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HOSSAM MAGHRABY

Ain shams University
Faculty of Medicine
Anesthesia, intensive care and pain management department

Acute kidney injury in polytrauma patients in intensive care unit: a prospective observational study

Thesis Submitted for fulfillment of Master Degree in CRETICAL CARE

By

Mahmoud Abdelrahman Seifelnasr Ebrahim

M.B.B.Ch., Faculty of Medicine, Cairo University

Under Supervision of

Prof . Mohammed Ismail Abd Elfattah Elsaidi

Professor of Anesthesia, intensive care and pain management

Faculty of Medicine Ain shams University

Dr. Hanaa Mohamed Abdallah El Gendy

Assistant Professor of Anesthesia, intensive care and pain management

Faculty of Medicine Ain shams University

Dr. Gamal Eldin Adel Abd El Hameed

Lecturer of Anesthesia, intensive care and pain management

Faculty of Medicine Ain shams University

Ain shams University
Faculty of Medicine
2020

ACKNOWLEDGEMENTS

First and foremost, all praise and all thanks to **ALLAH**, who has guided and enabled me by his mercy to fulfill this thesis which I hope to be beneficial for all.

I would like to express my profound gratitude to *Prof. Mohamed Ismael Abd Elfattah Elsaidi,* Professor of Anesthesia, intensive care and pain management Faculty of Medicine Ain shams University for his most valuable advises and support all through the whole work and for dedicating much of his precious time to accomplish this work.

I am also grateful to *Dr. Hanaa Mohamed Abdallah El Gendy,* Assistant Professor of Anesthesia, intensive care and pain management Faculty of Medicine Ain shams University for her unique effort, considerable help, assistance and knowledge.

I am also grateful to *Dr. Gamal Eldin Adel Abd El Hameed,* Lecturer of Anesthesia, intensive care and pain management Faculty of Medicine Ain shams Universityfor his unique effort, considerable help, assistance and knowledge he effored me throughout the performance of this work.

My special thanks to all staff members in Benha University for their cooperation in this work.

My deepest gratitude I extend to my whole family who offered me support, advice and motivation.

Mahmoud Abdelrahman Seifelnasr Ebrahim

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List of Abbreviations

ADQI	Acute Dialysis Quality Initiative
AKD	acute kidney disease
AKI	Acute Kidney Injury
AKIN	Acute Kidney Injury Network
CK	creatine kinase
CKD	chronic kidney disease
CK-MB	creatine kinase MB
CRRT	continuous renal replacement therapy
ECMO	extracorporeal membrane oxygenation
ED	emergency department
eGFR	estimated glomerular filtration rate
FET	Fisher's exact test
GCS	Glasgow Coma Scale
ICU	intensive care unit
IGFBP7	insulin-like growth factor binding protein 7
IHD	intermittent hemodialysis
ISS	Injury Severity Score
KDIGO	Kidney Disease Improving Global Outcomes
LOS	length of stay
MAP	mean arterial pressure
MDRD	Modification of Diet in Renal Disease
N-S	non significant
RAAS	Renin angiotensin aldosterone system
RIFLE	Risk, Injury, Failure, Loss of Kidney Function, End-Stage Kidney Disease
RRT	Renal Replacement Therapy
S	Significant
SCr	serum creatinine
SLED	sustained low efficiency dialysis
SPSS	Statistical package for social science
TIMP-2	tissue inhibitor of metalloproteinases 2
UOP	urine output

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Acute kidney injury in polytrauma patients in intensive care unit: a prospective observational study

[(a)] Mohammed Ismael Abd Elfattah Elsaaedy, [(b)] Hanaa Mohamed Abdullah El Gendy [(c)] Gam al Eldin Adel Abd El Hameed [(d)] Mahmoud Abdelrahman Seifelnasr Ebrahim

[(a)] Professor of Anesthesia, intensive care and pain management, Faculty of Medicine – Ain shams University.[(b)] Assistant Professor of Anesthesia, intensive care and pain management, Faculty of Medicine – Ain shams University,[(c)] Lecturer of Anesthesia, intensive care and pain management, Faculty of Medicine – Ain shams University, [(d)] M.B.B.CH., Faculty of Medicine, Cairo University.

