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Unexpected Failure Events in Surgical Patients: Failure of the System or of the Patient?

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Authors' contributions

This work was carried out in collaboration between all authors. Authors FB, SG and KK designed the study. Authors FB and SG wrote the protocol. Author FB wrote the first draft of the manuscript. Authors FK and DA managed the literature searches. Authors GV and KK managed the analyses of the study and edited the final draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Background: Unexpected failure events are undesired harmful effects, which result in prolonged hospital stay, higher mortality and morbidity rates and increased hospital costs. The aim of our study was to identify and thorough investigate patients hospitalized in our university surgical ward, who had to be transferred to the surgical ICU (SICU) due to such an event.
Methods: This was a retrospective observational study performed in the surgical ward of a large, urban, teaching hospital during a 2.5 year period. All failure events, which resulted in the transport of surgical patients from ward to the SICU, were included and reviewed.
Results: There were 56 failure events recorded in 43 patients. Most patients suffering a failure event were admitted through the Emergency Department as acute cases (55,81%) and in most cases the failure event was identified by a nurse on duty (51,8%). Respiratory failure was the most common final diagnosis after SICU admission (60,71%). Of the total 43 patients suffering one or more failure event, 14 died.

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Conclusions: Based on our results, it seems that high risk patients admitted through ED should be admitted into ICUs for safety reasons. Moreover, triggering systems and monitoring of postsurgical patients, especially respiratory monitoring, would be helpful in minimizing failure events.

Keywords: Failure events; perioperative events; SICU; postsurgical patients.

1. INTRODUCTION

Unexpected failure events are undesired harmful effects associated or not with medical interventions which result in prolonged hospital stay, higher mortality and morbidity rates and increased hospital costs [1,2]. Surgical patients are facing a significant risk of suffering a failure event and being transferred to an Intensive Care Unit (ICU) [3,4]. Despite the fact that failure events occur more often in complex settings such as the operating theatre and the ICU, surgical ward is often implicated as well [4,5]. Quality of perioperative care is extremely significant since it can have a great impact on outcome of surgical patients.

Due to the fact that failure events most often activate the cascade of complications and could be preventable in some cases, it is of high importance to record and thorough investigate all of the possible precipitating causes [6]. Identification of common underlying pathophysiological pathways could be helpful in planning alternative health care strategies to prevent them. Moreover, some recommendations could be made to optimize perioperative clinical practice to allow early recognition and appropriate treatment of deteriorating patients [7].

The aim of our study was to identify patients hospitalized in our university surgical ward, who had to be transferred to the surgical ICU (SICU) due to some failure event. In order to thorough investigate failure events and their preventability, we decided to record not only data directly related to the nature of each failure event but also the response of the health care providers, parameters related to the patient and final outcome.

2. METHODS

This is a retrospective observational study performed in the surgical ward of a large, urban, teaching hospital during a 2.5year period, between January 2012 and August 2014. All failure events, which resulted in the transport of surgical patients from ward to the SICU, were included and reviewed. Planned transfers to the SICU were excluded from the study.

Following patient related parameters were recorded: age, sex, hospital admitting service, reason for hospitalization, medications received on ward, thromboprophylaxis, clinical manifestation and vital signs before the failure event, type of failure event and performed medical interventions. Vital signs included: heart rate (HR), systolic arterial blood pressure (SBP), respiratory rate (RR), temperature (T) and pulse oximetry (if applicable). Moreover, thorough study of the medical record revealed details about the first witness of the failure event (nurse, physician or relative), the response chain (surgical physician on duty or hospital resuscitation team) and the final outcome.

All patient related data were entered into an Excel file for review purposes.

3. RESULTS

During the 2.5 year study period, 3440 patients were admitted in the university surgical ward of our hospital. According to our study, there were 56 failure events recorded in 43 patients (1.25%) and thirteen (30,23%) patients suffered a failure event twice during their hospital stay. Demographic data of our patients are depicted in detail on Table 1.

