**Acute Kidney Injury in Trauma Patients Admitted to Critical Care**

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**ABSTRACT**

**Introduction:** Acute kidney injury is a common complication in critically ill patients and the intensive care unit. Therefore, the present study was conducted to investigate the frequency and severity of acute kidney injury in trauma patients admitted to the ICU of Imam Khomeini Hospital from March 2017 to March 2018 so that perhaps using the information obtained, help a step towards prevention, diagnosis and quickly treat these patients and reduce their mortality.  

**Materials and Methods:** In this descriptive-analytical study, the files of 120 trauma patients admitted to the ICU from medical records were examined. demographic profile and kidney failure tests were extracted. Version 17 of SPSS software was used to data analysis.  

**Results:** In this descriptive-analytical study, 120 traumatic patients were included in the study that 100 (83.3%) of them were male and 20 (16.7%) of them were female with average age of 34.74±22.82. The acute kidney damage was observed in 10 people (8.3%). The most common concomitant trauma in AKI patients was pelvic and thoracic trauma. Of the 10 patients with acute kidney damage, 4 (40%) required dialysis. Of the 10 patients with acute renal failure, 6 (60%) died in the intensive care unit and 4 (40%) were discharged (P= 0.001).  

**Conclusion:** In this study, there was a significant relationship between acute renal failure and the consequence of hospitalized patients in intensive care.

**Keywords:** Trauma, Acute Kidney Injury, AKI, ICU, Mortality

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Introduction

Acute Kidney Injury (AKI) is a common consequence of severe trauma that is linked to increased morbidity and death in ICU patients (ICU). As more trauma patients survive their original life-threatening disease, earlier detection and treatment of consequences like AKI are critical areas for intervention, with the goal of improving short- and long-term outcomes. Early detection of AKI, limiting continuing or recurring renal injury, and providing supportive management of severe renal failure are the current approach to AKI management in the general critical care population [1-3]. Traditional AKI measures, such as urine output and serum creatinine, are late and non-specific biomarkers of renal impairment, making early preventative intervention difficult. As a result, efforts that focus therapies in patients with evolving AKI detected utilizing novel approaches such as risk prediction models and/or AKI-specific biomarkers are gaining traction [4]. Systemic inflammation, hypovolemic shock, heavy transfusion, rhabdomyolysis, abdominal compartment syndrome, and extensive surgery are all risk factors for AKI in serious trauma patients [5]. Because the onset of AKI or the requirement for renal support is frequently early after trauma, quick predictive modeling for the development of AKI or the need for renal support may allow measures to enhance outcomes, such as the initiation of RRT earlier [6-8]. Older age, more concomitant disease, and diabetes have all been identified as demographic risk factors for AKI in trauma patients. However, most earlier studies that attempted to predict AKI outcomes after significant trauma did not include early biochemical and clinical data [9-11]. Due to the fact that acute renal failure (AKI) is a common complication in patients admitted to the intensive care unit and increases the length of hospital stay, increases treatment costs and also increases patient mortality. Adopting some methods of prevention and treatment with proper fluid therapy and also reducing the use of nephrotoxic drugs in special cases, can lead to relative prevention of acute renal failure in these patients and thus reduce the associated complications and mortality; [12-14]. Therefore, knowing the information in this field, including the relative frequency, mortality rate and the relationship between acute renal failure and sex, age, as well as possible causes .... seems necessary. In this study, we aimed to investigate acute renal failure in ICU patients admitted to Imam Khomeini Hospital in Urmia, so that the information obtained may be a step towards prevention, diagnosis and rapid treatment of these patients and reduce their mortality.

Material and method
The aim of this descriptive-analytical study was to investigate the prevalence of acute renal failure or injury in trauma patients admitted to the ICU of Imam Hospital in Urmia and its relationship with mortality and morbidity of the hospital.

**Study population:** Trauma patients admitted to the ICU were enrolled in the study from April 2017 to the end of March 2017.

**Inclusion and Exclusion criteria:** Inclusion criteria are patients admitted to the ICU for trauma, exclusion criteria for patients with a history of chronic renal failure, patients with direct renal trauma, and patients admitted to the ICU for less than 24 hours.

