Outcome of admitted cases in the respiratory intensive care unit at Assiut University Hospital: effect of time

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Background
To determine the factors that affect the fate of cases admitted to the ICU is very important.
Objective
The aim of our study was to describe the effect of time in the form of complaint duration, admission delay time, and length of stay on the outcome of cases admitted to the ICU.
Patients and methods
This prospective descriptive analytic study was conducted among patients admitted to the respiratory ICU at Assiut University Hospital. Cases that spent less than 24 h in the ICU, those who died, and cases that were discharged or transferred from the ICU before completing data collection were excluded.
Results
A total of 254 patients were included in the study; 157 (61.8%) patients survived (survivors), whereas 97 (38.2%) patients deteriorated and died (nonsurvivors). We observed a significant statistical difference between the two groups (survivors and nonsurvivors) regarding complaint duration, admission delay time, and length of stay in ICU.
Conclusion
We concluded from this study that time, in its various forms, may have an important effect in the outcome for cases admitted to the ICU.

Keywords:
Assiut, effect of time, outcome, respiratory ICU

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Introduction

The ICU serves as an area for strict monitoring and care of cases with severe physiologic instability in need for technical and/or artificial life support [1]. The respiratory ICU is a place that provides closed monitoring combined with intensive treatment for cases with acute or worsening respiratory failure caused by a disease that is primarily respiratory [2]. Because of the use of expensive resources, ICU should be reserved for those patients with reversible medical conditions and who have reasonable possibility of significant recovery [3]. Therefore, determining the factors that affect the outcome of cases admitted to the ICU is utmost importance. The objective of this study was to describe the effect of time in the form of complaint duration, admission delay time, and duration of stay in the ICU on the outcome of cases managed in the respiratory ICU at Assiut University Hospitals.

Patients and methods

This prospective descriptive analytic study was conducted among patients who were admitted from October 2018 to September 2019 to the respiratory ICU at Assiut University Hospital.

The study was approved by the Scientific Ethics Committee of Faculty of Medicine of Assiut University. IRB approval number: 17100341.

An informed consent to deal with the patient's data for scientific aims was obtained from the patients or from their close relatives preceding the participation.

Patients who died, discharged, or those transferred from the intensive care before completing data collection were excluded from our study. The patient's fate was determined according to the mortality during their stay in the ICU and classified as survivors and nonsurvivors.

The severity of the illness was assessed according to the Acute Physiology and Chronic Health Evaluation, version II, score system (APACHE-II) [4].

Patient data were collected and recorded regarding the duration of the patient's complaint (defined as

the time elapsed between the date of the patient's first complaint and the date of admission to the ICU), admission delay time (defined as the time between acceptance of the patient by the intensive care team until arrival at the ICU), and length of stay (LOS) in the ICU (defined as the time between entry of patient in the ICU and his/her outcome).

Statistical analysis

Data were collected and analyzed those using SPSS (Statistical Package for the Social Science, version 20; IBM, Armonk, New York, USA). Continuous data were expressed in the form of mean ± SD or median (range), whereas nominal data were expressed in the form of frequency (percentage).

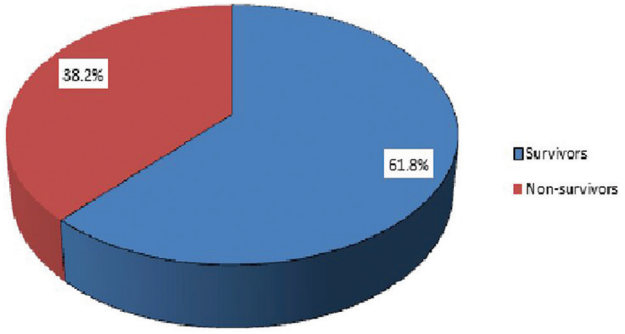
χ^2 test was used to compare the nominal data of different groups in the study, whereas Student *t* test was used to compare the mean of two different groups. Lemeshow–Hosmer goodness-of-fit statistics for APACHE-II was done with logistic regression to standardized mortality ratio based on APACHE-II. Diagnostic accuracy of duration of complaint, admission delay time, and length of ICU, as well as diagnostic accuracy of APACHE-II was assessed with receiver operating characteristic curve. Level of confidence was kept at 95% and hence, *P* value was significant if less than 0.05. The data were nonparametric.

