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PREVALENCE OF POSTOPERATIVE HEMORRHAGE AFTER UNDERGOING INTRACRANIAL PROCEDURES: A SURVEY OF 356 CASES

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ABSTRACT

BACKGROUND: Postoperative hemorrhage (POH) remains a frequent and potentially dangerous complication in neurosurgical practice with profound impact on the prognosis of patient.

OBJECTIVE: The aim of this study was to determine the prevalence of postoperative hemorrhage after intracranial procedures and explore the possible predisposing factors for POH.

METHODOLOGY: :This retrospective study was conducted on data between April 2019 and June 2024. The present study enrolled all patients who underwent intracranial surgical procedures in the management of various brain disorders. The data collected included age, gender, initial diagnosis, comorbidities, radiation and chemotherapy history, the type of surgery performed, post operative hemorrhage, mortality and morbidity of the patients. Data analyses were conducted using the (SPSS) version 25.

RESULTS: A total of 356 craniotomies were performed, of which 14(4%) patients had postoperative hemorrhage (POH). Among these, 5 (35%) patients had hemorrhage after tumor removal, 4 (25%) after aneurysm clipping, and 6(40%) after endoscopic pituitary tumor resection. The average time for hemorrhage to occur was within the first 24 hours of surgery. Hypertension was identified as a significant risk factor for POH in 20% of cases.

CONCLUSION; Postoperative hemorrhage (POH) after intracranial surgeries continues to be a serious complication. Intracranial procedures such as endoscopic pituitary tumor resection, tumor removal, and aneurysm clipping, are associated with increased incidence of post operative hemorrhage. Majority of the cases can be observed in the first 24 hours after surgery, highlighting the need for close observation.

KEYWORDS: :Complications, intracranial procedures, patient outcomes, postoperative hemorrhage

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INTRODUCTION

the most important factors to consider when choosing one surgical approach over the other. The most common post-operative complications in intracranial procedures include post-operative hemorrhage (POH), post-operative elevated intracranial pressure, shunt failure, incomplete tumor resection, cerebrospinal fluid (CSF) leak and intracranial or superficial surgical site infections. Postoperative hemorrhage (POH) is an uncommon but potentially serious adverse event of cranial surgeries (1). The incidence of post-operative hemorrhage is 0.8 to 1% with a mortality as high as 18%(2). Different risk factors are associated with the post operative hemorrhage including pre-existing medical comorbidities such as hypertension, coagulopathies, and haematological abnormalities and particular lesion pathologies such as tumors.(3).

Most postoperative hemorrhage cases have been shown to be epidural or intraparenchymal in studies. Based on MRI/CT, POH was the most common indication of unplanned re-operative surgeries with 40% of the cases attributed to subdural hemorrhage. Unlike other surgical specialties consequences of postoperative hemorrhage are very drastic (4). Preoperative medication with anti-platelets increases the risk of POH (4,5). Hypertensive patients and patients with amyloid angiopathy also show high risk of POH after cranial surgery (6,7). Tumors differ in their propensity for hemorrhage and even without surgical manipulation not infrequently present as unsuspected causes of intracranial hemorrhage. There is increased risk of POH after subtotal resection of glioma surgery (8) A significantly higher risk of post craniotomy hematoma (PCH) is also associated with alcohol consumption (9). Early detection of POH is important and CT brain should be advised after 24-48 hrs. of surgery (10,11). Poor Karnofsky score is also associated with post-operative hemorrhage (12). Postoperative haemorrhage might substantially influence the patients' neurological prognosis after intracranial procedures. (13)

The aim of this study was to determine the incidence of postoperative hemorrhage after intracranial procedures and determine the possible predisposing factors for POH.

METHODOLOGY:

This cross-sectional study was conducted at Prime Teaching Hospital, Peshawar, KP, Pakistan, between April 2019 and June 2024 using retrospective data from the hospital records. All the patients included in this study provided written informed consent for participation in the study. The study was approved by the Institutional Review Board (IRB) of the Hospital.

Patients who experienced postoperative hemorrhage following craniotomy for various brain pathologies were included in the study. Additionally, patients who underwent reoperation for the evacuation of intracerebral hemorrhage were considered for inclusion. Patients who had non-significant hematomas or were re-explored for brain ischemia were excluded from the study.Perceived data sources comprised of demographic data that incorporated age and gender, clinical information including first diagnosis, concurrent diseases, prior radiation or chemotherapy before surgery, surgical data comprised of the date and type of recurrent or second surgery and outcomes that comprised of mortality and morbidity GOS scores.

