Predictors of Outcome in Inter-hospital Transferred Neurosurgical Patients with Cranial Pathology in a University Hospital in Nepal

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Date of Submission:12th February 2026 Date of Acceptance: 7th March 2026 Date of Publication: 15th March 2026

Abstract

Introduction: Inter-hospital transfer (IHT) of neurosurgical patients is common; however, little is known about the impact of transfer parameters on clinical outcomes in the South Asian population. Although the transfer process is an important aspect of the continuation of care, the principles of safe transfer are still evolving in low and middle-income countries like Nepal. So, this study aims to describe the current status of IHT in neurosurgical patients and identify the predictors for poor outcomes.

Methods: This was a prospective, observational, and analytical study done in the Department of Neurosurgery, Tribhuvan University Teaching Hospital (TUTH). All adult neurosurgical patients with cranial pathology referred from other hospitals were eligible for participation. Patients were admitted and managed as per the departmental protocol. Patients were followed up for 3 months for clinical outcomes, recorded as favorable and unfavorable. Different clinical and transfer parameters were analyzed to identify the predictors of poor outcomes in this patient population.

Results: Of 936 neurosurgical patients presenting to TUTH emergency, 337(36.0%) were IHT patients. After the exclusion of 13 patients, 324 patients were included in the final analysis. The median age was 56.9(± 16.1) years. Two hundred ninety (90.0%) patients were transferred in an ambulance with only 2.1% of them being accompanied by a health worker. The overall unfavorable outcome was noted in 134(41.0%) whereas the mortality was 46(14.2 %.) On multivariate regression analysis, low admission Glasgow Coma Scale (GCS) and diagnosis of intracerebral hemorrhage (ICH) were significant predictors of poor outcomes.

Conclusion: Inter-hospital transfer is common in neurosurgical practice. Low GCS on admission and diagnosis of ICH were found to be associated with unfavourable outcomes in our study. Though unfavourable outcomes are comparable with those who come directly to the hospital based on the contemporary literature, the practice of safe transfer should be instituted in the country.

Keywords: Craniotomy, Inter-hospital transfer, Mortality, Outcome

Access this article online

Website: https://www.nepjol.info/index.php/NJN

DOI: https://doi.org/10.3126/njn.v23i1.90852

HOW TO CITE
Thapa, B., Gurung, A., Gurung, A., Pradhanang, A., Sedain, G., Shilpakar, S. K., & Sharma, M. R. Predictors of Outcome in Inter-hospital Transferred Neurosurgical Patients with Cranial Pathology in a University Hospital in Nepal. NJNS. 2026;23(1):27-34

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ISSN: 1813-1948 (Print), 1813-1956 (Online)

Introduction

Neurosurgery is a field where the time from the incident / symptom onset to the time of starting definitive treatment is crucial. So, timely and appropriate transfer of neurosurgical patients is a must for good outcomes. Inter-hospital transfer(IHT) of neurosurgical patients requires complex coordination among several patient management teams including emergency care physicians, neurosurgeons, ICU intensivists, paramedics, and prehospital care teams [(1)]. A well-coordinated and timely patient transfer significantly contributes to decreasing morbidity and mortality[(2)]. The indications for patient transfer in neurosurgery include the absence of neurosurgical services (necessary equipment, operating room facilities, and human resources), subspecialty or interdisciplinary requirements, patient preference, or financial constraints. Even with the availability of neurosurgeons throughout the country, there are only few hospitals that can deal with complex vascular diseases and

skull base surgery [3]. So, despite the increase in regionalization of medical care, the transfer of patients to tertiary centers is inevitable [4,5].

A safe transfer of patients starts once a decision to transfer is made followed by adequate communication between the referring and receiving hospitals.. Standard guidelines and transfer safety checklists have been published by several groups [6–8]. However, adequate communication with transfer requests is practiced in less than 1% of IHTs in low and middle-income countries (LMICs)[9]. In Nepal, the practice of safe transfer is evolving. Data on mode of transport has shown increased use of ambulances from 10% to 37 % [10–12]. However other aspects of safe transfer are not practiced adequately citing reasons as inadequate staff, financial issues or lack of awareness and training of emergency medical services [10,13].