Abstract

Background: Acute Kidney Injury (AKI) is a common complication of severe trauma patients and is associated with increased morbidity and mortality. Injury Severity Score (ISS) > 15 represents approximately 10% of all trauma patients in intensive care unit (ICU). The primary outcome of the study was to correlate between the AKI by using RIFLE criteria and the trauma severity by using ISS .While; the secondary outcomes were; identifying the incidence of AKI in polytrauma patients, the length of ICU and hospital stay and 28 days mortality. **Methods:** This is a prospective observational study which was conducted during the period from May 2020 to September 2020. It Included 60 cases of polytrauma patients who have ISS>15, at Ain shams university hospitals, their ages ranged from 18-70 years. All patients' data were recorded for: Injury Severity Score (ISS). RIFLE criteria. Length of ICU and hospital stay. 28 days mortality**.** **Results:** There was no correlation between the incidence of AKI and the severity of the trauma by using ISS. Incidence of AKI the percentage was (45 %) among all the studied cases. According to RIFLE criteria, within this population, patients were classified as (21.7%) of the patients in the Risk stage; (18.3%) of the patients in Injury stage, and (5%) of the patients in Failure stage. There was statistically significant difference between AKI and No AKI regarding risk factors, percentages of sepsis, rhabdomyolysis, drugs, abdominal trauma and hypovolemic shock were higher in AKI patients than No AKI patients. There was no statistically significant difference between AKI patients and No AKI patients regarding mechanical ventilation, ICU stay, Hospital stay and 28d Mortality. **Conclusion:** The incidence of acute kidney injury in polytrauma patients in the intensive care unit was high and the overall mortality of our patients was as high as that reported in other studies. A better comprehension of risk factors associated with trauma-associated AKI is important, such as rhabdomyolysis, sepsis, abdominal trauma (compartment) and hypovolemic shock.

Key words: acute kidney injury – polytrauma- intensive care unit

Corresponding Author Name: **Mahmoud Abdelrahman Seifelnasr Ebrahim**
Phone Number: 01112435527 **Email:** mahmoudseif2013@gmail.com

INTRODUCTION

Acute Kidney Injury (AKI) is a common complication of severe trauma patients and is associated with increased morbidity and mortality. However, early diagnosis and treatment of AKI and its complications improve short and long-term outcomes **(Eriksson et al., 2015).**

Injury Severity Score (ISS) > 15 represents approximately 10% of all trauma patients in intensive care unit (ICU); furthermore, 23% of them developed AKI and 10% required Renal Replacement Therapy (RRT) **(Morris et al., 1991).**

Trauma patients have many risk factors for AKI such as hypovolemic shock, rhabdomyolysis, massive transfusion, major surgeries and abdominal compartment syndrome **(Bihorac et al., 2013).**

Rhabdomyolysis is a syndrome that is caused by musculoskeletal tissue damage that leads to release of large amounts of intracellular elements, which particularly affect renal function. 10–50% of patients with some degree of marked rhabdomyolysis develop AKI, and it has been suggested that rhabdomyolysis contributes to 5–25% of all cases of AKI **(Huerta-Alardin et al., 2005).**

Laboratory diagnosis of rhabdomyolysis includes; creatine kinase (CK) and creatine kinase MB (CK-MB) as serum markers of muscle necrosis. Histologically, there is cellular swelling which is caused by alteration of the osmotic gradients and cell membrane rupture with leakage of nuclear and cytoplasm contents. **(Mikkelsen et al., 2004).**

Renal failure related to rhabdomyolysis is caused by renal vasoconstriction, ischemia, myoglobin cast formation, direct cytotoxic effect of myoglobin and hyperuricemia **(Sharp et al., 2004).**

