Characteristics of Adult Intensive Care Unit Patients at a University Hospital

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Abstract

Intensive Care Unit (ICU) is an advanced service available in hospitals for potentially recoverable patients who have acute life-threatening single or multiple organ system failure due to disease or injury. The aim of this study is to explore the characteristics of adult ICU patients at a university Hospital in Bangladesh. A descriptive study design was carried out to conduct this study. Data were collected from 112 conveniently selected ICU patients, by observing their medical documents and interviewing patients' attendants. The findings of this study showed that the mean age of the recruited ICU patients was 55.82 ± 19.185 years. Most of the participants were male 63.4%, Muslims 89.3%, and married 84.8%. The most common co-morbidities were DM 49.1%, HTN 47.3% and CKD 33.0%. Among the ICU patient, 50.9% was unconscious and 60.7% of patients were in mechanical ventilation. The health related characteristics such as systolic blood pressure, diastolic blood pressure, serum electrolytes, arterial blood gas analysis, etc were at the normal limit and the most common ICU related complication was septicemia 15.2%, and aspiration pneumonia 18.8%. The average length of stay in ICU was 7.73 ± 8.782 days. The outcome characteristics of ICU patients were death at 49.1% and live was 50.9%. ICU is an important component of tertiary care hospital that admits patients with severe and life-threatening conditions. This study findings show that the elderly population with DM, HTN and CKD are frequently admitted in the ICU and have been suffering from multiple ICU related complications and challenges.

Subject Areas

Nursing, Nutrition

1. Introduction

An intensive care unit (ICU) is an organized system for the provision of care to critically ill patients that provides intensive and specialized medical and nursing care, an enhanced capacity for monitoring, and multiple modalities of physiologic organ support to sustain life during a period of life-threatening organ system insufficiency [1]. ICU patients are the ill person who has acute life-threatening single or multiple organ system failure due to disease or injury [2]. The critically ill people in ICUs are a large and expensive component of modern health care [3].

The prevalence of critical care capacity has global disparities both in developed and developing countries. Among developed countries approximately 1, 6400 patients in England [4]; about 4 million patients in the United States are admitted to ICU each year [5] and In the United States, up to half of all people experience ICU care during their final year of life and the demand is increasing [3]. In developing countries like Africa, the overall ICU admission was 15%. Although the proportion of hospitalized patients admitted to the ICU increased over time, from 2005 to 2014 increased ICU admission rate from 0.7% to 2.8% [6]. In Bangladesh, it was realized that one-third of total admissions were shifted to critical care units (32.85%) [7].

There are varieties of admission characteristics of ICU patients. One study found in Germany 66.7% were admitted to the ICU as an emergency admission, of which underwent unscheduled surgery was 50% and 33.3% patients were admitted following elective surgery. Trauma, cardiac diseases and gastrointestinal diseases were the most frequent causes of ICU admission [8]. Another study in Sub-Saharan Africa found that the most common ICU admission characteristics were surgery, medical conditions, and trauma including burns and traumatic brain injuries. Infection was the most common medical condition leading to ICU admission [6]. In Bangladesh the most prevalence of ICU admission is from the medical discipline (59.92%) and other disciplines such as surgical (37.53%), gynecological, obstetric and other disciplines (2.25%) [9].

More old patients are admitted to ICU due to the age structure of the world population has shifted with the proportion of old people increasing [10]. In Denmark, a Study found that the proportion of patients aged > 80 increased from 11.7% to 13.8% from 2005 to 2011 [11]. The geographic variation in ICU use for patients > 85 years old was also seen in other studies where it was less common in England (1.3%) than in the United States (11.0%) [12]. Another Data from the United States estimates approximately 55% of all ICU bed days are incurred by patients aged ≥ 65 years [10].

Gender-related differences were discussed in previous studies but it's unclear

whether gender was a predictive factor of clinical outcome. In Austria, men were admitted to ICU more than women even the severity of illness was the grater in women. Gender bias has been described in other clinical settings [13]. In one study from Sweden, 60% of all ICU care was spent on men but they did have a higher severity of illness compared to women [14]. In Austria showed that men more than women were admitted to ICU even when illness severity was greater in women [15]. One study found in Pakistan showed that there were 46.5% male and 53.5% female patients admitted to ICU [16].