Statistical data analysis was done on IBM SPSS version 25. Frequency distribution was employed to describe demographic and clinical characteristics and chi-square tests were used to determine the relationship between risk factors and postoperative hemorrhage outcomes.

RESULTS

In this series of 356 intracranial procedures, majority of the participants were males ,231 (65%) as compared to females 125 (35%). Mean age of the participants were 42± 5 years years.

Table 1: Demographic Characteristics of Participants

Demographic Parameter	Value
Total Participants	356
Male Participants	231 (65%)
Female Participants	125 (35%)
Mean Age	42 ± 5 yearsyears

Majority of the craniotomy procedures 182 (51%) were performed for supratentorial lesions followed by surgery for pituitary tumors 36 (10%). A total of 32 (9%) of patients had retro sigmoid craniotomy for microvascular decompression (MVD), 25 (7%) underwent retro sigmoid craniotomy for acoustic neuroma and other CP angle lesions, and 25 (7%) had suboccipital craniotomy for midline posterior fossa tumors. A total of 39 cases (11%) were classified in the "other" category, which included hemicraniectomies, CSF leaks, traumatic skull fractures, wound infections, seizure/epilepsy, and suboccipital craniectomies for Chiari malformation.

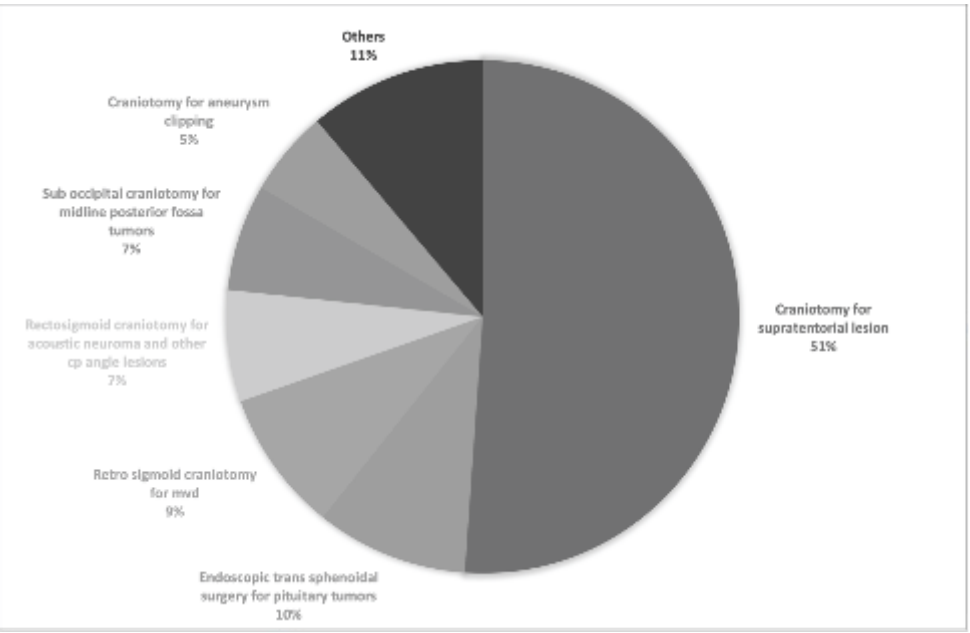

Figure 1: Pie chart illustrating percentages of intracranial procedures performed for different conditions

Incidence of post operative hemorrhage:

The overall incidence of postoperative hemorrhage (POH) associated with some degree of morbidity was reported in 14 (4%) patients. The highest incidence of postoperative hemorrhage occurred in patients undergoing endoscopic pituitary tumor resection 6 (40%). Symptomatic postoperative hemorrhage occurred in 5(35%) of the patients undergoing craniotomy for tumor removal, 4 patients (25%) underwent aneurysm clipping. Disseminated intravascular coagulation (DIC) was present in one patient who developed postoperative hematoma.

Most of the postoperative hemorrhage cases in this study were intracerebral 8(56%) followed by epidural 4(32%), subdural 1(8%) and intrasellar 1(4%)

Table 2: Incidence of post operative hemorrhage

Variables	Frequency (Percentage)
Overall Incidence of POH	14 (4%)
Endoscopic pituitary tumor resection	6 (40%)
Craniotomy for tumor removal	5 (35%)
Aneurysm clipping	4 (25%)
Postoperative hematoma with DIC	1 (7%)
Types of Postoperative Hematomas	
Intracerebral hematoma	8 (56%)
Epidural hematoma	4 (32%)
Subdural hematoma	1 (8%)
Intrasellar hematoma	1 (4%)

During treatment, 4 patients died. Of the survivors, three patients had a Glasgow Outcome Scale (GOS) score of 5, five patients had a GOS score of 4, and two patients were discharged with a GOS score of 2.

