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ORIGINAL ARTICLE

Unplanned Readmission to Surgical Intensive Care Unit in Zagazig University Hospitals: Prevalence and Risk Factors

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ABSTRACT

Background : Unplanned readmissions to the intensive care unit (ICU) are extremely unwelcome, increasing discrepancy in care, making resource design problematic and potentially growing length of stay and death. This study aimed at identifying the prevalence and risk factors associated with unplanned readmission to Surgical ICU in Zagazig University Hospitals.

Method:
This prospective cross section study was done on 102 patients admitted to surgical ICU, Zagazig University Hospitals then patients were discharged and followed up for possible unplanned readmission again. All patients underwent history taking, clinical examination and laboratory studies.

Results:102 patients were enrolled, out of them 16 patients (15.7%) were readmitted again to the ICU. Patients with congestive heart failure and cancer were associated with high readmission as well as patients who were discharged at nighttime or weekend discharge were statistically significant associated with readmission**.** Patients with. High APACHE II score (Acute Physiology and Chronic Health Evaluation II score), high leuocytic count, high creatinine, high bilirubin, high C-reactive protein (CRP) and low platelets count on day of discharge were risk factors statistically significant associated with readmission**.**

Conclusions: Prevalence of unplanned readmission to surgical ICU ZUH was 15.7%. Risk factors associated with ICU readmission are high APACHE II score on admission, presence of CHF or cancer, development of sepsis during ICU stay and high CRP on day of discharge.

Keywords: Unplanned Readmission; Risk; Prevalence; Surgical ICU

INTRODUCTION

Intensive Care Unit readmissions are return back of critically ill patient within a definite time period. It happens when a patient who had been quit a hospital is readmitted to the same hospital or another one within a specified time frame. The original hospital stay is often called the "index admission" and the succeeding hospital stay is known as the "readmission." Different time periods have been used, the commonest being 30-day and 90-day readmissions [1].

Intensive Care Unit readmission badly disturbs patients and healthcare systems. It may take place due to unresolved acute illness, continuing chronic illness, the progress of new medical complications, or from gaps in outpatient care [2-3].

Readmission rates have progressively been used as an outcome measure in health services research and as a quality scale for health systems. Decreasing the number of hospital readmissions is a crucial policy for improving the quality of health care and dropping associated expenditures [4].

Being aware of predictors linked to unintended hospital readmission may let policymakers know and easily recognize high-risk patient to be targeted for upcoming interventions.

This work aimed to identify the prevalence and risk factors associated with unplanned readmission to Surgical ICU in Zagazig University Hospitals.

METHODS

Institutional Review Board (IRB) approval were obtained. Written informed consent was obtained from all participants and the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

1.Study Design, Study Setting, and Study Participants*:*

This prospective cross-sectional study was conducted in Surgical ICU in Zagazig University Hospitals, 102 patients were randomly selected from admitted patients to Surgical ICU within six months period from12th September 2018 to 10th March 2019.

2. Sample size:

Assuming that rate of admission of patient to ICU is 420 cases per year with prevalence of readmission is 9.6% [5], So, sample size was calculated by OPEN-EPI program to be 102 cases with CI 95%. We have intended to treat and replace any drop out by new cases so we did not need any percentage of non-responders nor drop out. Systematic random technique was adopted to collect patients.

3.Inclusion criteria :

The study includes Patients admitted to Surgical ICU according to admission policies[6].

4.Exclusion criteria:

We excludes Patients who died during their first ICU admission .Also Planned readmission was excluded (defined as an admission after elective surgery, which was scheduled at least 24 hours before).

5.Data collection:

The data for enrolled 102 patients had been collected as following; Patient characters (Age& Sex), Primary diagnosis on index admission, associated co-morbidities. APACHE II score[7] was calculated on admission**.** The need for mechanical ventilation during ICU stay, number of days on ventilator and sepsis if occurred during period of admission were recorded. Last laboratory parameters on discharge day (Serum Bilirubin, Creatinine, Leukocyte count, Platelet count, C- reactive protein) .Patients were discharged according to Surgical ICU discharge policies[6]

Readmitted patients who are the group of patients who were unplanned readmitted to the Surgical ICU within 30 days after initial discharge during the same hospitalization period were identified and their data was compared with the corresponding data of non readmitted patients.