ICU costs are expected to rise due to an aging population and the increasing severity of illness among hospitalized patients [17]. Overall critical care accounts for a significant portion of health care costs, as 11% of hospital admission now incorporate a stay in the ICU [18]. Calculating the costs of ICU is helpful in assessing of intensity of interventions and analyzing patient characteristics, while identification of cost drivers leads to optimum utilization of resources [19].

Impacts of ICU patients may experience several during and after their stay in ICUs. Some patients who recover from critical illness suffer from long-term psychological disturbances such as depression, anxiety and other chronic stress syndromes [20]. Other studies focus on an outcome such as functional status, ability to live at home, influence on the social network, and the burden on the family [21]. The data concerning the patterns of admission is of fundamental importance to specialist training. Moreover, an understanding of the case mix that presents to an Acute Medical Unit is critical for identifying priority areas for ongoing service development, and educational priorities, and for informing the research agenda [22]. A lot of studies have been conducted on different aspects of ICU patients [16] [18] [23]. However, there are very few studies focused on the characteristics of the ICU patients that can guide the health and nursing profession during providing care, particularly in Bangladesh. Therefore, this study is intended to explore the characteristics of Intensive Care Unit (ICU) patients at a university hospital in Bangladesh.

2. Methods

2.1. Study Design and Participants

This is a descriptive exploratory study which aims to explore the patient's characteristics, ICUs admission characteristics and ultimate outcome of the ICU patients among adult patients aged 18 years and above at a University Hospital in Bangladesh. The participants of this study were adults who were admitted with acute illness and chronically on acute illness in the ICU of BSMMU, Dhaka Bangladesh. Total of 112 samples were collected conveniently. This study was conducted at Bangabandhu Sheikh Mujib Medical University, Shahbag, Dhaka, Bangladesh.

2.2. Data Collection

Research instrument was developed by the researcher based on literature review

and experts opinion. The questionnaire consists of three sections. Section I consists of socio demographic characteristics include age, gender, religion etc, Section II consists of Health and ICU admission related characteristics of patients such as Causes of admission, Types, Sources etc. Section III consists of clinical characteristics of the ICU patients such as Blood pressure, RBS, Serum electrolytes etc and section IV consists of Invasive Procedures performed on ICU patients such as Intubation, Tracheostomy, Central venous catheter etc. The questionnaire was translated into Bengali by bilingual expert.

Data were collected by the researcher from Intensive Care Unit of BSMMU. Since the patients in ICU care setting were unconscious or psychologically disoriented, data was not directly collected from the patients, so the researcher collected the data from patient's legal guardians, hospital record, laboratory reports and observation of the patients. Researcher observed the patients from the time of data collection upto to discharge or death. Permission was taken before collecting data from Institutional Review Board (IRB) from Bangabandhu Sheikh Mujib Medical University and National Institute of Advanced Nursing Education and Research Dhaka, Bangladesh. Written permission was taken from the concern authorities of selected hospital. Informed written or verbal consent was taken from the legal guardian of the patients after describing the purpose and process of this study. The subjects' confidentiality and anonymity was strictly maintained with code numbers.

2.3. Data Analysis

After completion of data collection, all data were checked to manage for its consistency to minimized error. The relationship among frequencies, percentages, mean, and standard deviation were used to describe the characteristics of ICU patient.

3. Results

3.1. Socio-Demographic Characteristics of the ICU Patients

The findings of this study revealed that the mean age of the participants was 55.82 ± 19.185 years with the range from 18 to 86 years where the majority 61 (55.4%) of the patients were over 60 years old. Most of the participants were male (63.4%), Muslim were 89.3% and married were 84.8%. Almost all of the participants were educated. The occupational statuses of the participants were business 33.9%, Housewife 32.1%, retired 16.1% and others were 17.9%. The monthly income of the majority 58 (51.8%) of participants were in the range of 5000 to 49,000 with average 68,282.14 ± 85,915 BDT. The mean of total daily cost of the patient was 10131 ± 2328.555 with the range from 5500 BDT to 18,500 BDT where per day the average ICU service cost was 3318.75 ± 364.044 and daily medicine, investigation and other cost 6816.96 ± 2297.664. Among all participants only 39 (34.8%) were smoker and more than half of the participants were living in the urban area 63 (56.8%) (Table 1).

