International Journal of Neuro & Psychological Disorders

Journal homepage: www.mcmed.us/journal/ijnpd

PREVALENCE AND OUTCOME OF NEUROLOGICAL REFERRAL TO THE GENERAL INTENSIVE CARE UNIT

Aysha Al-Shareef* and Reem Alyoubi

Neurology Unit, Department of Internal Medicine, King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia.

Corresponding Author:- **Aysha Al-Shareef**
E-mail: mezo106@yahoo.com

Article Info

Received 23/09/2014
Revised 05/10/2014
Accepted 09/10/2014

Key words:- Critical care, Hospital mortality, Outcome, Length of stay, Neurological referrals, Intensive care unit, Mortality.

ABSTRACT

The impact of specialty ICU is not well known which raised question about the real need of a specialized neuro-critical and their impact on patient outcome. To determine the prevalence of neurological referrals to general ICU in comparison to other subspecialties and the mortality rate of neuro-critical patients managed at general ICU. A retrospective study was commenced through reviewing the patients' records. Data were collected on all patients admitted to ICUs of King Abdul-Aziz University hospital, Jeddah (kAUH) from 1st June 2011- May 31st2012.We include all neurological cases aged over 12 years admitted to the ICU with primary neurologic diagnosis. The following variables were recorded; age , sex , nationality, source of cases, diagnosis on admission, Glasgow comma scale (GCS) on admission to ICU, reason of referral to ICU, ICU length of stay, co-morbidities and need for mechanical ventilation. The outcome was categorized as death and discharged either improved or with ongoing illness). A total 560 patient were referred to general intensive care unit during the period June 1st 2011 to May 31st 2012. Out of them 89 patients were neuro-critical referrals representing 16% of all ICU admissions. Males represent 62.9% of them whereas Saudi patients constitute 22.5% of neurological referred cases. Most of them (74.7%) were referred from emergency department (ER) whereas 14.9% and 9.2% were referred from other hospital wards and operating room (OR), respectively. Length of ICU stay ranged between one and 310 days with a mean of 17.4 days and SD of 37.7 days. Death was reported among 25 cases (28.1%) whereas the remaining 64 (71.9%) patients were discharged. Out of them, 18 patients (28.1%) were improved while the remaining 46 patients (71.9%) expressed ongoing illness. Multivariate logistic regression analysis revealed that Patients aged between 36 and 65 years were at almost six-folded risk for death (Adjusted OR=6.02; 95% CI: 1.61-22.58) and those admitted from other wards were at higher significant risk for death (Adjusted OR=5.50; 95% CI: 1.38-21.86). Neurological patients need a specialized neuro-critical care to improve the patient care, but to reach a better conclusion we should compare the mortality to a neuro-critical care which not available in our medical centre.

INTRODUCTION

Neuro-critical care is a new subspecialty in the intensive care medicine in Saudi Arabia. We did not develop yet an organized neocortical care unit; all critical neurological and neurosurgical patients are managed at general intensive care unit. The impact of specialty ICU is not well known which raised question about the real need of a specialized neuro-critical and their impact on patient outcome.

It is documented that neurological patients have lower mortality and better outcomes when cared for in specialized neuro-intensive care units than in general ICUs [1-3].

Care in specialized intensive care units (ICUs) is generally of higher quality than in general care units. Neuro-critical care focuses on the care of critically ill patients with primary or secondary neurosurgical and neurological problems and was initially developed to manage postoperative neurosurgical patients. It expanded thereafter to the management of patients with traumatic brain injury (TBI), intracranial hemorrhage and complications of subarachnoid hemorrhage; including vasospasm, elevated intracranial pressure (ICP) and the cardiopulmonary complications of brain injury [4].

Neuro-critical illness heavily burdens the developing world including Saudi Arabia. Possible steps to improve the global practice of neuro-critical care include: (1) emphasis on prevention of neuro-critical illness through traffic safety and adequate outpatient treatment; (2) standardization of training requirements and skill sets; (3) guidelines on cost-effective measures including medications, equipment, and devices; (4) strengthening of surveillance systems and registries for both non-communicable and communicable neurological diseases; (5) expanded use of teleneurology; (6) educational exchanges of neuro-intensive health care workers; and (7) monitoring of neurological intensive care unit death rates due to nosocomial infections, neurological disease, and other causes [5].

