Characteristics and clinical outcome of patients treated in the respiratory ICU of Abbassia Chest Hospital

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Background Admission to the respiratory ICU (RICU) is based upon the nature and severity of the patient's acute medical illness, their need for ICU intervention(s) or monitoring, and the likelihood that such interventions and ICU management will improve outcome. Knowledge of patients' characteristics and outcome reflects the level of care in a given ICU and helps improve performance.

Aim The aim was to study the characteristics and clinical outcomes of patients admitted to the respiratory ICU of Abbassia Chest Hospital.

Settings and design A prospective analytical study was conducted.

Patients and methods The study was conducted on patients admitted to RICU of Abbassia Chest Hospital in the period from February 2017 to July 2017. The following data were collected: admission diagnosis, co-morbidities, simplified acute physiology 'simplified acute physiology score (SAPS)' II score, vital data, mechanical ventilation management, laboratory tests including microbiological, length of stay, final diagnosis, complications during stay in ICU and outcome at discharge including mortality, morbidities, and area of transfer.

Statistical analysis The data were entered and analyzed using SPSS 23. For each test, *P* value less than 0.05 was considered significant.

Results A total of 407 patients were admitted over the study period. Mean age of the patients was 55.45±17.88 years. Overall, 249 of them were males and 158 females. Most of the patients were referred from the emergency room. Of them, 206 patients were admitted owing to an exacerbation of underling chest disease and 201 were admitted owing to an acute insult, which caused respiratory failure (RF). Moreover, 281 (69.05%) had RF type II, whereas 126 (30.95%) had RF type I. Chronic obstructive pulmonary disease was the main underlying respiratory disease in 141 (34.64%), and pneumonia was the main acute event, which caused RF, in 138 (33.91%). The mean value of SAPS II score was 27.95 ±13.28, with nonsurvivors having higher SAPS II score of 33.8 compared with survivors of 20.94 ($P<0.001$). Mean length of ICU stay (LOS) was 5.889±5.96 days, with a significant correlation between LOS and mortality rate. Overall, 69.8% of the patients required mechanical ventilation (MV). The mean MV duration was 4.7±4.8 days. MV was associated with longer stay in ICU and a higher mortality. No complications were reported in 327 (80.3%) of patients, whereas 10.5% developed different complications. *Klebsiella* spp. was the most frequently isolated organism followed by Candida and Acinetobacter. Multidrug-resistant bacteria represented 7% of isolates. Colistin was the most effective in-vitro antibiotic. Levofloxacin was the most frequent empirically prescribed antibiotic.

Conclusion Respiratory ICU at Abbassia Chest Hospital serves a large number of patients with diverse respiratory critical illnesses. Most patients were males, in sixth decade of life, and had chronic obstructive pulmonary disease. Mechanical ventilation was applied to most patients and was associated with longer LOS and a higher mortality. MDR gram-negative infections were not infrequent. SAPS II score did not correlate well with the survival in the present study.
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Keywords: LOS, mortality, MV, patient characteristics, respiratory ICU, SAPS II

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Introduction

Respiratory ICU as a division of intensive care has been shown to benefit patients who are severely ill and medically unstable, that is, they have a potentially life-threatening disease or disorder [1].

Respiratory ICU patients are a heterogeneous group with severe illness, multiple system dysfunction, and multiple coexisting medical problems [2]. Approximately one-third of the hospital mortalities occur in critically ill patients inside ICU [3] are responsible for 10–20% of global hospital costs. Early identification of characteristics of critically ill patients requiring RICU and their suspected outcomes helps in improvement of these outcomes and reduction of their mortality rate [1].

Acute or acute-on-chronic respiratory failure (RF) is a common presentation of critically ill patients with interstitial lung disease (ILD) admitted to the ICU.

Abbassia Chest Hospital RICU was opened in 1997 and serves more than 600 cases every year, so this study was conducted to study the characteristics and clinical outcome of patients admitted to the respiratory ICU of

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Abbassia Chest Hospital to improve their outcomes and to achieve a higher survival rates.

Patients and methods

Patients

This study was conducted at the RICU of Abbassia Chest Hospital on 407 patients who were admitted from February 2017 to July 2017. There were 249 (61.33%) males and 158 (38.67%) females, with mean age of 55.45±17.88 years. According to admission diagnosis, 206 (50.6%) patients were admitted owing to exacerbation of the underlining pulmonary disease, whereas 201 (49.4%) patients were admitted owing to secondary respiratory causes.