Table 1. Socio-demographic characteristics of the ICU patients (N = 112).

Variables	Category	N (%)	M (SD)
Age (Year)			55.82 (19.185)
	<40 years	27 (24.1%)	
	40 - 60 Years	24 (21.4%)	
	>60 Years	61 (54.5%)	
Gender			
	Male	71 (63.4%)	
	Female	41 (36.6%)	
Religion			
	Muslim	100 (89.3%)	
	Hindu	12 (10.7%)	
Marital Status			
	Married	95 (84.8%)	
	Single	14 (12.5%)	
	Others	3 (2.7%)	
Level of Education			
	Analphabet	3 (2.7%)	
	Secondary	77 (68.8%)	
	College and Higher	32 (28.6%)	
Occupation			
	Business	38 (33.9%)	
	Housewife	34 (32.1%)	
	Retired	18 (16.1%)	
	Others	20 (17.9%)	
Family Monthly Income (BDT)			68,282.148 ± 5915.88
	<50,000	72 (64.3%)	
	50,000 - 10,000	24 (21.4%)	
	>100,000	16 (14.3%)	
Daily ICU Service Cost (BDT)			3318.75 ± 364.044
	≤3500	108 (96.4%)	
	>3500	4 (3.6%)	
Daily Medicine, Investigation and Other Costs (BDT)			6816.96 ± 2297.664
	≤5000	37 (33.0%)	
	>5000	75 (67.0%)	
Total Daily Cost (BDT)			10,131 (2328.555)

Continued

	≤9500	59 (52.7%)
	>9500	53 (47.3%)
Smoking Habit		
	Smoker	39 (34.8%)
	Non-Smoker	73 (65.2%)
Living Area		
	Urban	63 (56.3%)
	Rural	49 (43.8%)

3.2. Health Status Related Characteristics of ICU Patients

Table 2 Findings revealed that half of the ICU patient 55 (49.1%) have the history of chronic illness of them HTN was 53 (47.3%) followed by DM 55 (49.1%), Stroke 8 (7.1%), Heart disease 2 (1.8), COPD 11 (9.8) and CKD were 37 (33.0%). Types of admission were elective 40 (35.1%) and medical emergency 36 (32.1%) and surgical emergency were 36 (32.1%). Maximum ICU patients admitted by transferring from other hospital 75 (67.0%) and the length of stay in the ICU was 7.73 ± 8.782 days. More than half of the participants were unconscious 57 (50.9). Most of the participants were using invasive ventilation 68 (60.7%). Among all patients, the most common ICU related complication was pressure ulcer 5 (4.5%), septicemia 29 (25.9%), VAP 14 (12.4), aspiration pneumonia 21 (18.8%), AKI 12 (10.7%) and UTI 1 (0.9%). On admission about half of the patients 53 (47.3%) had normal systolic blood pressure with a mean of 123.8929 mmHg, whereas 78 (69.7%) patients had diastolic blood pressure with a mean of 73.6607 mmHg. The average random blood sugar of the patient was 9.3716 ± 4.42156 mmol/L with the range of 1.8 to 22.60, among them about half of the patients 54 (48.2%) had hyperglycemia and 50 (44.6%) had normal blood glucose. It was also found that about 54 (48.2%) had hypernatremia, 30 (26.8%), had normal potassium level 51 (45.5%) and 55 (49.1%) had normal chloride. The ABG result shows that 54 (48.2%) patient had normal level of pH, only 16 (14.3%) had normal level of carbon dioxide (CO_2), 54 (46.4%) had normal level of oxygen, more than half of the patients 60 (53.6%) had normal level of bicarbonate and only 34 (30.4%) of patients had normal level of BEcef. During the data collection period overall outcome of the participants was death 55 (49.1%), transferred to another ward 46 (41.1%) and very few of the patients were discharged to home 11 (9.8%) (Table 2).

