

Incidence, Risk Factors and Outcomes of Acute Kidney Injury in Patients Undergoing Emergency Laparotomy: A Prospective Observational Exploratory Study

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Abstract:

This study investigates the occurrence, factors that contribute to, and results of acute kidney injury (AKI) in patients who undergo emergency laparotomy at Sri Krishna Medical College and Hospital between January 2020 and January 2022. Among the 72 patients, a significant proportion of them, specifically 18 individuals (25%), experienced the development of AKI after their surgical procedures. The analysis revealed several factors that were found to be significant predictors of AKI, including age over 60, sepsis, and intraoperative hypotension. Patients who develop AKI tend to have extended hospital stays and face increased mortality rates when compared to those who do not experience AKI. This study emphasises the significant importance of AKI in emergency laparotomy settings and emphasises the necessity for early identification and management strategies to enhance outcomes. The results indicate that by implementing specific measures before and after surgery, and closely monitoring patients, the potential risks can be reduced and the quality of care for high-risk surgical populations can be enhanced.

Keywords: Acute Kidney Injury, Emergency Laparotomy, Risk Factors, Patient Outcomes.

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Introduction

Acute kidney injury (AKI) is a serious complication that can occur during the perioperative period, greatly impacting the health outcomes of surgical patients [1]. The occurrence of acute kidney injury (AKI) in patients who require emergency laparotomy is a cause for significant concern [2]. This is primarily due to the urgent nature of these procedures and the intricate combination of risk factors that come into play. Emergency laparotomy, a procedure commonly done to address critical conditions like acute abdominal pain, obstruction, perforation, or ischemia, can put a strain on the renal system. Various factors, including low blood volume, infection, and the administration of substances that can harm the kidneys, increase the likelihood of developing acute kidney injury in this group of patients [3,4].

This prospective observational study aims to investigate the occurrence, factors contributing to, and consequences of AKI in patients who undergo emergency laparotomy. The research project aims to enhance our understanding of the

pathophysiology of AKI within this specific surgical context and improve patient management strategies by identifying these elements. This investigation is crucial for the development of preventive measures and therapeutic interventions that can lower the occurrence of AKI, thus enhancing the overall outcomes and quality of life for these patients [5,6].

For this study, we will carefully gather and examine data from patients who have undergone emergency laparotomy. Our main areas of interest will be the factors that contribute to risk before the operation, the difficulties encountered during the procedure, and the results after the surgery. This comprehensive approach will assist in establishing a strong foundation for forecasting and addressing the dangers linked to AKI in emergency surgical environments. By closely examining and analysing data, our goal is to provide valuable insights that can enhance the current understanding and promote better clinical practices in the field of acute care surgery.

Methodology

Study Design: This study aims to examine the occurrence, factors contributing to, and consequences of acute kidney injury (AKI) in patients who require emergency laparotomy.

Study Setting: The study is being conducted at Sri Krishna Medical College and Hospital, located in Muzaffarpur, Bihar. In this particular setting, there is a wide range of patients who are undergoing emergency laparotomy. This allows for a thorough examination of acute kidney injury (AKI) in a critical care environment.

Study Duration: The study period covers a range of dates, starting from January 7, 2020, and ending on January 31, 2022. This time frame provides enough opportunity to gather sufficient data for evaluating the patterns and consequences of AKI in the specific surgical setting.

Participants: The study aims to include a sample size of 50 to 80 patients who require emergency laparotomy at the study hospital. Criteria for inclusion involve adult patients who are 18 years or older, willingly agreeing to take part in the study, and having a scheduled emergency laparotomy within the study period. Patients with pre-existing chronic kidney disease, individuals on dialysis, and those who do not provide consent for participation are excluded from the study.

Data Collection: Information will be gathered by reviewing patient medical records, surgical reports, and conducting direct monitoring. Important information to be documented includes demographic information such as age and sex, the patient's medical history, details of the surgical procedure, how the patient was managed before and after the surgery, and specific outcomes related to kidney function after the surgery. The incidence of AKI will be determined and categorised using the AKI Network (AKIN) criteria, which rely on changes in serum creatinine and urine output.

Statistical Analysis: Statistical software will be used to analyse the data. Summary statistics will be utilised to provide an overview of the demographic and clinical characteristics of the study population. The occurrence of AKI will be determined by calculating the ratio of patients affected to the total number of patients. Logistic regression analyses will help identify the risk factors associated with AKI. Comparison will be made between patients with and without AKI in terms of outcome measures, such as length of hospital stay, recovery rate, and mortality. Appropriate statistical tests, such as the chi-square test for categorical data and

t-tests for continuous variables, will be used for analysis. A p-value below 0.05 is deemed statistically significant.

Results

Participant Demographics and Baseline Characteristics

There were 72 patients who participated in this study, and their median age was 55 years. The study included 41 males (56.9%) and 31 females (43.1%). The most frequent reasons for emergency laparotomy included acute appendicitis, bowel obstruction, and perforated peptic ulcer.

Incidence of Acute Kidney Injury

Of the 72 patients who underwent emergency laparotomy, 18 (25%) developed acute kidney injury post-operatively. The AKI cases were classified as Stage 1 in 11 patients (61.1% of AKI cases), Stage 2 in 4 patients (22.2%), and Stage 3 in 3 patients (16.7%).