Exclusion criteria

Patients who are admitted to RICU for less than 24 h will be recorded but will not be included in the statistical analysis.

Methods

All data were collected from patients (if possible) or their relatives, and the cases were followed up till discharge from RICU.

All cases were subjected to the following:

(1) Full detailed medical history was taken, including personal, present and past history of chronic medical diseases, smoking habits, history of addiction, previous ICU admission, and mechanical ventilation (MV) management.
(2) Full thorough clinical examination was done, including general and local chest examination to detect the proper cause of admission, type of RF, and assessment of the proper on-admission simplified acute physiology score (SAPS) II score.
(3) Plain chest radiography (posteroanterior, or anteroposterior according to circumstances).
(4) ECG or echocardiography (ECHO) and computerized tomography study if needed.
(5) Laboratory investigations:
    (a) Arterial blood gases.
    (b) Liver and kidney function tests.
    (c) Complete blood count.
    (d) Serum Na^+ and K^+.
    (e) Virology profile for detection of hepatitis viruses (HCV and HBV), respiratory viruses (H1N1 and H5N1), and HIV infections.
    (f) Microbiological culture study of sputum (acid-fast and pyogenic), blood and urine samples, and antibiotic cultures sensitivity was done.
(6) Length of stay (LOS) and MV duration were recorded.
(7) Assessment of the outcome which will be either death or discharge to chest ward, home or referral to any other department to complete the treatment.

Statistical analysis

The data were entered and analyzed using SPSS 23 (SPSS Inc., Chicago, Illinois, USA). Data were summarized using the arithmetic mean, the SD, χ^2-test, Fisher exact test and t-test. For each test, P value of less than 0.05 was considered significant.

Results

This study was conducted on 407 patients, with mean age of 55.5±17.8 years. Of those patients, 249 (38.7%) were males, whereas the rest were females (Fig. 1). Regarding smoking history, 256 (62.9%) were nonsmokers, whereas 143 (35.2%) were smokers and the rest (1.9%) were ex-smokers. Regarding addiction status, 12 (2.95%) were addicted and 395 (97.05%) had negative addiction status, as shown in Table 1.

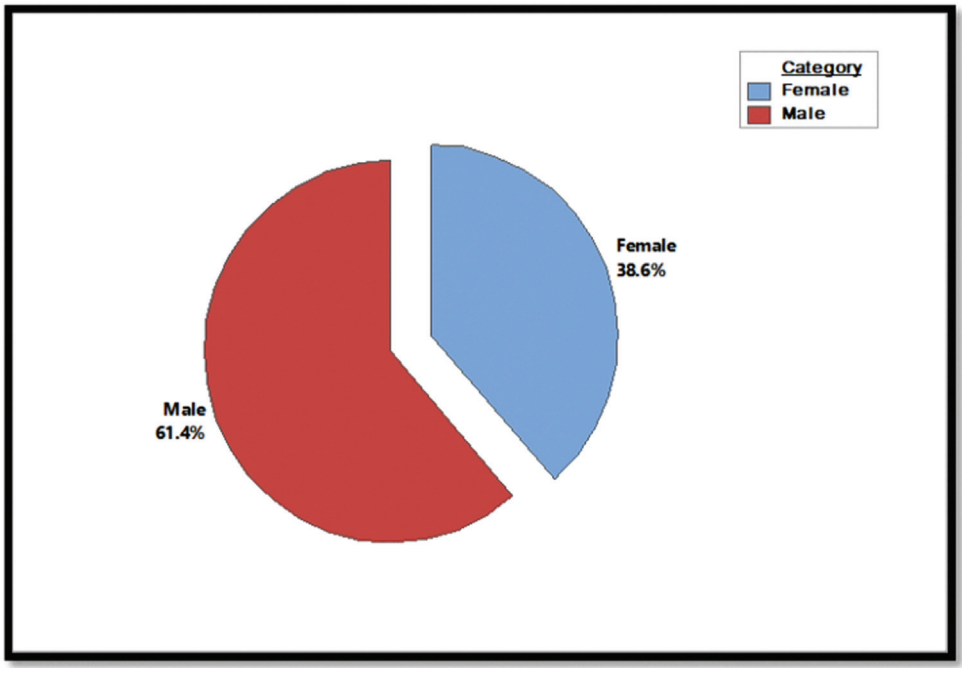
Most of them (71.74%) were referred from the emergency department in our hospital, whereas 22.36% were referred from ward. The rest of them were referred to the ICU from other hospitals, as shown in Table 1.

