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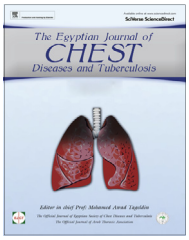

ORIGINAL ARTICLE

Patterns of admitted cases to Respiratory Intensive Care Unit at Zagazig University Hospitals, Egypt

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KEYWORDS

Admission;
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Abstract *Background:* It is well accepted that early appropriate referral of patients to an ICU can significantly reduce early and possibly late mortality in the critically ill. At the same time improper selection of patients for ICU, often limits bed availability in ICUs. This in turn, adversely affects the dynamics of the whole hospital.

Objective: To determine the admission pattern and outcome of patients in the Respiratory Intensive Care Unit (RICU) of Zagazig University Hospitals, Egypt.

Design: The study was carried out as a prospective analytical study.

Patients and methods: All cases admitted to RICU during the period from March 2010 to October 2010. They were 200 cases {126 males (63%) and 74 females (37%)} with an age range from 11 to 86 years. They were classified according to the causes of admission to RICU into 162 cases due to primary respiratory causes (81%) and 38 cases due to secondary respiratory causes (19%). On admission the following were carried out for all patients: full medical history, chest examination, assessment of Glasgow Coma Scale (GCS) and Acute Physiology and Chronic Health Evaluation II (APHCHE II) score, arterial blood gases analysis, plain chest and heart X-ray, computerized tomography (CT) electrocardiography (ECG) or echocardiography (ECHO) study when needed and assessment of the outcome.

Results: Two hundred cases were admitted during the study period: 57% were referred by chest physicians, 14.5% from other hospitals, 13.5% from other departments and others from chest ward

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and emergency room (ER). The mean GCS and APHACHE II score were 12.7 ± 3.97 and 14.4 ± 6.5 respectively. The length of stay in RICU was 7.2 ± 7.4 days. Analysis of outcome of the cases showed that 70 patients (35%) were transferred to chest ward, 61patients (30.5%) died and 54 patients (27.0%) were discharged to home. There was a significant difference between cases with primary (1^{ry}) and secondary (2^{ry}) respiratory causes regarding outcome ($P < 0.005$) with mortality rate (26.6%) among cases with 1^{ry} respiratory causes while in cases with 2^{ry} respiratory causes were 60.4%. Outcome as regards source of admission showed that the highest percentage of death occurred among cases referred from chest ward and non chest physicians (63.7% and 62.5%) respectively. There was a significant association between outcome and duration of stay ($P < 0.001$). Concerning the outcome on using mechanical ventilation, the mortality rate in mechanically ventilated patients was 52.05% while in non mechanically ventilated patients it was 47.5%.

Conclusion: This study showed that the best prognosis of admitted patients to RICU was for those who were transferred earlier especially those transferred by chest physicians and patients with 1^{ry} respiratory diseases than those with 2^{ry} respiratory diseases. Also, cases with high Glasgow Coma Scale and low APACH II score and those with a short duration of stay in RICU, especially without the need for mechanical ventilation had a good prognosis. Therefore, considering those aspects in the clinical practice would be reflected as a better outcome on dealing with RICU patients.

Introduction

An Intensive Care Unit (ICU), is a specialized section of a hospital that provides comprehensive and continuous care for persons who are critically ill and who can benefit from treatment [1]. Patients are generally admitted to an ICU if they are likely to benefit from the level of provided care. Intensive care has been shown to be beneficial for patients who are severely ill and medically unstable that is, they have a potentially life threatening disease or disorder [2].

Respiratory Intensive Care Unit (RICU) patients are a heterogeneous group with severe illness, multiple system dysfunction and multiple coexisting medical problems [3].

About one third of hospital mortality occurs in critically ill patients inside Intensive Care Unit (ICU) [4]. A Clinician has to consider many inter-related factors in making a prognosis regarding outcome in critically ill patients, including age, severity and irreversibility of the acute illness, physiological reserve and response to therapy [5].