STATISTICAL ANALYSIS

Data collected throughout history, basic clinical examination, laboratory investigations and outcome measures coded, entered and analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) software for analysis. According to the type of data qualitative represent as number and percentage, quantitative continues group represent by mean ± SD , the following tests were used to test differences for significance;. difference and association of qualitative variable by Chi square test (X^2) . Differences between quantitative independent groups by t test or Mann Whitney, predictors by logistic regression . P value was set at ≤ 0.05 for significant results & ≤0.001 for high significant result.

RESULTS

Only 102 critically ill patients completed this study while the other ten patients did not (5 died, 5 withdrawn). Out of them16 patients (15.7%) were readmitted to the ICU after being discharged to ward(Figure 1). 11 patients (10.8%) were early readmitted during the 1st 48 hours after discharge while only 5 (4.9%) patients were readmitted after 48 hours (Table 1).

Patients with Congestive heart failure (CHF) and cancer were associated with readmission more than other co- morbidities showing statistical significance and patients who developed sepsis during their index admission were highly statistically associated with readmission. Also patients with nighttime or weekend discharge were highly statistically associated with readmission(Table 2).

Patients with high APACHE II score, high total leucocytic count (TLC), high creatinine, high bilirubin, high C-reactive protein (CRP) and low platelets count are statistically associated with readmission(Table 3).

Readmission is more likely to occur in patients who admitted to ICU with traumatic brain injury TBI or have higher APACHE II score on admission. Also CHF or cancer are statistically associated with high readmission. Patients who developed sepsis during ICU stay or have higher CRP on day of discharge are highly risk for readmission(Table 4).

Table 1: Readmission distribution among studied group

Variable	N (%)
Readmitted cases	16 (15.7)
Early readmission	11 (10.8)
Late readmission	5 (4.9)

N= Total number of patients.

Table 2: Univariate analysis of risk factors associated with readmission among the studied patients:

Variable		Non Readmitted	Readmitted	P
		N=86 (%)	N=16 (%)	
Sex	Male	64 (74.4)	13 (81.2)	0.56
	Female	22 (25.6)	3 (18.8)	
Type of cases#	TBI (12)	8 (66.7)	4 (33.3)	0.055
	Spinal cord injury (9)	9 (100)	0	
	Abdominal trauma (11)	9 (81.8)	2 (18.2)	
	Chest trauma (8)	4 (50)	4 (50)	
	Postoperative (62)	56 (90.3)	6 (9.7)	
Co- morbidities	DM	62 (72.1)	11 (68.8)	0.73
	HTN	58 (67.4)	10 (62.5)	0.65
	CHF	17 (19.7)	7 (43.7)	0.002*
	Cancer	13 (15.1)	6 (37.5)	0.002**
	Lung disease	37 (43.0)	10 (62.5)	0.06
	Renal disease	27 (31.3)	5 (31.2)	0.99
	Liver disease	14 (16.2)	3 (18.75)	0.73
MV	Not need	40 (46.5)	4 (25.0)	0.11
	Need	46 (53.5)	12 (75.0)	
Time of discharge	Day	60 (69.7)	6 (37.5)	0.02*
	Night	26 (30.3)	10 (62.5)	
Day of discharge	Working day	70 (81.3)	7 (43.7)	0.0002**
	Weekend	16 (18.7)	9 (56.3)	
Sepsis	No	66 (76.7)	1 (6.2)	<0.001**
	Yes	20 (23.3)	15 (93.8)	

Chi square X^2 test # percentage in this variable was calculated in relation to row
N= Total number of patients.
Quantitative data were expressed as number and percentage.
* P≤ 0.05 statistical significance ** P≤ 0.001statistical high significance
DM: Diabetes Mellitus HTN: Hypertension CHF: Chronic Heart Failure
APACHE II: Acute Physiological And Chronic Health Evaluation II
TBI: Traumatic Brain Injuries.