Regarding type of RF, 281 (69.05%) had RF type II, whereas 126 (30.95%) had RF type I. Regarding final outcome, the mortality rate in our RICU was 54.79%, as shown in Table 1.

Regarding admission diagnosis, owing to exacerbation of an underlying pulmonary disease (primary respiratory causes), 206 (50.6%) were admitted to RICU, and majority of them (141, 34.64%) were patients with chronic obstructive pulmonary disease (COPD) with acute exacerbation. However, 201 (49.4%) were admitted owing an acute insult, which causes a secondary pulmonary diseases. Majority of them (138, 33.91%) were admitted to RICU because of pneumonia, as shown in Table 2.

Microbiological examination of different cultures was done, and we found that 25.31% of our patients had positive sputum culture for pyogenic infections whereas 1.72% had positive sputum cultures for TB; only 0.98% had positive blood culture results and 0.49% had positive urine culture results. *Klebsiella* spp. (8.6%) was the commonest organism isolated followed by Candida (7.37%) and Acinetobacter (5.16%) in our RICU, as shown in Table 3.

Figure 1



Sex distribution of studied respiratory icu patients.

Table 1 Demographic data, characteristics, and outcome of patients admitted to respiratory ICU

Variables	*n* (%)
Age	
Mean±SD	55.5±17.9
Sex	
Female	158 (38.7)
Male	249 (61.3)
Smoking status	
Ex-smoker	8 (1.9)
Nonsmoker	256 (62.9)
Smoker	143 (35.2)
Addiction status	
No	395 (97.05)
Yes	12 (2.95)
Referral site	
ER	292 (71.75)
Ward	91 (22.36)
Other hospitals	24 (5.9)
Respiratory failure type	
Type I	126 (30.95)
Type II	281 (69.05)
Outcomes	
Survival	184 (45.21)
Nonsurvival	223 (54.79)
Outcome of discharged patients	
No specific recommendation	70 (17.2)
Home with O_2 therapy	3 (0.74)
Referred to ward with O_2 therapy	111 (27.27)

ER, emergency department.

Table 2 Admission diagnosis of the studied patients

Underlining pulmonary disease 'primary respiratory causes' diagnosis	*n* (%)
COPD	141 (34.64)
Hypoventilation	4 (0.98)
Diffuse parynchymal lung diseases	26 (6.39)
Lung cancer	23 (5.65)
Bronchiactesis	8 (1.97)
Bronchial asthma	4 (0.98)
Total	206 (50.6)
Acute cause of admission	
Pneumonia	138 (33.91)
Pneumonia+pleural effusion	51 (12.53)
Pneumonia+septic shock	25 (6.14)
Lung abscess+septic shock	10 (2.46)
Pneumothorax	8 (1.79)
Pulmonary edema	6 (1.47)
Myocardial infarction	2 (0.49)
Pulmonary embolism	6 (1.47)
TB+septic shock	31 (7.63)
Total	201 (49.4)

COPD, chronic obstructive pulmonary disease; TB, tuberculosis.

Our results showed that the mean value of SAPS II score was 27.95±13.28, and it was found to be higher in the nonsurvivors (33.8) than that in the survivors (20.94), with a significant difference between both groups, with *P* value less than 0.001, as shown in Table 4.

Regarding the LOS, our results showed that mean LOS was 5.889±5.96 days, and a significant statistical association was found between length of ICU stay and mortality rate, as it was found that the nonsurvivors

were associated with prolonged length of ICU stay than the survivors, as shown in Table 5.

Regarding management by MV, our results showed that 284 (69.8%) patients were managed using MV, with mean MV duration of 4.69±4.84 days. Management by MV was associated with higher mortality rate, as it was found that most nonsurvivors were those who were managed by MV, and also the duration of MV management was increased in nonsurvivors than in the survivors, with significant *P* value of less than 0.0001, as shown in Table 6.

