Determinants of Intensive Care Unit Transfer in Patients Admitted to the Medical Ward of an Academic Hospital in Jeddah

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ABSTRACT

Objective: This study aimed to identify the proportion of patients who had clinical deterioration in the medical ward that required intensive care unit transfer and the factors associated with this transfer.

Methods: A retrospective study of all patients admitted to the medical wards of King Abdulaziz University Hospital between 2010 and 2013 was performed. The demographics, admitting department, diagnosis at the time of admission to the ward, and cause of intensive care unit transfer were collected. Patients at risk for deterioration and early intensive care unit transfer were identified using physiologic threshold criteria.

Results: A screening of 38380 patients admitted to the various medical services during the study period was performed. Of these, 356 (0.9%) required intensive care unit transfer. Most patients were initially admitted from the emergency department (66.3%), while transfers from another hospital comprised approximately 1%. Intensive care unit transfer patients were more likely to have ischemic heart disease (P < 0.001), diabetes (P < 0.001), renal failure (P < 0.001), or sepsis associated with pressure ulcers (P < 0.001). They were also more likely to be bedridden (P < 0.001) or initially ventilated in the medical ward (P < 0.001). The mortality rate of the patients was 3.9% with patients who died being more likely to have unstable blood pressure at the time of admission (P = 0.026).

Conclusions: This study identified several factors that were associated with intensive care unit transfer. Clinicians should consider these factors when determining patient disposition to ensure timely and appropriate management.

Keywords

Clinical deterioration; Intensive care unit; Medical ward; Patient transfer.

Citation:


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INTRODUCTION

The urgent transfer of patients from medical or surgical wards to the intensive care unit (ICU) provides a challenge to physicians. Recent studies show that in-hospital mortality for patients admitted directly to the ICU is lower than that for patients transferred from the ward to the ICU[11, 31]. Similarly, patients who are emergently transferred from the medical or surgical ward appear to have significantly higher in-hospital mortality than patients who enter the ICU from the emergency department (ED) or another hospital[6].

The timing of transfer to the ICU may be an important factor determining the outcome for in-patients. In addition, the timing of numerous acute care interventions (thrombolytic drugs, aspirin and β-blockers in patients with myocardial infarction, and thrombolytic agents in stroke patients) has a considerable impact on patient mortality[11, 31]. Findings from previous studies[8, 9] suggest that up to half of the cases of cardiopulmonary arrests on general medical and surgical wards could have been prevented by earlier transfer of cases to the ICU. Unfortunately, these studies were limited because they relied on expert opinion instead of explicit criteria to retrospectively determine cases in which respiratory or cardiac arrest may have been avoided. Other studies have suggested subjective criteria—namely the onset of acute dyspnea or non-response to treatment—to identify patients who are at risk for severe deterioration[10, 11]. Nevertheless, in order to reduce in-hospital mortality of patients hospitalized on medical and surgical wards, it is crucial for clinicians to identify at-risk cases before they become critically ill or physiologically deranged.

The objective of this study was to identify the proportion of patients who had severe clinical deterioration in the medical ward and required ICU transfer. It also aimed to investigate the factors that were associated with ICU transfer by comparing various characteristics of these patients to those of patients who did not require ICU transfer.

METHODS

The study was conducted during a four-year period (January 2010 through December 2013) at the Multi-disciplinary Internal Medicine Department of King Abdulaziz University Hospital (KAUH), Jeddah. At the time of the study, the medical ward of the institution had a capacity of 124 beds (62 for males and 62 for females), while the ICU had 23 beds. Also included were patients admitted to the medical daycare unit and capture patients admitted for dialysis and endoscopy. The ICU of KAUH works in a closed-system fashion. Intensive care unit consultants are the supervising and treating physicians, but all physicians on the medical staff are allowed to follow their patients admitted to the ICU. The study was approved by the Ethics Research Committee of King Abdulaziz University.

Study Design and Patient Population

A retrospective chart review was performed of the medical records for all patients, including those who were transferred to the ICU from the medical wards. After identifying patients requiring ICU transfer, those patients were compared to the cohort of patients who required admission to the medical unit; excluding patients with a hospital stay of one day, patients who had been admitted to Day Care, chemotherapy, or dialysis and discharged on the same day.

Prior to ICU transfer, all patients were co-managed by a medical team according to subspecialty. Each team comprised a treating consultant, a specialist and/or fellows, three to five medical residents, and three to six medical interns. The physiologic threshold criteria that were used to identify patients at risk for deterioration and early ICU transfer included the following: systolic blood pressure (BP) < 101 mmHg or > 200 mmHg; respiratory rate < 9 cycles per minute; heart rate < 50 or > 120 beats per minute; and an altered level of consciousness, including new-onset agitation or confusion or unresponsiveness to verbal commands. Furthermore, all patients who developed cardiac and/or respiratory arrest were transferred to the ICU after resuscitation.

