

Comparative Clinical Audit of Neurosurgical Procedures Across Three Institutions: A Multi-Center Retrospective Study

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ABSTRACT:

Background: Institutional audits are essential in neurosurgery to evaluate the quality of care, identify gaps, and guide improvements. Comparing multiple centers provides a broader understanding of practice patterns and outcomes.

Methods: This is a multi-center retrospective review of neurosurgical procedures performed at Shaheed Suhrawardy Medical College Hospital (ShSMCH), Popular Medical College Hospital (PMCH), Dhaka and Pranto Specialized Hospital (PSH), Mymensingh over Jan 2022- Dec 2024. Key variables including case volume, procedure types, outcomes, and complication rates were analyzed.

Results: A total of 530 cases were analyzed: ShSMCH (200), PMCH (180), and PSH (150). The mortality rates were 5%, 1%, and 0.6% respectively, while complication rates were 14%, 3%, and 5%. The most common procedures were Fenestration & Discectomy, Spinal Stabilization, ACD, Brain Tumor Excision, VP shunt and Trauma Craniotomy.

Conclusion: This study highlights institutional variations in neurosurgical practice and outcomes, indicating the need for standardized care protocols and quality improvement initiatives.

Key Words:

Neurosurgical audit, complication rate, mortality rate, spinal surgery, cranial procedures, quality improvement, multi-center study

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Introduction

Neurosurgical services in developing countries often encounter challenges related to resource limitations, delayed presentations, and varying expertise. Regular institutional audits enable assessment of care quality and outcomes. Comparative studies among institutions can further highlight variations and guide strategies for standardization and improvement. This study aims to compare neurosurgical practice patterns, case volumes, and outcomes across three tertiary hospitals.

Materials and Methods

This is a retrospective, descriptive, and comparative study conducted across three tertiary neurosurgical centers: Shaheed Suhrawardy Medical College Hospital (ShSMCH), Popular Medical College Hospital (PMCH), Dhaka and Pranto Specialized Hospital (PSH), Mymensingh, covering the period from January 2022 to December 2024. Data were collected from institutional surgical logbooks, focusing on total number of cases, procedure types, mortality, and complication rates. Descriptive statistics were used for analysis and comparison.

Definitions:

Mortality was defined as any patient death directly or indirectly attributable to the neurosurgical condition or its treatment, occurring during the same hospital admission or within 30 days postoperatively.

Complication refers to any adverse event occurring during the perioperative period requiring medical or surgical intervention, including infection, CSF leak, neurological deficit, or reoperation.

The time frame considered for mortality in this audit was 30-day in-hospital mortality.

Result

Table 1: Combined Neurosurgical Data (Jan 2022 - Dec 2024)

Institution	Total Cases (2022-2024)	Mortality (n,%)	Complications (n,%)
ShSMCH	200	10 (5%)	28 (14%)
PMCH	180	2 (1.1%)	06 (3.3%)
PSH	150	01 (0.66%)	08 (5.3%)

Table 2A: Shaheed Suhrawardy Medical College Hospital Data Table

Parameters	ShSMCH
Total Cases	200
Mortality (n, %)	10 (5%)
Complications (n, %)	28 (14%)

Table 2B: Popular Medical College Hospital Data Table

Parameters	PMCH
Total Cases	180
Mortality (n,%)	02 (1.1%)
Complications (n,%)	06 (3.3%)

Table 2C: Pranto Specialized Hospital Data Table

Parameters	PSH
Total Cases	150
Mortality (n,%)	01 (0.66%)
Complications (n,%)	08 (5.3%)

Table 3: Frequency of Diagnosis (N-530)

Diagnosis	Number of Cases
Prolapsed Lumbar Intervertebral Disc (PLID)	210
Spinal Canal Stenosis/Spondylolisthesis (Grade I/II/III)	64
Compressive Cervical Myelopathy/radiculopathy	71
Cranial Lesions (tumor)	44
Cranial Lesions (hematoma/vascular lesion)	38
Intradural Spinal Tumors	27
Hydrocephalus	26
Meningocele/meningocele	21
Traumatic Spinal Fracture	25
AA Dislocation	04

Table 4: Types of Neurosurgical Procedures Performed (N-530)

Procedure	Number of Cases
Fenestration & Discectomy/Microdiscectomy	195
Laminectomy with or without Discectomy/Laminoplasty	15
ACDF	71
Spinal Stabilization	80
Burr Hole / Craniotomy/DC	82
Intradural Tumor Excision	27
VP Shunt/LP shunt	26
Excision & repair of NTD	21
Vertebroplasty/MISS	13

Table 5: Mortality Rate Comparison

Institution	Total Cases	Mortality (n)	Mortality Rate (n%)
ShSMCH	200	10	5.0
PMCH	180	2	1.1
PSH	150	1	0.66

