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Temporal delay in neurosurgical patients and outcome in a tertiary care center in Nepal

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ABSTRACT

Background: Neurosurgery is a field where time from the incident to get treatment is very crucial. In low-income countries, the referral system is not well developed. In our country, a proper referral system is in the initial phase of development. We conducted a study assessing the number of visits a neurosurgery patient made before finally reaching to our center.

Methods: This is a prospective observational study involving seventy patients, conducted at Tribhuvan University Teaching Hospital, Kathmandu, Nepal. Demographic characteristics, neurological diagnosis, and numbers of other centers the patients visited and outcome at discharge and in one month was assessed.

Results: Thirty-five (50%) patients were males. Thirty-three (47.1%) patients were admitted due to head injury and 13 (18.5%) were diagnosed with subarachnoid hemorrhage. Surgery was done in 32 (45.7%) patients. Fifty-three (75.7%) patients were transferred from other hospitals. Out of 53 patients, 30 (56.6%) and 17 (32%) had visited to one and two hospitals respectively. Unavailability of the neurosurgery facility was the main reason (77.4%) for the transfer. Overall mortality was 12.9%. The trend for mortality and length of hospital stay was higher in the group who visited other centers before coming to us than those who came directly.

Conclusions: Visiting multiple hospitals where there is no neurosurgical service available is an important reason for delay. There is a need to develop neurosurgical facilities in the different parts of the country along with establishment of an effective referral mechanism.

Keywords: Delay; Nepal; neurosurgery; outcome; prospective study

INTRODUCTION

Time from the incident to receiving definitive treatment is crucial in neurosurgical emergencies.[1-3] In severe traumatic brain injury (TBI), hypoxia and hypotension are detrimental. There are many literatures suggesting a direct correlation between temporal delay and worse outcome.[4-7] According to the Brain Trauma Foundation guidelines, surgery for acute subdural hematomas (SDHs) and acute epidural hematomas (EDHs) should be done without delay to address severe TBI patients which has been replicated by studies.[1,8,9] A systematic review showed better functional recovery and higher survival rates by aggressive timely surgical interventions.[10]

Lack of organized trauma system is the main reason for delay in receiving definitive care.[11] In Nepal, the referral system is not well established yet. This study was conducted to determine the factors related to temporal delay in receiving definitive neurosurgical care and prehospital transport modalities. This study will reflect some burning issues in the delay in getting the appropriate treatment for neurosurgical patients in Nepal.

METHODS

This was a prospective observational study conducted at Tribhuvan University Teaching Hospital (TUTH) from April 2019 to June 2020 (3 months). All patients who were admitted through Emergency Department were included in the study. Ethical approval was obtained from the Institutional Review Committee of Institute of Medicine, Nepal, prior to patient recruitment. An informed consent was taken for the conduct of this research either from the patient or legal guardian. All patients were treated as per the protocol of the Department of Neurosurgery, TUTH. A pro forma was used to collect the data.

The variables included patient demographics (age, sex),

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mode of injury, Glasgow Coma Scale (GCS) at admission, symptoms, initial diagnosis, type of health care facilities visited, time intervals (time of ictus to the first health care, time of ictus to our Emergency room (ER), ictus to surgery (if operated)), reason for transfer, mode of transfer and the type of vehicle used, number of hospital transfer, management (surgery/conservative/referred) in the referring facility, duration of hospital stay at our hospital, and the outcome (mRS at discharge and in 1 month).

Severity of TBI was stratified by admission GCS level: mild (GCS 13-15), moderate (GCS 9-12), and severe (GCS 3-8). The outcomes of the patients were analyzed at discharge and in one month using mRS and were categorized as those with good (mRS 0-2) and poor outcomes (mRS 3-6).[12112] For the EDH and acute SDH patients, separate analysis was done since these patients often need urgent surgery and prognosis greatly depends on the time since injury.

Statistical analyses were performed using Stata version 21.0 (Stata Corp, College Station, Texas). Descriptive statistics were used to describe patient characteristics and time lags. Time interval for the EDH and SDH and brain contusion leading to significant mass effect with life threatening condition and thus was analyzed separately.

RESULTS

There was a total of 70 patients. There was equal sex distribution and age ranged from 1 to 84 years (mean 42 years). Thirty-three (47.1%) patients were admitted due to TBI (mild, moderate and severe were 25 (35.7%), 3 (4.3%), and 5 (7.1%) respectively). Thirteen (18.5%) patients had subarachnoid hemorrhage (SAH) followed by intracerebral hemorrhage (ICH) and others as shown in Table 1. Among the patients with TBI, 10 (12.8%) patients had EDH, 3 (4.2%) acute SDH, 6 (8.5%) brain contusion, 2 (2.8%) compound depressed fracture, 2 (2.8%) simple depressed fractures, and 1 (1.4%) traumatic cerebro-spinal fluid (CSF) rhinorrhea.

