Department of Neurosurgery Unit-II, PINS, Lahore
Email: drmubashirmalik151@gmail.com

Date of Submission: 01-01-2023
Date of Revision: 22-02-2023
Date of Acceptance: 27-02-2023
Date of Online Publishing: 05-03-2023
Date of Print: 05-03-2023

DOI: 10.36552/pjns.v27i1.828

INTRODUCTION

For decades, surgical clipping has been the standard treatment for intracranial aneurysms. Since its advent, endovascular coiling has been replacing clipping rapidly and extensively.[1] A bulk of short-term and smaller, while a few long-term and larger trials and studies including International Subarachnoid Aneurysm Trial – ISAT (2002) have been done to compare both of these treatment modalities.[2] Currently, microsurgical clipping and endovascular coiling are considered the standard treatment for intracranial aneurysms.[2] More emphasis is now being given to individualizing the selection of the treatment option based on aneurysm features like size, shape, location, number dome: neck and calcification, patient factors like co-morbidities, age, rupture status, and mass effect, and the availability of the treatment option.[3] Both of these modalities have their pros and cons and are often compared in terms of mortality, neurological outcome, rebleeding, vasospasm, seizures, rehabilitation, and retreatment along with other peri and post-procedure complications.[4] Moreover, the status of the patient at presentation and pre-operative status including GCS – Glasgow Coma Scale, Fisher Grade, WFNS – World Federation of Neurological Societies Grade, and Hunt and Hess Grade, are also taken into account regarding the need, urgency, and choice of the intervention and also to determine the prognosis.[5,6] To date, microsurgical clipping is an established and valid treatment option for anterior circulation aneurysms.[7] It is utilized more commonly because of its extensive availability of well-established specialized centers and well-trained surgeons. Even, though it is the only available treatment option in several regions, especially in under-developed and developing countries. The mainstay of treatment for intracranial aneurysms in the department of Neurosurgery Unit II at Punjab Institute of Neurosciences, Lahore, is microsurgical clipping.

The surgical audits are based on analyzing the standards of care provision and the identification of shortcomings in the ward policies and practices. These are crucial to establishing, maintaining, and improving patient care.[8] Regular feedback in the form of audits is critical for quality improvement and maintenance. There is always room for improvement, and excellence can only be achieved by searching for and trying to keep filling that room. This audit aims to review and document the morbidity and mortality rates after surgical clipping for intracranial aneurysms. This can be used to assess the standard of treatment provision and also to obtain feedback by comparing the findings with the conclusions of other published studies in the literature. This may also serve as a baseline study for comparison in future audits.

MATERIAL AND METHODS

Study Design and Study Setting

A Retrospective observational study was conducted at the Department of Neurosurgery, Unit-II, Punjab Institute of Neurosciences (PINS), Lahore, from July 2019 to December 2021.

Patient Management

Microsurgical clipping of the intracranial aneurysm was performed. All the patients with radiologic diagnosed intracranial aneurysms were admitted to the department of Neurosurgery Unit II. Pre-operative work-up was completed including radiologic work-up: CT brain plain, CT angiography and/or Digital Subtraction Angiogram and if needed, MRI brain plain and with contrast, and work-up for anesthesia fitness and assessment and management of co-morbidities, if present. Informed consent for surgery, anesthesia, and ICU admission was taken. All the patients were operated on under general anesthesia with endotracheal intubation. Different surgical teams undertook the procedures. The position was made according to the location of

the aneurysm. Craniotomy was performed, the dura opened and microsurgical dissection was done. A temporary clip was used only if needed during the surgery. A permanent clip was applied in all the cases. Post-operatively, all the patients were kept in ICU for observation. The post-operative assessment was done with neurological examinations and CT brain plain during the hospital stay and a later CT angiogram during follow-up visits.

Follow-up

Follow-up was taken at 3 months. Following were the follow-up endpoints: acute new onset neurological deterioration/deficit, rebleeding, vasospasm, revision surgery, and mortality.

