

## Factors affecting Mortality in Neurosurgical ICU of Manipal Teaching Hospital, Pokhara, Nepal.

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Received: April 20, 2019

Accepted: May 20, 2019

Published: July 30, 2019

### How to cite this article:

Karmacharya B, Yogi N, Baral P et al. Laparoscopic Needle assisted Repair of Inguinal Hernia in Children in Manipal Teaching Hospital, Pokhara. *Nepal Journal of Medical Sciences* 2019;4(2):25-31

## ABSTRACT

**Introduction:** Mortality is an important self-assessment tool in medical practice. This study assesses various factors associated with mortality in Neurosurgery ICU (NS-ICU).

**Methods:** A prospective, cross-sectional study was carried out from January 2017 to December 2017 in 416 patients admitted to NS-ICU. The age, sex, diagnosis, GCS, pupil's abnormality, vital parameters, laboratory parameters, comorbidities were compared in between mortality and survival group. The individual component of GCS was further evaluated.

**Results:** Out of 416 patients, 374 (89.90%) patients were in survival group and 42 (10.10%) patients in mortality group. Trauma 188(45.20%) and Cerebrovascular accident 133(31.97%) were commonest diagnosis on admission. The GCS, eye-opening and motor component of GCS, abnormal pupils, hypertension (HTN), diabetes mellitus (DM), diastolic blood pressure (DBP), heart rate (HR), operated cases and serum urea levels were found to have significant difference between mortality and survival group. These parameters were further subjected to binary logistic regression which showed DBP (B-0.01, p=0.00), HR (B0.02, p=0.00), motor score of GCS (B-0.50, p=0.04), operated cases (B 1.13,p=0.00), abnormal pupils (B1.85,p=0.00), DM (B1.56, p=0.00) to have significant association with mortality.

**Conclusions:** High heart rate, low diastolic BP, low motor score of Glasgow Coma Scale, abnormal pupils, diabetes mellitus and operated cases were found to be significantly associated with mortality.

**Key words:** Intensive care unit; mortality; neurosurgery.

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## INTRODUCTION

Mortality has been a key quality measure of a hospital ever since Florence Nightingale first created a league table to compare mortality rates of various London hospitals in the mid-19<sup>th</sup> century.[1,2]

Death is a prominent and undesirable outcome in medical institutions and increased mortality rates compared to other similar units denotes poor quality care of the unit concerned. It shows the need of self-assessment and introspection to formulate measures to bring changes in level of care.

This study assessed various factors associated with mortality in our Neurosurgery Intensive Care Unit (NS-ICU) and compared it with data available for similar facility within and outside the country.

## METHODS

A prospective cross-sectional study was carried out from January 2017 to December 2017 after approval from the institutional review board. A total of 416 patients were admitted during the study period in Neurosurgery ICU (NS-ICU) of Manipal Teaching Hospital, Pokhara, Nepal. Various patient characteristics (age, sex) and clinical characteristics (diagnosis, Glasgow Coma Scale; GCS, pupillary abnormality, vital parameters, laboratory parameters, comorbidity) were compared in between two groups; mortality and survival group. The components of GCS were also individually studied in terms of eye opening score, motor score and verbal score to see the effect of individual components in mortality. Abnormal pupils were defined as unreactive and dilated pupils. Patients who went home or to other center either referred or against medical advice were excluded from the study.

Statistical analysis was done using IBM SPSS 20.0 software. All the parameters of the

patients were tested for association in two outcome groups using student's t test for quantitative variables and chi square or Fischer Exact test whichever applicable for categorical variables. All the variables showing significant association were subjected to binary logistic regression. P-value  $\leq 0.05$  was considered statistically significant.

## RESULTS

Out of 416 patients included in the study 374 (89.90%) patients were in survival group and 42 (10.10%) patients in mortality group. The diagnosis at the time of admission in Neurosurgical Intensive Care Unit (NS-ICU) has been tabulated in Table 1.

