

# PATTERN OF CLINICAL PRESENTATION AND OUTCOME OF NEUROLOGICAL DISORDERS IN CRITICAL CARE

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## ABSTRACT

**Objective:** Patients with neurological disorders are commonly seen in the intensive care units. There is a need to constantly monitor the pattern of their data in order to optimize their management and improve outcome. The present study targeted to appraise the pattern of neurological disorders and their outcomes in an intensive care unit.

**Study Design:** Retrospective Cross-sectional study.

**Place and Duration of Study:** Department of Critical Care Medicine (CCM), Pakistan Institute of Medical Sciences (PIMS), Islamabad. 09 years (2014-2022).

**Methodology:** A retrospective study was carried out in the Medical Intensive Care Unit (MICU) of PIMS, a tertiary care facility in the federal capital, Islamabad. Data registers were reviewed for retrieving information regarding demographics, clinical presentation and final outcome of patients. Ethical clearance of the study was taken and administrative permission for data usage was granted by departmental head. The categorical variables were measured as frequency & percentage while the continuous numerical data as mean & standard deviation.

**Results:** The mean age of the patients was  $33.0 \pm 15.3$  years, with male gender in slight majority 178 (53.9%). Guillain-Barre syndrome (GBS) in 66 (20.0%) cases, status epilepticus 57 (17.2%), encephalitis 44 (13.3%), Cerebral venous thrombosis (CVT) 41 (12.4%), tuberculous meningitis 35 (10.6%), and bacterial meningitis 18 (5.4%) were the main diagnoses. There were 92 (27.8%) deaths and 234 (70.9%) recoveries in patients with neurological disorders. Mortality was found on the rise with 34.4% deaths of neurological patients in the Intensive Care Unit (ICU) in 2022, compared with 20.8% in 2014.

**Conclusion:** GBS, status epilepticus, encephalitis, CVT, tuberculous meningitis and bacterial meningitis were the main neurological conditions. More than one-fourth patients died, most of them were between 20 and 40 years who had comorbid conditions like diabetes and hypertension.

**Key words:** ICU, Neurological conditions, outcome, pattern.

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## INTRODUCTION

Critically ill neurological patients are a significant health issue, challenging the healthcare workers and settings. Overall, neurological disorders constitute around 20% global disease burden, the majority being in the developing world, all require critical management<sup>1</sup>. Neuro-critical care or intensive care for neurological disorders is a specialized field that deals with

the management of life-threatening neurological disorders including identification, prevention and treatment of secondary brain injury<sup>2</sup>.

Neuro-critical patients may suffer from severe morbidity but still a significant proportion could be saved with timely identification and targeted management. Many patients primarily having infection and respiratory failure also develop a neurological condition, these patients are more prone to mortality. Mortality rate for neurological complications is 55% when compared with 29% in those without these complications. Thus, proving that mortality in neuro-critically ill cases is very high<sup>3,4</sup>. Neurological complications increase both length of hospital stays as well as the chances of death. Prior to admission in the intensive care unit, the clinical examination is very crucial in terms of evaluation of patients with baseline neurological disorders. Thus, these patients need constant monitoring and evaluation in order to understand their progress during

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intensive care therapy. In this regard, the compliance of good clinical practice guidelines becomes crucial<sup>5</sup>.

The neuro-critical care has significantly advanced in the recent past, with its primary target being the care of critically ill patients having any of the acute neurological conditions<sup>6</sup>. The neurological cases in the Intensive Care Unit (ICU) fall into two categories: the primary neurological case, admitted from the beginning by a neurologist/internist and secondary, a consultation for any neurological manifestation in a patient already admitted in ICU, under the care of an internist or intensivist<sup>6,7</sup>.

There is dearth of data describing the scope of this practice as well as the epidemiological distribution of neurological cases in the Medical Intensive Care Unit (MICU)<sup>8,9</sup>. This study aimed to assess the trends of clinical presentation and outcome of neurological patients in the intensive care units.

## PATIENTS AND METHODS

This retrospective analysis of data from the MICU of a public tertiary care hospital i.e. Pakistan Institute of Medical Sciences (PIMS), Islamabad was collected over a span of 9 years from 2014 to 2022. The medical record of patients with neurological complications who had complete data regarding the clinical presentation and outcome was retrieved and analyzed. The ethical review board of PIMS hospital gave approval to conduct the study and data collection. Permission to use the patient record was taken from the head of department.

