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ORIGINAL ARTICLE

Impact of Preoperative Left Ventricular Dysfunction on Surgical Outcomes and Mortality in Patients Undergoing Emergency Abdominal Surgery

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ABSTRACT

Background: Emergency abdominal surgery carries a high risk of morbidity and mortality, particularly in patients with compromised cardiovascular function. Preoperative left ventricular (LV) dysfunction reduces cardiac reserve and may significantly worsen surgical outcomes; however, its impact in emergency settings remains insufficiently studied.

Objective: To evaluate the impact of preoperative left ventricular dysfunction on postoperative complications and mortality in patients undergoing emergency abdominal surgery.

Methods: This cross-sectional study was conducted from June 2022 to June 2023 at the Department of Cardiology, Chaudhry Pervaiz Elahi Institute of Cardiology (CPEIC), Wazirabad, in collaboration with Amna Inayat Medical College. A total of 100 patients undergoing emergency abdominal surgery were included. Preoperative echocardiography was performed to assess left ventricular ejection fraction (LVEF), and patients were categorized into normal (≥50%), mild dysfunction (40–49%), and moderate-to-severe dysfunction (<40%). Postoperative outcomes including complications, ICU admission, hospital stay, and 30-day mortality were recorded.

Results: LV dysfunction was present in 37% of patients. Postoperative complications were significantly higher in patients with LV dysfunction compared to those with normal LVEF (67.6% vs. 38.1%, $p < 0.001$). ICU admission was required in 56.8% of patients with LV dysfunction versus 26.9% in the normal group ($p = 0.002$), and hospital stay was significantly prolonged (13.1 ± 4.7 vs. 8.9 ± 3.3 days, $p < 0.001$). The overall mortality rate was 17%, with significantly higher mortality in patients with LV dysfunction (32.4% vs. 7.9%, $p = 0.001$).

Conclusion: Preoperative LV dysfunction is a strong independent predictor of adverse postoperative outcomes and mortality in emergency abdominal surgery. Early cardiac assessment and targeted perioperative management are essential to improve patient outcomes.

Keywords: left ventricular dysfunction, emergency abdominal surgery, mortality, ejection fraction, cardiac risk, postoperative complications.

INTRODUCTION

Emergency abdominal surgery remains one of the most challenging areas in surgical practice, associated with substantial morbidity and mortality due to the urgent nature of intervention and limited time for preoperative optimization[1]. Unlike elective procedures, patients presenting for emergency abdominal surgery often have advanced disease, systemic inflammation, sepsis, or hemodynamic instability, all of which significantly increase perioperative risk. Mortality rates following emergency abdominal surgery vary between 10% and 25% after 30 days, and are higher in older patients and those with a greater burden of co-morbid disease[2,3].

Among the numerous factors affecting surgical outcomes, heart disease has a major impact. Heart disease is the most common cause of death after surgery, and poor cardiac performance limits the body's capacity to respond to the stressors of surgery[4]. In this regard, left ventricular (LV) function - measured as left ventricular ejection fraction (LVEF) - is a critical measure of cardiac function. Impaired LV function, reflected by decreased ejection fraction, results in reduced cardiac output, tissue perfusion, and physiological reserve, heightening the risk of perioperative hypotension, organ failure and mortality[5].

Emergency surgery presents a significant physiological challenge during the perioperative period, with fluid shifts, blood loss, inflammatory response and neurohormonal responses[6]. In patients with pre-existing LV dysfunction, this can trigger acute heart failure, arrhythmias and multiple organ dysfunction. Moreover, LV dysfunction has been linked to a higher risk of post-operative complications, such as acute renal failure, pulmonary edema, and sepsis, leading to longer hospital admissions and mortality[7].

