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Original Article

Should neurology patients be treated in the general intensive care unit or not?

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Abstract

Aim: To examine neurology patients treated in a general intensive care unit for more efficient use of intensive care beds as well as for underscoring the need for neurological intensive care units.

Material and Methods: Demographic characteristics, concomitant conditions, duration of intensive care unit stay, prognosis, and the need and reasons for mechanical ventilation were examined and recorded in a cohort of patients admitted to the tertiary intensive care unit of the Research and Training Hospital, Adiyaman University between January 2014 and December 2015.

Results: A total of 164 patients, (82 male and 82 female) with a mean age of 74.18 ± 12.72 years (range: 28-99) admitted and followed up in a tertiary intensive care unit were assessed. The most common indication for admission was ischemic cerebrovascular disease (n=124, 75.6%). The mean duration of intensive care unit stay was 10.76 ± 12 days. Pneumonia, multi-organ failure syndrome, acute respiratory distress syndrome, menengitis, and respiratory arrest were found in 21.3%, 14.0%, 1.8%, 0.6%, and 28.7% of the patients, respectively. Invasive mechanical ventilatory support was given to 48.2% of the cases, with a mean duration of 3.84 ± 7.57 days. In all, 17.7% of the patients survived.

Conclusion: Prolonged duration of intensive care unit stay in critically ill patients as well as the occurrence of concomitant conditions lead to an increased need for invasive mechanical ventilation with an associated increase in mortality. We believe that admission of critically ill patients to specialized intensive care units or closed-system intensive care units with multi-disciplinary care may help improve the prognosis and the quality of care.

Keywords: Intensive Care Unit; Cerebrovascular Disease; Invasive Mechanical Ventilation.

INTRODUCTION

Literature data suggest that neurological intensive care units (ICU) and specialized care teams are able to decrease mortality, improve quality of life, and allow more efficient use of healthcare resources in several neurocritical patient groups as compared to general ICU (1-3). Intensive care is defined as the diagnostic and therapeutic process administered following the temporary dysfunction and/or failure of one or more organ systems associated with impaired body functions. This process involving the supportive care for such functions is continued until the root cause of the organ dysfunction is eliminated (4). The patient selection for such a technologically advanced care unit with limited numbers of beds requires a careful approach (5). From an neurological ICU perspective, neurology patients are generally considered critically ill. Characterization of these patients bears clinical significance with regard to the development of standardization methods for clinical research and for the assessment of the treatment outcomes. Thus, the clinical characteristics and prognosis of neurology patients admitted to the general ICU of Research and Training Hospital, Adiyaman University, were examined in the current study. We also aimed at emphasizing the need for special neurological intensive care units, in addition to providing data that could help improve the quality of critical care.

MATERIAL and METHODS

The study center, i.e. Research and Training Hospital of Adiyaman University, provides tertiary intensive care in accordance with the Official Notice on the Principles

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and Methods of Intensive Care issued by the Turkish Ministry of Health. The protocol of this cross-sectional descriptive study was approved by the Medical Faculty of Adiyaman University (date: 27 Oct 2015, No: 2015/07-1). No written consent forms were used, as the study was retrospectively designed. The patient data were retrieved from the digital hospital database. Age, gender, primary diagnosis responsible for general ICU admission, duration of intensive care, prognosis, concomitant conditions, and the need and duration of mechanical ventilation (MV) were recorded and retrospectively analyzed in this group of neurological patients admitted to the ICU of our hospital between January 2014 and December 2015.

Statistical analyses

Statistical analyses were performed using SPSS 15.0 software pack. The normal distribution of quantitative variables was tested with one-sample Kolmogorov Smirnov test. The comparison of two independent groups was performed with independent two-sample test, while Mann Whitney U test was used for data without normal distribution. The results were expressed with mean ± SD for data with normal distribution, and with median values (min-max) for those without normal distribution. Qualitative (categorical) variables were analyzed with chi-square and Fisher's exact test, and the results were expressed as frequency and percentage. The significance level was set at a p value of < 0.05.