**Summary of implementation method**

Considering the inclusion and exclusion criteria, after explaining the purpose of the study and how to conduct it to the patients themselves, and obtaining informed consent from them about 130 people who have referred during 12 months to Imam hospital were randomly assigned to the study. During this study, all records of the above patients in medical records were examined and demographic characteristics (age, sex) and paraclinical tests related to renal failure and patients on dialysis were extracted and statistical analysis was performed. Inclusion criteria are patients admitted to the ICU for trauma, exclusion criteria for patients with a history of chronic renal failure, patients with direct renal trauma, and patients admitted to the ICU for less than 24 hours.

Kidney failure is a condition in which the kidneys cannot function properly and means a severe reduction in kidney function. There are four systems for defining AKI: RIFLE, AKIN, CK and KDIGO, which we study in this system. We used KDIGO according to which the definition of AKI is as follows:

1) Increase in serum creatinine level by 0.3 mg / dl within 48 hours or

2) Increase in serum creatinine level by 1.5 times the basal level in 7 days or

3) Urinary output less than 0.5 mg / Kg / h for 6 hours [16]. Finally, the obtained data were statistically analyzed using SPSS version 26 statistical analysis software. Independent t test was used for quantitative variables such as the level of requested tests, and Pearson test and Spearman coefficient were used to determine the relationship between data. Significance level was considered P <0.05.
Ethical considerations

The present study was approved by the regional ethics committee of Tabriz University of Medical Sciences based on the Helsinki Declaration with the ethics code IR.UMSU.REC.1398.067 Patients entered the study after explaining the purpose of the study and how to do it to patients and if they wished. Admission to the study was completely optional and also all participants in the study, could withdraw from the study at any stage of the study, patient information will be completely confidential and the information used without mentioning the personal identity of individuals was examined. No additional treatment intervention or additional cost was imposed on patients.

Result

In this descriptive-analytical study, 130 trauma patients admitted to the ICU of Imam Khomeini Hospital in Urmia were included in the study, of which 10 were excluded from the study and finally the study was continued with 120 patients. 100 patients (83.3%) were male, 20 patients (16.7%) were female and the mean age was 34.74 ±22.82 years. 10 patients (8.3%) had acute kidney injury, of which 7 (70%) had pelvic, abdominal and chest trauma, and out of 110 patients without kidney injury, 60 patients (54.5%) had abdominal, pelvis and chest trauma. Out of 10 cases of acute kidney injury, 5 cases (4.2%) had abdominal trauma in general, 34 patients (28.3%) required mechanical ventilation and 38 patients (31.7%) required transfusion. Out of 44 patients with head trauma, 21 (47.7%) had a decrease in level of consciousness (GCS>10).In the acute kidney injury group, 6 patients (60%) and in the non-acute kidney injury group, 39 patients (35.5%) had chest trauma. According to Fisher Exact test, there was a significant relationship between chest trauma and acute kidney injury. Did not exist (P = 0.11).

Table 1: Relationship between Acute Kidney Injury and Trauma

<table>
<thead>
<tr>
<th>variables</th>
<th>Acute kidney injury</th>
<th>Non Acute kidney injury</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelvic trauma</td>
<td>6 (60%)</td>
<td>16 (14.5%)</td>
<td>0.003</td>
</tr>
<tr>
<td>Chest trauma</td>
<td>6 (60%)</td>
<td>39 (35.5%)</td>
<td>0.11</td>
</tr>
<tr>
<td>Abdominal trauma</td>
<td>5 (50%)</td>
<td>39 (35.5%)</td>
<td>0.27</td>
</tr>
<tr>
<td>Head trauma</td>
<td>5 (50%)</td>
<td>27 (24.5%)</td>
<td>0.09</td>
</tr>
<tr>
<td>Trauma of other organs</td>
<td>7 (70%)</td>
<td>40 (36.4%)</td>
<td>0.042</td>
</tr>
</tbody>
</table>
Discussion