Studies have shown that neurological deterioration can occur during transfer and the risk is increased if it is not safely practiced. A study by Alaraj et al showed that 10.8% patients deteriorated neurologically during transfer. There was an observed mortality of 99 patients (6.9%) among 1429 IHT neurosurgical patients. Multivariate analysis showed that age, hydrocephalus, use of anticoagulants or antiplatelet drugs, patient with known renal failure, and diagnosis of intracerebral hemorrhage (ICH) to be associated with worse outcomes and mortality [14]. Similarly, a study done at Tribhuvan University Teaching Hospital (TUTH) has shown 20% poor outcomes (mRS score 3-6) in IHT neurosurgical patients. Long duration of transfer(>48) hours was associated with a mortality of 10% which was higher than the overall mortality of IHT patients (2.8%) [15]. The lack of a structured and well-organized trauma referral system is one of the major causes of delay in delivering definite neurosurgical care for patients with head trauma [16,17].

Literature regarding the study to identify risk factors associated with poor outcomes of Inter-hospital transferred neurosurgical patients is sparse in Nepal. This study aims to study and analyze the risk factors that will help us to improve the quality of care in patient management regarding the safe transfer of brain-injured patients. Thus this study was conducted with the objective that the findings will be helpful for the implementation of strategies that would help decrease mortality and morbidity of neurosurgical patients and improve overall outcome.

MATERIALS AND METHODS

This prospective, observational and analytical study was conducted at the Department of Neurosurgery at TUTH over a period of one year(December 2022-December 2023).We included all adult (>16years of age) neurosurgical patients with cranial pathology transferred to TUTH emergency after referral from another hospital. Those patients who were not admitted to TUTH neurosurgical facilities were excluded from the study.
Study variables were recorded using a pro forma. All patients admitted to TUTH were managed according to the protocol of the Department of Neurosurgery and Critical care. Patients of ICH are managed as per AHA/ASA guidelines. The trauma patients are managed according to fourth edition of the Brain Trauma Foundation (BTF) with some modifications. Aneurysmal SAH patients are given options of endovascular intervention and surgery at admission. If patients opt for endovascular then they are facilitated to the appropriate centers. Patients of brain tumor are usually admitted for workup and surgery performed on semi elective basis except for those presenting with midline shift and features of cerebral herniation. The three month clinical outcome was evaluated using the modified Rankin scale (mRS) score. Clinical outcomes will be dichotomized into 2 groups.

a)Favourable outcome (mRS score 0-2)
b)Unfavourable outcome (mRS score3-6)

Ethical Consideration

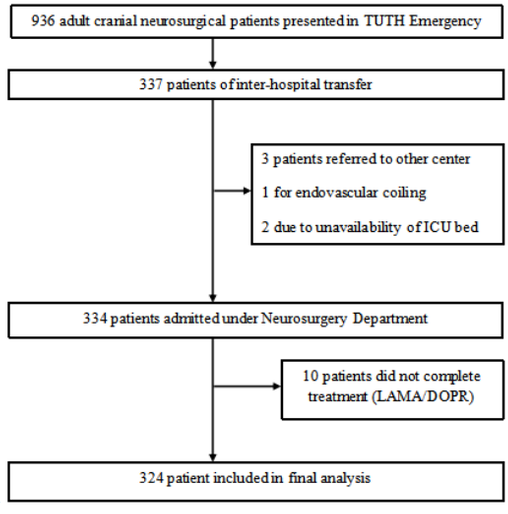
The study was conducted after the approval of the research proposal from the Institutional Research Committee of Tribhuvan University and Teaching Hospital. [Reference no: 253[6-11] E2]. All participants or legal guardians signed an informed consent form before being enrolled in the study. Confidentiality was maintained throughout data collection, analysis and thesis writing.