RESULTS

A total of 164 neurology patients (82 male, 82 female) treated and monitored at the ICU of our hospital were enrolled. Of these, 124 (75.6%) had ischemic cerebrovascular disease (ICVD), 31 (18.9%) had intracerebral hemorrhage (ICH), 9 (5.5%) had status epilepticus as the primary diagnosis requiring intensive care. The mean age of the patients was 74.18 ± 12.72 years (min-max: 28-99 y), with a mean length of ICU stay of 10.76 ± 12 days (1-70). According to ICU stay time, statistically significant difference was found in women (p=0.003). Concomitant conditions included pneumonia in 35 patients (21.3%), multiple organ failure syndrome (MOFS) in 23 (14.0%), acute respiratory distress syndrome (ARDS) in 3 (1.8%), and meningitis in 1 (0.6%) (Table 1). Of the patients who developed anemia, 26 (74.3%) were female, and 9 (25.7%) were male with a significant difference (p=0.001). Respiratory arrest developed in 47 patients (28.7%), of whom 23 (48.9%) were female and 24 (51.1%) were male. Of these patients who developed respiratory arrest, 44 (93.6%) had ICVD, 2 (4.3%) had epilepsy, and 1 (2.1%) had ICH, and this difference was statistically significant (p=0.002). Invasive mechanical ventilation support was given to 45 patients (95.7%) who developed respiratory arrest, and 34 patients (29.1%) who did not develop respiratory arrest (p=0.000) (Table 2). Death occurred in 45 patients (95.7%) with respiratory arrest and in 77 patients (97.5%) who required invasive mechanical ventilation support (p=0.000). One of the 2 patients who developed respiratory arrest was discharged from the ICU, while the other was referred to the patient ward (Table 3).

Table 1. Demographic findings, length of intensive care unit stay, diagnoses, need for invasive mechanic ventilation and duration of treatment, concomitant disorders, and the distribution of prognostic variables

Variable	
Mean age ± SD (range)	74.18+12.72 (28-99)
Length of hospital stay ± SD, days (range)	10.76+12 (1-70) 6
Gender n (%)	
Female	82 (50%)
Male	82 (50%)
Diagnosis	
Epilepsy	9 (5.5%)
Ischemic CVD	124 (75.6%)
Intracerebral hemorrhage	31 (18.9%)
Prognosis	n (%)
Discharge	17 (10.4%)
Ward	12 (7.3%)
Death	135 (82.3%)
Mechanical Ventilation (MV) n (%)	
No	85 (51.8%)
Yes	79 (48.2%)
Duration of MV (days) ± SD (range)	3.84+7.57 (0-50)
Concomitant conditions (%)	
Pneumonia	
Yes	129 (78.7%)
No	35 (21.3%)
Respiratory arrest	
No	117 (71.3%)
Yes	47 (28.7%)
ARDS	
No	161 (98.2%)
Yes	3 (1.8%)
MODS	
No	141 (86.0%)
Yes	23 (14.0%)
Meningitis	
No	163 (99.4%)
Yes	1 (0.6%)

CVD: cerebrovascular disease; MV: mechanical ventilation; ARDS: acute respiratory distress syndrome; MODS: multi-organ dysfunction syndrome

Table 2. The effect of concomitant conditions on diagnosis and invasive mechanical ventilation

	Pneumonia		Respiratory Arrest		ARDS		MODS		Meningitis	
Diagnosis n (%)	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Epilepsy	7 (5.4%)	2 (5.7%)	7 (6.0%)	2 (4.3%)	9 (5.6%)	0 (0.0%)	9 (6.4%)	0 (0.0%)	9 (5.5%)	0 (0.0%)
Ischemic CVD	94 (72.9%)	30 (85.7%)	80 (68.4%)	44 (93.6%)	121 (75.2%)	3 (100%)	104 (73.8%)	20 (87.0%)	123 (75.5%)	1 (100%)
Intracerebral Hemorrhage	28 (21.7%)	3(8.6%)	30(25.6%)	1 (2.1%)	31 (19.3%)	0 (0.0%)	28 (19.9%)	3 (13.0%)	31 (19.0%)	0 (0.0%)
MV n(%)No	65 (50.4%)	20(57.1%)	83(70.9%)	2 (4.3%)	85 (52.8%)	0 (0.0%)	70 (49.6%)	15 (65.2%)	85 (52.1%)	0 (0.0%)
MV n(%)Yes	64 (49.6%)	15 (42.9%)	34 (29.1%)	45 (95.7%)	76 (47.2%)	3 (100%)	71 (50.4%)	8 (34.8%)	78 (47.9%)	1 (100%)
P	0.478		0.000		Ψ0.110		0.166		Ψ0.482	