Sample Size

Non-probability, non-randomized consecutive sampling was considered. A total of 180 patients (n=180) were included in the study. All these patients underwent surgical clipping in the department of Neurosurgery Unit II at Punjab Institute of Neurosciences, Lahore, during the study period.

Inclusion Criteria

All the patients underwent surgical clipping for ruptured intracranial anterior circulation aneurysms in the department of Neurosurgery Unit II at PINS, Lahore, during the study period.

Exclusion Criteria

Patients with incomplete medical records were not included. Also, medico-legal files were excluded.

Data Collection & Analysis

The source of data was patient file progress notes, operation notes, nursing notes, radiology scan films and reports, OPD notes, and records of readmission. Data were entered and analyzed by using SPSS 22 version. Quantitative variables such as age and demographic variables were described as Mean ± S.D. for both groups. Qualitative variables such as gender and performance and complications were described as frequency and percentage for both groups. Comparison of both groups for surgical outcome was done by using the chi-square test and t-test according to the nature of outcome variables. A P-value of ≤ 0.05 was considered significant.

RESULTS

Age & Gender Distribution

The age range was 17 – 70 Years. The mean age was 44.32 ± 13.75 years. There were 121 male and 59 female patients.

Pre-operative Assessment

The pre-operative assessment was documented in the form of GCS- Glasgow Coma Scale, Fisher Grade, WFNS- World Federation of Neurological Societies Grade, and Hunt and Hess Grade.

The stratification of the patients according to Fisher's grading was: Grade I – 161 patients (89.4%), Grade II – 12 patients (6.7%), and Grade III – 7 patients (3.9%) (p =< 0.001).

The stratification of the patients according to WFNS grading was: Grade I – 151 patients (83.9%), Grade II – 20 patients (11.1%), Grade III – 3 patients (1.7%), and Grade IV – 6 patients (3.3%) (p = < 0.001).

The stratification of the patients according to Hunt and Hess grading was: Grade I – 134 patients (47.4%), Grade II – 45 patients (25%), and Grade III – 1 patient (0.6%) (p = < 0.001).

According to location, the distribution of 180 aneurysms clipped was Anterior Communicating Artery (ACOMM): Artery aneurysm in 85 patients (47.22%), middle cerebral artery (MCA) aneurysms in 51 patients (28.3%), internal cerebral artery (ICA) aneurysms in 16 patients (8.9%), distal

Table 1: The pre-operative stratification of the patients according to Fisher Grade, WFNS- World Federation of Neurological Societies Grade, and Hunt and Hess Grades.

Variable	Level	Counts	Total	Proportion	p	95% CI for the Proportion Lower	Upper
Fisher Grade	1	161	180	0.894	< .001	0.840	0.935
	2	12	180	0.067	< .001	0.035	0.114
	3	7	180	0.039	< .001	0.016	0.078
WFNS Grade	1	151	180	0.839	< .001	0.777	0.889
	2	20	180	0.111	< .001	0.069	0.166
	3	3	180	0.017	< .001	0.003	0.048
	4	6	180	0.033	< .001	0.012	0.071
Hunt and Hess Grade	1	134	180	0.744	< .001	0.674	0.806
	2	45	180	0.250	< .001	0.189	0.320
	3	1	180	0.006	< .001	1.406e -4	0.031

Table 2: Patient Outcome in terms of new-onset Neurological Deficit, Rebleeding, Vasospasm, Revision surgery, and Mortality.