Statistical Analysis

The collected data was entered and analyzed in Statistical Package for the Social Sciences version 26.0 (SPSS v 26.0). Categorical variables were expressed as percentages and frequency. Continuous variables were expressed as mean with SD and median. A test of normality was done using the Shapiro-Wilk test.The Chi-square or Fisher exact test is used to test the significance of the association between categorical variables For non-normally distributed data, Mann Whitney U test was used. Bivariate and multivariate analysis was done to find the association between explorative variables and outcome. The level of significance was set as 0.05.

RESULTS

During the study period, 936 adult patients with cranial pathology presented to emergency department of TUTH. Out of this, 337 patients of inter-hospital transfer were assessed for eligibility. Three patients were referred from emergency to other hospital due to unavailability of ICU bed and endovascular services in our center. A total of 334 patients were admitted under Department of Neurosurgery. However, 10 patients did not complete the treatment in TUTH and were excluded from the study. So a total of 324 patients were enrolled in our study and included in final statistical analysis.



Figure

Demographics and Clinical Characteristics

The mean age of the patient was 56.90 ± 16.14 years (range 17-93 years). There was a preponderance of the male population of 61.7 % with a male-to-female ratio of 1.6:1.

Reasons for IHT

The most common reason for the transfer was a lack of neurosurgical facilities (n =236), financial constraints (n = 41), and trust issues (n =31). The reason for and frequency of IHT are shown in Table 1.

Table 1: Reasons for IHT

Reason	Frequency
No neurosurgical facilities	236 (72.8)
Financial constraints	41 (12.7)
Trust issues	31 (9.6)
Need for multidisciplinary care	6 (1.9)
Lack of ICU bed	2 (0.6)
Others	8 (2.5)

Geographical Distribution

Transfers were made from all seven provinces of Nepal with most of them from Bagmati province (55.6%) followed by Madesh province (14.8%). Within Bagmati, the highest number of transfers were from within the capital itself 80 (25%) followed by Dhading 29 (9%) and Nuwakot 19 (5.9%). Outside Bagmati province, transfer was highest from Janakpur 20 (6.2%) followed by Khotang 10 (3.1%).

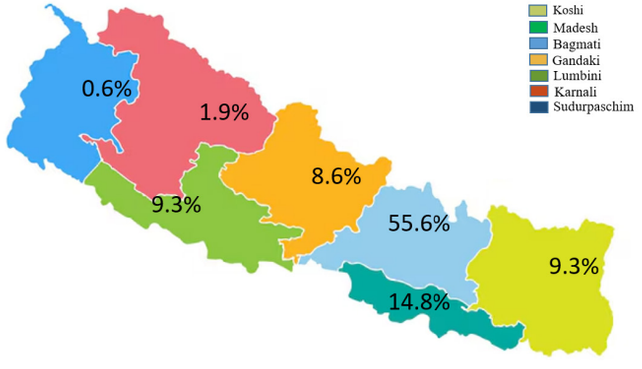


Figure 2: Geographical distribution of inter-hospital transfer patients according to province

Level of Referring Hospital

Based on the level of referring hospital, most of the patients were referred from primary 191(59%) followed by tertiary 85(26.2%) and secondary 48(14.8%).

Pre-transfer Management

Ninety patients (28%) had been evaluated by a neurosurgeon in the referring hospital. Most of the patients who had been reviewed by neurosurgeons were from Kathmandu (59 patients) followed by 6 from Pokhara, 5 from Chitwan, and 3 from Janakpur. A transfer call was made to the neurosurgeon on duty at TUTH before transferring patients in 7 (2.1%) patients. Four patients from Kathmandu and three patients from Pokhara were transferred after a telephone conversation. Before transfer, 85 (26.2%) patients had received some form of primary treatment in a referring hospital.