The current study aimed to determine the prevalence of neurological referrals to general ICU in comparison to other subspecialties and the mortality rate of neurocritical patients managed at general ICU. In addition, we aimed to correlate the outcome of neuro-critcial patient managed at general ICU with multiple variable including primary neurological diagnosis, length of stay, and co-morbidities and finally to find out if a specialized neuro-critical ICU is a requirement for the neurological patient for better care by determination of the mortality rate and the burden of neuro-critical patients at general ICU.

SUBJECTS AND METHODS

A retrospective study was commenced through reviewing the patients' records to identify the prevalence of neurological cases referred to medical ICU in comparison to other medical subspecialties as well as to identify the outcome of these patients. The outcome was categorized as death and discharged either improved or with ongoing illness)

Data were collected on all patients admitted to ICUs of King Abdul-Aziz University hospital, Jeddah (kAUH) from 1stJune 2011- May 31st2012. KAUH is classified as a secondary or tertiary care center. The patient information were recorded from medical charts and electronic data base of KAUH.

We include all neurological cases aged over 12 years admitted to the ICU with primary neurologic diagnosis. We excluded all patients with primary diagnosis of non neurological problems and those aged less than 12 years. The following variables were recorded; age , sex ,nationality, source of cases, diagnosis on admission, Glasgow comma scale (GCS) on admission to ICU, reason of referral to ICU, length of stay in ICU, co-morbidities and need for mechanical ventilation.

The primary diagnosis refers to the neurologic or neurosurgical critical disease that led to the admission to the ICU unit. The medical ICU patient care is provided by multi-displinary team including the primary ICU doctors, neurologist, neurosurgeon and other medical subspecialties. Medical co-morbidities referred the presence of other medical disease either before or during ICU hospitalization. GCS scale on both admission and discharge were recorded, we recorded the requirement of mechanical ventilation regardless the duration.

Statistical analysis

Statistical analysis was done using statistical package for social science (SPSS software-version18). The qualitative data were presented in the form of number and percentage. Chi-square was used to compare between qualitative data of two groups. Odds ratio and 95 % confidence interval was calculated to estimate the risk. The quantitative data were presented in the form mean and standard deviation. Student t test was used to compare quantitative data. Logistic regression was done to determine the predictors of death. Significance was considered when p value less than 0.05.

RESULTS

A total 560 patient were referred to general intensive care unit during the period June1st 2011 to May 31st 2012.Out of them 89 patients were neuro-critical referrals representing 16% of all ICU admissions Table 1.

Out of 89 neurological patients, 12 were admitted to the hospital two times. As seem in table 2, males represent 62.9% of them whereas Saudi patients constitute 22.5% of neurological referred cases. Regarding their age, 46.1% aged between 36 and 65 years while 21.3% aged over 65 years.

Regarding their sources, most of them (74.7%) were referred from emergency department (ER) whereas 14.9% and 9.2% were referred from other hospital wards and operating room (OR), respectively as illustrated in figure 1.

Regarding diagnosis of cases on ICU admission, stroke and infections were the commonest diagnoses on admission representing 36% and 28.1% of cases, respectively. Table 3

Glasgow coma scale on admission ranged between 3 and 15 with a mean of 8.3 and standard deviation of 3.8 whereas on discharge it ranged between 3 and 15 with a mean of 11.02 and standard deviation of 4.1. This difference was statistically significant, $p<0.001$.

Length of ICU stay ranged between one and 310 days with a mean of 17.4 days and SD of 37.7 days. Regarding reasons for referral of neurological cases to

ICU, coma was the reason in almost two-thirds of cases (66.3%). Figure 2

As obvious from figure 3, mechanical ventilation was required by almost two-thirds of cases (66.3%). Diabetes mellitus and hypertension were reported among 32.6% and 38. 2% of cases, respectively whereas 42.2% of cases reported no co-morbid illness. Table 4

Regarding their outcome as evident from figure 4, death was reported among 25 cases (28.1%) whereas the remaining 64 (71.9%) patients were discharged. Out of them, 18 patients (28.1%) were improved while the remaining 46 patients (71.9%) expressed ongoing illness.