Table 3 Positive microbiological results of cultures of the studied patients and isolated organisms

Variables	*n* (%)
Microbiological study (positive)	
Sputum AFB	7 (1.72)
Sputum pyogenic culture	103 (25.31)
Blood culture	4 (0.98)
Urine culture	2 (0.49)
Organism isolated	
Staphylococcus aureus	8 (1.97)
MRSA	18 (4.42)
Acinetobacter	21 (5.16)
Citrobacter	12 (2.95)
Klebsiella	35 (8.6)
Pseudomonas	17 (4.18)
Proteus	1 (0.25)
E. coli	7 (1.72)
Candida	30 (7.37)

AFB, acid-fast bacillus.

Regarding the fate of extubation trials, our results showed that most MV cases failed to be extubated from the first trial. Overall, 52.6% of those MV patients who failed to be extubated from the first trial were successfully extubated at the second trial, and the rest of them failed to be extubated.

No complications were reported in 80.3% of patients, whereas 10.5% showed MV-related complications, and the rest of our patients were complicated by different complications like bed sore, urinary tract infection (UTI), deep venous thrombosis (DVT), and blood transfusion reactions in low percentages, as shown in Table 7.

The mortality rate of our studied patients in the 6 month was 54.79%. The fate of 184 survived patients was as follows: 111 patients were referred to the ward, 70 were discharged without recommendation, and 3 were discharged with home on O_2 therapy, as shown in Table 1 and Fig. 2.

Table 4 SAPS II score of admitted patients and comparison between survival and nonsurvival regarding SAPS II score

Variables				
SAPS				
Mean±SD	27.95±13.28			
	Outcome		*t*	*P*
Variable	Nonsurvival (mean)	Survival (mean)		
SAPS	33.8	20.94	11.4	0.0001

SAPS, simplified acute physiology score.

Table 5 Length of stay of admitted patients and comparison between survival and nonsurvival regarding length of stay

Variable				
Length of stay (days)				
Mean±SD	5.89±5.96			
	Outcome		*t*	*P*
Variable	Nonsurvival (mean)	Survival (mean)		
Length of stay (days)	6.79	4.79	3.6	0.0001

Table 6 Management by MV and its duration of admitted patients and comparison between survival and nonsurvival

Variable				
Management by MV				
Yes		284 (69.8)		
No		123 (30.2)		
Duration of MV (days)				
Mean±SD		4.69±4.84		
	Outcome		*t*	*P*
Variable	Nonsurvival (mean)	Survival (mean)		
Management by MV [*n* (%)]				
Yes	210 (51.6)	74 (18.81)		0.0001
No	13 (3.19)	110 (27.03)		
Duration of MV (days)	5.2	3.24	4.4	0.0001

MV, mechanical ventilation.

Discussion

RICU is defined as 'an area for the monitoring and treatment of patient with acute RF due to primary respiratory cause and of patient with acute or chronic RF' [1].

This study was carried out to study the characteristics and clinical outcome of patients admitted to the respiratory ICU of Abbassia Chest Hospital. Most of them (71.74%) were referred from the emergency department in our hospital, whereas 22.36% were referred from the ward, and the rest of them were referred to the ICU from other hospitals.

Table 7 Complication developed in the studied patients during ICU stay

Complication	*n* (%)
Not reported complications	327 (80.3)
Mechanical ventilation related	43 (10.5)
Bedsores	16 (3.9)
Drug induced hepatotoxicity	7 (1.6)
Urinary tract infection	6 (1.5)
Deep venous thrombosis	5 (1.4)
Blood transfusion reaction	2 (0.5)
Wound infection	1 (0.3)