Table 1. Admitting diagnosis of patients (n = 70).

Diagnosis	Frequency (%)
TBI	33 (47.1)
Subarachnoid hemorrhage	13 (18.6)
Intracerebral hemorrhage	7 (10.0)
Spine injury	6 (8.6)
Neurocysticercosis	2 (2.9)
Brain tumor	2 (2.9)
Others	7 (10.0)

TBI = traumatic brain injury

Out of 70 patients, surgery was done in 32 (45.7%) and 37 (52.8%) were managed conservatively and 1 (1.4%) patient was referred elsewhere. Among TBI patients, craniotomy was done in 11 (33.3%) and other surgeries done are described in Table 2.

Table 2.Types of surgical procedure done (n =32).

Types of surgery	Frequency (%)
Craniotomy and evacuation of hematoma	9 (12.9)
Craniotomy and microsurgical clipping of aneurysm	7 (10.0)
Decompressive craniectomy	3 (4.3)
Posterior instrumentation	3 (4.3)
Burr hole and evacuation of hematoma	2 (2.9)
Craniotomy and elevation of depressed fracture	2 (2.9)
External ventricular drain	2 (2.9)
Others	4 (5.7)

Out of 70 patients, 17 (24.3%) came directly to our hospital whereas 53 (75.7%) patients were transferred from other hospitals. Patients visited to 1, 2, 3, 4 and 5 hospitals before reaching to our centers were 30 (56.6%), 17 (32%), 4 (7.5%), 1 (1.9) and 1 (1.9%) respectively. The reason behind the transfer is as shown in Table 3. The majority went to a hospital where there was no neurosurgical facility (n=41 (77.4%)) and then were referred either to our hospital or elsewhere. “Unavailability” means no neurosurgery department. “Better facility” means either the patient wanted to get treatment in “famous” hospital though he/she could have been managed in previous hospitals like private hospitals in their own hometown. Or in few hospitals there were neurosurgeons but they could not perform complex cases. In some situation the patient had to be referred because the multi-specialty care was not available there.

Table 3. Reasons for transfer.

Reason for transfer	Frequency (%)
Unavailability of Neurosurgery	31 (58.5)
Unavailability of Neurosurgery, better facility*	8 (15.0)
Considered better facility	7 (13.2)
Financial constraints	4 (7.6)
Unavailability of Neurosurgery, economy*	2 (3.8)
Unavailability of ICU bed	1 (1.9)

**Patients who visited more than one centers and reason for transfer from each facility.*

The patient who went to 5 hospitals before coming

to TUTH was a 50-year-old female who had SAH. She was taken to the first hospital within 2 hours of ictus. Because of unavailability of neurosurgery facility there, she was transferred to successive 4 hospitals. In the fifth hospital she was diagnosed with ICA aneurysm. Because of the financial constraints she then came to our center for further treatment and the time taken for her to reach our center was 168 hours.

As shown in Table 4, the average time to reach from the ictus/trauma to first hospital was 18 hours and then to our hospital 58 hours. Mean time from the ictus to admission to our center was 64 hours and to surgery was 142 hours. On separately analyzing the patients with EDH and SDH, the mean time from ictus to surgery was 18 hours.

Table 4.Time intervals from ictus/trauma to arrival to hospitals.

Time interval	Frequency (N)	Minimum (hour)	Maximum (hour)	Mean (hour)
Ictus to our ER (EDH/ SDH)	10	3	46.75	17.91
Ictus to admission	70	1.75	483	64.13
Ictus to first hospital	70	0.25	240	18.39
Ictus to our ER	70	0.16	480	58.75
Ictus to surgery	33	1.0	678.58	142.13

EDH - epidural hematoma; SDH - subdural hematoma; ER - emergency department

Only 26 (37.1%) patients used ambulance for reaching the first hospital while others used rented vehicles (e.g., car, taxi). None used air transport system. Outcome was assessed using mRS at discharge and in 1 month. Good mRS was seen in patients who were transferred without delay both at discharge and in 1 month as shown in Table 5.

Table 5.mRS at discharge and in 1 month.