Mode of Transfer

Ground transfer was the most common mode of transfer in IHT patients. The commonest mode of ground transfer was ambulance in 290 (90%). None of the patients transferred via ambulance had a transfer checklist filled according to national ambulance guidelines. Ten patients were transferred via air. A total of 7 (2.1%) patients were transferred with accompanying medical personnel (paramedic, doctor or nurse). The median time of transfer for all patients was 5 hours (interquartile range [IQR] 3-6hours).

Table 2: Distribution of different Modes of transfer during IHT (n=324)

Types	Frequency
Ground transfer	
a.“क” Ambulance b.“ख” ambulance Patient transport vehicle	5 239 46
Private vehicle	20
Public vehicle	4
2.Air transfer	
Helicopter	7
Airplane	3

Events during Transfer

There were 10% reported events during the transport of patients. The most common was vomiting (7.1%) followed by a decline in consciousness (2.1%). One patient with extradural hemorrhage had a seizure during transfer and 3 patients with TBI had bleeding from scalp wounds.

Clinical Recordings at Admission

The median GCS recorded at the time of admission was 15(interquartile range 11-15). The median blood pressure, heart rate and oxygen level at the time of admission are given in the table 3.

Table 3: Blood pressure, Heart rate and Oxygen level at admission

Vitals	Median (IQR)
Systolic BP(mmHg)	160(130-180)
Diastolic BP(mmHg)	100(90-110)
Heart rate (bpm)	80(70-89)
SPO2 (%)	93(92-95)

Medical Comorbidities

A presence of one or more medical comorbidities was found in 216 patients. Seventeen patients were found to use blood thinners (anticoagulant or antiplatelet drugs).

Imaging

A total of 23 patients had hydrocephalus on CT scan at admission.

Diagnosis and Management in TUTH

The most common diagnosis included Intracerebral hemorrhage in 211 (65.1%) followed by TBI in 55 (17%) and aneurysmal subarachnoid hemorrhage in 23 (7.1%). Out of 324 patients, surgery was advised in 106 patients. However, a total of seven patients refused the surgical option. Ninety-nine patients underwent surgical intervention. The most commonly performed procedure were craniotomy and hematoma evacuation 36 (36.4%), craniotomy and microsurgical clipping of aneurysm 21 (21.2%), and burr hole and hematoma drainage 13 (13.1%). The median time to surgery after arrival in hospital was 7.5 hours (IQR 4-33 hours).

Table 4: Diagnosis at admission

Diagnosis	Frequency
Intracerebral hemorrhage	211 (65.1)
Traumatic Brain Injury	55 (17)
Mild TBI Mild complicated TBI Moderate TBI Severe TBI	11 28 6 10
Aneurysmal subarachnoid hemorrhage	23 (7.1)
Chronic subdural hematoma	16 (4.9)
Brain tumor	8 (2.5)
Tubercular meningitis with hydrocephalus	5 (1.5)
Malignant cerebral infarction	4 (1.2)
Brain abscess	2 (0.6)

Outcome

An overall mortality of 46 (14.2%) patients was recorded over 3 months. The distribution of mRS at 3 months is shown in Figure 3. The outcome was dichotomized into favorable and unfavorable based on the mRS score. Overall 41% of the study population had unfavourable outcomes of mRS ≥ 3. An overall mortality of 46 (14.2%) patients was recorded over 3 months. The distribution of mRS at 3 months is shown in Figure 3. The outcome was dichotomized into favorable and unfavorable based on the mRS score. Overall 41% of the study population had unfavourable outcomes of mRS ≥ 3.

