

Determinants of Outcome among Intensive Care Unit Patients in a Nigerian Tertiary Hospital.

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Abstract

Communities in sub-saharan Africa with limited access to health care often have a disproportionately high prevalence of critically ill patients. The challenges faced by many countries in Africa make it important to develop innovative and cost effective ways to provide critical care services and maximize the use of limited ICU bed spaces. Understanding the determinants of outcome in ICU patients should lead to better decision making when allocating limited ICU bed spaces.

This was a retrospective study from January to December 2019. With the aid of a proforma, relevant information concerning patients' biodata, associated medical condition, indication for ICU admission, critical care interventions provided and outcome of care were retrieved from the records.

One hundred and three ICU patients were included in the study. Sixty-two (59.6%) were males while 41 (39.4%) were female. The mean age of the patients was 38.31yr. Fifty patients did not survive to ICU discharge giving a mortality rate of 48.5%. Gender (χ^2 1.556, p 0.212258), age (U = 1319.5, z = 0.03299, p 0.97606), associated medical disease (χ^2 0.01435, p 0.704814) and ICU length of stay (U = 1175, z = 0.98649, p = 0.32218) did not have a statistically significant impact on ICU outcome. Patients who had mechanical ventilation (χ^2 18.8976, p 0.000014) and inotropic support (Fishers exact p 0.0012) had a poorer outcome than those who did not (Table I).

We conclude that patients who require mechanical ventilation and inotropic support are more likely to have a poorer ICU outcome than those who do not.

Key words: Intensive care, mechanical ventilation, mortality

Introduction

The Intensive Care Unit (ICU) is an essential component of modern healthcare delivery. The unit caters for a subset of patients whose illnesses, injuries and complications are of such severity that they require additional care beyond what can be provided in a regular hospital ward.

The management of these patients usually require additional physician and nursing staff availability of certain equipment for respiratory support, invasive monitoring and the ability to provide continuous infusion of pharmacologic agents.

Intensive care began in the 1950s during the polio epidemic.¹ Since then, ICUs have been established in several communities in Europe and North America. Establishment of ICUs in Africa has lagged behind and the first ICU in Nigeria was established in the University of Nigeria Teaching Hospital (UNTH) Enugu, in 1973.² The ICU in the University of Ilorin Teaching Hospital was established in 1991.

Often, communities in sub-saharan Africa with limited access to clean water and food and primary health care, have a disproportionately high prevalence of critically ill patients.³

South African and Uganda have 75 and 1 ICU bed per million population respectively while many countries in sub-saharan African have fewer than 20 beds for their entire population.⁴ In contrast, USA has 336 ICU beds per million population.⁵ The challenges faced by many countries in Africa make it important to develop innovative and cost effective ways to provide critical care services and maximize the use of limited ICU bed spaces.⁶

Understanding the determinants of outcome in ICU patients should lead to better decision making when allocating limited ICU bed spaces.

Patients and Methods

Study Setting

The study was conducted at the University of Ilorin Teaching Hospital, Ilorin, Nigeria. This hospital is a referral centre for patients from Kwara State and neighbouring states of Kogi, Niger, Ekiti and Oyo. The ICU is a four bedded unit equipped with mechanical ventilators, mobile X-ray machine, blood-gas analyzer, syringe and infusion pumps.

Study population

The records of all patients admitted into the ICU during the study period were retrieved and

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analysed.

Study design

This was a retrospective study of all patients admitted into the ICU between 1st January and 31st December, 2017. Study participants were identified from Institutional record books and clinical records (casenotes). The case notes were retrieved from the records department. With the aid of a proforma, relevant information concerning patients' biodata, associated medical condition, indication for ICU admission, critical care interventions provided and outcome of care were retrieved from the records. All patients admitted into the ICU from January to December 2017 were included. The patients were either transferred or admitted into the ICU from various locations in the hospital during the study period. There were no exclusion criteria.

Ethical permission was obtained from the Ethical Review Board of the University of Ilorin Teaching Hospital.