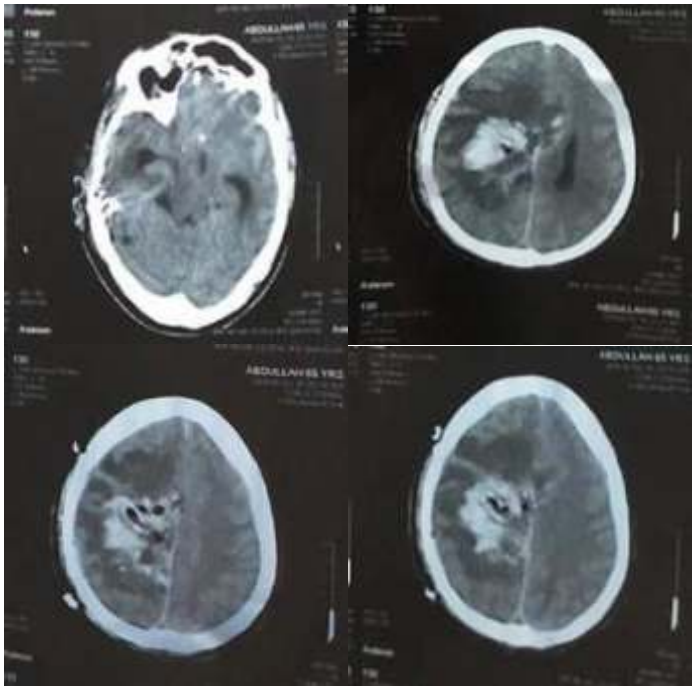

Figure 2. POH after frontal to parietal craniotomy

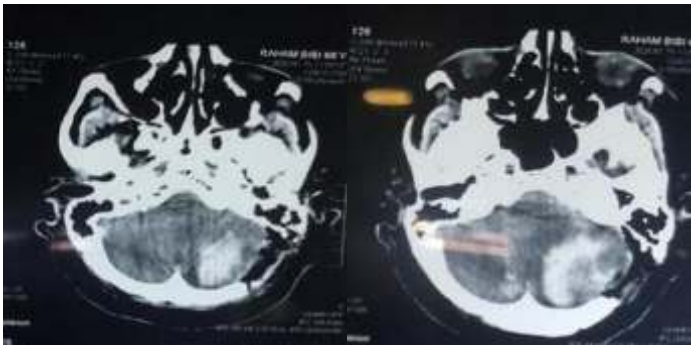

Figure 3. Post operative hematoma after left retrosogmoid

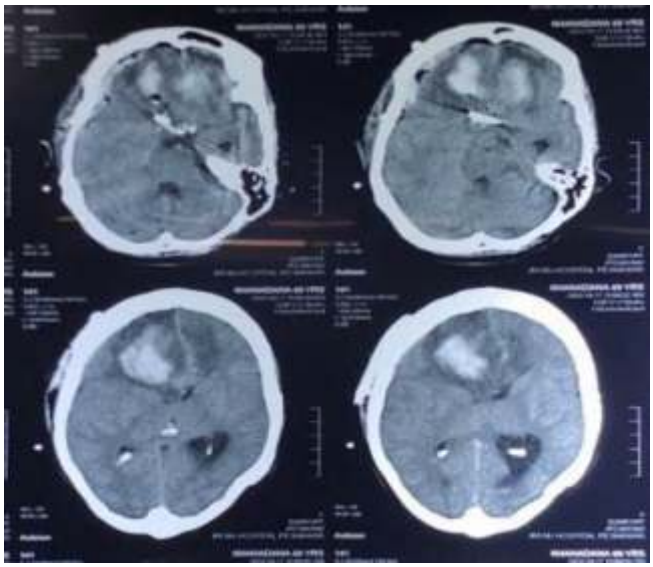

Figure 4. Post op hematoma after OGM surgery

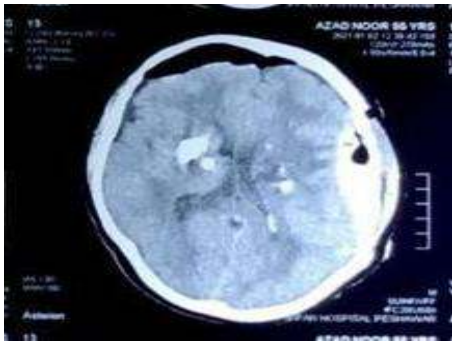

Figure 5. Post operative Epidural hematoma after parietal glioma surgery

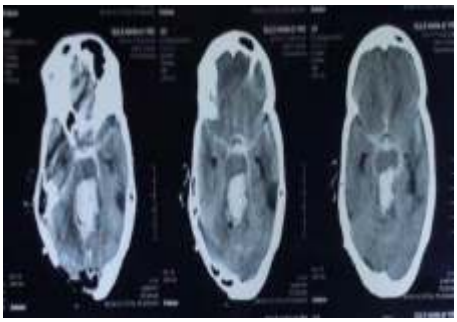

Figure 6. Post operative posterior fossa hematoma

Association of Hypertension and Coagulopathy with Postoperative Hemorrhage

Out of the total 14 patients having post operative haemorrhage, 11 (79%) of patients exhibited coagulopathy, specifically thrombocytopenia (platelet count <100,000/mm³), and 9(64%) had hypertension (systolic blood pressure ranging from 160 to 195 mmHg). These risk variables were found to be significantly associated with postoperative bleeding, with a chi-square value of 6.54 (p = <0.001) for coagulopathy and 8.23 (p = 0.014) for hypertension

Table 3: Association of risk factors with Postoperative Hemorrhage

Risk Factor	Postoperative Haemorrhage (n = 14)		Chi-Square Value	p-Value
Hypertension (160–195 mmHg)	**Yes** 9 (64%)	**No** 5 (36%)	8.23	0.014
Thrombocytopenia (<100,000/mm³)	**Yes** 11 (79%)	**No** 3 (21%)	6.54	<0.001

DISCUSSION

The current study aimed to evaluate the prevalence and outcomes of postoperative hemorrhage (POH) following 356 intracranial procedures at Prime Teaching Hospital, Peshawar. Respectively, our findings revealed 14 (4%) of POH incidence, which is comparable with other investigations estimating 0.8 – 6.9% in craniotomy patients as described by Kafka et al. (1988) in series of 4992 intracranial procedures. Therefore, while the incidence of POH seems to vary across studies, as it does across patients, this condition nevertheless continues to cause morbidity and death postoperatively, and should therefore be closely monitored and managed, even after the operation is complete.The highest rates of POH were observed in patients undergoing craniotomy for tumor removal and aneurysm clipping. In our series, 5% of patients who underwent aneurysm clipping experienced symptomatic postoperative hemorrhage, As reported by Lillemäe et al.