Demographic data, the initial admitting department, and initial diagnosis at the time of admission to the medical ward before ICU transfer, and the cause of ICU transfer were recorded for all patients included in the study.

Statistical Analysis

The data were entered and analyzed using version 16 of Statistical Package for the Social Sciences (IBM Inc, Armonk, New York, USA). Descriptive statistics were calculated for all variables. The chi-square test was used to determine the relationship between categorical variables, while the independent t test was used to compare various baseline and clinical characteristics between patients who required ICU transfer and those who did not. Differences were considered significant at the .05 level. Results are expressed as frequency (percent) and mean (standard deviation [SD]).

RESULTS

Out of 38380 patients screened, 356 (0.93%) patients required ICU transfer. Including only patients who were admitted to the medical wards (N = 3482 patients), the proportion of patients requiring ICU admission was about 10% (356/3482). Women comprised nearly half of the ICU transfer sample (n = 183; 51.4%), and non-Saudis accounted for approximately two-thirds of the cases (n = 243; 68.3%). The mean (SD) age of the patients was 52.5 (18.6) years (range, 13-91 years), and patients aged ≤ 65 years constituted a larger majority of the sample (n = 255; 71.6%).
The majority of patients were initially admitted from the emergency department (66.3%), while transfers from another hospital comprised only about 1% (Table 1). Most of the patients who were transferred to the ICU were diabetics on sliding-scale insulin, bedridden patients, or those who had been intubated on the ward. The least common clinical conditions documented in ICU transfer cases were meningitis, pulmonary embolism (PE), atrial fibrillation (AF), and human immunodeficiency virus (HIV) infection.

Further analysis showed that male patients were older than females; however, the results were not significant (P = 0.052). Similarly, there was no difference in ICU transfer between the different medical services (cardiology, endocrinology, gastroenterology, rheumatology, respirology, neurology, oncology, nephrology, infectious diseases, and general internal medicine) (P = 0.174). Patients with malignancies were less likely to be transferred to the ICU. Among the 356 patients transferred to the ICU, only 14 (4%) had a history of malignancy (P = 0.004). In addition, patients who were transferred to intensive care were more likely to have IHD (P < 0.001), diabetes (P < 0.001), renal failure (P < 0.001), or sepsis associated with pressure ulcers (P < 0.001). They were also more likely to be bedridden (P < 0.001) or initially ventilated in the medical ward (P < 0.001). No significant differences were found between ICU and non-ICU transfer cases in terms of age and gender (Table 2).

The hospital outcome of the patients transferred to ICU was variable. The mean (SD) length of hospitalization for patients who did not require ICU transfer was 6.3 (7.3) days (median, 4 days; range, 2-33 days). This was not different from those who had been transferred to ICU (mean, 6.1 [8.3] days; median, 4; and range, 2-33). Fourteen patients died, resulting in a mortality rate of 3.9%. Of these, ten were < 65 years old. Eight (57.1%) of the 14 patients were male; however, there was no significant difference in mortality between genders (P = 0.35). Among mortality cases, 10 (71.4%) had unstable BP at the time of admission (P = 0.026). There was no relation between mortality and time of admission to the medical ward (P = 0.082).

**DISCUSSION**

Clinical deterioration requiring intensive care occurred in less than ten percent of the patients, who, in most cases, had been admitted through the emergency department. Unplanned ICU transfer was associated with co-morbid conditions such as IHD, diabetes, renal failure, or sepsis. Similarly, bedridden patients and those who were initially ventilated in the medical ward were more likely to be transferred to the ICU.

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**TABLE 1.**
Frequency of patients transferred from the medical ward to the intensive care unit by Admitting Department.

<table>
<thead>
<tr>
<th>Admitting Department</th>
<th>Frequency (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical and Obstetrics and Gynecology Wards</td>
<td>15 (4.2)</td>
</tr>
<tr>
<td>Admission Unit</td>
<td>15 (4.2)</td>
</tr>
<tr>
<td>Day Care</td>
<td>23 (6.5)</td>
</tr>
<tr>
<td>Emergency Department</td>
<td>236 (66.3)</td>
</tr>
<tr>
<td>Other Hospital</td>
<td>4 (1.1)</td>
</tr>
<tr>
<td>Outpatient Department</td>
<td>63 (17.7)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>356 (100.0)</strong></td>
</tr>
</tbody>
</table>