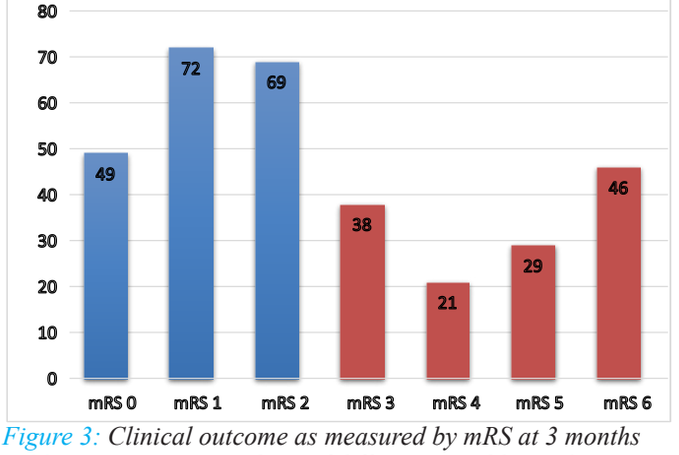


Figure 3: Clinical outcome as measured by mRS at 3 months

Table 5: Univariate analysis of different variables with

Baseline characteristics	Favourable outcome mRS≤ (n=190)	Unfavourable outcome mRS≥3(n=134)	Total n=324	p-Value
Age				
Mean± SD	55.6± 16.4	58.7± 15.6	56.9± 16.1	p=0.23
Sex				
Male	119	81	200	p=0.69
Female	71	53	124	
Neurosurgery consult before transfer				
Yes	50	40	90	p=0.48
No	140	94	234	
Pre-referral treatment				
Yes	51	34	85	p=0.69
No	139	100	239	
Medical personnel during the transfer				
Yes	3	4	7	p=0.45
No	187	130	317	
Event during transfer				
Yes	19	15	34	p=0.73
No	171	119	290	
Arrival GCS				
Median(IQR)	15(14-15)	12.5(9-15)	15(11-15)	p<0.001
Duration of transfer (hours)				
Median(IQR)	5(1-6)	5(2-6)	5(3-6)	p=0.215
Time to surgery (hours)				
Median(IQR)	8.5(4.2-48)	6(4-9)	7.5(4-33)	p=0.065
Systolic BP (mmHg)				
Median(IQR)	160(128-180)	162(140-190)	160(130-180)	p=0.002
Diastolic BP(mmHg)				
Median(IQR)	95(80-95)	100(90-120)	100(90-110)	p=0.002
Heart rate(bpm)				
Median(IQR)	80(77-90)	80(67-89)	80(70-89)	p=0.098
SPO_2(%)				
Median(IQR)	93(92-95)	92(92-94)	93(92-95)	p=0.663
Medical comorbidity				
Yes	115	101	216	p=0.005
No	75	33	108	
Presence of hydrocephalus				
Yes	12	11	23	p=0.513
No	178	123	301	
Use of blood thinner				
Yes	8	9	17	p=0.319
No	182	125	307	
Diagnosis				
ICH	106	105	211	p=0.001
Non-ICH	84	29	113	

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on univariate analysis were included in a multivariable logistic regression model (table 6).

Table 6: Multivariate logistic regression analysis to find the association between variables and outcomes

Variables	Odds ratio	95% CI
Medical		
co-morbidity	1.2	0.6-2.6
Systolic BP	1.0	0.9-1.0
Diastolic BP	1.0	0.9-1.0
GCS on arrival	0.7	0.7-0.8
Diagnosis	2.7	1.2-5.7

DISCUSSION

This study describes the current state of affairs regarding the inter-hospital transfer of neurosurgical patients in Nepal with special emphasis on outcome. With increasing healthcare facilities spread across Nepal in the last 20 years, the aspect of IHT is more common [5]. This holds especially in neurosurgery as many hospitals in the periphery either do not have neurosurgeons or lack neurosurgical armamentarium including imaging or critical care services [4]. There is a lack of proper referral mechanisms in Nepal which affects the timely management of neurosurgical patients and ultimately patient outcomes [3].