Table 3: Relation between ICU readmission and age, MV duration and laboratory investigations on day of discharge among the studied patients:

Variables	Non Readmitted (N=86)	Readmission (N=16)	P
	Mean ± SD	Mean ± SD	
Age	59.1±8.82	61.5±8.57	0.319
MV_DURATION	3.08±1.37	2.75±1.21	0.444
APACHEII	21.26±6.3	40.81±7.62	<0.001**
TLC	8.5±4.37	14.0±3.26	<0.001**
PLT	253.41±56.59	202.75±68.83	0.002**
Creatinine	1.52±0.45	2.031±0.51	<0.001**
Bilirubin	1.28±0.31	2.18±0.91	<0.001**

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Variables	Non Readmitted (N=86)	Readmission (N=16)	P
CRP	62.24±24.0	98.62±19.83	<0.001**
ICU LOS	6.83±2.26	7.06±0.92	0.698

* P≤ 0.05 statistical significance ** P≤ 0.001statistical high significance
TLC : Total Leukocyte Count PLT: Platelet CRP: C-Reactive Protein
MV: Mechanical Ventilation LOS: Length Of Stay
APACHE II: Acute Physiological And Chronic Health Evaluation II

Table 4: Multi-logistic regression of predictors of unplanned readmission among the studied patients:

Factors	OR	95% C.I .for		P
		Lower	Upper	
APACHE II	4.512	1.254	11.255	0.008**
TLC	2.622	0.874	17.852	0.2541
PLT	0.955	0.541	1.389	0.3214
Creatinine	1.515	0.687	9.5412	0.524
Bilirubin	1.957	0.941	18.521	0.841
CRP	2.833	1.113	14.251	0.042*
TBI	3.214	1.0214	25.254	0.021*
CHF	4.954	1.847	8.654	0.001**
Cancer	3.547	1.214	27.654	0.018*
Time of discharge	2.358	0.914	18.654	0.078
Sepsis	5.845	2.238	13.254	<0.001**

OR Odds ratio
CI confidence interval
* P≤ 0.05 statistical significance ** P≤ 0.001statistical high significance
TLC : Total Leukocyte Count PLT: Platelet CRP: C-Reactive Protein
APACHE II: Acute Physiological And Chronic Health Evaluation II
CHF: Chronic Heart Failure TBI: Traumatic

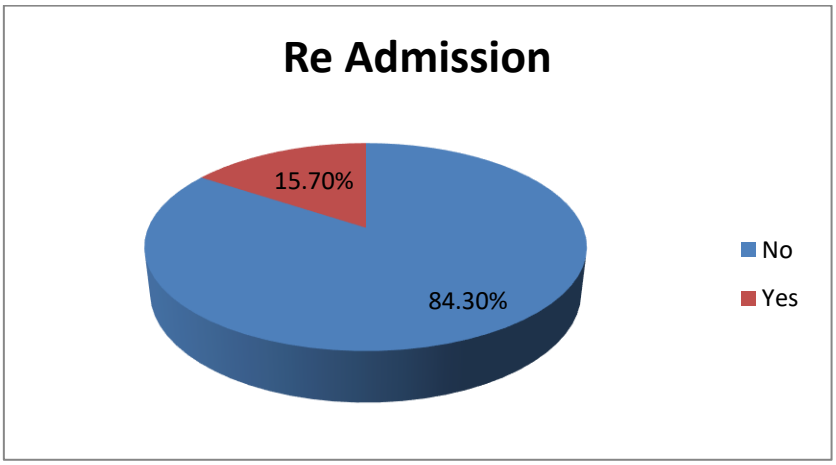

Figure 1 : ***Readmission distribution among studied group***

DISCUSSION

Unresolved acute diseases, continuing chronic illness, the occurrence of new complications or gaps in ward care can be the reason of readmission [2-3].

During the study period, a total of 102 patients were observed. The cumulative prevalence of unplanned return to ICU was 15.7 %. This rate is somewhat higher than that stated by de Araujo and his colleagues [8] which was 13.7 %. This could be enlightened by that study did not exclude patients with no readmission risk, including patients who died in the ICU or who were discharged home directly from the ICU.

In a systematic review, the incidence of ICU readmissions in North America and Europe ranged between 4 and 14% and still fixed during the last decades [9].