3.3. Assessment of Invasive Procedure Performed to ICU Patients

Results in Table 3 showed that 61 (54.5%) patients were intubated and 9 (8.0%) had tracheostomy tube was 9 (8.0%). Most of the patients 89 (79.5%) had nasogastric tube in situ. 64 (55.4%) had central venous catheter and intravenous cannula had 49 (43.8%). Almost all 109 (95.5%) of patients had Foley's catheter

Table 2. Distribution of health status related characteristics of ICU patients (N = 112).

Variable	Category	N (%)	M ± SD
ICU Admission Due to			
	Acute illness	57 (50.9%)	
	Chronic illness	55 (49.1%)	
History of Chronic Illness			
	HTN	53 (47.3%)	
	DM	55 (49.1)	
	Stroke	8 (7.1)	
	Heart Disease	2 (1.8)	
	COPD	11 (9.8)	
	CKD	37 (33.0)	
Types of Admission			
	Medical	36 (32.1)	
	Surgical	36 (32.1)	
	Elective	40 (35.1)	
Sources of Admission			
	Other Hospital	75 (67.0)	
	Operating Room	20 (17.9)	
	Others	17 (15.2)	
Length of Stay in ICU			7.73 ± 8.78
	1 - 24 days	109 (97.3)	
	25 - 49 days	2 (1.8)	
	>50 days	1 (.9)	
Using Ventilation			
	Invasive	68 (60.7)	
	Spontaneous	12 (10.7)	
	Non-Invasive	32 (28.6)	
GCS Score (3 - 15)			
	Unconscious (3 - 8)	57 (50.9)	
	Semiconscious (9 - 12)	31 (27.7)	
	Conscious (13 - 15)	24 (21.4)	
ICU Related Complication			
	Pressure ulcer	5 (4.5%)	
	Septicemia	29 (25.9%)	
	VAP	14 (12.5)	

Continued

	Aspiration Pneumonia	21 (18.8)
	AKI	12 (10.7)
	UTI	1 (0.9)
SBP on Admission (mmHg)		123.89 ± 27.97
	Normal (<120)	53 (47.3%)
	Pre-hypertensive (120 - 139)	21 (18.8%)
	Stage 1 HTN (140 - 159)	27 (24.1%)
	Stage 2 HTN (>160)	11 (9.8%)
DBP on Admission (mmHg)		73.66 ± 19.06
	Normal (<80 mmHg)	78 (69.6%)
	Pre HTN (80 - 90 mmHg)	8 (7.1%)
	Stage1 HTN (90 - 99 mmHg)	14 (12.5%)
	Stage2 HTN (>100 mmHg)	12 (10.7%)
RBS on Admission (mmol/L)		9.37 ± 4.42
	Hyperglycemia > 9	54 (48.2%)
	NormalValue (4.4 - 8.9)	50 (44.6%)
	Hypoglycemia < 4.3	8 (7.1%)
Serum Sodium on Admission		138.85 ± 8.31
	Hyponatremia (<133.9)	8 (7.1%)
	Normal value (134 - 145)	50 (44.6%)
	Hypernatremia (>145.1)	54 (48.2%)
Serum Potassium on Admission		3.84 ± .80
	Hypokalamia (<3.4)	30 (26.8%)
	Normal Value (3.5 - 4.5)	51 (45.5%)
	Hyperkalamia (>4.6)	22 (19.6%)
Chloride on Admission (mEq/L)		104.29 ± 9.73
	Hypochloremia < 95.9	14 (12.5%)
	Normal Value (96 - 106)	55 (49.1%)
	Hyperchloremia (>106.1)	43 (38.4%)
pH on Admission		7.40 ± 0.10
	7.11 - 7.34	24 (21.4%)
	7.35 - 7.45	54 (48.2%)
	7.46 - 7.83	34 (30.4%)
CO_2 on Admission (mmHg)		40.86 ± 13.63