Ψ: Fisher's Exact test
CVD: cerebrovascular disease; MV: mechanical ventilation

Table 3. Diagnosis at admission to ICU, prognosis and mortality

	Prognosis			P
Diagnosis n (%)	Discharge	Ward	Death	
Epilepsy	3 (33.3%)	0 (0.0%)	6 (66.7%)	
Ischemic CVD	10 (8.1%)	7 (5.6%)	107 (86.3%)	0.029
Intracerebral Hemorrhage	4 (12.9%)	5 (16.1%)	22 (71.0%)	
MV n (%)				
No	16 (18.8%)	11 (12.9%)	58 (68.2%)	0.000
Yes	1 (1.3%)	1 (1.3%)	77 (97.5%)	
Respiratory Arrest				
No	16 (13.7%)	11 (9.4%)	90 (76.9%)	0.017
Yes	1 (2.1%)	1 (2.1%)	45 (95.7%)	

CVD: cerebrovascular disease; MV: mechanical ventilation

DISCUSSION

The concept of intensive care unit dates back to 1960s, and the first attempt to define the admission criteria for ICU is represented the intensive care unit conference held by the "National Institutes of Health" in 1983 (5). The high-costs associated with intensive care together with the limitations in the number of patient beds and resources necessitated the definition of "Intensive Care Unit Admission Criteria" and gave rise to the concept of "Patients who will most benefit from intensive care" (5). In 1999, the Society of Critical Care Medicine proposed guidelines for admission, triage, and discharge for ICUs (5). The decision to admit patients to ICU depends on a number of factors such as the priorities, diagnosis, and objective parameter models. Despite such proposals, each institute should develop its own guidelines according to their own needs and conditions. From a neurological viewpoint, the diagnostic model includes acute stroke associated with alterations in consciousness, metabolic, toxic or anoxic coma, intracranial bleeding with herniation risk, acute subarachnoid bleeding, meningitis or encephalitis associated with altered consciousness or respiratory difficulty, central nervous system or neuromuscular disorders associated with neurological or respiratory dysfunction, status epilepticus, patients suitable for organ transplantation with documented brain death or risk of brain death who require intensive care support, severe head trauma and accompanying neurological disorders (5).

In 2002, a neurology intensive care working group set up by the Turkish Neurology Association stated the opinion that it would be useful to define the field of neurological intensive care as a sub-branch and/or a branch of neurology and neurosurgery specialties (6). As a result of intensive efforts by the society, the law No 6225 dated 26 April 2011 came into force, which classifies algology, clinical neurophysiology, and intensive care as a sub-branch of neurology (7). Despite this, neurological intensive care as a sub-branch of neurology has not reached the desired level of expertise.

Currently, patients requiring neurological intensive care are admitted to a general ICU in our facility. The mean duration of ICU stay was 10.76 ± 12 days in our study (min-max: 1-70 days), with female patients having a significantly more prolonged ICU stay.

In a study examining 2381 patients admitted to a neurological ICU after its establishment, a shortened length of stay was reported both in the neurological ICU (4.2 ± 4.0 vs. 3.7 ± 3.4 days, $p < 0.001$) and hospital (9.9 ± 80 vs. 8.4 ± 6.9 days, $p < 0.001$) (8). Again, a retrospective analysis in the neurological ICU found reduced rates of