The eligibility criteria included critically ill patients with any neurological condition, admitted in the medical intensive care unit. Data was collected from admission registers and patients' files which included study requisite information such like age, gender, diagnosis, and final outcome during the hospital stay. The study data was collected on prescribed pro-forma designed for this study. The patients with incomplete medical record and those with non-neurological presentations were excluded from the study. Similarly, the critical cases referred from the external health facilities, who died during transportation or died on just entering the MICU on the same day, were also excluded.

The primary outcome of the study was assessed as neurological clinical presentation and the final outcome in terms of death or recovery ("complete recovery" means closure of tracheostomy and improvement in neuromuscular weakness;

"partial recovery" means the patient shifted to the ward with tracheostomy and partial improvement in neuromuscular weakness). The neurological clinical presentation was labeled as an "identified diagnosis" if the neurological diagnosis was established and as a "non-specific neurological condition" if there was neuromuscular weakness without an established neurological diagnosis. The patients having respiratory failure were labeled as having "respiratory failure" Type-I or Type-II and as "impending ventilatory failure" if the failure type was not established. The data was gathered by a single physician so that continuity and quality could be maintained and selection bias be rectified.

## CAPSULE SUMMARY

- This study identified the pattern of neurological conditions and their outcome in a medical intensive care unit.
- GBS, status epilepticus, encephalitis, CVT, tuberculous meningitis and bacterial meningitis were the main neurological conditions.
- More than one-fourth of patients died, most mortalities were between 20 and 40 years of age and those having comorbidities.
- There is a linear trend of increase in the mortality of neurological patients in critical care.

**Data Analysis:** The categorical variables like gender, cause of admission, diagnosis and outcome were calculated as frequency, and percentages while the continuous numerical ones like age were measured as mean and standard deviation. The outcome was analyzed according to age and gender of the patients using Chi square test. A p-value of <0.05 was considered statistically significant.

## RESULTS

Total 330 patients presented with neurological disorders to the MICU during the study period. The ages of patients were between 12-83 years with mean age  $33.0 \pm 15.3$  years. Close to three-fourth study patients were younger than 40 years. There were 84 (25.5%) of up to 20 years age, 102 (30.9%) between 21 and 30 years while 53 (16.1%) were between 31 to 40 years. Male gender was a bit predominant with 178 (53.9%) cases. When the pattern of neurological patients presenting to the MICU every year was assessed, it was witnessed that of the total 330 cases, 53 (16.1%) presented in 2014, 44 (13.3%) in 2015, 53 (16.1%) in 2016, and 42 (12.7%) in 2017. While in 2018 total 26 (7.8%), in 2019 total 27 (7.6%), and in 2021 total 16 (4.8%) neurological cases presented to the MICU. This linear trend of neurological presentation was significantly variable between years. (Table 1)

The cause of admission in majority of study cases, 124 (37.5%), was non-specific neurological condition, and poor Glasgow Coma Scale (GCS), 80 (24.2%), as well as impending ventilatory failure, 54 (16.3%). Other frequent causes were neurological emergency, 47 (14.2%), and respiratory failure in 17 (5.1%). (Figure 1)

The primary diagnosis of these patients in the intensive care unit was found out to be: Guillain-Barre syndrome (GBS) in 66 (20.0%) cases, status epilepticus 57 (17.2%), encephalitis (viral and bacterial) 44 (13.3%), cerebral venous thrombosis/arrest 41 (12.4%), tuberculous meningo-encephalitis 35 (10.6%), pyogenic bacterial meningitis 18 (5.4%), meningo-encephalitis

of non-established cause 11 (3.3%), non-thymoma AchR-Ab positive 18 (5.4%), and intracranial bleed 8 (2.4%). The common comorbidities noted were diabetes mellitus in 65 (19.7%) cases, hypertension 78 (23.6%) and Chronic Kidney Disease (CKD) 17 (5.1%). The patients with No-Known-Co-Morbid were 156 (47.3%). (Table 2)