Continued

	<37.9	62 (55.4%)
	38 - 42	16 (14.3%)
	>42.1	34 (30.4%)
Oxygen on Admission (mmHg)		109.80 ± 49.48
	Hypoxemia < 74.9	26 (23.2%)
	Normal Value (75 - 100)	54 (46.4%)
	Hyperoxymia (>100.1)	34 (30.4%)
Bicarbonate on Admission (HCo$_3$) (mmol/L)		25.09 ± 6.12
	<21.9	30 (26.8%)
	22 - 28	60 (53.6%)
	>28.1	22 (19.6%)
BEcef on Admission (mmol/L)		1.11 ± 4.99
	−10 to −1.9	34 (30.4%)
	−2 to 2	34 (30.4%)
	>2.1	43 (38.4%)
Outcome of the Patient		
	Discharge	11 (9.8%)
	Transferred to Ward	46 (41.1%
	Death	55 (49.1%

Table 3. Assessment of invasive procedures performed to ICU patients (N = 112).

Invasive Procedures	Performed [n (%)]
Intubation	61 (54.5%)
Tracheostomy	9 (8.0%)
Nasogastric Tube	89 (79.5%)
IV Cannulation	49 (43.8%)
Central Venous Catheter	64 (55.4%)
Foleys Catheter	109 (95.5%)
Femoral Catheter	10 (8.9%)

and femoral catheter 10 (8.9%) who have planned for hemodialysis.

3.4. Relationship between Patient Characteristics and Outcomes

Table 4 The relationship between Patient Characteristics and Outcomes results showed that the age (>60) is tends to have higher death outcome (p = 0.374), Gender (p = 0.326), Religion (p = 0.198), Level of education (p = 0.111), Smoking habit (p = 0.441) and Living area (p = 0.569). There were no significant

Table 4. Relationship between patient characteristics and outcomes (N = 112).

Variables	Category	No of Death	X^2 (P)
Age (Years)	<40 years	11	1.965 (0.374)
	40 - 60 years	12	
	>60 years	32	
Gender	Male	37	0.420 (0.326)
	Female	18	
Religion	Muslim	51	1.338 (0.198)
	Hindu	4	
Level of Education	Analphabet	1	2.670 (0.111)
	Educated	54	
Smoking Habit	Smoker	22	0.118 (0.441)
	Non-smoker	33	
Living Area	Urban	30	0.420 (0.569)
	Rural	25	

relationship between Patient Characteristics and Outcomes.

4. Discussion

This chapter presents the discussion of the findings of this study in the following three headings: Socio-demographic characteristics, health related status characteristics, invasive procedure related characteristics and the relationship between socio-demographic and outcome of the ICU patients.

The study finding of socio-demographic information shows that the age of the majority of the recruited ICU patients were above 60 years old. This study was compared with internationally and other national study also nearly similar to this age group [3] [24]. In Bangladesh average life expectancy now at 72 years [25] but the mean age of this study was less than 60 years because some young adults was admitted due to other medical problem. Most of the ICU patients were male, married and Muslim. This was the common scenario in Bangladesh. The male predominance may be related to greater degree of illness. In country perspective male are the main earning members in the family. They spend their maximum time outside of home and they were not properly maintaining their healthy lifestyle. Therefore, they become more ill than that of female Bangladesh is a second largest Muslim country in the world. As their religious perspective most of Muslim women are strongly disagree to go to hospital at their end of life. They want a peaceful death in their home setting in front of family member.

The health related characteristics of ICU patients showed that almost half of all patients are admitted due to acute illness and another half of the patients have some comorbidities for this reason they were suffering from chronic illness and

admitted in ICU due to acute or chronic illness. The most common co-morbidities were DM which was consistent with other study was done on acute kidney injury [26]. Diabetes mellitus is currently the commonest endocrine disorder, affecting nearly 6% of the world's population. Type 2 DM is likely to remain undiagnosed for many years. The gap between the onset of the disease and clinical diagnosis of diabetes leads to the development of these chronic complications [27]. Due to secondary complication may the percentage of DM was high in this study. Development of secondary complications may be attributed to the early age of diabetes onset, resulting in prolonged exposure of body organs and tissues to high blood glucose levels [28]. In this study the co-morbidity of HTN was 47.3% and compared to other studies where HTN was 60.5% [29] which was higher than this study. The prevalence of HTN in Bangladesh among adult and elderly people was 40% - 65% [30]. HTN affects on body system as a result of patients experience narrowed arteries, damage and aneurysm. As a result, coronary artery disease, stroke, dementia and other cognitive function impairment and due to multisystem involvement patient's condition becomes worsening and is followed by ICU admission for organ support. CKD was the third co-morbidity in this study whereas another study done in Bangladesh had co-morbidities of CKD which was double than our study [29]. DM and HTN is an independent risk factor for nephropathy and causing AKI followed by CKD. Different studies showed that now a day the incidence of AKI is increasing tremendously and for the lack of proper management patients became admitted in the ICU.