The demographic and clinical variables are presented in Table 2.

The laboratory and vital parameters among the study groups are presented in Table 3.

Diastolic blood pressure (DBP), Heart rate (HR) and serum urea were found to have significant difference in between the groups.

All the parameters showing significant statistical difference were subjected to binary logistic regression and those having significant associations with mortality are tabulated in Table 4.

Diastolic blood pressure, Heart rate, motor score of GCS, Operated group, abnormal pupils and Diabetes mellitus were the parameters found to have significant association with mortality in our study.

**Table 1. Diagnosis at the time of admission in Neurosurgery ICU during study period**

Diagnosis	Number (%)	Diagnosis	Number (%)
Head Injury	145 (34.86%)	Hydrocephalus	4(0.96%)
Spinal Injury	30(7.21%)	CSDH	9(2.16%)
Polytrauma	13(3.13%)	PIVD	11(2.64%)
Intracerebral Hemorrhage	122(29.33%)	Seizure	20(4.80%)
Ischemic stroke	7(1.68%)	NPH	2(0.48%)
Tumor	20(4.81%)	Sinus Venous Thrombosis	4(0.96%)
Spinal Tumor	1(0.24%)	Brain Abscess	2(0.48%)
Aneurysm	12(2.88%)	Post Decompressive	3(0.72%)
AVM	1(0.24)	Tubercular Meningitis	1(0.24%)
Angionegative SAH	4(0.96%)	Transverse Myelitis	1(0.24%)
Neuroglia Cyst	3(0.72%)	Hemifacial Spasm	1(0.24%)

AVM: Arteriovenous Malformation, SAH: Subarachnoid Hemorrhage, CSDH: Chronic Subdural Hemorrhage, PIVD: Prolapsed Intervertebral Disc, NPH, Normal Pressure Hydrocephalus, Trauma (Head Injury, Spine Injury, Polytrauma)

**Table 2. Demographic and clinical variables.**

S.N	Variable	Survival Group	Mortality Group	P value
1	Age Category			0.97
	<16 Years	43(11.5%)	5(11.9%)	
	16-55 Years	181(48.4%)	21(50%)	
	>55 Years	150(40.1%)	16(38.1%)	
2	Sex			0.39

	Male	249(66.6%)	31(73.8%)	
	Female	125(33.4%)	11(26.2%)	
3	Diagnosis			0.36
	Trauma	173(46.3%)	15(37.5%)	
	Cerebrovascular	116(31%)	17(40.5%)	
	Accident	85(22.7%)	10(23.8%)	
	Others			
4	Operated cases	127(34%)	25(59.5%)	0.00
5	GCS			0.00
	3-8	34 (9.10)	10 (23.80%)	
	9-12	68(18.20%)	10(23.80%)	
	13-15	272 (72.70%)	22(52.40%)	
6	Eye Score	3.57 ± 0.928	3.12 ± 1.29	0.03
7	Verbal Score	4.14 ± 1.400	3.79 ± 1.52	0.12
8	Motor Score	5.51 ± 1.040	4.57 ± 1.76	0.00
9	Abnormal Pupils	38(10.20%)	19(45.20%)	0.00
10	Hypertension	81(21.7%)	21(50%)	0.00
11	Diabetes Mellitus	34(9.1%)	17(40.50%)	0.00

Eye score, verbal score and motor score are presented as mean ± SD, Cerebrovascular Accident (Ischemia stroke, Hemorrhagic CVA, Angionegative SAH).