**TABLE 2.**
Factors associated with medical ward to the Intensive Care Unit Transfer

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Non-ICU transfer (n = 3482)</th>
<th>ICU transfer (n = 356)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female sex</td>
<td>1774 (51.0)</td>
<td>183 (51.4)</td>
<td>.460</td>
</tr>
<tr>
<td>Age &gt;65 years</td>
<td>947 (27.2)</td>
<td>101 (28.4)</td>
<td>.340</td>
</tr>
<tr>
<td>IHD</td>
<td>532 (15.3)</td>
<td>102 (28.7)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>1074 (30.8)</td>
<td>166 (45.6)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Renal failure</td>
<td>155 (4.5)</td>
<td>36 (10.1)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Stroke</td>
<td>167 (4.8)</td>
<td>15 (4.2)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Sepsis associated with pressure ulcers</td>
<td>172 (5.0)</td>
<td>52 (14.6)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Bedridden</td>
<td>369 (10.5)</td>
<td>98 (27.5)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Initial mechanical ventilation in the medical ward</td>
<td>56 (1.6)</td>
<td>168 (47.2)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*Data are presented as frequency (percent) unless otherwise specified.
Abbreviations: ICU = Intensive Care Unit; IHD, Ischemic Heart Disease.
Earlier reports[12-14] have attempted to assess the risk of unplanned ICU transfer in patients who were admitted to the general wards. Similar to the present findings, a previous report found that diabetes, IHD, and renal failure were risk factors for unplanned ICU transfer[15]. Contrary to the present findings, other authors[16] reported that advanced malignancy was associated with risk of unplanned ICU transfer. However, the association between advanced malignancy and ICU transfer in that study was only present in cases with infection. While bedridden patients are not at risk for ICU transfer unless they develop a potentially-life threatening complication requiring intensive care[17], many considerations are taken into account before transferring bed-bound patients to the ICU. In the present context, religious and cultural commitments play a role in giving such patients—who typically present several co-morbid conditions, including diabetes mellitus and hypertension[16]—at least a trial of ICU care. Of note, the relationship between comorbid illness and ICU transfer, which was described in this study's cases, suggests that patients with co-morbid conditions have a low physiologic reserve, and this correlates with the knowledge that underlying medical conditions are also associated with increased mortality in hospitalized patients[17-19].

Unplanned ICU transfer of ward patients has previously been associated with worse outcomes[20]. In this study, this occurrence was not as striking, and no difference was found in the mean length of hospitalization for ICU transfer versus non-transfer patients. Furthermore, the mortality rate among patients who were transferred was 3.9%, which is much lower than that reported in other studies. For example, Kennedy et al. [20] reported that patients who were transferred to the ICU had a mortality rate of 24%. In another study that investigated the impact of delayed ICU transfer[21], a mortality rate of 28% was reported among ward-to-ICU transfer patients. The observed low mortality in this report may be due to the relatively young age of the patients, in addition to this facility's practice of maintaining a low threshold for seeking early evaluation from the ICU team.

The finding that most of the mortality cases in this study had unstable blood pressure readings at the time of admission underscores the importance of close monitoring in patients who have shock requiring vasopressors, as part of ICU risk stratification. In these cases, we used specific physiologic criteria to identify patients at risk of clinical deterioration and subsequently triggered an ICU consultation for cases that met the physiologic threshold criteria, which are similar to those required to activate a rapid-response system. While there are controversial data surrounding the effectiveness of such systems[22-25], a prior study showed that implementation of medical emergency teams was not associated with a decline in ICU performance[26]. Other authors found a significant and linear improvement in outcomes associated with an increase in the use of medical emergency response teams[27], a finding that was also reported in a single-center study conducted in a teaching hospital[28]. Nevertheless, the implications of these findings remain an issue of debate owing to differences in study design, statistical power, data analysis and study execution.

This study has all the limitations inherent to observational retrospective studies. In addition, no adjustment was made for some factors that may affect the risk of medical deterioration and ICU transfer. These include the presence of a systemic inflammatory response syndrome on presentation, prior history of ICU admission, and laboratory and imaging findings such as anemia, leukocytosis, etc. Further, the physiologic threshold criteria that were used to identify patients at risk for deterioration and early ICU transfer must be carefully considered: how well did the present study's criteria predict the need for eventual ICU transfer? All patients who were urgently transferred to the ICU from another ward met a physiologic threshold criterion prior to transfer. However, no evaluation was made regarding the performance of this measure or the time between when patients met the physiologic threshold criteria and their transfer to the ICU. Previous studies[2,19] showed that the slow transfer of patients was associated with increased mortality and morbidity, with one report[29] stating that each one hour increase in delay in transfer to the ICU after reaching a critical Cardiac Arrest Risk Triage score was associated with a significant increase in the odds of ICU mortality. Moreover, no follow-up data was available on the study's patients post-discharge. Lastly, this is a single center experience which may not be applicable to other centers.