As shown in table 5, amongst studied variables, only patient`s age and the source of admission were significantly with their outcome. Regarding, patient`s age, the highest death rate was reported among patients in the age group 36-65 years (41.5%) compared to 13.8% among those aged between 12 and 35 years. The difference was statistically significant, p=0.030 Concerning the source of admission, death rate was highest among patients admitted from wards (61.5%) compared to those reported among patients admitted from ER department (24.6) whereas no death was reported among patients admitted from OR. The difference was statistically significant, p=0.005. All other studied variables as illustrated from table 5 were not significantly associated with the outcome. Regarding length of ICU stay, it was longer among died patients compared to those discharged (26.04±63.50 versus 13.97±20.10). However, this difference was not statistically significant, p=0.176.

In a multivariate logistic regression analysis, considering patients in the age group 12-35years as a reference category, those aged between 36 and 65 years were at almost six-folded risk for death (Adjusted OR=6.02; 95% CI: 1.61-22.58). Compared to patients admitted from ER, those admitted from other wards were at higher significant risk for death (Adjusted OR=5.50; 95% CI: 1.38-21.86).

Table 1. Frequency of patient referred to general ICU between june 1st 2011 and may 31st 2012, KAUH

Specialty	Type of referral(560)
Renal	144
Neurology	89
Respiratory	65
Non specific	50
ID	46
Gagetrointestinal	37
Oncology	26
Surgical	40
Gynacology	8
Endocrine	37
Heamatology	9
Immunology	26
Rhumatology	6

Table 2. Demographics of the neurological referred cases.

Patients	Frequency	Percent
Age (years)		
12-35	29	32.6
36-65	41	46.1
>65	19	21.3
Gender		
Male	56	62.9
Female	33	37.1
Nationality		
Saudi	20	22.5
Non-Saudi	69	77.5

Table 3. Diagnosis of neurological referred cases on admission

Diagnosis	Freq n= 89	%
Stroke	32	36
Infections	25	28.1
Trauma brain injury	15	16.9
Neurosurgical	9	10.1
Epilepsy	6	6.7
Demyleination	1	1.1
Post anoxi	1	1.1

Table 4. Co-morbidity among neurological cases referred to ICU

Co-morbidity	Freq n=89	%
DM	29	32.6
HTN	34	38.2
Renal	2	2.2
Cardiac	7	7.9
Respiratory	3	3.4
Non	46	42.2

Table 5. Factors associated with the outcome of neurological cases referred to ICU: bivariate analysis

Patients	Outcome		χ^2-value	P-value
	Death N=25	Discharge N=64		
Gender				
Male (n=56)	16 (28.6)	40 (71.4)		
Female (n=33)	9 (27.3)	24 (72.7)	0.017	0.895
Nationality				
Saudi (n=20)	6 (30.0)	14 (70.0)		
Non-Saudi (n=68)	19 (27.5)	50 (72.5)	0.047	0.829
Age (years)				
12-35 (n=29)	4 (13.8)	25 (86.2)		
36-65 (n=41)	17 (41.5)	24 (58.5)		
>65 (n=19)	4 (21.1)	15 (78.9)	7.031	0.030
Source of admission*				
ER (n=65)	16 (24.6)	49 (75.4)		
Ward (n=13)	8 (61.5)	5 (38.5)		
OR (n=8)	0 (0.0)	8 (100)	10.755	0.005
Diagnosis				
Stroke (n=32)				
Infections (n=25)	11 (34.4)	21 (65.6)		
Traumatic brain injury	6 (24.0)	19 (76.0)		
(n=6)	4 (26.7)	11 (73.3)		
Neurological disorders	2 (22.2)	7 (77.8)		
(n=9)	0 (0.0)	6 (100)		
Epilepsy (n=6)	2 (100)	0 (0.0)	8.465	0.132
Others (n=2)				
GCS at admission (n=70)				
<8 (n=34)	8 (23.5)	26 (76.5)		
≥8 (n=36)	8 (22.2)	28 (77.8)	0.017	0.896
Reason for ICU admission				
Coma (n=59)	19 (32.2)	40 (67.8)		
Status epilepticus (n=7)	3 (42.9)	4 (57.1)		
Post-neurological (n=8)	1 (12.5)	7 (87.5)		
Others (n=15)	2 (13.3)	13 (86.7)	3.830	0.280
Co-morbidity				
Yes (n=43)	12 (27.9)	31 (72.1)		
No (n=46)	13 (28.3)	33 (71.7)	0.001	0.970
Mechanical ventilation				
Yes (n=59)	13 (22.0)	46 (78.0)		
No (n=30)	12 (40.0)	18 (60.0)	3.178	0.075
Diabetes mellitus				
Yes (n=29)	7 (24.1)	22 (75.9)		
No (n=90)	18 (30.0)	42 (70.0)	0.333	0.564