Variable	Level	Counts	Total	Proportion	p	95% CI for the Proportion Lower	Upper
Acute new onset neurological deterioration/deficit	Nil	169	180	0.939	< .001	0.893	0.969
	Yes	11	180	0.061	< .001	0.031	0.107
Rebleeding	Nil	174	180	0.967	< .001	0.929	0.988
	Yes	6	180	0.033	< .001	0.012	0.071
Vasospasm	Nil	171	180	0.950	< .001	0.907	0.977
	Yes	9	180	0.050	< .001	0.023	0.093
Revision surgery	Nil	169	180	0.939	< .001	0.893	0.969
	Yes	11	180	0.061	< .001	0.031	0.107
Mortality	Nil	165	180	0.917	< .001	0.866	0.953
	Yes	15	180	0.083	< .001	0.047	0.134

anterior cerebral artery (DACA) aneurysm in 15 patients (8.3%), and Posterior Communication (PCOMM) artery aneurysms in 13 patients (7.2%).

Temporary Clip Application

The temporary clip was applied during surgery in 24 patients (13.3%), while it was not applied in the rest of the cases i.e., 156 patients (86.7%).

Patient Outcome

The patient outcome endpoints included acute new onset neurological deterioration/deficit, rebleeding, vasospasm, revision surgery, and mortality. The neurological examination and radiologic findings were mainly used to assess these. The results showed the incidence of these outcomes as acute new onset neurological deterioration/deficit in 11 patients (6.1%), rebleeding in 6 patients (3.3%), vasospasm in 9 patients (5.0%), revision surgery in 11 patients in (6.1%) and mortality in 15 patients (8.3%).

DISCUSSION

This audit was carried out to assess the results of clipping of anterior circulation aneurysms in the department of Neurosurgery Unit II, PINS. The results of the audit were compared with those of other published studies to determine the

standards of management.

Aneurysmal subarachnoid hemorrhage occurs most commonly between 40 and 60 years of age and the mean age range is 50 to 55 years.[9-11] 180 patients were included in our audit with a mean age of 44 years. 55 years was the most common age value for aneurysmal subarachnoid hemorrhage in this audit.

After admission for subarachnoid hemorrhage, the determination of the source of the hemorrhage is vital to the management. Radiological modalities such as CT brain, CT angiogram, Digital subtraction angiogram, and MRI brain may detect the aneurysm as the source of the bleed.[12] These are also important for further management and treatment decision-making processes. The optimal treatment plan should involve necessary radiology, pre-operative assessment, management of co-morbidities, surgical planning, the timing of intervention, and case individualization.[2-3] The pre-operative assessment includes GCS – Glasgow Coma Scale, Fisher Grade, WFNS – World Federation of Neurological Societies Grade, and Hunt and Hess Grade. A lot of studies have compared these scoring systems but there is no final verdict about any of these being the gold standard. Still, these are applied commonly and are used to guide management decisions and also predict the outcome.[13-14] In our audit, the majority of the patient was good grade patients – 161 patients (89.4%) were Fisher grade I, 151 patients (83.9%) were WFNS grade I and 134 patients (47.4%) were Hunt and Hess grade I. Patients with higher grades were also observed – 7 patients (3.9%) were Fisher grade III, 6 patients (3.3%) were WFNS grade IV and 1 patient (25%) was Hunt and Hess grade III. This shows the diversity of the pre-operative status of the patients and it is quite common during neurosurgical practice to encounter a such versatile set of patients.

Many intracranial aneurysms arise from Internal Carotid artery circulation and the mainly frequent location is the Anterior Communicating artery. The location of an aneurysm determines the natural history and management plan, especially the surgical approach.[15-16] The frequency of origin of aneurysms in descending order in our data was – 85 patients 47.2% from Anterior Communicating Artery (ACOMM) Artery followed by 51 patients 28.3% from Middle Cerebral Artery (MCA), 16 patients 8.9% from Internal Cerebral Artery (ICA), 15 patients 8.3% from Distal Anterior Cerebral Artery (DACA) and 13 patients 7.2% from Posterior Communication (PCOMM) Artery.

During surgery, the role of temporary clipping has been long debated. It is recommended that surgeons should use temporary clips under suitable circumstances and indications only and there is no need for the application of a temporary clip in all cases.[17] In our data, a temporary clip was applied during surgery in 24 patients – 13.3% only.