Distribution of patients according to their admission route into the hospital and their original underlying surgical condition and diagnosis are depicted in detail in Table 2.

As it was expected, in most of the cases the failure event was identified by a nurse on duty. More specifically, in 29 (51,79%) cases a nurse was the first witness of the failure event, in 18 (32,14%) a physician on rounds (resident or attending and in 9 (16,07%) a relative of the patient.

Mean length of hospital stay until the failure event was 7±1,5 days for the non emergent and 2±0,8 days for the emergent cases.

Table 1. Demographic data of patients with failure events

Parameters		
Gender	Males	30 (69,77%)
	Females	13 (30, 23%)
Age (mean age in years)		71±27
Prior admission in PACU or SICU for ≤1 day		16 (37,21%) Emergent cases 17 (39,53%) Non emergent cases
ASA-PS classification	1	0
	2	5 (11,63%)
	3	24 (55,81%)
	4	14 (32,56%)
APACHE II score (median)		21±9

Table 2. Admission route and initial surgical condition of patients with failure events

Total number: 43	Non emergent cases: 19	Emergent cases: 24
Trauma	0	8
Acute care surgery	0	8
Colorectal surgery	8	4
Hepatobiliary surgery	4	0
Endocrine surgery	2	0
Breast surgery	1	0
Vascular surgery	2	4
Minimal invasive surgery	2	0

Table 3. Vital organs function impairment in patients with failure events

Organ system	Non emergent cases		Emergent cases	
	Single failure	Multiple organ failure*	Single failure	Multiple organ failure*
Respiratory Impairment	12	10	8	8
Cardiovascular System Impairment	2	17	2	13
Central Nervous System Impairment	1	7	0	9
Renal Function Impairment	0	3	1	7
Cardiac Arrest	0	2	0	6

*(*In several patients there has been derangement in function of more than one vital organs)*

In the vast majority of the failure events, there had been an alteration in the respiratory parameters [38/56 (67,86%)] either objective such as tachypnea and low pulse oximetry values or subjective such as breathing difficulties. Sole alteration of other vital parameters such as HR, SBP or T without any involvement of the respiratory system was documented in only 6 cases (10,71%). In most of the cases there has been a derangement in function of more than one vital organ. A more detailed presentation of the impairment in vital organs function is depicted in above Table 3.

In total, in 34 of the 56 failure events (60,71%), intubation was indicated either on ward or right after SICU admission. Vasoactive medication was used in 30 out of 56 (53,57%) and antibiotics in 32 out of 56 (62,5%) cases respectively.

Respiratory failure was the most common final diagnosis after SICU admission, among which 8 cases of acute respiratory distress syndrome, 3 of pneumonia, 2 of pulmonary embolus, 3 of aspiration and 1 case of pneumothorax were included. The second and third most common diagnosis was sepsis and hypovolemia and/or

any electrolyte disturbance. It is important to underline the fact that in several patients more than one diagnosis has been made. The complete list of final diagnoses is presented in Table 4.

Table 4. Final diagnosis after SICU admission

Final diagnosis	Number
Respiratory failure	34
Sepsis	28
Hypovolemia and/or Electrolyte disturbance	24
Acute renal failure	6
Acute Myocardial Ishemia	4
Intrabdominal bleeding	3
Anastomosis rupture	2
Evisceration	2
Epileptic seizure	1

(In several patients more than one diagnosis has been made)

Of the total 43 patients suffering one or more than one failure events, 14 (32,56%) died. Three of them died on ward, right after their failure event and before SICU admission and the rest survived to be admitted but not to be discharged from SICU. In total, the most common final cause of death was respiratory failure followed by cardiovascular causes in 6 patients (2 of whom had also suffered respiratory failure). Death of the three patients who died before SICU admission was attributed to cardiovascular causes.