Our series describes the demographic and clinical characteristics, different modes of transfer, management, and outcome of IHT with cranial pathology in a major university hospital in Nepal. Though a small series from a global perspective, this is the largest series of IHT patients from a single center in Nepal and serves to give a perspective on how inter-hospital transfer is being practiced in the Nepalese context.

Demographics

Our study included 324 adult IHT patients with cranial pathology. This constitutes 36% of all neurosurgical admissions from emergency. The previous study by Sah et al from TUTH in 2021 showed a much higher number of IHT patients (75%) (12). The difference is probably explained by the fact that only patients with cranial pathology were included in the present study. There was a male preponderance (61.7%) in our study with a median age of 56.9 ± 16.1 years for both sexes. An earlier study by Sah et al showed equal sex distribution and a mean age of 42 years (12). Our study showed that the majority of the patients (75.0%) were referred from outside Kathmandu. There were transfers from all seven provinces of Nepal with Bagmati (55.6%) being the highest followed by Madesh (14.8%). District-wise, the highest referral was from Kathmandu 80 (25%) followed by Dhading 29 (9%), Janakpur 20 (6.2%), and Nuwakot 19 (5.9%). Dhading and Nuwakot are the surrounding districts of Kathmandu Valley and lack neurosurgical facilities and account for a larger number of referrals. However Janakpur district even having neurosurgical services, had also a high number of referrals. On further interviewing the patients and relatives from Janakpur, most of them were not aware of these services in their area.

Reasons for Transfer

The most common reason for IHT in our study was the unavailability of neurosurgical facilities (73.0%). This factor remains unchanged compared to our previous report which showed 77.4% of IHT were due to the unavailability of neurosurgical facilities [12]. Studies on the neurosurgical workforce of Nepal have demonstrated that there is increased availability as well as accessibility to neurosurgical services in Nepal [4,5]. However, more than half of the neurosurgeons are centered within Kathmandu [5]. Our study showed 75.0% of patients being transferred from outside Kathmandu which explains the fact that unavailability of neurosurgical services remains the most common reason for IHT. The next most common cause of transfer was financial constraint (12.7%) which is corroborated with previous studies [18,19]. Our hospital being a government university hospital provides surgical care at subsidized rates which is affordable to patients [20].

Transfer Details

The most common mode of transfer was ground transfer (97.0%) in our study with the majority of the patients transferred via an ambulance (90.0%). Compared to the previous studies on the use of ambulances for transfer(31-43%), utilization of ambulance services increased [10,12,13]. There has been an improvement in the transport of critically ill patients to the hospital with the introduction of 3-digit toll-free numbers for ambulance service and the extension of services within and outside Kathmandu by Nepal Ambulance Services [21]. There were 3.0% instances of air transfer in our study with the majority of them being from the Khotang district. Khotang is a hilly district in eastern Nepal which is 340km far from Kathmandu.

Only 2.1% of all IHT in our study, patients were accompanied by a paramedic. This is similar to another study from India which has shown that only 3.6% of cases are accompanied by either a paramedic or nurse [22]. Another study from South India has shown that 87.1% of transfers were unaccompanied [23]. A study done in Pakistan regarding ambulance use found that only 4.1% of the patients were accompanied by the ambulance [24]. Also, previous studies on IHT from Nepal have shown that majority of the ambulance (70.0%) do not have licensed paramedic onboard during transport [25,26]. The ambulances are poorly staffed, under-resourced and ambulance driver lack formal training and credentialing. None of the transfer done via ambulance in our study had a checklist filled at transfer as per the National Ambulance Guidelines. This data shows that Emergency medical services (EMS) in Nepal are still in infancy. There were 10% events reported during the transfer of patients in our study. A study done among IHT of brain-injured patients in 2012 showed 36% of events noted during transfer with most of them being hemodynamic instability requiring some form of intervention [27]. Alaraj et al have shown that 10.8% of patients have neurological decline and 6.9% of mortalities reported during IHT of neurosurgical patients [14]. The mortality during transfers is not reported in our study. The events in our study were reported by the patient party and not medical personnel. Since the majority of the transfers (96.4%) were unaccompanied by health workers, the hemodynamic events were not recorded and thus not reported in our study. Although the analysis of any event during transfer and clinical outcome did not reach statistical significance in our study, the need for a trained health worker during the safe transfer of a patient cannot be underestimated.