Critically ill patients are responsible for 10–20% of global hospital costs and the ability to identify critically ill patients who will not survive until hospital discharge may allow identification of high risk patients [6].

It is well accepted that early appropriate referral of patients to an ICU can significantly reduce early and possibly late mortality in the critically ill. At the same time improper selection of patients for ICU who block ICU beds often limits bed availability in ICUs. This in turn, adversely affects the dynamics of the whole hospital [7].

This study was carried out to determine the different patterns of admitted cases to Respiratory Intensive Care Unit, Zagazig University Hospitals stressing on patient's characteristics, their referral sources, reasons for admissions together with their ICU manipulations and outcomes.

Patients and methods

Patients

This study was carried out at the Respiratory Intensive Care Unit (RICU), Zagazig University Hospitals and included all cases admitted during the period from March 2010 to October 2010. They were 200 cases {126 males (63%) and 74 females (37%)} with an age range from 11 to 86 years. They were classified according to the causes of admission to ICU into 162 cases due to primary (1^{ry}) respiratory causes (81%) and 38 cases due to secondary (2^{ry}) respiratory causes (19%).

Methods

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

All cases were subjected to the following:

1- Thorough medical history stressing on: History of smoking, treating physicians before ICU admission, Primary diagnosis, Source of ICU admission.
2- Full clinical examination in ICU: general and local chest examination.
3- Assessment of Glasgow Coma Scale (GCS): [8].
4- Assessment of APACHE II score within 24 h of admission [9].
5- Plain chest X-ray (posteroanterior, or anteroposterior according to circumstances).
6- Electrocardiography (ECG) or echocardiography (ECHO) and computerized tomography (CT) study if needed
7- Laboratory investigations;
   - Arterial blood gas (ABG) analysis.
   - Liver and kidney function tests.

- Complete blood count (CBC).
- Serum electrolytes (Na, K and Ca).
- Coagulation profile (PT, PTT and INR).
- Other investigations according to the included cases: (e.g. D dimer, cardiac enzymes).

8- Treatment program, Length of stay was recorded for all cases.
9- 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, checked and analyzed using Epi-Info version 6 and SPSS for Windows version 8 [10]. Data were summarized using: The arithmetic mean (X), The standard deviation (SD), Chi-Square (X^2) test and *t*-test. For each test, *P* value of $<0.05$was considered significant.

Results

The demographic data and other characteristics of admitted cases were summarized in Table 1: They were 126 males (63.0%) and 74 (37%) were females, with age range from 11 to 86 years with a mean age of 59.7 ± 14.0.

114 Cases (57%) were transferred from chest physician, 29 cases (14.5%) from other hospitals, 27 cases (13.5%) from other department, and other cases referred from chest ward (11 cases) and emergency room ER. Mean ± standard deviation of APACH 11 score and GCS of admitted cases were 14.4 ± 5.6 and 12.7 ± 3.97 respectively. The length of stay of admitted cases in RICU ranged from 1 to 60 days with mean 7.2 ± 7.4. As regards outcome of all cases admitted to RICU 30.5% were dead, 35% were transferred to chest ward, 27.0% were discharged home and 7.5% transferred to other department.

Cases were classified according to causes of admission to RICU into: 162 cases (81%) with primary (ry) respiratory causes and 38 cases (19%) with secondary respiratory causes Fig. 1.

Table 2 shows incidence of primary and secondary respiratory diseases of patients admitted to RICU AECOPD (31.6%), RF (14.3%), severe pneumonia (11.1%) represent high percentage, among cases with 1^{ry} respiratory causes, while among cases with 2nd respiratory causes, Neurological disorders (31.6%), post cardiac arrest (31.6%) and malignancy (29%) represent high percentage.

Table 3: shows that there was no statistically significant difference between cases of 1^{ry} and 2nd respiratory causes regard-

Table 1 Demographic data, characteristics and outcome of the studied cases who were admitted to RICU.