4. DISCUSSION

According to the results of our study, ASA-PS 3 and 4 surgical patients are at higher risk of suffering a failure event. This finding is in accordance with other literature studies and can be adequately explained by the fact that ASA-PS 3 and 4 category involves patients with one or more severe systemic diseases, sometimes poorly controlled with at least some functional limitation [8]. Therefore, it seems necessary to be even more careful when discharging such a patient from the SICU to the ward since monitoring conditions/standards on ward are far less than ideal.

Furthermore, more patients were admitted through emergency hospital services, which indicates that emergent cases might be at higher risk compared to elective admissions. One possible reason for this might be that generally in emergency cases there isn't enough time to prepare patients for surgery in an optimal way as far as the patient's current general condition, his/her comorbidities and chronic prescribed medication are concerned. Therefore, worse outcome in emergent cases is pretty much expected and this is also suggested by similar studies in the literature [8]. The fact that this difference was not statistically significant could be attributed to the relatively small total number of failure events.

Another important finding of our study was that most of our patients, namely 33 out of 43 (76,74%), had already been admitted to the SICU prior to the failure event. This result is indicating that patients, who have already met criteria for admission to ICU are most in danger of suffering a failure event after ICU discharge to the ward. One possible explanation for that could be that physiologic alterations caused by the underlying primary disease or the operation itself are still not reversed after ICU discharge.

Despite the fact that the cost of ICU hospitalization is expensive for the hospital, the insurance companies and sometimes also for the patient and therefore should be limited to the lowest possible level, readmission to the ICU after a failure event is even more expensive both in terms of money and overall medical costs and patient outcomes.

The nurse to patient ratio in an average surgical ward does not allow appropriate monitoring of the patients in order to identify any clinical deterioration before the occurrence of a failure event. Therefore, it seems appropriate to find the right balance between longer than necessary and shorter than indicated ICU stay and moreover to organize intermediate care units for patients after ICU discharge.

This might be more important for emergent cases, where mean length of ward stay before the failure event were 2 days in 17 out of 19 patients (89,47%), which is even more indicative of an inappropriate transfer from SICU to the ward.

In the vast majority of the failure events (70%), there had been an alteration in the respiratory parameters and cardiovascular function was the second most common to be affected. This result underlines the importance of respiratory and cardiovascular monitoring in postsurgical patients, which has been observed to be at a rather sub-optimal level, due to a shortage of

personnel, as well as of appropriate monitoring devices.

In most patients deterioration presented with a combination of objective and subjective signs. Early recognition of deteriorating patients is crucial for enhancing survival rates. Therefore, there has been a great effort in the literature to develop some kind of "track and trigger" systems with specific recorded parameters and a guide of different levels of activation codes according to the reached total score [9]. Nevertheless, it seems that those systems are not that specific to reliably discriminate between survivors and non-survivors [10-13]. Indeed, "track and trigger systems" are considered adequately specific in recognizing patients at risk of cardiac arrest or unexpected death and they generally seem to be valuable tools in the hands of the nursing staff in order to monitor ward patients and to activate emergence pathways appropriately [14,15]. However, these warning systems cannot substitute the clinical evaluation of patients and in any case they should be used as supplementary aids to guide patient care.

One main limitation of our study is the retrospective nature of our work, which makes it difficult to draw direct results and to be certain about the credibility of the findings. Moreover, the fact that in most of the cases more than one physician and or somebody of the nursing staff were implicated in patient care in combination with time lapse between the failure event and its analysis, make it difficult to be able to sketch out and reproduce the actual setting. Finally, the small total number of failure events, which indeed is similar to other literature studies, does not allow any hasty generalization of the study results and imposes caution when trying to apply any of the trial data and conclusions into daily clinical routine [8].

5. CONCLUSION

This study underlines the importance of surgical perioperative care, which can have a great impact on outcome. Failure events in the perioperative setting can in some cases be preventable and identification of common underlying pathophysiological pathways could be helpful in preventing them. Based on our results, it seems that high risk patients admitted through ED should be admitted into ICUs for safety reasons and triggering systems and monitoring of postsurgical patients, especially respiratory monitoring, would be helpful in minimizing failure events.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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