Acute kidney injury (AKI) is a global health problem [15-17]. However, the incidence, risk and protective factors for AKI vary according to the economic situation in different parts of the world as well as according to the hospital facilities. Therefore, the aim of this study was to evaluate the frequency and consequences of acute renal failure in trauma patients admitted to the ICU of Imam Khomeini Hospital in a period of one year with 120 trauma patients. In our study, the highest percentage of trauma patients were 83.3% male. In line with our study, in the study of Santos et al. [11, 18-20], males accounted for a higher percentage of trauma patients than females. In our study, the incidence of acute kidney injury in trauma patients was 4.2%, which is lower than in the Santos (11) study. It was not considered in the study of santos and the differences in existing classification methods, such as KDIGO, RIFLE and AKIN (all three based on creatinine changes and / or decreased urine output). In the study of santos [21-23], most cases of brain injury were a type of trauma that directly affects the kidneys by reducing glomerular perfusion. In addition, brain damage is associated with repeated use of mechanical ventilation and longer stays in the ICU [24-26]. The overall incidence of AKI in other studies was in the range of 16 to 39% [27-29] which is due to the difference in progress in trauma care and subspecialty trauma treatment in recent years, as well as proper hydration in the center under study [30-32]. In Mitra Jebel Ameli study, the relative frequency of acute kidney injury in ICU patients was reported to be 25.96%, which is higher than our study, due to the high sample size and the fact that 126 patients The patients in his study had acute renal failure before hospitalization, because we excluded patients with previous kidney damage. Other studies showed that the rate of acute kidney damage acquired from the community was 0.4-0.9% and 4.9.7% in hospitalized patients [33-35]. Also, in our study, the highest percentage of acute kidney injury in trauma patients is in people with pelvic, abdominal and chest injuries. These findings are in line with the results of the study by Ilqer et al. [36] More

<table>
<thead>
<tr>
<th>Condition</th>
<th>Frequency (%)</th>
<th>Comparison</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need dialysis</td>
<td>4 (40%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Requires mechanical ventilation</td>
<td>5 (50%)</td>
<td>29 (26.4%)</td>
<td>0.11</td>
</tr>
<tr>
<td>Loss of consciousness</td>
<td>5 (50%)</td>
<td>77 (70%)</td>
<td>0.17</td>
</tr>
<tr>
<td>Need surgery</td>
<td>7 (70%)</td>
<td>89 (80.9%)</td>
<td>0.40</td>
</tr>
<tr>
<td>Hospital Outcome (dead)</td>
<td>6 (60%)</td>
<td>10 (9.1%)</td>
<td>0.001</td>
</tr>
</tbody>
</table>
created is aligned. In our study, there is a significant difference between the outcome of patients with acute kidney injury and patients without kidney injury. And finally confirmed the very high impact of acute kidney injury on the mortality of ICU patients. Also, with the study of Payen et al. [37] who in their study showed that the 60-day mortality rate in patients with AKI, 36% And in patients without AKI was 16% (P <0.01) is correlated. Lai et al. (15) concluded from their study that trauma patients with AKI have worse outcomes than trauma patients without AKI. This requires more care in trauma patients with AKI to reduce mortality. Baitello et al. [38] examined the incidence of AKI in patients admitted to the intensive care unit in Europe and examined the effect of patient characteristics and fluid balance on outcome. Older patients with AKI had higher disease severity and sepsis [39]. The mortality rate in patients with AKI was higher than in patients without AKI, especially in patients with oliguria. Data analysis showed that age, SAPS II, heart failure, liver cirrhosis, body fluid balance and mechanical ventilation were independently associated with 60-day mortality in these patients. These results are consistent with the findings of our study only in terms of mortality of patients with acute kidney injury.

**Conclusion**

Due to the fact that acute renal failure (AKI) is a common complication in patients admitted to the intensive care unit and increases the length of hospital stay, increases treatment costs and also increases patient mortality. Adopting some methods of prevention and treatment with proper fluid therapy and also reducing the use of nephrotoxic drugs in special cases, can lead to relative prevention of acute renal failure in these patients and thus reduce the associated complications and mortality; Therefore, knowing the information in this field, including the relative frequency, mortality rate and the relationship between acute renal failure and sex, age, as well as possible causes .... seems necessary. In this study, we aimed to investigate acute renal failure in ICU patients admitted to Imam Khomeini Hospital in Urmia, so that the information obtained may be a step towards prevention, diagnosis and rapid treatment of these patients and Reduce their mortality. Finally, it can be said that acute renal failure in our study in the intensive care unit due to trauma is less common than other studies, but our study also showed that the mortality rate of these patients is associated with acute renal failure. Therefore, according to the presented materials, more attention to trauma patients with acute renal failure in the intensive care unit is necessary both in terms of prevention and in terms of rapid diagnosis and timely treatment.
Recommendation

It is recommended that in future studies, trauma and non-trauma patients admitted to the intensive care unit who suffer from acute renal injury during ICU admission be examined with a larger number of samples. Allocating medical equipment and trained personnel to the intensive care unit will play an important and undeniable role in the treatment and care of trauma patients with AKI and in order to prevent the bad consequences and mortality of these patients.

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