Data Analysis

Results generated from this study were expressed as frequencies or proportions of total, means and standard deviations. Quantitative data with normal distribution were analyzed with the student t-test while the Mann-Whitney test was used for skewed data. Chi-

square test or Fisher's exact test were applied to categorical variables using the software package SPSS version 16.0. A p-value of less than 0.05 was considered statistically significant.

Results

One hundred and three ICU patients were included in the study. Sixty-two (59.6%) were males while 41 (39.4%) were female. The mean age of the patients was 38.31yr.

Source of ICU admission

Patients were admitted from several locations in the hospital but the operating theater and the Accident and Emergency ward accounted for most admissions with 40 (38.84%) and 39 (37.86%) patients respectively. The paediatric wards accounted for 12 (11.65%) ICU admissions while the surgical, medical and obstetrics and gynaecology wards accounted for 7 (6.80%), 4 (3.88%) and 1 (0.97%) admission respectively. Of the 40 post-operative admissions, 16 (40%) had emergency procedures while 24 (60%) had elective surgeries.

Indication for ICU admission

Sixty (58.25%) patients were admitted for ventilatory support. Other indications for admission were monitoring, airway management, delayed

Table I: Determinants Of ICU Outcome

	Total	Discharge	Death	Statistical test	<i>p</i>
Gender					
Male	62	35	27	X ² 1.556	0.212258
Female	41	18	23		
Assoc Med. Disease					
Present	39	21	18	X ² 0.01435	0.704814
Absent	64	32	32		
Surgery					
Yes	40	26	14	X ² 4.8024	0.02842
No	63	27	36		
Urgency of surgery					
Emergency	16	7	9	X ² 5.293	0.021411
Elective	24	19	5		
Mechanical Ventilation					
Yes	60	20	40	X ² 18.8976	0.000014
No	43	33	10		
Inotropic support					
Yes	21	4	17		Fishers exact 0.0012
No	82	49	33		
Days to ICU admission		4.34(33.96)	1.82(7.7)	U is 1205 z-score 3.02875	0.00244
ICU length of stay		3.7 (33.52)	2.51 (4.49)	U = 1175 Z =-0.98649	0.32218
Mean Age (years)		38.6 (27.24)	37.995 (23.26)	t 0.2634 (CI-11.372, 8.7112)	0.7928

recovery from anaesthesia, cardiovascular support and severe sepsis with 37 (35.92%), 18 (17.48%), 11 (10.68%), 8 (7.77%) and 5 (4.85%) respectively.

Associated Medical conditions

Thirty-nine (37.86%) patients had at least one medical condition with cardiovascular disease occurring in 29 of them. This is the most frequent associated medical condition (74.36%). Other medical conditions were sickle cell disease 2 (5.13%), obesity 1 (2.56%), Tuberculosis 2 (5.13%), Pregnancy 1 (2.56%), Peptic ulcer disease 1 (2.56%), Non-Hodgkin's Lymphoma 1 (2.56%), renal failure 2 (5.13%). One patient with hypertension also had diabetes mellitus.

Mechanical ventilation

Sixty patients (57.7%) were admitted for ventilatory support. The mode of support was Synchronized Intermittent Mandatory Ventilation (SIMV) in 56 patients. Intermittent Positive Pressure Ventilation (IPPV) and Continuous Positive Airway Pressure (CPAP) were only used in 2 patients each.

ICU outcome

Fifty patients did not survive to ICU discharge giving a mortality rate of 48.5%. Gender (χ^2 1.556, $p=0.212258$), age ($U=1319.5$, $z=0.03299$, $p=0.97606$), associated medical disease (χ^2 0.01435, $p=0.704814$) and ICU length of stay ($U=1175$, $z=0.98649$, $p=0.32218$) did not have a statistically significant impact on ICU outcome. Post-operative patients had a better ICU outcome than non-operated ICU patients (χ^2 4.8024, $p=0.02842$). Among post-operative patients, those who had emergency surgeries also had better ICU outcome (χ^2 5.293, $p=0.021411$). Patients who had mechanical ventilation (χ^2 18.8976, $p=0.000014$) and inotropic support (Fishers exact $p=0.0012$) had a poorer outcome than those who did not (Table I). Also, patients who died were those who were transferred to ICU after a mean of 1.82 (7.7) days admission in the wards while those who survived had a longer duration of admission before ICU transfer with a mean of 4.34 (33.96) ($U=1205$, $z=3.02875$, $p=0.00244$).