During the study, the final outcomes were: 92 (27.8%) deaths and 234 (70.9%) complete or partial recoveries. Moreover, 4 (1.2%) patients left against medical advice. When the breakdown was checked year wise, a significant trend of increase in deaths was noted. There were 20.8% expiries in the year 2014 while the remaining cases had recovered. Similarly, 27.3% expired in 2015, 20.8% in 2016, and 25.0% in 2017. The death rate of patients rose to 46.2% in 2018, while one-third (33.3%) died in 2019. The trend of upward increase in mortality in the neurological patients continued and in the year 2020, there were 31.4% deaths, another 31.3% died in the year 2021 while in 2022, 34.4% neurological patients died in the ICU. A significant linear trend of increase in the mortality rates was witnessed between 2014 and 2022 (p-value, 0.007). (Figure 2 and Figure 3)

Furthermore, in the detailed analysis, the outcome of patients was assessed according to gender and age distribution. There

**Table 1: Baseline characteristics (n=330)**

Characteristics	No. of cases	%age
Age (Yrs)		
Mean ± SD	33.0 ± 15.3	
Range (min – max)	12 – 83	
Age categories (Yrs)		
Up to 20	84	25.5
21 to 30	102	30.9
31 to 40	53	16.1
41 to 50	43	13.0
51 to 60	27	8.2
61 or above	21	6.4
Gender		
Male	178	53.9
Female	152	46.1
Year wise distribution		
2014	53	16.1
2015	44	13.3
2016	53	16.1
2017	42	12.7
2018	26	7.9
2019	27	8.1
2020	37	11.2
2021	16	4.8
2022	32	9.6

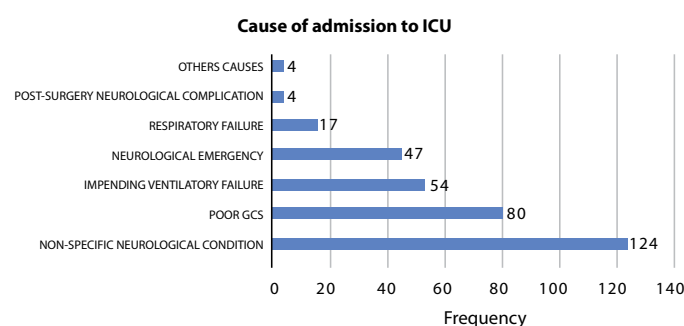
was recovery in 70 (29.9%) patients aged up to 20 years while 14 (15.2%) died in this age category. The greater proportion of patients was seen between 21 to 30 years, of these 63 (26.9%) recovered while 37 (40.2%) died and this difference was observed statistically significant (p-value, 0.006). Significantly more patients died between 31 to 40 years of age (18.5% vs 15.4%) and those above 61 years (10.9% vs 4.3%) than those who recovered. There was slightly greater mortality observed in the males than females (52.2% vs 47.8%) while the recovery was also witnessed more in males than females (54.3% vs 45.7%). However, despite these proportionate variations, the difference was found out to be non-significant (p-value 0.65). (Table 3)

**Table 2: Clinical Manifestations (n=330)**

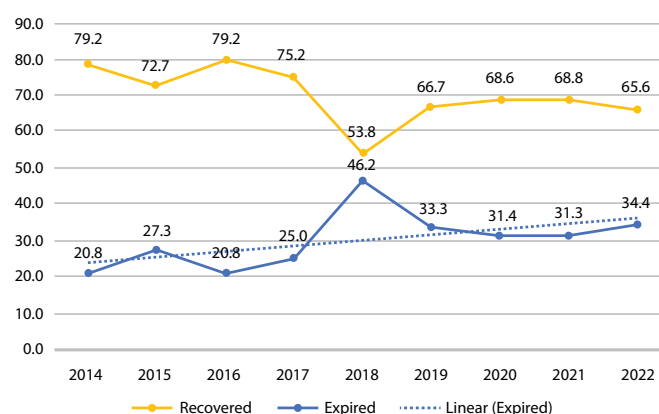
Manifestations	No of cases	%age
Final diagnosis		
Guillain-Barre Syndrome	66	20.0
Status Epilepticus	57	17.2
Encephalitis	44	13.3
Cerebral Venous Thrombosis/Arrest	41	12.4
Tuberculous Meningitis (TBM)	35	10.6
Bacterial Meningitis	18	5.4
MG-Non Thymoma- AchR A+	18	5.4
Intracranial Haemorrhage/stroke	10	3.0
CIDP	6	1.8
Transverse Myelitis LETM	4	1.2
Hypokalemia	4	1.2
Severe Sepsis	4	1.2
ADEM	4	1.2
PRES/Eclampsia	3	0.9
Subarachnoid Hemorrhage	3	0.9
Brain abscess + glioma + mucormycosis	4	1.2
Disseminated TB	2	0.6
TTP	2	0.6
Meningoencephalitis	2	0.6
Others	3	0.9
Co-morbidities		
No Known Co-Morbids	156	47.3
Diabetes Mellitus	65	19.7
Hypertension	78	23.6
Chronic Kidney Disease	17	5.1
Psychiatric Illness	5	1.5
Rheumatoid Arthritis	4	1.2
HIV	2	0.6
Others (Covid, Kochs)	3	0.9