Hypertension				
Yes (n=34)	9 (26.5)	25 (73.5)		
No (n=55	16 (29.1)	39 (70.9)	0.071	0.789
Renal diseases				
Yes (n=2)	2 (100)	0 (0.0)		
No (n=87)	23 (26.4)	64 (73.6)	0.077**	
Cardiac diseases				
Yes (n=7)	3 (42.9)	4 (57.1)		
No (n=82)	22 (26.8)	60 (73.2)	0.396**	
Respiratory diseases				
Yes (n=3)	1 (33.3)	2 (66.7)		
No (n=86)	24 (27.9)	62 (72.1)	0.633	
Hemorrhagic strok				
Yes (n=20)	4 (20.0)	16 (80.0)		
No (n=69)	21 (30.4)	48 (69.6)	0.02	0.901
Ischaemic strok				
Yes (n=21)	9 (42.9)	12 (57.1)		
No (n=86)	16 (23.5)	52 (76.5)	2.967	0.085

* Two missing and one admitted to high-dependency are were removed from analysis
** Fischer exact test

Table 6. Predictors of death among neurological cases referred to ICU: Multivariate logistic regression analysis

Patients	B	SE	p-value	Adjusted OR	95% CI
Age (years)					
12-35[a]					
36-65	-1.796	0.674	0.008	6.02	1.61-22.58
>65	-0.319	0.828	0.700	1.38	0.27-6.97
Source of cases					
ER[a]					
Ward	-1.705	0.704	0.016	5.50	1.38-21.86
OR	20.766	13909.3	<0.001	NA	NA

SE: Standard error B: slop [a]: Reference category
OR: odds ratio CI: confidence interval

Figure 1. Source of neurological cases referred to ICU (n=87)