Table 6: Complication Rate Comparison

Institution	Total Cases	Mortality (n)	Complication Rate (n%)
ShSMCH	200	28	14.0
PMCH	180	6	3.3
PSH	150	8	5.3

Statistical Analysis

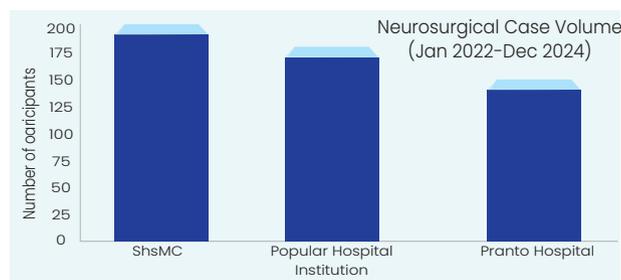
A Chi-square test was performed to compare mortality and complication rates among the three hospitals.

- ****Mortality Rates Comparison:**** The Chi-square test yielded a value of 1.230 with a p-value of 0.541. This indicates that the differences in mortality rates across the three hospitals are not statistically significant ($p > 0.05$).

- ****Complication Rates Comparison:**** The Chi-square test yielded a value of 0.868 with a p-value of 0.648. This suggests that the differences in complication rates among the institutions are also not statistically significant ($p > 0.05$).

These results suggest that, despite numerical differences, the outcomes in terms of mortality and complication rates were statistically comparable across the three centers during the study period. The overall distribution of neurosurgical cases and outcomes across the three institutions is presented below.

Table 7: Overview of Cases



Discussion

This comparative audit revealed variations in neurosurgical workload, case mix, and outcomes among the three institutions evaluated. ShSMCH (Shaheed Suhrawardy Medical College Hospital) demonstrated the highest volume of cases with a relatively higher mortality (5%) and complication rate (14%), while PSH (Pranto Specialized Hoospital) exhibited a lower mortality (0.6%) and complication rate (5%) despite handling fewer cases. PMCH (Popular Medical College Hospital) displayed intermediate performance metrics.

In patterns of Mortality, most deaths occurred in cases involving trauma craniotomy and brain tumor excision, primarily due to postoperative hemorrhage, sepsis, or respiratory failure. These findings highlight the need for targeted postoperative surveillance and ICU support in high-risk procedures. In patterns of complications, the most frequently encountered complications were wound infections, cerebrospinal fluid (CSF) leaks, neurological deficits, and shunt malfunctions.

These variations can be attributed to multiple factors, including differences in Patient demographics and referral patterns: Higher volume centers like ShSMCH often attract more complex cases and also this is a government teaching institute where the resident’s supervised training is ensured, resulting in average outcomes [1].

ShSMCH showed a higher proportion of infection-related complications, which may be related to resource limitations and patient volume, stressing the importance of stringent perioperative protocols.

Availability of infrastructure and perioperative support: Institutions with well-equipped ICU, availability of imaging, and dedicated neurosurgical nursing care tend to have lower complication rates [2]. Surgical expertise and standardization of care pathways: Regular morbidity and mortality meetings, use of checklists, and adherence to infection prevention protocols have been associated with improved neurosurgical outcomes [3,4]. Studies from other LMIC settings have demonstrated similar patterns of variability across institutions [5]. Dewan et al. highlighted the disparities in neurosurgical capacity globally and emphasized the role of institutional audits in capacity building and advocacy for resource allocation [6]. Warf et al. specifically noted that outcome variability in African

neurosurgical centers were influenced by both technical factors and systems of care [7]. Additionally, McCutcheon et al. underscored the need for surgical quality registries in LMICs to drive data-informed improvements and accountability [8].

The observed disparity in mortality rates—5% at ShSMCH compared to 0.66% at PSH—though statistically non-significant, raises important clinical considerations. ShSMCH, being a high-volume government teaching hospital, receives complex referrals and manages cases with broader case severity. This, coupled with infrastructure strain, trainee participation, and delayed referrals, may contribute to higher adverse outcomes. These disparities, while within acceptable statistical thresholds, suggest actionable pathways for institutional improvement through targeted training, improved critical care support, and standardized post-operative monitoring protocols.

Our findings also emphasize the importance of institutional benchmarking, which not only highlights gaps in surgical outcomes but also encourages peer learning and adoption of best practices across centers. Future studies should explore the specific factors contributing to the higher complication rates at ShSMCH and assess targeted interventions such as surgical mentoring, infection control training, and postoperative care optimization. Limitations of the study include its retrospective design, potential underreporting of minor complications, and lack of granular data on patient comorbidities and surgical indications.

Conclusion

This multi-center audit demonstrates variations in neurosurgical practices and outcomes across three institutions. Targeted interventions focusing on standardization of surgical protocols, infection prevention, and surgical training may help improve patient outcomes and institutional efficiency. Regular audits should be institutionalized to promote quality assurance and benchmarking.

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