The most common complications associated with the aneurysmal subarachnoid hemorrhage and the surgical clipping include acute neurological deterioration, new onset neurological deficit, rebleeding, vasospasm, seizures, hydrocephalus intra-operative rupture, failure to obliterate the aneurysm, and hospital stay.[7,17-18] We analyzed our data according to the frequencies of acute new onset neurological deterioration/deficit, rebleeding, vasospasm, revision surgery for re-clipping or associated complication, and mortality. The neurological examination and radiologic findings were mainly used to assess these and were documented in the form of doctors' and nurses' notes. These notes and the radiological information were analyzed to identify the complications.

Acute neurological deterioration after clipping may be as high as 40% with almost 50% of these being in the form of a drop in GCS score and about 60% as new onset motor deficits.[19] The analysis of our data showed acute new onset neurological deterioration in the form of a decrease in the preoperative GCS score and acute

new-onset focal deficits in 6.1% – 11 patients.

The objective of surgery in aneurysm clipping is to reduce the risk of rebleeding by completely excluding the aneurysm from the circulatory pathway. However, sometimes it is not possible to achieve this goal and the risk of rebleeding persists. The main culprit is the incomplete obliteration of the aneurysm mainly due to its large size, difficult-to-access location, and inadequate surgical technique. But there is a small risk of rupture and rebleed even after complete occlusion of the aneurysm. It is therefore recommended to get an angiogram earlier after surgery. But a lot of centers lack this facility due to no or less readily availability of angiogram facilities. The risk of rebleeding after clipping depends extremely on the extent of occlusion and may range from 1.1% for complete occlusion through 2.9% for 91% to 99% occlusion and up to 17.6% for less than 70% occlusion.[20] In another study, the frequency of incomplete aneurysm occlusion after surgical clipping was given as 2 – 49% according to different surgical series the risk of rebleeding after aneurysm clipping was estimated to be 1.3% in general.[21] In our data, the rate of rebleed after clipping was 3.3% as 06 patients suffered this complication.

Vasospasm is a dreadful complication after subarachnoid hemorrhage as well as after the intervention for aneurysms and it might affect the patient outcome negatively. Clinical vasospasm is more important than radiographic one. Peak incidence is within the first two weeks. The rate of vasospasm after clipping of an aneurysm has been reported between 5.8% and 9.1%, though some studies have reported higher rate frequencies too.[2-,23] In our data, 09 patients (5.0%) suffered from clinical vasospasm after surgery.

The revision surgery might be needed after clipping mostly for reclipping and any of the complications of subarachnoid hemorrhage or post-surgical complications. Revision surgeries in such cases are frequently performed for reclipping, rebleeding, bone flap removal, ventriculoperitoneal shunt, and tracheostomy. The rate of such revision procedures is reported to be about 4.2%.[24] In our data analysis, such revisions were performed in 11 patients (6.1%).

The mortality rates after aneurysmal subarachnoid hemorrhage and after surgical clipping are highly varied in different studies. The mortality rate is influenced by patient factors such as advanced age, co-morbidities, and a poor pre-operative status along with the complications of the disease process and surgical complications like rebleeding, vasospasm, seizures, hydrocephalus, and metabolic derangements. In the published literature, the mortality rate after surgical clipping is given as studies1.1%, 8.6%, 9.9%,25%, and even up to 40%.[25-27] In our audit, 15 patients died within the first three months after surgery – 8.3%.

LIMITATIONS

It is a retrospective study. It is based on the data collected from a single unit of neurosurgery. The comparison of outcomes between individual surgical teams was not done.

CONCLUSION

Given the above discussion, it can be claimed that the outcome of patients who underwent surgical clipping of ruptured anterior circulation aneurysms in the department of Neurosurgery Unit II, PINS, Lahore, is comparable to the results of the studies and trials in the published literature and can be quoted in the national and international literature for same region and ethnicity and can be taken as reference.