mortality (35.8%), catheter-related urinary tract infection (50%), central venous catheter infection (100%), and ventilator associated pneumonia (50%). Also patient satisfaction was 28.3% improved (9). In another study involving critically ill patients with a prolonged duration of ICU stay, the mean age was 64.55 ± 19.23 years, with 50% of the patients being female. The most common reason for ICU admission was cerebrovascular events (41.7%), and the mean duration of ICU stay was 129 and mortality rate was 63.3% (10). In one study with 1033 patients admitted to a re-structured internal ICU, 139 of the patients (13%) were found to have a neurological disorder as the primary reason for ICU admission with a mortality rate of 31% (n=43). Of the overall group, 5.2% received treatment due to cerebrovascular events (11). Again, the patient characteristics, need for organ support, and length of stay were compared in a group of surgical and medical patients admitted to a mixed ICU in order to obtain data for more effective use of mixed intensive care unit beds. In that study, of the 154 patients included 55 (35.7%) had medical and 99 (64.3%) had surgical conditions, and within the former group, 1 patient (1.8%) had a neurological disorder (12). A total of 291 patients (156 female, %53.6; 135 male, %46.3) was investigated in another study, where 117 patients (40.2%) were admitted due to ischemic stroke and 35 (12%) due to hemorrhagic stroke. The reported rates of mechanical ventilator use, and ventilator associated pneumonia were 30% and 13.4%, respectively (13). In our study, the mean age was 74.18± 12.72 years, and 50% of the patients were female. According to the published literature (1,10,13), cerebrovascular diseases represent a leading cause of ICU admission, and our findings were consistent with these observations. Mortality rate was high, i.e. 82.3%, in this group, probably due to the conditions of the general ICU and concomitant diseases developing due to prolonged stay in the ICU.

The incidence, indication, and timing of the intubation and its outcomes were compared in a total of 230 patients who had cerebral infarction or intracerebral hemorrhage requiring mechanical ventilation. Of these patients, 74 had ICVD and 156 had ICH (mean age 61 ± 16 years; female to male ratio: 1.15 to 1), with 6% and 30% of the ICVD and ICH patients requiring intubation, respectively. Male gender and advanced age were found to be associated with significantly increased likelihood of mortality among ICVD and ICH patients, respectively (14). In the present study, 48% of patients had a requirement for endotracheal intubation and invasive mechanical ventilation. Need for mechanical ventilation was also found to be high in patients with ICVD. The mean duration of invasive mechanical ventilation was 3.84 ± 7.57 days, and 50.6% of the cases were female.

Clinical studies have clearly pointed out to significant prognostic and economic advantages of the management of a variety of neurological conditions by neurologists/ neurosurgeons in the ICU. Also, neurologic ICUs and specialized management teams can provide a mortality advantage in several neurocritical patient groups as compared to generalized intensive care, with improvement in prognosis, life quality, and resource utilization (15-18).

For instance, in a previous study examining the effect of transformation of a general ICU to a neurological ICU with full time employment of neurologists, the duration stay was reduced for patients with ischemic stroke (previous period 23 vssubsequent period 77), intracerebral hemorrhage (81 vs. 74), and subarachnoid bleeding (70 vs.108). However, mortality rates did not differ significantly (19). In another study comparing critical neurology patients during general intensive care and after re-structuring to a neurological ICU (1087 and 1279 patients, respectively), a significant improvement was observed in all of the parameters tested such as the in-hospital mortality (relative reduction 9.9%), ICU mortality (relative reduction 21%), length of ICU stay (relative reduction 17%), and rate of discharge from hospital to home (relative increase 15%) (20). In the light of these literature data, it can be assumed that neurological intensive care has become requirement now and there must be relationship between neurological ICU and general ICU.

The limitations of our study include the small sample size in a single-center as well as its retrospective nature. Therefore, our findings may not be extrapolated to all critically ill patients with neurological disorders who are admitted to an ICU.

CONCLUSION

Critically ill subjects are physiologically unstable, and require close clinical monitoring together with the need for careful and prompt therapeutic decisions. An aging population with associated comorbid and critical medical conditions along with limited numbers of patient beds require that hospital managements take actions to increase the bed capacity of ICUs, and appropriate referral sites (intensive care, acute care, or palliative care) should be selected based on the priorities of the critically ill. We believe that neurological patients who are in need of intensive care will cause less complications if they are admitted to neurological intensive care units and will contribute positively to the mortality and morbidity of patients.We think that longitudinal and multicentre studies are needed.

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