Age	X ± SD	59.7 ± 14.0
	(Range)	(11–86 years)
Duration of complaint (in days)	X ± SD	11.4 ± 17.0
	(Range)	(1–90)
GCS	X ± SD	12.7 ± 3.97
	(Range)	(3–15)
APACHE II score	X ± SD	14.4 ± 6.5
	(Range)	(2–30)
Gender		N %
		126
	Males	63.0
	Females	74 37.0
Smoking		N %
		111
	Non smoker	55.5
	Current smoker	45 22.5
	Ex-smoker	44 22
Duration of stay (in days)		N %
		139
	⩽7 day	69.5
	>7 day	61 30.5
	X ± SD	7.2 ± 7.4
	(Range)	(1–60)
Source of admission(referral)		N %
		114
	Chest physicians	57.0
	Non chest physicians	8 4.0
	Chest ward	11 5.5
	Other hospitals	29 14.5
	Emergency room (ER)	11 5.5
	Other departments	27 13.5
Outcome		N %
		61
	Death	30.5
	Home discharge	54 27.0
	Chest ward discharge	70 35.0
	Other department discharge	15 7.5

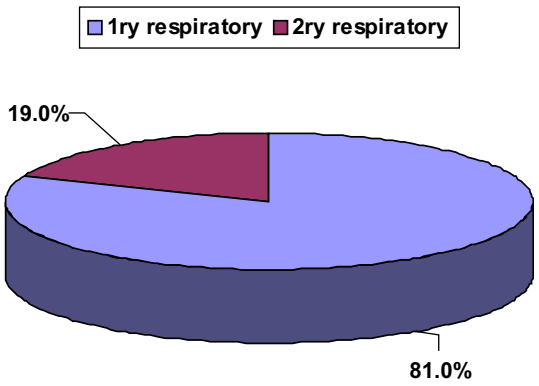

Figure 1 Shows pattern of admitted cases to RICU, they were 162 cases of 1ry respiratory cause and 38 cases of 2ry respiratory causes.

Table 2 Incidence of primary and secondary respiratory diseases of patients admitted to RICU.

1ry Respiratory diseases	N (162)	%
Pulmonary embolism	13	8
AECOPD	51	31.5
RF	23	14.2
Exacerbation of bronchial asthma	7	4.3
Pleural effusion	17	10.5
Exacerbation of ILD	17	10.5
Severe pneumonias	18	11.1
Obstructive sleep apnea	6	3.7
Lung cancer	6	3.7
Lung abscess	4	2.5
2ry Respiratory diseases	N (38)	%
Cardiac	3	7.8
Post cardiorespiratory arrest	12	31.6
Malignancy	11	29
Neurological disorders	12	31.6

ing, age, timing before admission, APACHE II score, duration of stay, ($P > 0.05$).

Fig. 2 shows a significant positive correlation between timing before ICU admission and duration of stay in ICU (r: 0.29, $P < 0.005$).

Fig. 3 shows that there was a significant difference between cases with 1ry and 2nd respiratory causes as regards outcome as mortality rate in cases of 1ry respiratory causes was 23.6% while in cases of 2nd respiratory causes was 60.4% ($P < 0.005$).

Table 4 shows there was a highly significant difference in outcome as regards source of admission ($P < 0.001$) as a high percentage of death was among cases referred from non chest physician and chest ward (62.5% and 63.7%) respectively (Table 4).

Table 5 shows the highest percentage of death among cases diagnosed malignant, neurological disorder (23%) for each, RF (19.7%), cardiac arrest (14.8%), while AECOPD constituted the highest percentage of discharge to home (28%) and to chest ward (37.1%).

Table 6 shows there was a significant statistical association between outcomes and duration of stay in ICU (in days) $P < 0.004$.

Table 7 shows there was a statistically significant difference in outcome in relation to GCS ($P < 0.001$) while no significant difference in outcome in relation to APACHE II was observed ($P = 0.08$).

Table 8 shows there was a highly significant difference regarding APACHE 11 score between cases on mechanical ventilation and non mechanically ventilated ($P < 0.001$).