Recommendations

Regular surgical audits should be implemented in a surgical unit. Further audits should be done prospectively. Besides the department as a whole, individual surgical teams should also carry on

their analysis. A wider range of complications should be included in future studies.

REFERENCES

1. vanDijk JM, Groen RJ, TerLaan M, Jeltema JR, Mooij JJ, Metzemaekers JD. Surgical clipping as the preferred treatment for aneurysms of the middle cerebral artery. Acta Neurochir (Wien). 2011; 153 (11): 2111-2117.
2. Zhu W, Ling X, Petersen JD, Liu J, Xiao A, Huang J. Clipping versus coiling for aneurysmal subarachnoid hemorrhage: a systematic review and meta-analysis of prospective studies. Neurosurg Rev. 2022; 45 (2): 1291-1302.
3. Sharma, Rajan Kumar & Yamada, Yasuhiro &Kawase, Tsukasa & Kato, Yoko. To clip or coil? Proposal of individual decision making. Interdisciplinary Neurosurgery, (2019: 17.
4. Ahmed SI, Javed G, Bareeqa SB, et al. Endovascular Coiling Versus Neurosurgical Clipping for Aneurysmal Subarachnoid Hemorrhage: A Systematic Review and Meta-analysis. Cureus, 2019; 11 (3): e4320.
5. Tewari M, Aggarwal A, Mathuriya S, Gupta V. The outcome after aneurysmal sub arachnoid hemorrhage: a study of various factors. Ann Neurosci. 2015; 22 (2): 78-80.
6. Fang Y, Xu S, Lu J, et al. Validation and Comparison of Aneurysmal Subarachnoid Hemorrhage Grading Scales in Angiogram-Negative Subarachnoid Hemorrhage Patients. Biomed Res Int. 2020; 2020: 9707238. Published 2020 Feb 28.
7. Huang, G., Sun, Y., Li, J. et al. Therapeutic Effects of Microsurgical Clipping at Different Time Points on Intracranial Aneurysm and Prognostic Factors. Artery Res. 2021; 27: 135–142 ().
8. Green, A. & van Rij, Andre & Watters, David &Dewan, P. & Poxon, V. & Montgomery, P. Surgical Audit and Peer Review: A Guide, 2002.
9. Shea AM, Reed SD, Curtis LH, Alexander MJ, Villani JJ, Schulman KA. Characteristics of nontraumatic subarachnoid hemorrhage in the United States in 2003. Neurosurgery, 2007; 61 (6): 1131-1138.
10. Rinkel GJ, Djibuti M, Algra A, van Gijn J. Prevalence and risk of rupture of intracranial aneurysms: a systematic review. Stroke, 1998; 29 (1): 251-256.
11. Jordan LC, Johnston SC, Wu YW, Sidney S, Fullerton HJ. The importance of cerebral aneurysms in childhood hemorrhagic stroke: a population-based study. Stroke, 2009; 40 (2): 400-405.
12. Gauvrit JY, Leclerc X, Ferré JC, et al. Imagerie de l'hémorragie sous-arachnoïdienne [Imaging of subarachnoid hemorrhage]. J Neuroradiol. 2009; 36 (2): 65-73.
13. Mooij JJ. Editorial: grading and decision-making in (aneurysmal) subarachnoid haemorrhage. Interv Neuroradiol. 2001; 7 (4): 283-289.
14. Rosen DS, Macdonald RL. Subarachnoid hemorrhage grading scales: a systematic review. Neurocrit Care, 2005; 2 (2): 110-118.
15. Keedy A. An overview of intracranial aneurysms. Mcgill J Med. 2006; 9 (2): 141-146.
16. Diaz FG, Fessler RD, Velardo B, Kennedy C, Wilner H. Anterior circulation aneurysms: surgical perspectives. J Clin Neurosci. 1994; 1 (4): 222-230.
17. Kumar S, Sahana D, Menon G. Optimal Use of Temporary Clip Application during Aneurysm Surgery – In Search of the Holy Grail. Asian J Neurosurg. 2021; 16 (2): 237-242.
18. Kang Xk, GuoSf, Lei Y, Wei W, Liu Hx, Huang Ll, Jiang Ql. Endovascular coiling versus surgical clipping for the treatment of unruptured cerebral aneurysms: Direct comparison of procedure-related complications. Medicine, 2020; 99: 13 (e19654).
19. Mahaney KB, Todd MM, Bayman EO, Torner JC; IHAST Investigators. Acute postoperative neurological deterioration associated with surgery for ruptured intracranial aneurysm: incidence, predictors, and outcomes [published correction appears in J Neurosurg. 2020 Feb 07; 132 (6): 2009. J Neurosurg. 2012; 116 (6): 1267-1278.
20. Johnston SC, Dowd CF, Higashida RT, et al. Predictors of rehemorrhage after treatment of ruptured intracranial aneurysms: the Cerebral Aneurysm Rerupture after Treatment (CARAT) study. Stroke, 2008; 39 (1):1 20-125.
21. Obermueller, K., Hostettler, I., Wagner, A. et al. Frequency and risk factors for postoperative aneurysm residual after microsurgical clipping. Acta Neurochir. 2021; 163: 131–138).
22. Muirhead WR, Grover PJ, Toma AK, Stoyanov D, Marcus HJ, Murphy M. Adverse intraoperative events during surgical repair of ruptured cerebral