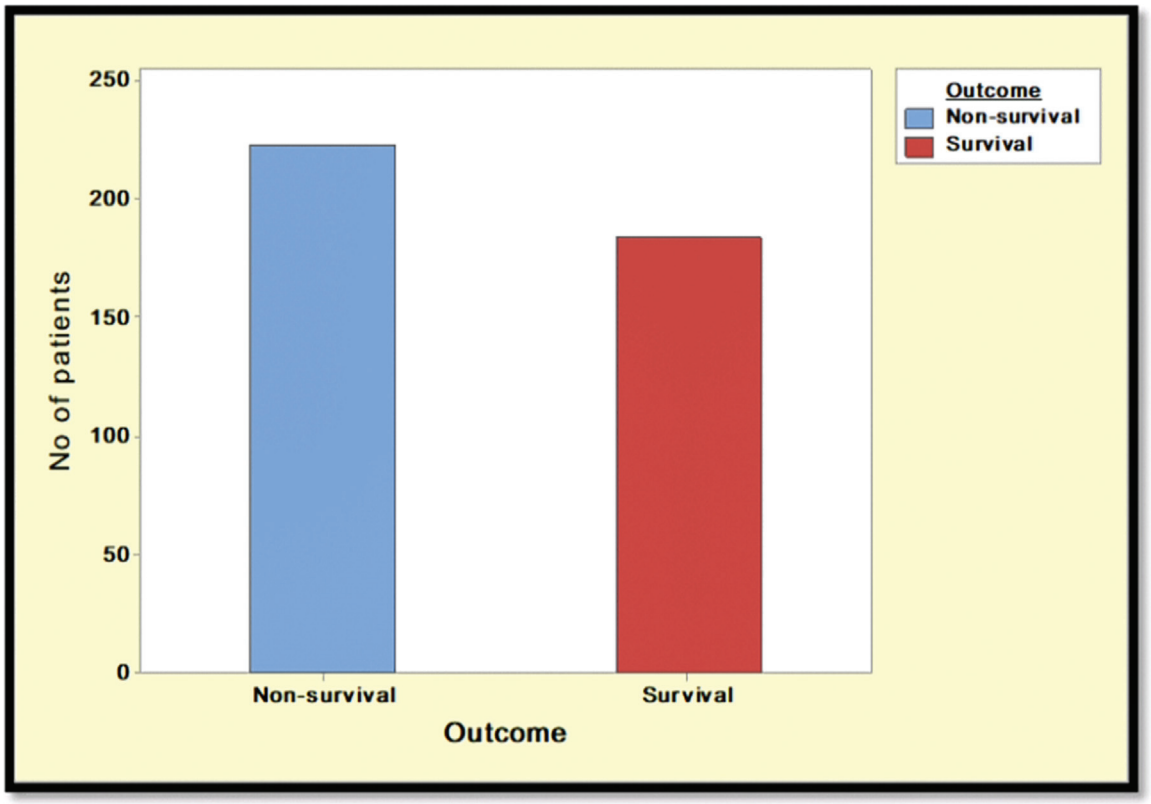
In the study done by Ghoneim *et al.* [1] on 200 patients who were admitted in the Respiratory Intensive Care Unit (RICU) of Zagazig University Hospitals in the period from March 2010 to October 2010, most of the cases were referred to the ICU from chest physician followed by other hospitals and other departments in their hospital.

The mean age of the studied patients group was 55.5 ±17.9 years. Similar to our findings were those of Ghoneim *et al.* [1], Zamzam *et al.* [4], and Chiwhane and Diwan [5], as the mean age in these studies were 59.7±14.0, 58.47±8.21, and 52 years, respectively.

Male patients were ~61.33% of our patients, whereas 38.67% were female. Bolaji and Kolawole [6] showed a sex distribution of 185 (62.7%) males and 110 (37.3%) females in general ICU. Moreover, Ghoneim *et al.* [1] showed that males were 63.0% whereas females were 37.0%. Chiwhane and Diwan [5] reported that sex distribution of 74.7% were males and 25.3% were females.

Regarding smoking history of our patients, 62.9% were nonsmoker, 35.14% were smokers, and the rest of our

Figure 2



Overall outcome of studied respiratory ICU patients.

patients (1.97%) were categorized as ex-smoker. This is similar to Ghoneim *et al.* [1], who reported that nonsmokers were 55.5%, whereas 22.5% were current smokers and 22% were ex-smokers.

RF types I (30.95%) and II (69.05%) were the exact cause of RICU admission. In 206 (50.6%) patients, RF occurs owing to exacerbation of a primary respiratory causes, and COPD with acute exacerbation (34.64%) was the main one of them. However, in 201 (49.4%), RF occurs secondary to an acute insult, which in turn causes a respiratory disorder; pneumonia was found to be the main acute event (33.91%) in those group of patients.

Acute exacerbation of COPD cases was the main cause of respiratory ICU admission, as it was reported in 31.4% of the cases in the study done by Ghoneim *et al.* [1].