Results

A total of 254 patients were included in the study; 157 (61.8%) patients survived (survivors), whereas 97 (38.2%) patients deteriorated and died (nonsurvivors), as shown in Fig. 1.

The nonsurvivors had higher mean age than the survivors, and there was a significant difference between both groups regarding sex distribution, as most survivors were females.

Figure 1



Outcome of patients included in the study.

Regarding smoking history, there was a significant difference between the two groups as most nonsurvivors were current smokers, whereas most survivors were never smokers.

In this work, the acute exacerbation of chronic obstructive pulmonary disease was the most frequent admission diagnosis. All different diagnoses had negligible difference between both the groups.

Both groups had negligible difference regarding different comorbidities with exception of diabetes mellitus, which was significantly higher among nonsurvivors.

The main source of referral for admitted patients was the emergency room, and there was no significant difference in the relation between referral source and patient outcome.

The mean APACHE-II scores were significantly higher in nonsurvivors in comparison with survivors, as shown in Table 1, and at a cutoff point of more than 16, the APACHE-II scoring system was able to expect the mortality among our studied patients, as shown in Fig. 2.

The nonsurvivors had significantly longer duration of complaint before admission in relation to survivors, as shown in Table 2; at a cutoff point of more than 4 days, the duration of complaint was able to predict mortality among the studied patients, as shown in Fig. 3.

The admission delay time was significantly longer in nonsurvivors in comparison with survivors (Table 3),

Table 1 Acute Physiology and Chronic Health Evaluation, version II score, among the studied patients

	Total (*n*=254)	Survivors (*n*=157)	Nonsurvivors (*n*=97)	*P*
APACHE-II	16.70±5.70	11.85±4.24	22.68±6.47	<0.001

Data were expressed as frequency mean±SD. APACHE-II, Acute Physiology and Chronic Health Evaluation, version II. *P* value was significant if less than 0.05.

Table 2 Duration of patient complaint among the studied patients

Complaint duration	Total (*n*=254)	Survivors (*n*=157)	Nonsurvivors (*n*=97)	*P*
Mean time (days)	4.31±2.02	3.47±1.50	5.67±2.04	<0.001

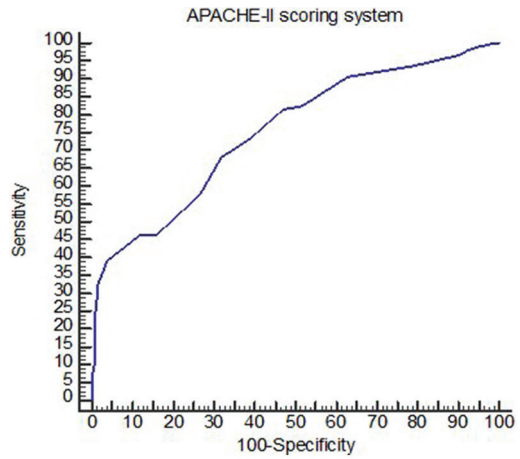
Data were expressed as mean±SD. *P* value was significant if less than 0.05.

Table 3 Admission delay time among the studied patients

Admission delay	Total (*n*=254)	Survivors (*n*=157)	Nonsurvivors (*n*=97)	*P*
Mean time (h)	6.58±3.45	5.40±2.10	8.49±5.71	<0.001

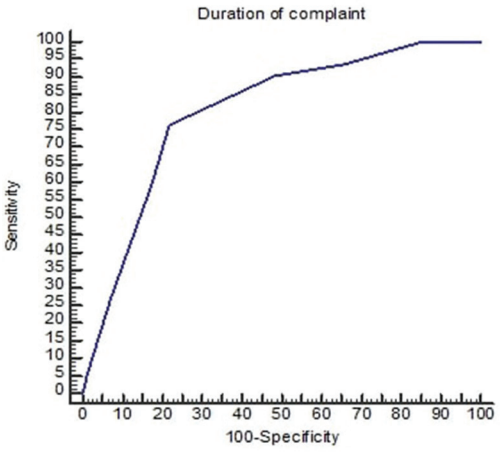
Data were expressed as mean±SD. *P* value was significant if less than 0.05.