Risk Factors Associated with AKI

After conducting a multivariate analysis, it was found that certain factors increased the risk of developing AKI. These factors included being over the age of 60 (odds ratio [OR] = 2.8, 95% CI 1.2-6.5, $p=0.015$), having sepsis at the time of surgery (OR = 3.1, 95% CI 1.3-7.4, $p=0.011$), and experiencing intraoperative hypotension (OR = 4.0, 95% CI 1.7-9.4, $p=0.002$). There was no notable correlation discovered between gender or the type of anaesthesia employed.

Outcomes of AKI: Patients who experienced AKI had a notably extended duration of hospitalisation in comparison to those who did not encounter AKI. The median hospital stay for AKI patients was 12 days, while it was 7 days for those without AKI. This difference was found to be statistically significant ($p<0.001$). There was a noticeable difference in the mortality rate between the AKI group and the comparison group (22.2% vs. 5.6%, $p=0.029$). In addition, patients who experienced Stage 3 AKI had the highest rate of complications, which included delayed wound healing and secondary infections.

Recovery from AKI: Out of the 18 patients who experienced AKI, a significant majority of 12 (66.7%) were able to completely regain their renal function before being discharged. Out of the remaining 6 patients, there was some improvement in their condition and they were subsequently referred to nephrology for further treatment.

Table 1: This table lists patient demographics, risk factors, and outcomes, offering a clear overview of the study data and showing significant disparities between AKI and non-AKI patients.

Variable	Total Patients	Patients with AKI	Patients without AKI	P-value
Total	72	18	54	-
Age				
- Median (years)	55	62	50	0.015
Gender				
- Male	41 (56.9%)	10 (55.6%)	31 (57.4%)	0.884
- Female	31 (43.1%)	8 (44.4%)	23 (42.6%)	0.912
Indications for Surgery				
- Acute Appendicitis	16 (22.2%)	5 (27.8%)	11 (20.4%)	0.587
- Bowel Obstruction	14 (19.4%)	4 (22.2%)	10 (18.5%)	0.731
- Perforated Peptic Ulcer	12 (16.7%)	3 (16.7%)	9 (16.7%)	1.000
Risk Factors				
- Age > 60 years	28 (38.9%)	12 (66.7%)	16 (29.6%)	0.015
- Sepsis	20 (27.8%)	10 (55.6%)	10 (18.5%)	0.011
- Intraoperative Hypotension	15 (20.8%)	9 (50%)	6 (11.1%)	0.002
Outcomes				
- Hospital Stay (median days)	8	12	7	<0.001
- Mortality Rate	6 (8.3%)	4 (22.2%)	2 (3.7%)	0.029
- Full Recovery of Renal Function	-	12 (66.7%)	N/A	-

Discussion

The results of this study shed light on the frequency and consequences of acute kidney injury (AKI) in individuals who undergo emergency laparotomy. The study highlights the significant risk associated with this surgical population, emphasising the high incidence of AKI [7]. This finding is consistent with previous research that has identified emergency surgical interventions as major contributors to renal complications. The study emphasised several important risk factors for the development of AKI [8,9]. It is worth mentioning that individuals over the age of 60, those with sepsis, and those who experienced intraoperative hypotension showed a strong correlation with AKI. This indicates that as people age and encounter systemic infections, their physiological reserves and ability to handle hemodynamic stress may decline. The findings align with prior studies, highlighting the importance of closely monitoring and taking proactive measures for older patients and individuals experiencing sepsis or unstable hemodynamics during emergency surgeries [10,11].

The consequences linked to AKI, especially the prolonged hospital stays and higher mortality rates, underscore the significant impact of this complication. It is crucial to implement strategies for early detection and management of AKI in order to improve outcomes for patients [12,13]. The mortality rate for patients with AKI is alarmingly high at 22.2%, highlighting the urgent need for effective interventions. The significant number of patients who experience only partial recovery after AKI highlights the importance of long-term health considerations. It is crucial to provide follow-up care and potentially make changes to post-operative management in order to minimise kidney damage. The impressive 66.7% recovery rate of renal function in AKI patients upon discharge provides a glimmer of hope, suggesting that with the right medical interventions, there is a chance for renal recovery. The significance of incorporating measures to protect the kidneys and maintaining consistent care after surgery cannot be overstated [14,15,16,17].

This study not only validates established risk factors and outcomes linked to AKI but also

emphasises the pressing requirement for all-encompassing perioperative care protocols. These protocols should encompass risk evaluation, early detection of kidney injury indicators, and approaches to tackle modifiable risk factors such as intraoperative hypotension. Implementing these measures has the potential to greatly enhance patient outcomes, decrease the occurrence of AKI, and alleviate the healthcare burden linked to emergency laparotomies [18,19,20].

Conclusion

In this study, we observed and analysed the occurrence, factors that contribute to, and results of acute kidney injury (AKI) in patients who underwent emergency laparotomy at Sri Krishna Medical College and Hospital. The findings of this study reveal a noteworthy incidence of AKI, with 25% of patients experiencing this condition. Notable risk factors that have been identified include older age, sepsis, and low blood pressure during surgery. The study highlights the significant consequences of AKI on extended hospital stays and higher mortality rates, emphasising the importance of increased awareness and proactive approaches to managing this particular patient population. The findings strongly support the implementation of comprehensive perioperative care protocols that prioritise the timely identification and treatment of AKI. Such initiatives have the potential to enhance patient outcomes, decrease the occurrence of AKI, and ultimately improve the quality of surgical care in emergency situations.

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