A pre-transfer call was made in only 3% of all IHTs in this study. These findings are consistent with literature from neighboring nations showing pre-transfer communication made in 1-3% of all transfers [22,28]. However, analysis of pre-transfer communication and outcome did not reach significance in our study. A small sample size for analysis may have resulted in non-significant findings. In our study, we had 2 patients of IHT who were subsequently referred from TUTH ER due to the unavailability of an ICU in TUTH. This could have been avoided if a pre-transfer communication was made.

The median duration of transfer was 5 hours (IQR 3-6). Since most of the transfers were made from within Bagmati province, the median time was 5 hours. Analysis of the duration of transfer and outcome did not reveal any statistical significance in our study. This is similar to other studies that have shown that delay in treatment did not affect overall outcome [29,30]. Our study shows that only 28% of patients had been evaluated by a neurosurgeon prior to transfer. However analysis of pre-transfer neurosurgical consultation and clinical outcome did not show any significance in this study. Previous studies on pre-transfer screening of patients by neurosurgeons prior to transfer have demonstrated that there is decreased cost and unnecessary transfer in screened patients although the length of stay and outcome remains same [31,32]. Our data shows lack of communication among doctors in referring and receiving hospital during transfer. Some form of pre-referral treatment was received by only 26%patients. However this did not affect the clinical outcome in statistical terms.

Diagnosis

Intracerebral hemorrhage was the most common diagnosis in IHT patients accounting for 65.1% of cases. This is similar to other literature that shows up to 73% of ICH constitute IHT[18,33]. Other common diagnoses in our study include TBI (17%), aneurysmal SAH (7.1%), CSDH (4.9%), brain tumor (2.5%), TB meningitis (1.5%), Malignant ischemic stroke (1.2%) and Brain abscess (0.6%). A previous study by Sah et al done at TUTH had 47.1% cases of TBI followed by aneurysmal SAH in 18.6% and ICH in 10%.(12)The referral of TBI has decreased compared to the past possibly due to the increased road safety measures and increased availability of neurosurgeons throughout the country [7,33]. Aneurysmal SAH remains another most common transfer group of patients with standard guidelines from AHA/ASA recommending transfer and management of SAH patients to a tertiary center [34].

Clinical Presentation at Admission

The mean systolic blood pressure (SBP) and diastolic blood pressure (DBP) at admission in our study were 157.58 ±31.57 and 99.30 ± 20.56 respectively. Since the majority of our diagnosis was ICH in our study, the findings of both high SBP and DBP are similar to another study which shows a high BP associated with patients in this subgroup. A study done in Nepal has shown mean SBP and DBP in patients with ICH to be 174.01±25.7 and 103.2±15.6 [35]. The mean SBP and DBP in INTERACT trail is 179±17mmHg and 101±15 mmHg [36]. Although the admission SBP and DBP were found to be associated with poor outcomes in univariate analysis, this did not reach statistical significance on multivariate analysis. The possible explanation of high BP in the neurosurgical patients include cerebral autoregulatory response to increase cerebral perfusion pressure , Cushing's reflex in response to raised ICP, sympathetic response , underlying chronic hypertension or damage to different areas of brain [37]. The median SPO2 in our study was 93 %(IQR 92-95) and median heart rate was 80bpm (IQR70-89). Both of the parameters did not show statistical significance to clinical outcomes.