aneurysms: a systematic review. Neurosurg Rev. 2021; 44 (3): 1273-1285.
23. Proust F, Hannequin D, Langlois O, Freger P, Creissard P. Causes of morbidity and mortality after ruptured aneurysm surgery in a series of 230 patients. The importance of control angiography. Stroke, 1995; 26 (9): 1553-1557.
24. Dasenbrock HH, Smith TR, Rudy RF, Gormley WB, Aziz-Sultan MA, Du R. Reoperation and readmission after clipping of an unruptured intracranial aneurysm: a National Surgical Quality Improvement Program analysis. J Neurosurg. 2018; 128 (3): 756-767.
25. Alshekhlee A, Mehta S, Edgell RC, et al. Hospital mortality and complications of electively clipped or coiled unruptured intracranial aneurysm. Stroke, 2010 Jul; 41 (7): 1471-1476.
26. Anderson, I. A., Kailaya-Vasan, A., Nelson, R. J., and Tolias, C. M. (2019). Clipping aneurysms improves outcomes for patients undergoing coiling. Journal of Neurosurg. 130, 5, 1491-1497, available from: < https://doi.org/10.3171/2017.12.JNS172759> [Accessed 09 August 2022
27. Stauning AT, Eriksson F, Benndorf G, Holst AV, Hauerberg J, Stavngaard T, Poulsgaard L, Rochat P, Eskesen V, Birkeland P, Mathiesen T. Mortality among patients treated for aneurysmal subarachnoid hemorrhage in Eastern Denmark 2017 – 2019. Acta Neurochirurgica. 2022; 164 (9): 2419-30.

Additional Information

Disclosures: Authors report no conflict of interest.
Ethical Review Board Approval: The study was conformed to the ethical review board requirements.
Human Subjects: Consent was obtained by all patients/participants in this study.
Conflicts of Interest:
In compliance with the ICMJE uniform disclosure form, all authors declare the following:
Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.
Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Mubashir Malik	1. Study design and methodology.
2.	Shehzad Safdar	2. Paper writing.
3.	Fauzia Sajjad	3. Data collection and calculations.
4.	Abdul Ghafoor	4. Analysis of data and interpretation of results.
5.	Usama Mansoor	5. Literature review and referencing.
6.	Amir Aziz	6. Editing and quality insurer.
7.	Muhammad Anwar	7. Overall Supervision and performed surgeries.