Table 9 shows mortality rate in mechanically ventilated patients to be 52.5% while in non mechanically ventilated patients it was 47.5%. There was a significant statistical association between mechanical ventilation and outcome among all studied cases ($P < 0.001$).

Discussion

RICU is defined as "an area for the monitoring and treatment patient with acute respiratory failure due to primary respiratory cause and of patient with acute or chronic respiratory failure" [11].

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 [2].

About one third of hospital mortality occurs in critically ill patients inside Intensive Care Unit (ICU) [4].

It is well accepted that early appropriate referral of patients to an ICU can significantly reduce early and possibly late mortality in the critically ill. At the same time improper selection of patients for ICU who block ICU beds often limits bed availability in ICUs. This in turn, adversely affects the dynamics of the whole hospital [7].

This study was carried out to evaluate the different patterns of admitted cases to Respiratory Intensive Care Unit stressing on patient's characteristics on admission, their referral sources and timing of admissions together with their ICU manipulations and outcomes.

In this study, two hundred patients were admitted to RICU. They were; 126 males (63.0%) and 74 females (37.0%) with a mean age of 59.7 ± 14.0 (Table 1). These result

Table 3 Comparison between1ry and 2ry respiratory causes of admitted patients regarding their: age, timing before admission, APACHE II score, duration of stay.

	1ry Respiratory (mean ± SD)	2ry Respiratory (mean ± SD)	t	P
Age	59.9 ± 13.8	58.5 ± 15.1	0.57	0.56
Timing before admission	11.97± 17.9	8.7 ± 11.8	1.03	0.3
APACHE II	14.2 ± 6.9	15.7 ± 6.8	1.18	0.23
Duration of stay	7.1 ± 7.6	7.6 ± 6.8	0.35	0.72

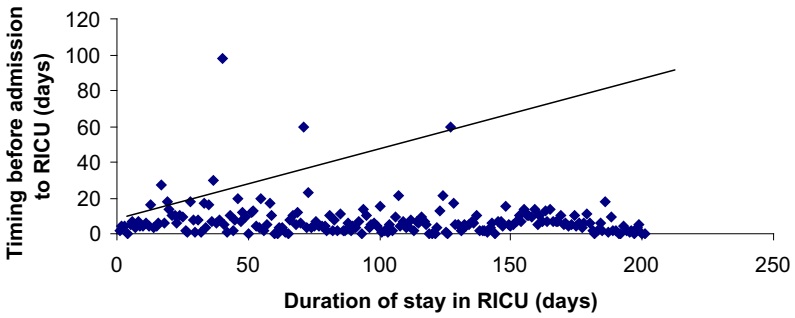

Figure 2 The correlation between timing before ICU admission and duration of stay in ICU (in days.

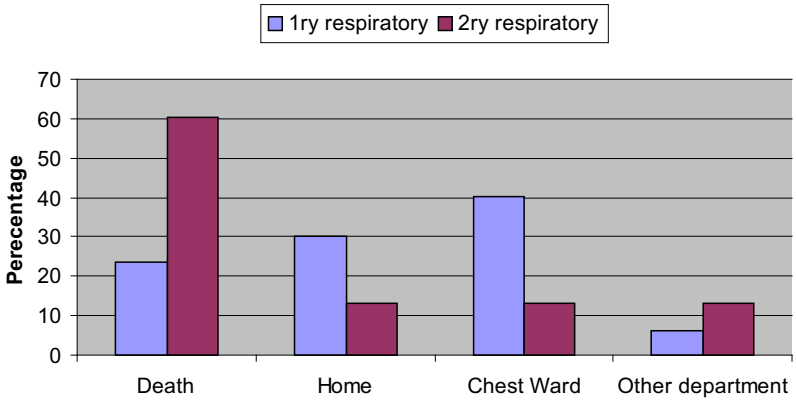

Figure 3 Percentage of outcomes of all admitted cases to RICU.

Table 4 Outcomes of cases admitted to RICU in relation to the source of admission.