AKI is classified according to RIFLE classification (acronym for Risk, Injury, Failure, Loss and End-stage) which based on changes in serum creatinine and urine output **(Ostermann and Chang, 2007).**

The early diagnosis and prompt treatment of the complications of rhabdomyolysis are preventable and have good prognosis with low morbidity and mortality**.** This is particularly relevant in polytrauma patients, where other factors such as hypovolemic shock which plays an important additive role in the pathogenesis of ARF **(Bagley et al., 2007).**

Aim of the Work

The primary outcome of the study was to correlate between the AKI by using RIFLE criteria and the trauma severity by using Injury Severity Score (ISS) .The secondary outcomes were; identifying the incidence of acute kidney injury in polytrauma patients in ICU, the length of ICU and hospital stay and 28 days mortality.

Chapter 1. Acute Kidney Injury

Introduction

Acute kidney injury (AKI) is a complex syndrome characterized by a decrease in renal function, associated with numerous etiologies and pathophysiological mechanisms (**Hoste et al., 2018**).

It is a common diagnosis in hospitalized patients, associated with poorer short- and long-term outcomes and increased health care costs (**Hoste et al., 2018**).

The incidence of AKI has increased in the recent years to be nearly 25% (**Susantitaphong et al., 2013**).However, there is significant variability in the reported incidence of AKI, which is associated with the different characteristics of the populations studied, cause of AKI, and diagnostic criteria used (**Hoste et al., 2018**). Additionally, the lack of studies assessing AKI in community settings and comparing critically ill and non-critical patients hampers the characterization of the epidemiology of AKI (**Susantitaphong et al., 2013**).

The importance of recognizing AKI applies to pediatric and adult patients, as well as ambulatory, hospitalized, and critically ill patients in multiple clinical settings, due to its prognostic impact. The incidence of AKI is the lowest in ambulatory patients and higher in critically ill and patients which need dialysis (**Bagshaw et al., 2007**).

Indeed, AKI occurs in up to 40% of acute decompensated heart failure hospitalizations, which differs according to the criteria used to define AKI. This is known as cardiorenal syndrome type 1 and is an important prognostic factor (**Ronco et al., 2010**).

Importantly, with the increase in patients with heart failure, the prevalence of this syndrome is also estimated to rise in the near future.

Mortality rates have declined in critically ill patients, although an increase has been reported in patients with dialysis-requiring AKI (**Amin et al., 2012**).

AKI is more common in older patients and those with predisposing factors, who present with a higher rate of comorbidities and higher probability of developing severe disease (**Singbartl and Kellum, 2012**).

Sepsis is the leading cause of AKI in critically ill patients, accounting for 50% of cases. Furthermore, the differences in patient characteristics, setting, pathophysiology, and outcomes distinguish septic AKI as a separate clinical entity from non-septic AKI (**Bellomo et al., 2017**).

Indeed, septic AKI patients are more likely to require mechanically assisted ventilation and vasoactive drugs, and have longer hospital stays, a higher likelihood of dialysis-requiring AKI, and higher in-hospital mortality rates. Moreover, they have an increased probability of renal function recovery (**Lopes et al., 2009**).

Surgery is another important cause of AKI that accounts for up to 40% of in-hospital AKI cases (**Grams et al., 2016**). The highest rates of AKI are found after cardiac (18.7%), general (13.2%), and thoracic (12.0%) surgeries, representing the impact of surgical settings on the incidence variability (**Gameiro et al., 2018**).

Recently, the Acute Disease Quality Initiative Workgroup proposed the term acute kidney disease (AKD) to reflect the continuing pathological processes and adverse events developing after AKI. AKD is defined by presenting Kidney Disease Improving Global Outcomes (KDIGO) stage 1 criteria for longer than 7 days after an AKI initiating event. This definition includes the post-AKI period in which critical interventions potentially alter the progression of kidney disease, therefore