Discussion

This study found that ICU mortality rate was 48.5%. This is unusually high compared to the worldwide rate of 16.2% found in a large study that looked at patients from several continents.⁷ This rather high rate may be due to the severity of disease in the patients that were transferred to ICU. Many patients were referred for ICU care late due to the limited coverage of health insurance which means that relatives of ICU patients have to pay for care out of pocket. Cost considerations therefore mean that

consent for transfer to ICU is usually withheld until all other means are exhausted. The use of an ICU score for severity of illness like APACHE is better at determining the significance of mortality rates. Unfortunately, these tests were not in routine use when the study was conducted.

Patient's age did not have a statistically significant impact on ICU outcome. This is probably because the average age of study participants was 38.31 years. The mean age of patients in an European study was 60.6 ± 17.4 years in 2002 and 62.5 ± 17.0 years in 2012.⁸ While in mainland China the mean age was 58.5 ± 19.2 yrs.⁹ In an older subset of patients, the impact of age on outcome may have been more telling. Age was an independent risk factor for poor outcome in trauma patients treated in ICU.¹⁰ In a review article, mortality rates were found to be higher in elderly ICU patients than in younger patients.¹¹ The poorer prognosis was due to associated factors with ageing such as severity of illness and premorbid functional status.

In our study, the patients' gender did not contribute to poor outcome. The impact of gender on ICU outcome has not been clearly established. While one study found that male gender contributed to poor outcome in postoperative ICU patients¹² another could only confirm better prognosis in female ICU patients less than 50 years of age while those above 50 years did not have a significant difference compared to men.¹³

The presence of associated medical conditions did not have a statistically significant impact on ICU outcome. This may be because a large proportion of our patients had cardiovascular disease (especially systemic hypertension) which was usually controlled and did not significantly impact outcome. Intensive Care Unit length of stay also did not have a statistically significant impact on mortality. This is in agreement with a study by Williams *et al* which showed that most deaths occurred in ICU within the first few days of ICU admission and increasing length of ICU stay was not associated with increased risk of in-hospital mortality.¹⁴ In this study, postoperative patients had a better outcome than non-operated patients. This was surprising as the stress of surgery could have been expected to have an adverse effect on the outcome of ICU care. However, adequate and effective utilization of the intensive care unit has been found to improve outcome in high-risk surgical patients. The patients that had a poor outcome were those that were initially managed in the wards after their operations before transfer to ICU.¹⁵

Patients who had mechanical ventilation and inotropic support had a poorer outcome than those who did not. This may simply reflect the fact that these modalities of treatment are generally used for more severe cases in the ICU. However, it may also be a reflection of the adverse effects of these therapeutic

regimens on critically ill patients.

Mechanical ventilation, though life-saving, is associated with several adverse effects. These include intubation-related complications like laryngospasm, bronchospasm, tube dislodgement, local trauma to the oral cavity, dentition, pharynx, larynx, and trachea; hematoma formation; tracheal stenosis or necrosis.¹⁶

Others are ventilator associated pneumonia,¹⁷ ventilator-induced diaphragmatic dysfunction,¹⁸ ventilator-induced lung injury.¹⁹ While inotropic therapy are valuable in maintaining patient haemodynamics of the short term, they have been associated with an increased risk of bacteremia and arrhythmias. The complications from mechanical ventilation and inotropic support can adversely affect the prognosis of patients and may be responsible for the poor outcome with these modes of treatment that was found in our study.

Conclusion

The requirement for mechanical ventilation and inotropic support were predictors of poor outcome among ICU patients. More studies are needed on the use of lung protective strategies which may reduce morbidity and mortality associated with mechanical ventilation.

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