(2017) a rate that is comparable to the 0.6% to 1.1% incidence found in other studies (14). These observations support previous studies concluding that aneurysm surgery results in increased bleeding rates because of the fragile subtle nature of cerebral vessels. A comparable risk of POH was noted in craniotomy for tumor resection by Kashkoush et al. (2017), who noted similar risk of hemorrhage particularly among patients with complex or large tumors in whom vascular violation is likely to ensue. (15)

Endoscopic procedures, particularly those for pituitary tumor removal via transsphenoidal surgery, had 10 cases of postoperative hemorrhage in our study, which is a little higher than the typical 0.5% to 2.0% reported in the literature by Osorio et al (2013).(16) This difference could be due to the characteristics of the patients for instance size and location of the tumor, the technical difficulty of the operation since it is particularly around vessels. Furthermore, in complex cases, Nikolay, et al. (2024) points out that, though endoscopic approaches are widely considered as minimally invasive, postoperative bleeding and leakage of cerebrospinal fluid are possible .(17) Our study also noted that 9% of patients developed POH following craniotomy for AVM resection, which is higher than the rates of 4.4% to 8.0% reported in the literature according to Chui et al.(2020) The higher rates observed in our study may be explained by AVM resections being dictated for highly vascular tumors which may be difficult to manage during the operation. Large or deep location of the AVM may lead of large amount of bleeding which can cause problems in postoperative care of the patient. (18)