Regarding microbiological examination of different cultures, *Klebsiella* spp. (8.6%) was the commonest organism isolated followed by Candida (7.37%) and Acinetobacter (5.16%) in our RICU.

Tan *et al.* [7] found that the most common ICU-acquired strains were *Acinetobacter baumannii*, *Pseudomonas aeruginosa*, *Stenotrophomonas maltophilia*, *Staphylococcus aureus*, *Enterococcus* spp., and *Klebsiella pneumoniae*, whereas He *et al.* [8] reported that *Staphylococcus pneumoniae* and *Staphylococcus aureus* were found to be the predominant Gram-positive strains in the general ward (34.70–41.18%) and RICU (41.66–54.87%), respectively ($P>0.05$). *Pseudomonas aeruginosa* and *Acinetobacter baumannii* were the predominant gram-negative strains in the general ward (19.17–21.09%) and RICU (29.60–33.88%), respectively ($P>0.05$) [8].

The mean value of SAPS II score was 27.95±13.28, and it was found to be higher in the nonsurvivors (33.8) than that of the survivors (20.94) with a significant difference between both groups, with *P* value less than 0.001. This mean that SAPS II score can be used as a predictor of mortality in ICU as the nonsurvivors were having higher SAPS II scores than the survivors.

In the study done by Zin El-Abdeen *et al.* [9], they also found a significant difference between survivors (21.64 ±9.88) and nonsurvivors (39.38±17.36) regarding SAPS II score ($P=0.002$) and the nonsurvivors had a higher SAPS II score than the survivors. Regarding the ICU LOS, our results showed that mean LOS was 5.889±5.96, and a significant statistical association was seen between length of ICU stay and mortality rate, as it was found that the nonsurvivors were associated with prolonged length of ICU stay than the survivors.

In the study done by Ghoneim *et al.* [1], the LOS in RICU was 7.2±7.4 days, and they also reported that there was a significant statistical association between outcomes and duration of stay in ICU (in days).

Moreover, these findings were in agreement with that of Brown and Sullivan [10], Schönhofer *et al.* [11], and Arabi *et al.* [12] who have suggested that mortality is directly proportional to the duration of stay in the ICU because the incidence of nosocomial infection would rise with prolonged ICU stay, and onset of multisystem organ failure increases the mortality also.

Our results was against Williams *et al.* [13] who reported in their study on 22298 critically ill patients that increasing LOS in ICU was not associated with an increased risk of in-hospital mortality after adjusting for other covariates, but was associated with an increased risk of long-term mortality after hospital discharge.Regarding management by MV, our results showed that 284 (69.8%) patients were managed using MV with mean MV duration of 4.69 ±4.84 days. Management by MV was associated with higher mortality rate, as it was found that majority of the nonsurvivors were those who were managed by MV, and also there was an increase in the duration of MV management in nonsurvivors than in the survivors, with significant *P* value of less than 0.0001.

Fialkow *et al.* [14] reported that the mortality rate of patients who required mechanical ventilation was higher, which may have been related to the severity of illness.

Moreover, Feng *et al.* [15] reported that age and duration of MV are strongly associated with mortality and posthospital disposition.

No complications were reported in 80.3% of patients, whereas 10.5% showed MV-related complications, and the rest of our patients were complicated by different complications like bed sore, UTI, DVT, and blood transfusion reactions in low percentages.

The outcome of those 407 patient was analyzed, and it showed that 45.21% of them were survivors (184/407) and 54.79% were nonsurvivors (223/407); this means that the morality rate in our RICU was 54.79%.

Overall, 70 (17.2%) survivors of the whole cases were discharged home with no specific recommendations, whereas 27.27% of the whole cases were referred to

ward with O2 therapy and 0.74% were discharged to home on O_2 therapy.

The mortality rate in the study done by Ghoneim *et al.* [1] was 30.5% and 27.0% of patients were discharged to home, whereas 35.0% of them were referred to chest ward, and the rest 7.5% were discharged to other departments.

Moreover, Bolaji and Kolawole [6] found an ICU mortality rate of 37.3% in their study. The worldwide ICU mortality rate ranges from 14.5 to 30.7% [16].

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Conflicts of interest
There are no conflicts of interest.

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