Outcomes	Source of admission							
	Chest phy.		Other phy.		Chest ward		Other depart.	
	N (114)	%	N (8)	%	N (11)	%	N (67)	%
Death	18	15.7	5	62.5	7	63.7	31	46.3
Home	46	40.3	0	0.0	0	0.0	8	11.9
Chest ward	43	37.7	3	37.5	3	27.3	21	31.4
Other depart.	7	6.3	0	0.0	1	9	7	10.4

$X^2 = 40.87$ $P < 0.001$.

Table 5 Outcomes of cases admitted to RICU in relation to final diagnosis.

	Death		Home		Chest ward		Other depart.	
	N (61)	%	N (54)	%	N (70)	%	N (15)	%
Pulmonary embolism	2	3.3	6	9.5	3	4.3	2	13.3
Pulmonary edema	1	1.6	0	0.0	0	0.0	1	6.7
AECOPD	9	14.8	15	28	26	37.1	1	6.7
RF	12	19.7	3	5.7	7	10.0	1	6.7
Bronchial asthma	2	3.3	5	9.5	0	0.0	0	0.0
Pleural effusion	1	1.6	5	9.5	8	11.4	3	20.0
ILD	1	1.6	7	13.0	9	12.9	0	0.0
Post cardiac arrest	9	14.8	1	2	1	1.4	1	6.7
Pneumonia	8	13.1	6	11.2	4	5.7	0	0.0
Cardiac	0	0.0	1	2	0	0.0	0	0.0
Other (malignancy, neuro)	14	23.0	3	5.7	4	5.7	4	26.7
Obstructive sleep apnea	1	1.6	1	2	2	2.9	2	13.1
Lung abscess	1	1.6	0	0.0	3	4.3	0	0.0

$X^2 = 86.59$ $P < 0.001$.

Table 6 Outcomes of all admitted cases to RICU in relation to duration of stay in RICU.

Outcomes	≤1 Week		>1 Week	%
	N (139)	%	N (61)	%
Death	34	24.5	27	44.3
Home discharge	45	32.4	9	14.7
Chest ward discharge	52	37.4	18	29.5
Other depart. discharge	8	5.7	7	11.5

$X^2 = 12.93$ $P < 0.004$.

is parallel to Finkielman et al. [12] who found that the mean patient age in ICU was 62.3 ± 17.6 years.

The cases were classified according to causes of admission into (162) cases with primary respiratory causes (mean age, 59.9 ± 13.8 years) and (38) cases with secondary respiratory causes (mean age, 58.5 ± 15.1 years) with no significant difference between them as regards age ($P = 0.56$). The high percentage of admission in cases with 1^{ry} respiratory cause, were: acute exacerbation of chronic obstructive pulmonary disease (31.5%), respiratory failure patients (14.2%), severe pneumonia patients (11%) and the higher percentage of cases admitted due to secondary respiratory causes were malignancy, postcardiorespiratory arrest and neurological disorders (26.3%, 31.6% and, 23.7% respectively) (Tables 2 and 3, Fig. 1).

Bolaji and Kolawole [13] found that the two most common indications for admission to ICU were status asthmaticus and respiratory failure (3.7% for each). However, David et al. [14] found that neuromuscular weakness, pneumonia, septic shock, respiratory arrest, congestive heart failure, AECOPD, cardiac arrest, were the most common indications for medico-surgical ICU admission in their study.

In the current study there was no significant difference ($P = 0.3$) in timing before RICU admission (in days) between cases with 1^{ry} respiratory cause (11.97 ± 17.9 days) and cases of 2^{ry} respiratory cause (8.7 ± 11.8 days) Table 3. This result points to the fact that cases with 1^{ry} respiratory causes had a delay before admission to RICU which might be related to poor manipulations of the treating physicians regarding their decisions of proper timing for referral (though the majority are chest physicians), on the other hand, cases with 2^{ry} respiratory causes were referred to RICU earlier, possibly due to their presence at other departments or ICUs (at the hospital) under more proper care.