Figure 2



ROC curve for APACHE-II scoring system in predicting mortality. APACHE-II, Acute Physiology and Chronic Health Evaluation, version II; ROC, receiver operating characteristic.

Figure 3



ROC curve for complaint duration in predicting mortality. ROC, receiver operating characteristic.

and at cutoff point more than 7 h, the admission delay time was able to predict mortality among the studied patients (Fig. 4).

The mean LOS in the ICU was significantly longer in nonsurvivors in comparison with survivors (Table 4), and a cutoff point for LOS of more than 11 days, it was able to predict mortality among the patients (Fig. 5).

Table 4 Length of ICU stay among the studied patients

	Total (*n*=254)	Survivors (*n*=157)	Nonsurvivors (*n*=97)	*P*
Mean ICU stay (days)	13.15±3.33	9.67±1.34	16.56±3.45	<0.001

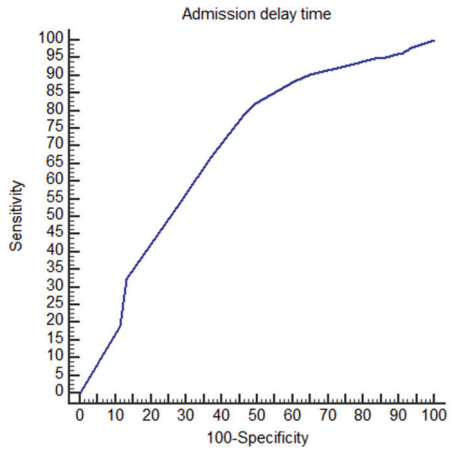
Discussion

Of the 254 patients who were included in this study, 157 (61.8%) patients survived (survivors), whereas 97 (38.2%) patients deteriorated and died (nonsurvivors). Bolaji and Kolawole [5] demonstrated an ICU mortality rate of 37.3%, which is almost similar to our study rate. In a study by Ghoneim *et al.* [6], a 30% mortality was reported, which is less than our work rate. Khalil *et al.* [7] reported on their study that mortality in respiratory ICU was 54.7%, which is clearly higher than that of our study. The global ICU mortality rate ranges from 14.5 to 30.7% [8]. Differences between different studies regarding mortality may be related to several factors, including disease severity; facilities provided in the ICU, skills, and timing with which they were admitted [9].

Regarding the first studied time in our work, the mean duration of the patient's complaint was 4.31 ± 2.02 days among all patients studied, and this was lower than the time recorded by Ghoneim *et al.* [6] (11.4 ± 17.0 days). Our findings also revealed that the mean duration of complaint was significantly longer among nonsurvivors compared with survivors (5.67 ± 2.04 vs. 3.47 ± 1.50), and at cutoff point of more than 4 days, complaint duration had 76.4% sensitivity and 78% specificity, with area under the curve of 0.80 and overall accuracy was 77% for predicting mortality within the ICU. However, we want to focus attention on that we were unable to find some previous research studies describing thus the duration of complaint and its effect on the outcome of cases admitted to the ICU.