Another major chronic illness was COPD admitted in the ICU during this study period. This study finding showed more than half of the patients admitted in this hospital were from other hospital because ICU treatment cost is very much expensive in private sector which is not affordable for low income people. So people are more interested to get specialized treatment with very little cost BSMMU ICU provides service with very few cost. In government sector there is very limited bed capacity and shortage of available resources. At the time of this study period there was no general emergency in this study setting. Per day approximately 7 - 10 applications submitted for ICU admission. Most of the patients during their acute illness not get admission directly to this ICU due to shortage of bed capacity. They get admission on priority basis and availability of bed. Invasive ventilation using was higher than non-invasive like BIPAP, face musk. Only 10.7% were using spontaneous ventilation. ICU related complication sometime depend on the length of stay. In this study we observed the participants were not stay for long time in the ICU but maximum patients came from other setting with the complications. So their ICU related complications like pressure ulcer, septicemia, ventilator-associated pneumonia, aspiration pneumonia, acute kidney injury, and urinary tract infection were developed during ICU stay. According to Glasgow Coma Scale above half of all participants were unconscious.

On admission clinical characteristics of these patients near about half had

normal systolic blood pressure and more than half of all participants had normal diastolic blood pressure.

Regarding random blood sugar of the participant maximum were hyperglycemic because they have previous history of DM. On the acute stage of any illness it could be high due to increase stress factor. Other biochemical test report showed that on admission nearly half of them were hypernatremic, but most of the participants had normal Serum potassium, serum chloride, and arterial blood Gas analysis level. On admission the most of the patients' carbon dioxide value was below normal but Oxygen and bicarbonate value was in normal value. Finally outcome of this study reported that nearly half of the patients were died in the ICU whereas only 9.8% were discharged to home.

In the invasive procedure performed to ICU patients showed that more than half of all patients were intubated. To prevent Life-threatening complications of ICU patients, intubation may be one of the most common invasive procedures. Tracheostomy also has the most frequent bed side procedure in the ICU to keep the airway healthy and require for long time ventilation. In this study majority of the patient had nasogastric tube because most of the patients were unconscious and semiconscious. In the ICU setting patients may require drugs for prompt action and need more IV access. For these reason in this study participant more than half of all had central venous catheter. Almost all patients had Foley's catheter may be due to strictly manage the intake and output of fluid volume. There was no available facility outside of the bed and for the bed ridden patients. This study found that there was limited facility for hemodialysis with very few costs. Among the participants, only 8.9% had femoral catheters that need hemodialysis along with ICU support, treatment and care. There is no significant relationship between socio demographic characteristics and outcome of the ICU patient but some variables may be susceptible to relate causes of the outcome of ICU patients.

5. Conclusion and Recommendation

5.1. Conclusion

The intensive care unit is an important component of tertiary care hospital that admits patients with severe and life-threatening conditions. This study finding shows that higher age with pre-existing chronic disease DM, HTN and CKD are associated with ICU admission. The majority of our study population in the ICU is elder and even though we have limited data for comparison. On admission, most of the patients were unconscious and receiving mechanical ventilation. The fact that more than half of the ICU admission from other hospitals was explained by the researcher due to unavailability of bed in the country. Critical care remains a neglected area of health service delivery in this setting with a large number of patients with potentially treatable conditions not having access to health services. It is necessary to optimize of nurse-patient ratio; continuing nursing education and proper guidance to practice will reduce the mortality of

ICU patients. These data provide baseline information on the ICU patient in a setting.

5.2. Recommendation

Further correlation study with more samples in different settings would be recommended to identify this study gap.

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Conflicts of Interest

The authors declare no conflicts of interest.

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