In this study, the APACHE II scores were not significantly different between cases with primary chest diseases and cases with secondary chest diseases because there are 15 cases admitted and discharged at the same day without APACHEII score ($P = 0.23$) Table 3. This previous finding was in disagreement with that of Agarwal et al. [15] who found that the APACHE II score significantly differs in the two groups. The probable reason for this is the difference in the baseline characteristics of the study population in the two groups (cases with respiratory failure due to COPD, cases with respiratory failure due to other causes). ARF due to COPD were significantly older when compared to other causes of ARF (mean age, 56 years in COPD group versus 39 years in the others; $P < 0.0001$). This difference led to a higher APACHE II scores in the COPD population compared to the other group (mean APACHE II scores, 21.7 in the COPD group versus 16.7 in the other group; $p > 0.0001$).

Table 8 The relation between APACHE II and mechanical ventilation (MV) of all studied cases.

	N	APACHE II X ± SD	t	p
Non MV	130	12.4 ± 5.4	7.4	<0.001
MV	55	19.2 ± 6.5		

The duration of stay in RICU ranged from 1 to 60 days (mean 7.2 ± 7.4 days), 15 cases were admitted for nearly 1 day, while the longest duration of stay was 2 months for two cases (a case with brain and lung abscesses and other with respiratory failure on MV due to neuromuscular disorder (Table 1). This result agrees with that reported by Bolaji and Kolawole [13] who found ICU admissions ranged from 1 to 181 days (mean 4.8 ± 11.22 days). A large percentage of cases 134 (45.5%) were admitted for 2 days or less. The longest duration of admission (181 days) was for a patient who had severe head injury.

Looking for the duration of stay in ICU in cases with 1^{ry} respiratory causes, it was 7.1 ± 7.6 days, while cases with 2^{ry} respiratory causes it was 7.6 ± 6.8 days ($P = 0.72$) (Table 3). This figure is in agreement with that reported by Agarwal et al. [15] who found a non significant difference in duration of stay in COPD-caused ARF (3.5 ± 1.6) and in ARF due to other causes (4 ± 3.1). It is clear from the results of the present series, and that of others that the duration of stay in RICU is dependent essentially on the causes of admission and underlying causes.

In the present study there was a significant positive correlation between timing before ICU admission and duration of stay in ICU ($P < 0.05$), Fig. 2. This finding is in agreement with that of Arabi et al. [16] who mentioned that a prolonged ICU stay can adversely affect the health status by increasing the risk of infection, complications, and possibly mortality. Operationally, it impacts upon ICU bed availability and result in cancellation of elective surgery, leading to long waiting times. The lead-time, also defined as the time spent on the

Table 7 The mean value ± SD of GCS, APACHE II score and its relation to outcome in all studied cases.

	Death N = 61	Home N = 54	Chest ward N = 70	Other depart. N = 15	F	P
GCS	10.6 ± 4.86	14.2 ± 2.7	13.6 ± 2.9	11.86 ± 4.5	11.08	<0.001
	3–15	3–15	3–15	3–15		
APACHE	16.1 ± 7.16	12.7 ± 5.8	14.4 ± 6.2	14.7 ± 6.9	2.27	0.08
	5–28	2–26	3–30	6–26		

Table 9 The statistical comparison between mechanically ventilated (MV) patients and non-mechanically ventilated patients regarding outcomes.

	Death		Home		Chest ward		Other depart.		X^2	P
	N (61)	%	N (54)	%	N (70)	%	N (15)	%		
Non MV pt.	29	47.5	46	85.5	52	74.3	10	66.7	20.49	< 0.001
MV pt.	32	52.5	8	14.8	18	25.7	5	33.3		

ward before ICU admission, is also prolonged, a factor known to affect patient outcome.

There was a significant difference between the outcomes of patients with 1^{ry} respiratory causes and those of 2^{ry} respiratory causes, being in favor of former (23.6% and 60.4%) deaths respectively Fig. 3. This result suggested that most of the cases of 2^{ry} respiratory causes were referred to RICU in a bad situation compared to those of 1^{ry} respiratory causes.