It was also reported in our findings that hypertension is a major predictor of the risk of postoperative hemorrhage. Preoperative and intraoperative hypertension, especially during the postoperative phase, is causatively related to the development of postoperative hematomas due coagulopathy that results from enhanced vascular permeability and capillary fragility Lisano-Díez et al (2022). This study also identified that 9 (64%) of the patients experienced post operative hemorrhage with hypertension in the range of 160-195,hence the significance of maintaining crucial blood pressure within the operative period could not be over emphasized. (19)Although our study did not specifically gathered data on the association between certain other risk factors.However, prior research has highlighted the findings which revealed the contributing effect of comorbidities including diabetes, radiation therapy, and chemotherapy on hemorrhage.Findings from the study by Zhang et al.(2020) showed that diabetic patients had a higher incidence of hemorrhage post-craniotomy.(20)

Depending on its type, hemorrhage was classified as subdural hematoma, epidural hematoma, intracranial hematoma, and parenchymal hematoma In our study, intracebral was the most frequently identified 8 (56%) in our group of patients, with other papers putting epidural hematomas first (Tallon et al., 2008). They may have arisen from the surgical approaches used in our study, and the kinds of operations performed particularly those whose principles involved handling the brain and/or the dura mater. Subdural haematomas are often venous and may be slower to develop, which may provide an explanation for chronicity in some of our patients. (21)

The management of post operative hemorrhage is very important under certain conditions. In the present series, 14 patients underwent reoperation due to hematoma and 7 patients reoperated within the first 24 hours postoperatively. This is in agreement with Wells et al (2018) who observed that early removal of post-surgery hematomas enhances patients' recovery and lowers death rates. (22) All together four patients died during the course of the treatment, however it is stable with the improvement of complications following POH treatment. But there were better results with three patients having GOS of 5 and five patients having GOS of 4 indicating that though there is the risk of POH, early surgery can lead to good recovery. Our results are in line with the studies by Henry et al. (2006), where they supported that despite the increased risk of POH, the management of this complication can improve functional results in the majority of patients. (23)

The limitation of this study included the utilization of a cross-sectional study design and that it has a retrospective nature which may have influenced the results of data collection as well as the patient sample. Furthermore, owing to the focus of the sample only from one hospital, the results cannot be generalized to hospitals with different sets of patients or environments, or differently performing surgery. In addition, there is minimal information follow up on some of the patients and thus, the status of their follow-up, the results in the long run and the history with regards to postoperative hemorrhage is not well established. Further studies should be planned with regard to the use of prospective data collection, integration of multiple centers, as well more comprehensive examination of the number of pre- and postoperative factors including medical prescriptions, and

genetic profile for aiming at identification of all risk factors for postoperative hemorrhage.

CONCLUSION

In cranial surgery, postoperative hemorrhage is a devastating complication with a high mortality and morbidity rate. Pre-existing medical comorbidities such as hypertension, coagulopathies, and hematological abnormalities, intraoperative hypertension and blood loss, tumors, persistent subdural hematomas, and haemostasias deficits are all common risk factors responsible for POH. Timely detection and evacuation of hematoma is an important prognostic factor. Patients with these conditions need special care to prevent returns to the operating room.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest related to this publication.

FINANCIAL DISCLOSURE STATEMENT

No dedicated financial support or external funding was received for the completion of this work

REFERENCES

1. Senders JT, Goldhaber NH, Cote DJ, Muskens IS, Dawood HY, De Vos FY, Gormley WB, Smith TR, Broekman ML. Venous thromboembolism and intracranial hemorrhage after craniotomy for primary malignant brain tumors: a National Surgical Quality Improvement Program analysis. Journal of Neuro-oncology. 2018 Jan;136:135-45.

2. Postoperative complications after craniotomy for brain tumor surgery. Anaesth Crit Care Pain Med. 2017 Aug 1;36(4):213–8.

3. Seifman MA, Lewis PM, Rosenfeld JV, Hwang PY. Postoperative intracranial haemorrhage: a review. Neurosurgical review. 2011 Oct;34:393-407.

4. Surgical postoperative bleeding associated with aspirin ingestion in: Journal of Neurosurgery Volume 50 Issue 5 (1979) [Internet]. [cited 2020 Jul 15]. Available from: https://thejns.org/view/journals/j-neurosurg/50/5/article-p682.xml

5. Greuter L, Ullmann M, Mariani L, Guzman R, Soleman J. Effect of preoperative antiplatelet or anticoagulation therapy on hemorrhagic complications in patients with traumatic brain injury undergoing craniotomy or craniectomy. Neurosurgical focus. 2019 Nov 1;47(5):E3.