**Table 3: Distribution of the outcome according to gender and age (n=330)**

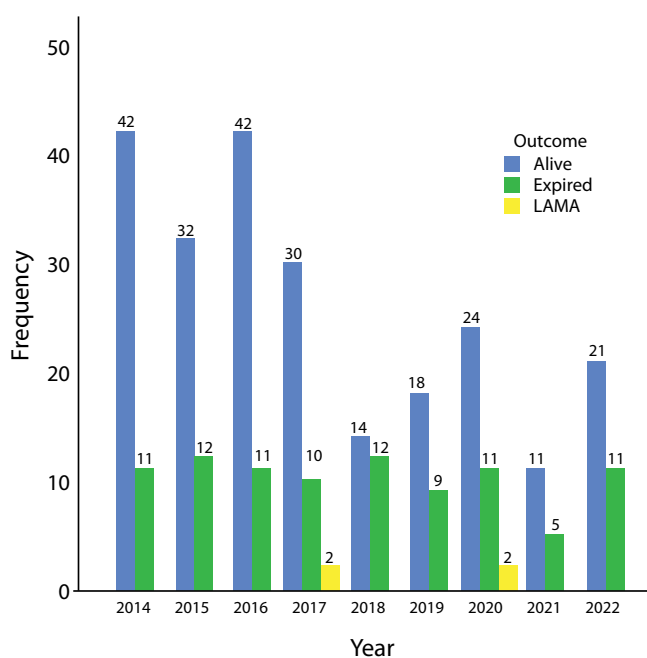
	Outcome			Total n=330(%)	p-value
	Recovered/alive n=234(%)	Expired n=92(%)	LAMA n=4(%)		
<b>Age (years)</b>					
Up to 20	70 (29.9)	14 (15.2)	0 (0.0)	84 (25.5)	0.006
21 to 30	63 (26.9)	37 (40.2)	2 (50.0)	102 (30.9)	
31 to 40	36 (15.4)	17 (18.5)	0 (0.0)	53 (16.1)	
41 to 50	32 (13.7)	11 (12.0)	0 (0.0)	43 (13.0)	
51 to 60	23 (9.8)	3 (3.3)	1 (25.0)	27 (8.2)	
61 or above	10 (4.3)	10 (10.9)	1 (25.0)	21 (6.4)	
<b>Gender</b>					
Female	107 (45.7)	44 (47.8)	1 (25.0)	152 (46.1)	0.65
Male	127 (54.3)	48 (52.2)	3 (75.0)	178 (53.9)	



**Figure 1: Distribution of causes of admission to ICU (n=330)**



**Figure 3: Trend of mortality of neurological patients (n=330)**



**Figure 2: Outcome of patients (n=330)**

## DISCUSSION

This study found that neurological presentation in ICU varied year wise. During the Corona virus pandemic, less cases of other ailments were admitted in the intensive care. As witnessed in this study, mortality due to neuro-critical conditions had risen over the years in the MICU of PIMS between 2014 and 2022. There is a linear trend of increase in deaths which needs to be checked and targeted to minimize.