In the present series, studying the source of admission showed that 57.0% of cases were referred by chest physicians, 4.0% by non- chest physicians, 5.5% from chest ward, 13.5% from other departments, 14.5% from other hospitals and 5.5% from emergency room (ER) Table 1.

The majority of the cases who were referred by chest physicians were discharged from ICU to home (40.3%) while the majority of the cases who were referred by other physicians (62.5%) died. On the other hand, the majority of the cases who were referred from chest or other departments (63.7% and 46.3% respectively) died in RICU Table 4. These results suggested that initial management of cases by chest physicians had a good outcome compared to other physicians. On the other hand, the referral of cases from chest department had a poor outcome compared to other departments probably because of nearly exhaustion of all lines of management of the 1^{ry} respiratory causes which required a more time before referral to RICU.

In this study there was a high mortality rate in cases with malignancy and neurological disorders (23%), respiratory failure (19.7%) and cardiac arrest (14.8) ($P = 0.001$) Table 5. This can be explained because of non-specialty, the cases with respiratory failure of 2^{ry} respiratory causes were referred to RICU very late near death, while most cases discharged to home (27.8%) and ward (37.1) were COPD as they were early diagnosed and managed, this result was in agreement with that of Brown and Sullivan [17] who reported cases with COPD of better outcome. Arabi et al. [16], found that post cardiac arrest was associated with a high mortality risk and high incidence of complications and morbidity inside ICU.

Acute respiratory failure (ARF) is the most common organ failure in the ICU, and mortality is high. The outcome worsens in association with any other organ failure [18].

It was observed from Table 6 that there was a significant association between outcome and duration of stay in ICU ($P < 0.004$). The patients who stayed more than one week had a high mortality (44.3%) while for those who stayed less than a week it was 24.5%. This is because most cases who stayed more than one week had severe illness and they were on mechanical ventilation. This finding is in agreement with that of Schönhofer et al. [19] and Arabi et al. [16] who 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 increase the mortality.

Table 7 showed that there was a strong statistical association between GCS and mortality in ICU ($p > 0.001$). Bostos et al. [20] noted that complications inside ICU were common when GCS was less than 8 and added that persistent impairment of consciousness level is a risk factor for increasing morbidity in ICU.

Table 8 showed a significant difference of APACHE II in mechanically ventilated (130) and non mechanically ventilated (55) patients ($P < 0.001$) which was in agreement with that of Matic et al. [21] who showed that APACHE II score has a high positive predictive value on mechanical ventilation. Also Ambrosino et al. [22] detected a high APACHE II score in mechanically ventilated cases.

Mechanically ventilated patients had a higher mortality (52.5%) than those who were not ventilated (47.5%) ($P < 0.001$) Table 9 as in this series, most mechanically ventilated patients had old age, there were 12 cases post arrest and 31 cases with GCS < 5 and APACH II > 23. This result is in agreement with that of Refaat [23] who stated that the use of mechanical ventilation could be associated with increased incidence of complications which may be due to ventilator itself or medication needed during ventilation.

Conclusions

It can be concluded from this study that there are many factors associated with the best prognosis in admitted patients to RICU, as early transfer of indicated patients, especially those treated and transferred by chest physicians, patients with 1^{ry} respiratory diseases than those with 2^{ry} respiratory diseases and also, cases with high Glasgow Coma Scale and low APACH II score and those with a short duration of stay in RICU, especially without the need for mechanical ventilation.

Recommendations

- While the results of the present study showed a pilot insight about the patterns of the patients admitted to RICU, a more detailed multicenter study is recommended taking into consideration a prolonged duration which would include more number of patients.
- A message should be directed to all hospitals, primary care, private clinics physicians for referral of the critical cases as early as they can to RICU and, if any, leaving the care of chest cases for chest physicians as this improves the outcome of patients and limits the economics of their management.

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