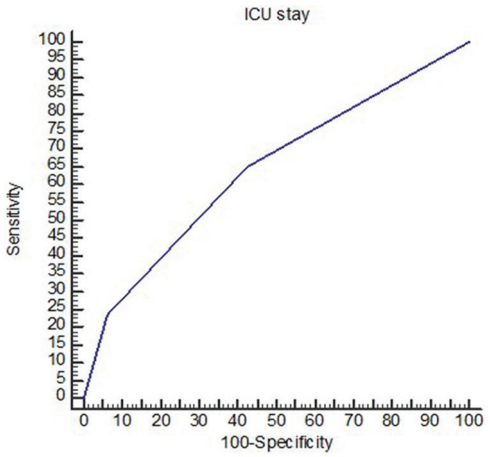
Regarding the second studied time in our work, the nonsurvivors had significantly longer mean admission delay time in comparison with survivors (8.49 ± 5.71 vs. 5.40 ± 2.10 h). At a cutoff point more than 7 h, the duration of admission delay time had 82% sensitivity and 50% specificity with area under curve was 0.69 and overall accuracy was 69.6% for prediction the mortality among studied patients. Cardoso *et al.* [10] described the effect of delayed ICU admission on mortality, when patients are admitted at a later point, pending bed availability. They described an increase in mortality by 1.5% for each hour of waiting time. Even in countries such as the United States, where there is no shortage of ICU beds, it was noticed that a more than 6-h delay in ICU transfer increased ICU mortality [11]. Young *et al.* [12] found a higher mortality in patients with 4 or more hours of delayed ICU management and likewise a study conducted in Greece by García-Gigorro *et al.* [13] noticed strong relation between an emergency room stay for more than 5 h and ICU mortality, in addition to the appearance of complications in intensive care. Al-Qahtani *et al.* [14] reported that delays in transferring patients from the emergency room to the ICU of more than 24 h were associated with increased rates of ICU mortality. However, other

Figure 4



ROC curve for admission delay time in predicting mortality. ROC, receiver operating characteristic.

Figure 5



ROC curve for length of ICU stay in predicting mortality. ROC, receiver operating characteristic.

studies concluded different results [15-17]. An analysis of 1609 ICU patients showed that there was a delay in admission in 9.3% of the sample. The group that had longer admission delay time needed ventilation more frequently and stayed on mechanical ventilation longer compared with patients admitted earlier. ICU mortality was similar between groups [16].

Regarding the third time studied in our work, it was noticed that the mean duration of stay in the ICU among the patients studied was 13.15 ± 3.33 days.

The mean LOS among the nonsurvivor group was longer than that of the survivor group (16.56 ± 3.45 vs. 9.67 ± 1.34), with a significant difference between the two groups. In a study by Khalil *et al.* [7], the results showed that the mean LOS was 5.88 ± 5.96 days, and a statistically significant association was found between the length of ICU stay and the mortality rate, as it was found that nonsurvivors were associated with a longer ICU stay than survivors (6.79 vs. 4.79). In the study carried out by Ghoneim *et al.* [6], the mean ± SD was 7.2 ± 7.4 days and they also reported that there was a strong association between outcome and length of ICU stay. Brown and Sullivan [18], Schönhofer *et al.* [19], and Arabi *et al.* [20] also suggested that mortality is strongly related to the duration of stay in ICU, because the occurrence of the hospital acquired infection would increase with increasing duration in ICU, and the appearance of multisystem organ failure also increases mortality. However, the aforementioned results were against those of Williams *et al.* [21], who described in their study of 22 298 critically ill patients that increase in the ICU stay had no effect on the increased risk of ICU mortality after adjusting for other factors, but was related to higher risk for mortality after leaving the hospital. The relation between prolonged ICU stay and the outcome in critically ill patients remains controversial. In our study, a cutoff for a LOS in the ICU of more than 11 days had a sensitivity of 65% and a specificity of 57% with an area under the curve of 0.64 and an overall precision of 60% for the prediction of mortality in the patients studied.

What can be considered a limitation of this study is that we did not take into account the effect of admission time on patient outcomes. Another limitation to mention is that we did not perform additional statistical analyses to confirm the importance of time in its various forms in predicting ICU mortality.

Conclusion

We concluded from this study that time, in its various forms, may have a strong effect on the outcome for patients admitted to the ICU.

Recommendation

We recommend that more studies be conducted on a huge number of patients and in more than one critical care units, with further additional statistical analyses.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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