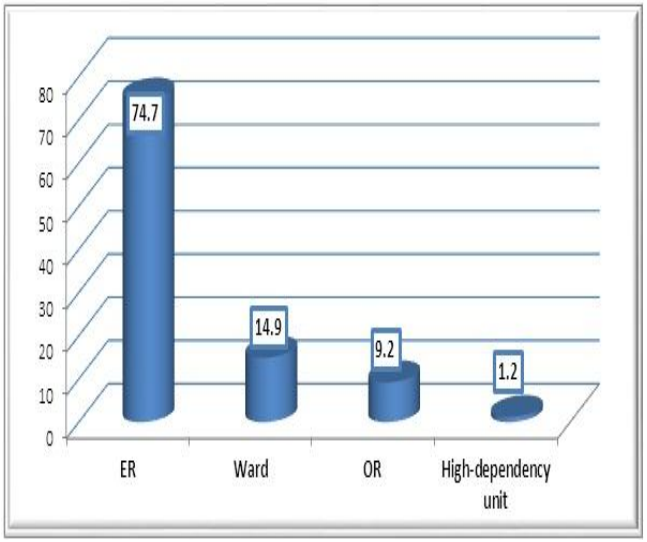


Figure 2. Reason of referral of neurological cases to ICU

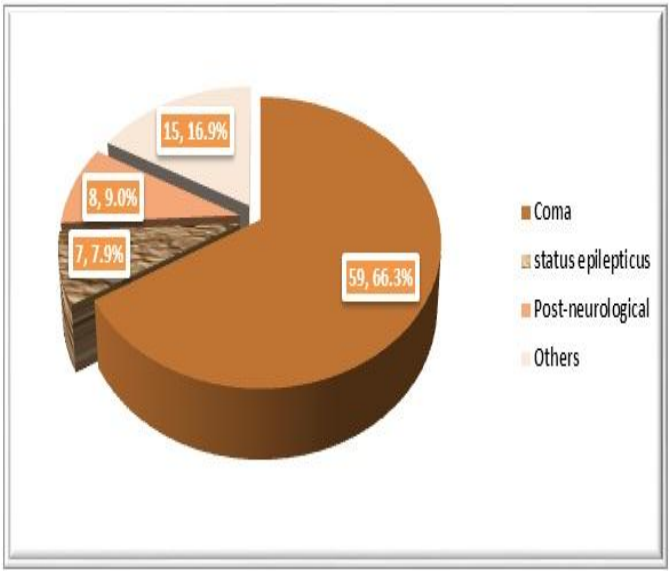


Figure 3. Need for mechanical ventillation among neurological cases referred to ICU

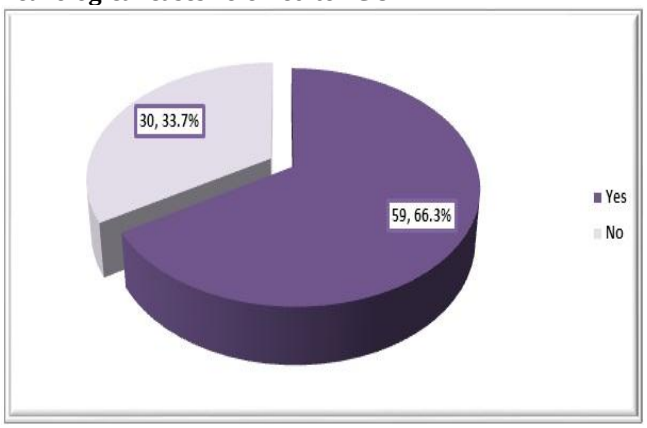
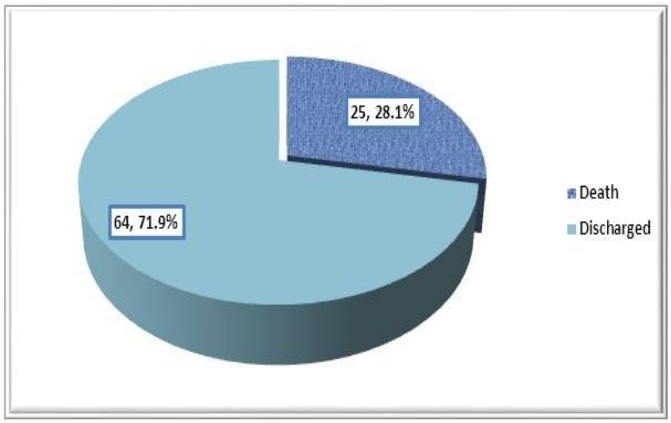


Figure 4. Outcome of neurological cases referred to ICU



DISCUSSION AND CONCLUSION

Neuro-critical care units have developed to coordinate the management of critically ill neurological patients in a single specialized unit, which includes many clinical domains. Care is provided by a multidisciplinary team trained to recognize and deal with the unique aspects of the neurological disease processes, as several treatable neurological disorders are characterized by imminent risk of severe and irreversible neurological injury or death if treatment is delayed [6].

Diringer and Edwards [7] concluded in their prospective study that mortality rate after intracerebral hemorrhage (ICH) is lower in patients admitted to a neurologic or neurosurgical (neuro) intensive care unit (ICU) compared to those admitted to general ICUs. In our study, a mortality rate of 28.1% has been reported among neurological patients admitted to general ICU compared to only 9% reported among patients admitted to specialized neuro-critical care unit in a study conducted by Suarez *et al*., [8] 15% in a study conducted by kim *et al*., [9] 18%, and 26.6% reported in Western countries studies (18.0 – 26.6%) [10-11]. A Korean study reported that the mortality of ICU patients was 31.0%, but this study was not focused only on the ICU patients with neurological problems [12].