Risk Factors for Poor Outcome

Medical comorbidities were recorded in this study and dichotomized into patients having or not having any medical comorbidities. A total of 216 patients had the presence of comorbidities. The presence of comorbidities was found to be statistically significant in univariate analysis, however did not reach statistical significance in multivariate analysis. Other risk factors such as the presence of hydrocephalus and the use of drugs (anticoagulant or antiplatelet) did not achieve statistical significance in our study. This is in contrast to the study by Alaraj et al on cranial IHT patients which showed that medical comorbidities/hydrocephalus and the use of blood thinners were associated with poor outcomes. Significant predictors of neurological deterioration were hydrocephalus (P = .005, OR 2) and use of clopidogrel (P = .003, OR 4.3), warfarin (P = .004, OR 2.6), or other systemic anticoagulants (P < .001, OR 10.1) and presence of renal failure (P = .05, OR 2.3) (14).

Clinical Outcome

The mortality recorded in our study is 14.2% and the unfavorable outcome is 41%. Mortality was similar to the previous study which showed 12.9% mortality [12]. However unfavorable outcomes were high compared to the previous study from TUTH which showed 20% [12]. Similarly, another study by Acharya et al showed 33.7% poor outcomes in neurosurgical patients admitted to the ICU in TUTH [38]. A study on IHT of neurosurgical patients has shown a mortality of 6.9 and an unfavorable outcome of 10.8% [14]. In our study, more than half of the patients had a diagnosis of ICH which may explain the high incidence of poor outcomes in our results. The incidence of unfavorable outcomes in ICH in the largest multicentric randomized trial comparing medical vs. surgery is 59-76% [39,40]. The diagnosis of IHT patients was dichotomized into ICH and non-ICH groups. On statistical analysis, univariate and multivariate analysis showed that diagnosis of ICH had higher odds of having poor outcomes (OR 2.7, CI 1.2-5.7). This finding is similar to a study done on IHT neurosurgical patients with cranial pathology by Alaraj et al, which showed diagnosis of ICH to be associated with worse outcomes, with neurological deterioration (P < .001; OR 3.37 [2.36-4.81], and death (P = .003; OR of 2.01 [1.28-3.18]). [14] A similar study done on critically ill IHT patients admitted to NeuroICU had also shown ICH to be a predictor of poor outcome in hospital discharge(OR 2.12[1.05-4.29];p=0.025) [41].

Limitations

Firstly, this is a single-center study though our hospital caters to a large number of patients, the unavailability of ICU and dedicated endovascular services precluded us from admitting some patients which could have potentially altered the results. Secondly, other specialized centers are providing neurosurgical services within Kathmandu and receiving neurosurgical referrals. So, the studied sample may not represent the status of IHT neurosurgical patients in Nepal. Thirdly, due to the time constraints, we could follow the patient only up to 3 months for

outcome analysis.

CONCLUSION

Inter-hospital transfer of neurosurgical patients remains a common practice due to the centralization of neurosurgical services in Nepal. Glasgow coma scale on admission and diagnosis of intracerebral hemorrhage was found to be associated with poor outcomes in this subset of patients. Our study sheds light on factors that need to be taken care of during the inter-hospital transfer of neurosurgical patients and subsequent initiatives for quality healthcare improvement. Our data suggest numerous opportunities for improvement of transfer efficiency. The status of inter-hospital transfer of neurosurgical patients was found to be poor and not complying with the standard recommendations. There was a lack of practice in terms of key elements of safe transfer like pre-hospital management, communication, choosing appropriate transport mode, continuity of care during transport, and finally documentation and handover at the receiving facility. This study highlights the room for improvement in the inter-hospital transfer of neurosurgical patients in Nepal. Further improvement may be achieved by better communication between the referring and receiving hospital before the transport is initiated and by strict adherence to checklists and published guidelines. Developing inter-hospital transfer protocols may be an effective strategy to efficiently allocate limited hospital resources and improve transfer systems.

ACKNOWLEDGEMENT

We are thankful to the participants of the study

FUNDING: No funding was obtained for the study

DISCLOSURES: Authors have nothing to disclose.

CONFLICT OF INTEREST: None.

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