In this study, the most frequent causes of admission to MICU were non-specific neurological deficit, poor GCS, impending ventilatory failure, respiratory failure and coma/neurological emergency. The most common clinical diagnoses were GBS and status epileptics followed by CVT, Tuberculous Meningitis (TBM) and bacterial meningitis. A previous study by Kiphuth et al. reported 60% of their patients suffering from stroke (Ischemic & Intracranial Hemorrhage, ICH),

other diagnoses were subarachnoid hemorrhage, epileptic seizures, meningoencephalitis, GBS and myasthenia gravis<sup>10</sup>. Comparatively, in the current study around 4.0% cases had stroke and intracranial or subarachnoid hemorrhage which was very low when compared with Kiphuth et al's findings. However, the lower number of stroke patients in our study is due to the allocation of 20 beds for stroke in the 60-bedded neurology ward and admission of surgical cases of stroke in the surgical ICU. Another study from India witnessed stroke and epilepsy as the main complications of neurological presentation<sup>11</sup>. Some studies from European region have witnessed epilepsy as the main indication followed by stroke<sup>12,13</sup>. Liu F and colleagues witnessed Myasthenic crisis (MC) followed by respiratory infections as the main cause of ICU admission as well as a combination of infections and hypokalemia<sup>14</sup>.

In the current study the most common comorbidities noted were diabetes mellitus and hypertension as well as CKD, Choudhry RN et al also reported a similar trend of comorbidities diabetes, hypertension, ischemic heart diseases and respiratory infections. They noted that comorbidities are prone to mortality<sup>15</sup>. Liu F noted the patients with comorbidities more likely to die of neurological conditions<sup>14</sup>. Similarly, in our study, comorbidities (diabetes, hypertension and CKD) were significantly associated with death.

In the current study, there were more than one-fourth deaths while about three-fourth patients recovered. There were also few cases who left against medical advice. The trend of mortality was also on the rise in this study, noted as 20.8% in 2014 and climbing up to 34.4% in 2022. Comparatively variable rates of mortality have been reported according to developed and under developed status of the countries. From China, Liu F et al witnessed mortality in 18.6% of their neurological cases admitted to ICU<sup>14</sup>. In their study most of the non-surviving group was older or very old patients, this is contrast with the current study as along with a significant number of older patients (61 years or above), the majority of deaths in this study took place in patients between 20 and 40 years. However, no variation was witnessed according to gender in the present study. Ali KM reported a similar trend of mortality with 22.2% deaths in their neurological patients. They witnessed stroke, encephalitis, status epilepticus, GBS and MG as main causes of death<sup>16</sup>. Comparatively, in our study too status epilepticus, encephalitis, GBS, MG along with bacterial meningitis were main reasons of death. In the developed world, the death rate in ICU due to neurological issues has been noted to be ranging from 5 to 10%<sup>12,13</sup>. Other investigators have witnessed a very high mortality in neuro-critical patients (up to 50 to 55.0%)<sup>7,17</sup>. The facilities and practices vary according to developing and developed status of countries, so the difference in death rates might be due to poor nutrition, lack of budgetary allocation for health and availability of merely basic facilities in the intensive care units.

The patients with neurological deficits must be identified early and given proper treatment in time. Alongside proper compliance of TORs for the intensive care units and through

avoidance of unnecessary pressures, the condition and outcome of critical care patients can be improved<sup>18,19</sup>.

Our study has many advantages, like a significant number of intensive care patient record was selected over a long period of 09 years, which made it possible to understand the pattern of serious neurological conditions and the final outcome. Some limitations of the study include the retrospective design with its built-in biases and missing data.

In brief, considering the importance of the topic, with the suffering and the poor outcome of neurological conditions, it may be argued that avoidable conditions like meningitis could be averted. There is a need to put special focus on the increasing trend of mortality in the ICU and avoid chances of any contamination and hospital acquired infections.

### CONCLUSION

This study showed that GBS, status epilepticus, encephalitis (viral and bacterial), CVT, tuberculous meningo-encephalitis and pyogenic bacterial meningitis to be the main neurological conditions. More than one-fourth of the patients died in this study, while most of the mortalities were noted between 20 and 40 years and those having comorbidities like diabetes and hypertension. There was a linear trend of increase in the mortality of neurological patients in the critical care. The data from critical units is crucial and there is a need to constantly monitor it. Further large scale prospective trials, using meticulous scientific methods, are required to evaluate more impactful scientific evidence on this topic with a focus on partial or complete recovery along with the mortality data.

### AUTHORS' CONTRIBUTION

S. Mujahid Gilani, Fazal e Rabbi	Drafting the Article
S. Muneeb Ali, Taha M.U Pasha	Analysis and interpretation of data
M. Iqbal Memon	Conception and design
S. Usama Iqbal, Aneeqa Butt	Acquisition of data
Salman S. Koul	Critical revision

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