	Good mRS (0-2)		Poor mRS (3-6)	
	Direct	Indirect	Direct	Indirect
At discharge	13/17 (76.4)	40/53 (75.5)	4/17 (23.5)	13/53 (24.5)
At 1 month	14/17 (82.4)	42/53 (79.3)	3/17 (17.6)	11/53 (20.8)

Overall mortality was 12.9% (one (1.4%) patient with brain tumor resection, 2(2.8%) with EDH, 1 (1.4%) with acute SDH, 4 (5.7%) with spontaneous lobar ICH with intraventricular extension (IVE), and 1 (1.4%) with spine injury). Only 2 patients died who were brought directly to our center. As the number of patients was too small, it was not, however, possible to make a statistical conclusion. Average hospital stay was longer by 2 days in the delayed group as shown in Table 6.

Table 6. Average hospital delay and mortality in direct and delayed patients.

Hospital transfer	Patients (n %)	Average hospital stays (days)	Mortality
Direct	17 (24.3)	11.93	2 (2.9%)
Delayed	53 (75.7)	13.68	7 (10%)
Total	70 (100)		9 (12.9%)

DISCUSSION

There is substantial evidence in the literature that in neurosurgical emergencies, time from the incident to definitive care is very crucial.[4-7] In a systematic review of studies on traumatic SDHs and EDHs with bilateral fixed and dilated pupils, despite the high mortality and morbidity, better functional recovery could be achieved in addition to higher survival rates by aggressive timely surgical interventions.[10]

We defined delay as a period >2 days from referral recommendation to either referral execution or referral non execution with the patient still alive 2 days after the recommendation.[13] In our patient population, the time to reach from the ictus to first hospital was about 18 hours and to our hospital 58 hours. A study published from India shows similar delay in transfer. [14] Studies published from high income countries (HICs) also show delay in transfer but of shorter duration.[4,7,11,14,15] The reasons for the delay in our context are multifactorial. Long distance to travel, limited (and costly) availability of air transport system, less than optimal road conditions, and ignorance and lack of proper dissemination of information regarding availability of neurosurgical facility are the most important factors. Some diseases could only be treated in the major centers (e.g., complex vascular) so that even neurosurgery facility being available, some patients needed to be transferred. This reflects that the neurosurgery centers with the capability to handle complex cases should also be established in the major cities in Nepal. Another most important factor is the lack of well-organized trauma system.[11] Only 17 (25.7%) patients came directly to our center and majorities were referred and the cause mostly was that neurosurgery facility was not in the hospitals they went first. This is in sharp contrast to HICs where the patients are taken to the definitive care facility directly from the trauma/ ictus scene. Only 26 (37.1%) patients used the ambulance

to reach the hospital. The majority used rented vehicles like car or taxi.

For severe TBI patients with acute SDH, the mortality rate for patients who received surgery within 4 h of injury in the United States was between 30% and 47% compared to 80% to 90% when surgery was delayed beyond 4 hours.[1,9] For severe TBI patients with EDH, the mortality rate increased from 17% to 65% when the duration between the onset of coma to surgical decompression was delayed beyond 2 hours.[9] Ten patients with EDH were admitted and 6 were operated and 2 (33%) died. Four patients with acute SDH were admitted and 3 were operated and 1 (33%) died. Mean time from incident scene to surgery was 17.13 hours which is much higher than that published from HICs.[3,7,14] Mortality was higher in our study than published in literature.[4] In addition to the high mortality associated with an initial severe TBI presentation, the rate of neurological status deterioration throughout the hospital stay has also been highly predictive of poor outcomes.[16]

In low-income countries like Nepal, where neither all hospitals are well equipped with the instruments needed for surgeries of spine and cranium nor they have neurosurgeons available, this study gives a baseline data on temporal delay. When the patients suffer trauma, they are primarily taken to nearby primary health care center, then referred to unspecified hospitals in other cities as per family or relative's suggestion. In these cities as well, they are again referred and finally reach that center where they get eventual treatment. During these long transfers there is a potential for significant neurological deterioration of even death. Examples include, patients with unstable fractures and patients with subdural and epidural hematomas. This study is an attempt to analyze the current status of the transfer system and degree of delay in getting the definitive neurosurgical care in Nepal. However, this is a single center study done at TUTH and does not reflect the experience of other major neurosurgical centers in Nepal. In addition, our sample size is not large enough to do subgroup analysis (e.g., to compare the outcome of the patients who came directly to us and to those who had a delay due to visiting other hospitals). Further larger studies involving multiple centers to look at the important problems are recommended.

CONCLUSIONS

Visiting multiple hospitals where there is no neurosurgical service available is an important reason for delay. There is a tendency for poor outcome in patients who suffered temporal delay due to various reasons. There is a need to develop neurosurgical facilities in the different parts of the country along with establishment of an effective referral mechanism to address this issue.

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