6. Yanagawa T, Sato H, Suzuki K, Ooigawa H, Takao M, Kurita H. Association of antithrombotic therapy with postoperative rebleeding in patients with cerebral amyloid angiopathy. Chinese Neurosurgical Journal. 2023 Sep 10;9(03):159-65.

7. Perez CA, Stutzman S, Jansen T, Perera A, Jannusch S, Atem F, Aiyagari V. Elevated blood pressure after craniotomy: a prospective observational study. Journal of Critical Care. 2020 Dec 1;60:235-40.

8.Ostrowski RP, He Z, Pucko EB, Matyja E. Hemorrhage in brain tumor–An unresolved issue. Brain Hemorrhages. 2022 Jun 1;3(2):98-102.

9. Johansson K, Johansson L, Pennlert J, Söderberg S, Jansson JH, Lind MM. Phosphatidylethanol levels, as a marker of alcohol consumption, are associated with risk of intracerebral hemorrhage. Stroke. 2020 Jul;51(7):2148-52.

10. Qoqandi O, Almubarak AO, Bafaquh M, Alobaid A, Alsubaie F, Alaglan A, Abukhamssin DA, Algharib MA, Alsomali AI, Alyamani M. Efficacy of routine post-operative head computed tomography on cranial surgery patients outcome. Neurosciences Journal. 2020 Aug 1;25(4):281-6.

11. Fokin AA, Knight JW, Davis B, Stalder R, Mendes MA, Darya M, Puente I. The timing and value of early postoperative computed tomography after head surgery in traumatic brain injury patients. Clinical Neurology and Neurosurgery. 2023 Mar 1;226:107606.

12. Goldberg M, Mondragon-Soto MG, Altawalbeh G, Baumgart L, Gempt J, Bernhardt D, Combs SE, Meyer B, Aftahy AK. Enhancing outcomes: neurosurgical resection in brain metastasis patients with poor Karnofsky performance score-a comprehensive survival analysis. Frontiers in Oncology. 2024 Jan 10;13:1343500.

13. Demetz M, Krigers A, Uribe-Pacheco R, Pinggera D, Klingenschmid J, Thomé C, Freyschlag CF, Kerschbaumer J. The role of postoperative blood pressure management in early postoperative hemorrhage in awake craniotomy glioma patients. Neurosurgical Review. 2024 Aug 22;47(1):452.

14. Lillemäe, Kadri, et al. "Incidence of postoperative hematomas requiring surgical treatment in neurosurgery: a retrospective observational study." World neurosurgery 108 (2017): 491-497.

15. Kashkoush, Ahmed I., et al. "Perioperative stroke after cerebral aneurysm clipping: risk factors and postoperative impact." Journal of Clinical Neuroscience 44 (2017): 188-195.

16. Osorio, Robert C., et al. "Risk Factors for Significant Postoperative Hemorrhage Following Pituitary Adenoma Resection: A Case–Control Study of 1,066 Surgeries." Journal of Neurological Surgery Part B: Skull Base 84.S 01 (2023): S149.

17. Tonchev, Nikolay, et al. "Postoperative Hemorrhage and Venous Thromboembolism in Patients with Pituitary Adenomas Under Acetylsalicylic Acid." Journal of Clinical Medicine 13.23 (2024): 7020.

18. Chui, Jason, Bahadur Niazi, and Lashmi Venkatraghavan. "Postoperative hemodynamic management in patients undergoing resection of cerebral arteriovenous malformations: A retrospective study." Journal of Clinical Neuroscience 72 (2020): 151-157.

19. Lizano-Díez, Irene, et al. "The burden of perioperative hypertension/hypotension: a systematic review." PLoS One 17.2 (2022): e0263737.

20. Zhang, Xiaoying, et al. "Association of diabetes mellitus with postoperative complications and mortality after non-cardiac surgery: a meta-analysis and systematic review." Frontiers in Endocrinology 13 (2022): 841256.

21. Tallon, John M., et al. "The epidemiology of surgically treated acute subdural and epidural hematomas in patients with head injuries: a population-based study." Canadian journal of surgery 51.5 (2008): 339.

22. Wells, Adam J., and Peter JA Hutchinson. "The management of traumatic brain injury." Surgery (Oxford) 36.11 (2018): 613-620.

23. Rosevear, Henry M., et al. "Characterization and management of postoperative hemorrhage following upper retroperitoneal laparoscopic surgery." The Journal of urology 176.4 (2006): 1458-1462.

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A.Conception or Design
B.Acquisition, Analysis, or Interpretation of Data
C.Manuscript writing
D.Critical Review and approval