Kurtz et al reported that neurological patients cared for in specialty neuro-ICUs underwent more invasive intracranial and hemodynamic monitoring, tracheostomy, and nutritional support, and received less IV sedation than patients in general ICUs.[1] These differences in care may explain previously observed disparities in outcome between neuro-critical care and general ICUs.

In the current study, neurological patients aged between 36 and 65 years were at 6-folded risk for death compared to younger patients. Considering that the prevalence of neurologic problems such as stroke increases with age, age alone is an important prognostic factor in the elderly patients admitted to neuro-ICUs [13-14].

In a study conducted by Kim et al in Korea, the mean length of neuro-ICU stay was 11.3± 14.4 days (range, 1 – 94 days) compared to17.4 days and SD of 37.7 days (range, 1-310 days). Although the length of ICU stay was longer among died patients in our study compared to those who were discharged (26.04±63.50 versus 13.97±20.10). However, this difference was not statistically significant. In previous studies [15-16], length of neuro-ICU stay was reported as independent predictors of unfavorable outcomes. This could be attributed partially to the relatively small size in our survey.

In general, early death has been shown to be higher in patients with hemorrhagic stroke than in those with ischemic stroke [17-18]. In our patients, the type of stroke did not influence survival in accordance with others [19].

Mechanical ventilation as a dependent predictor for death in ICU show different consequences [9]. In the present study, it was not significantly associated with death in ICU. Diagnosis on admission were reported as independent predictors of unfavorable outcomes [9,10,13]. Kiphuth IC *et al*., reported that the diagnoses of hemorrhagic stroke and cerebral neoplasm predispose for poor functional outcome, whereas GBS or myasthenia gravis were related to good functional outcome one year after discharge [20]. In our study, stroke and traumatic brain injury were accompanied with higher mortality rate whereas epilepsy was accompanied with between prognosis. However, this was not significant.

In accordance with our findings, previous studies reported that sex did not significantly differ between survivors and non-survivors in ischemic stroke patients admitted to ICU [21-22].

Patients referred from wards were at higher risk of death compared to those referred from operating room (OR) or emergency room (ER). This could reflect their general health status with co-morbid illness compared to healthier patients admitted to ER or OR.

This study has some important limitations. First, this study was a single center study, with all the possible corresponding biases. Thus, the results have low power to be generalized to all other neurological cases referred to ICUs. Second, this study does not provide very long-term follow-up data as it depends on retrospective reviewing of records of patients during a period of one year. These two

limitations ask for long-term, multicenter studies. In addition to lack of established neuro-critical care unit in our hospital to compare the outcome at general ICU and neuro-critical unit. Despite the limitations, this study is the first report about the predictors of functional outcome and death in neurological patients referred to ICUs in Saudi Arabia. In addition, considering the differences of outcomes, it is important to detect predictable risk factors for poor outcomes and manage aggressively.

We conclude from this study that neurological patients need a specialized neurocritical care to improve the patient care, but to reach a better conclusion we should compare the mortality to a neurocritical care which not available in our medical centre