CONCLUSION

Taken together, these findings demonstrate that the rate of unplanned ICU transfer at the medical ward of King Abdulaziz University was less than one percent. While it is challenging for physicians to identify at-risk patients for ICU transfer, recognition of these factors may allow for identification of early clinical deterioration to ensure that these patients are placed in a setting where deterioration may be more promptly and appropriately managed. Factors identified in this study include patients with comorbid illness, such as diabetes, renal failure, heart disease, and those who are intubated in the ward or bedridden. This study was a preliminary investigation into this topic, and future studies are warranted to further explore other factors that may affect the risk of medical deterioration and ICU transfer.

Disclaimer

The authors declare no potential conflicts of interest with respect to research, authorship, and/or publication of this manuscript.

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محددات نقل المرضى المنومين بقسم الطب البدني إلى وحدة العناية الفائقة بمستشفى أكاديمي

مدينة جدة

كمال الغلابي، وحمد نبيل الأعمى، ووسام الحجيلي، ومحمد عبد الوهاب، ومهند فلاتة، ويوسف قاري، وسالم
بازرة، وأحمد الجفني، ومريض ولي، وأيمن سندى، وأمانت الشريف، ومحمد الشيخي، وعبدالرحيم الشهري، ومحمد السلامة،
وتشادي الخياط، وأباظة الأولاني، وفاطمة الباجي، وعمرو فتح الدين، وأمانت الهذلي، وهما موصلي، وخلود غامري، ونوال بن
حتر، وهدياء الجلالي، ورنا بدراوي، ومحمد باشيط، وطارق الأعمي، وفاطم الزين، ومهيد السلمي، وعروب كعكي

قسم الطب البدني وحدة: أمراض القلب، الجهاز الحسسي، الأمراض الصدرية، الحضانة، الأعصاب، الأورام، الأمراض المعدية،

الأمراض الروطانية، الغدد الصماء، الطب البدني العام، أمراض الكلى، أمراض الشيخوخة، الطب النفسي

كلية الطب - جامعة الملك عبد العزيز

المملكة العربية السعودية

المستخلص

قدمة: تهدف هذه الدراسة إلى تحديد نسبة المرضى الذين تدهور حالتهم السريرية إلى درجة تتطلب نقلهم من الجناح الطبي

إلى وحدة العناية الفائقة والعمل المرتبط بهذا النقل.

الأسباب: قام الباحثون بتحليل هذه البيانات لتحديد فترات رفعي بقسم الطب البدني، حيث تم تدوين الخدمات في مستشفى جامعة الملك

عبد العزيز، جدة في الأعوام 2010 إلى 2013، ورصد العوامل المهمة بما في ذلك التركيبة السكانية وقسم التن祺ي المضني

والاختصاص عند الدخول، وقد تم تحديد المرضى المعرضين لخطر تدهور حالتهم الصحية وتفهمهم إلى وحدة العناية الفائقة باستخدام

معايير مكتوبة.

النتائج: احتملت الدراسة على 38380 مريضا في مختلف تخصصات الطب البدني خلال فترة الدراسة. حيث تم نقل 356 مريضا

من 2006 (21.3%) إلى وحدة العناية الفائقة، وكان نحول جميع المرضى إلى مستشفى عن طريق قسم الطوارئ (21,61%). في

حين شكل التحويل من مستشفى آخر ما يقرب من 1%. وكان المرضى الذين تم نقلهم إلى وحدة العناية الفائقة أكثر عرضة لمرض

القلب الإقفار (1,000+ (P<0.0001)، والسكري (1,000+ (P<0.0001)، والشرارة الإقفار (1,000+ (P<0.0001)، وكمشاكل أخرى، أوصاو

أيضا أكثر عرضة لانا يكونون من طريق القلب (1,000+ (P<0.0001)، أو من أولئك الذين يحتاجون لجهاز مساعدة للتنفس في الجناح الطبي (1,000+ (P<0.0001)، وقد بلغ معدل وفيات المرضى 3.04%، حيث كان المرضى الذين توفوا

الله أكثر عرضة لعدم استقرار ضغط الدم خلال الدخول المستشفى (0.0001) (P).

الخصائص: حددت هذه الدراسة العديد من العوامل المرتبطة تحويل المرضى إلى وحدة العناية الفائقة، وينبغي على الأطباء أخذ

هذه العوامل في الاعتبار. عند تحديد وحدة العلاجية المتبعة لتمويه المرضى في المستشفى، من أجل ضمان تقديم العناية الملائمة

في الوقت المناسب.