In another multicenter study, Kramer and colleagues stated that incidence of unplanned readmitted to the ICU was 6% [10].
Numerous possible factors, such as the American social context and the universal health care system may clarify why critically ill patients in USA displayed lesser readmission rates. In our hospital, patients are not discharged from the ICU unless they are hemodynamically stable with satisfactory general condition thanks to the lack of intermediary care units or step-down facilities. However, this lack of intermediary units may somewhat explain, the pretty higher rates of readmission, as all patients in need of vital sign monitoring are admitted directly to the ICU.
Among readmitted patients, early readmitted cases were eleven , indicating that they were prematurely discharged .We expected that premature ICU discharge is highly linked with early readmission. In harmony with former studies [11-12].
However, Kaben and colleagues in their study stated that premature discharge was not risk factor for readmission[13]. This may be attributed to institutional factors as level of care in ward and facilities.
However, Brooke and colleagues [14] , demonstrated that early discharge was concomitant with a significantly lower probability of readmission. This dissimilarity could be clarified by that study investigated only post vascular surgery.
However, identification of other high risk patients before they leave ICU may allow extra resources to be targeted towards them. This may include delayed discharge; discharge to a high dependency or other "step-down" unit; or more aggressive follow-up on the ward.

Factors linked univariately with a higher risk of ICU readmission in our study included CHF, cancer, higher APACHE II score, Sepsis, higher TLC, low platelet count, elevated bilirubin, and higher creatinine and CRP concentrations on the day of discharge to the hospital ward. Similar risk factors reported by Gülcher et al [15] and Silverstein et al[16].
Our study came hand by hand with other studies in medical ICUs where the acute physiology score section of APACHE II at ICU admission was found to be the independent risk factor most related to ICU readmission[17-18].
Results of multivariate logistic regression analysis was done with readmission to the ICU as the dependent factor. Variables included in the logistic regression analysis were primary diagnosis traumatic brain injury (TBI), co-morbid diseases (Heart failure, Cancer) APACHE II on admission, the presence of sepsis syndromes and parameters of organ function on the day of discharge from the ICU (TLC, Platelet count, serum creatinine, bilirubin, CRP). Sepsis is associated with high readmission rate in concordance with previous studies[19-20].
As well as we found that TBI is significantly associated with readmission in similarity to former studies [21-22].
In the current study, there is significant association between time of ICU discharge nighttime and weekend and rate of readmission as reported by different studies [23-24].
Other studies came in disharmony with ours showed that no effect of nighttime nor weekend discharge was present on ICU readmission. This difference could be explained by availability of intermediary care or step down ICU [25-26].
Increasing CRP concentrations on the day of discharge to the hospital ward, was independently accompanying with a higher risk of readmission to the ICU. This finding may specify that there was residual organ dysfunction and/or an inflammatory process that deteriorated on the hospital floor after ICU discharge causing subsequent readmission.
It is found that ICU LOS and mechanical ventilation are not predictor risk factors for readmission which could be explained by nature of majority of our ICU patients as postoperative. This came in disharmony with former studies [27-28]
Moreover, although the frequency of ICU readmission has been considered a quality indicator for ICU performance, it is important to focus on that; really, the "need" for ICU readmission could identify a very high-risk subgroup of patients at increased risk of poor outcomes rather than solely identify poor-quality post-ICU medical care.
One of the most important merits of our study that we investigated 30-day unplanned readmissions to a high turnover ICU, also we tried to identify the risk factors associated with readmission that may be helpful in risk stratification of patients before ICU discharge.
Our study has some limitations. First, the multivariate approach is limited by the variables included in the analysis; therefore, unmeasured variables may have influenced the results. Second, due to the observational nature of our study, we could not determine whether readmissions were

appropriate or not. Finally, our results may not apply to other ICUs with a different case-mix such as medical or mixed medico-surgical ICU patients.

In **conclusion** our results reported that the prevalence of unplanned readmission to surgical ICU was 15.7%. We found that risk factors associated with ICU readmission are high APACHE II score on admission, presence of CHF or cancer, admission with primary diagnosis TBI, development of sepsis during ICU stay and high CRP on day of discharge.

Concerning the previous results we recommend the following measures should be applied; Taking care of triage on discharge, paying attention to time of discharge and ward care, rapid response teams/ outreach/ nurse liaison. Increasing ICU bed availability to overcome crowdedness of critical ill patients is a main step to prevent early discharge from ICU to general wards.

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