REFERENCES

1. Kurtz P, Fitts V, Sumer Z, Jalon H, Cooke J, Kvetan V *et al*., (2011). How does care differ for neurological patients admitted to a neurocritical care unit versus a general ICU? *Neurocrit Care*, 15(3), 477-480.
2. Wijdicks EFM, Worden W, Miers A, Piepgras DG. (2011). The early days of the neurosciences intensive care unit. *Mayo Clin Proc*, 86, 903–906.
3. Mirski MA, Chang CW, Cowan R. (2001). Impact of a neuroscience intensive care unit on neurosurgical patient outcomes and cost of care: evidence-based support for an intensivist-directed specialty ICU model of care. *J Neurosurg Anesthesiol*, 13(2), 83-92.
4. O'Connor S, Ayres A, Cortellini L, Rosand J, Rosenthal E, Kimberly WT. (2012). Process improvement methods increase the efficiency, accuracy, and utility of a neurocritical care research repository. *Neurocrit Care*, 17(1), 90-96.
5. Mateen FJ. (2011). Neurocritical care in developing countries. *Neurocrit Care*, 15(3), 593-598.
6. Howard RS, Kullmann DM, Hirsch NP. (2003). Admission to neurological intensive care: who, when, and why? *J Neurol Neurosurg Psychiatry*,74, iii2-iii9
7. Diringer MN1, Edwards DF. (2001). Admission to a neurologic/neurosurgical intensive care unit is associated with reduced mortality rate after intracerebral hemorrhage. *Crit Care Med.*, 29(3), 635-40.
8. Suarez JI, Zaidat OO, Suri MF, Feen ES, Lynch G, Hickman J *et al*., (2004). Length of stay and mortality in neurocritically ill patients: impact of a specialized neurocritical care team. *Crit Care Med*, 32(11), 2311-2317.
9. Kim Y, Kwon S-B, Park H-J, Kim M-J, Hang S-S, Kang SY *et al*., 2012, Predictors of functional outcome of patients in neurological intensive care unit. *Neurology Asia*, 17(3), 219 – 225.
10. Broessner G, Helbok R, Lackner P, Mitterberger M, Beer R, Engelhardt K *et al*., (2007). Survival and long-term functional outcome in 1,155 consecutive neurocritical care patients. *Crit Care Med*, 35, 2025-2030.
11. Nfor TK, Walsh TS, Prescott RJ. (2006). The impact of organ failures and their relationship with outcome in intensive care: analysis of a prospective multicentre database of adult admissions. *Anaesthesia*, 61, 731-738
12. Koo MJ, Kim MH. (2002). A study about the factors concerned with death of ICU patients by the APACHE III tool. *J Korean Acad Adult Nurs*, 14, 93-101.
13. Saposnik G, Black S. (2009). Stroke in the very elderly: Hospital care, case fatality and disposition. *Cerebrovasc Dis*, 27, 537-43
14. Demoule A, Cracco C, Lefort Y, Ray P, Derenne JP, Similowski T. (2005). Patients aged 90 years or older in the intensive care unit. *J Gerontol A Biol Sci Med Sci*, 60, 129-132.
15. Yilmaz GR, Cevik MA, Erdinc FS, Ucler S, Tulek N. (2007). The risk factors for infections acquired by cerebral hemorrhage and cerebral infarct patients in a neurology intensive care unit in turkey. *Jpn J Infect Dis*, 60, 87-91.
16. Venker J, Miedema M, Strack van Schijndel RJ, Girbes AR, Groeneveld AB. (2005). Long-term outcome after 60 days of intensive care. *Anaesthesia*, 60, 541–546.
17. Burtin P, Bollaert PE, Feldmann L, Lelarge P, Bauer P, Larcan A. (1994). Prognosis of patients with stroke undergoing mechanical ventilation. *Intensive Care Med*, 20, 32-36.
18. Hambers BR, Norris JW, Shurvell BL, Hachinski VC. (1987). Prognosis of acute stroke. *Neurology*, 37, 221-225.
19. Steiner T, Mendoza G, De Georgia M, Schellinger P, Holle R , Hacke W. (1997). Prognosis of Stroke Patients Requiring Mechanical Ventilation in a Neurological Critical Care Unit. *Stroke*, 28, 711-715
20. Kiphuth IC, Schellinger PD, Köhrmann M, Bardutzky J, Lücking H, Kloska S *et al*., (2010). Predictors for good functional outcome after neurocritical care. *Crit Care*, 14(4), R136.
21. Lan MY, Wu SJ, Chang YY, Chen WH, Lai SL, Liu JS. (2006). Neurologic and non-neurologic predictors of mortality in ischemic stroke patients admitted to the intensive care unit. *J Formos Med Assoc*, 105, 653-658.
22. Rabinstein AA, Wijdicks EF. (2004). Outcome of survivors of acute stroke who require prolonged ventilator assistance and tracheotomy. *Cerebrovasc Dis*, 18, 325-331.