**Table 3. Laboratory and vital parameters among the study groups.**

S.N	Variable	Survival Group	Mortality Group	P value
1	Systolic BP	129.98 ± 30.80	118.29 ± 41.51	0.08
2	Diastolic BP	63.09 ± 27.28	43.02 ± 34.40	0.00
3	Heart Rate	85.47 ± 18.62	95.19 ± 18.44	0.00
4	Sodium	140.38 ± 4.01	139.02 ± 6.03	0.16
5	Potassium	3.96 ± 0.68	4.01 ± 0.50	0.63
6	Urea	31.13 ± 16.39	40.82 ± 24.93	0.01
7	Creatinine	1.34 ± 6.40	1.30 ± 1.43	0.96
8	RBS	129.83 ± 46.23	144.07 ± 37.33	0.05
9	TC	13.49 ± 11.27	19.53 ± 47.27	0.41
10	Platelets	236.61 ± 89.03	228.40 ± 111.84	0.58
11	INR	1.24 ± 0.82	1.35 ± 0.42	0.38

RBS: Random Blood Sugar, TC: Total Count, INR: International Normalized ratio

Data presented as mean ± SD

**Table 4. Parameters showing significant association with mortality in binary logistic regression.**

S.N	Variables	B	S.E	Wald	Sig
1	Diastolic BP	-0.01	0.00	7.38	0.00
2	Heart Rate	0.02	0.00	7.001	0.00
3	Motor Score	-0.50	0.24	4.08	0.04

6	Operated cases	1.13	0.41	7.64	0.00
7	Abnormal Pupils	1.85	0.53	12.14	0.00
8	Diabetes Mellitus	1.56	0.48	10.46	0.00

BP: Blood Pressur

## DISCUSSION

There are very few published literatures regarding outcomes and mortality patterns in Neurosurgical ICU (NS-ICU) in Nepal. However, study in outcome and mortality in NS-ICU is very common in international arena. Mortality in overall neurosurgical admissions has been reported in between 2.7-4.52% from various national and international series.[3-8] There are two previous studies done in Nepal about the mortality in Neurosurgical ICUs. Roka Y et al have reported 23% mortality in their series from Eastern Nepal.[9] Similarly a series from TUTH Kathmandu Nepal have reported their neurosurgical ICU mortality around 21.66%.[10] However, overall ICU mortality rate in our series was 10.10%. The lower mortality rate in our series can be explained by the fact that our neurosurgical admissions also included all operated cold neurosurgical cases like discectomy, minor spine surgery and chronic subdural hematoma which are usually admitted in high dependency ward or post-operative ward in other hospitals. We have a protocol to admit all operated cases done under general anesthesia to ICU.

In our study Trauma and Intracerebral hemorrhage are the commonest admissions in NS-ICU. Hammers et al and Sandeman R et al also report similar pattern of ICU

admissions in their series. [5-6] On comparison of our data with two similar studies from Nepal we found the pattern comparable with series from Roka et al, which represents the exact picture of most of the peripheral units of Nepal.[9] However the study from TUTH report tumors as the commonest neuro ICU admissions 32%, followed by trauma 27.6% and aneurysms 25%.[10] This is because of the fact that most of the patients with tumor do not present as emergency and fly or travel to the capital city Kathmandu which is few hours by flight or road from most of the peripheral centers.

In our study we found that diastolic blood pressure, heart rate, motor score of GCS, operated group, abnormal pupils and diabetes mellitus were the parameters found to have significant association with mortality. Akavipat P et al in their study have found increase in blood sugar level, increased body temperature and eye-opening component of GCS as significant predictors of mortality in neuro ICU.[11]

In our study we did not assess any well-defined scoring system like Acute Physiology and Chronic Health Evaluation (APACHE), Simplified Acute Physiology Score (SAPS), Sequential Organ Failure Assessment (SOFA) score and Oxford

Acute Severity of Illness Score (OASIS) neither did we include any complications that occurred during treatment, length of stay in ICU, other important laboratory parameters like arterial blood gas (ABG), liver function test (LFT) which is the biggest limitations of our study.

## CONCLUSION

High heart rate, low diastolic BP, low motor score of Glasgow Coma Scale, abnormal pupils, diabetes mellitus and operated cases were found to be significantly associated with mortality in patients admitted to NS-ICU in our study.

## CONFLICT OF INTEREST

None

## SOURCES OF FUNDING

None

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