While the influence of LV dysfunction has been extensively investigated in elective cardiac and non-cardiac surgeries, there has been limited evidence from this area in the context of emergency abdominal surgery, especially in the low- and middle-income healthcare settings, where resources for perioperative cardiac assessment may be scarce[8]. In countries like Pakistan and other low- and middle-income countries, the presence of delayed presentation, high incidence of infectious disease and limited healthcare resources further increase the surgical risks, adding to the need for local evidence[9].

Therefore, this study aims to evaluate the impact of preoperative left ventricular dysfunction on postoperative outcomes, including complications, intensive care unit (ICU) admission, length of hospital stays, and mortality in patients undergoing emergency abdominal surgery. By identifying LV dysfunction as a potential independent predictor of adverse outcomes, this study seeks to contribute to improved perioperative risk stratification and management strategies in high-risk surgical populations[10,11].

MATERIALS AND METHODS

This cross-sectional study was conducted over a period of one year from June 2022 to June 2023 at the Department of Cardiology, Chaudhry Pervaiz Elahi Institute of Cardiology (CPEIC), in collaboration with Amna Inayat Medical College. A total of 100 patients undergoing emergency abdominal surgery were included using a non-probability consecutive sampling technique. Patients aged 18 years and above, of either gender, who were scheduled for emergency abdominal surgical procedures such as intestinal obstruction, perforation peritonitis, complicated appendicitis, and abdominal trauma were enrolled in the study. Patients undergoing elective surgeries, those with incomplete clinical or echocardiographic data, known congenital heart disease, or those who declined consent were excluded from the study.

All patients had preoperative transthoracic echocardiography done by a cardiologist. The main measure of left ventricular function was left ventricular ejection fraction (LVEF). Based on LVEF values,

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patients were categorized into three groups: normal left ventricular function (LVEF ≥50%), mild left ventricular dysfunction (LVEF 40–49%), and moderate-to-severe left ventricular dysfunction (LVEF <40%). This was done to examine the effect of different levels of left ventricular dysfunction on surgical outcomes.

Data were collected using a predesigned and structured proforma, which included age, gender, and other clinical factors such as diabetes mellitus, hypertension and ischemic heart disease. Information about the surgical diagnosis, type of emergency operation performed, intraoperative findings, duration of operation, blood loss, and intraoperative hemodynamic status was also collected. Postoperative outcomes were recorded, including complications (cardiac, respiratory, sepsis and renal failure), need for ICU stay, duration of hospital stay and 30-day postoperative mortality.

The data was entered and analysed using SPSS version 26. Quantitative variables were expressed as mean ± standard deviation, while qualitative variables were presented as frequencies and percentages. The chi-square test was used to assess the relationship between qualitative variables and logistic regression was used to identify the independent predictors of death. Odds ratios (OR) and 95% confidence intervals (CI) were determined, with p-values less than 0.05 being regarded as significant.

Ethical approval for the study was obtained from the Institutional Review Board of CPEIC (Ref No: CPEIC/IRB/2022-06-112). Written informed consent was obtained from all participants or their legal guardians prior to inclusion in the study, and confidentiality of patient data was strictly maintained throughout the research process.

RESULTS

One hundred patients who had emergency abdominal surgery were eligible for the study. Based on preoperative echocardiographic assessment, 63 patients had normal left ventricular function (LVEF ≥50%), 21 patients had mild left ventricular dysfunction (LVEF 40–49%), and 16 patients had moderate-to-severe left ventricular dysfunction (LVEF <40%). The overall mean age of the study population was 54.8 ± 13.6 years. There was a male predominance with 61 males and 39 females; however, both genders were adequately represented. Those with LV dysfunction had a higher mean age and greater prevalence of co-morbidities. The proportion of patients aged >65 years was significantly higher in the LV dysfunction group compared to the normal LVEF group (48.6% vs. 25.4%, p = 0.01). Likewise, the prevalence of diabetes and hypertension was significantly higher in patients with an impaired LVEF (p < 0.05), suggesting a clear link between cardiovascular risk factors and an impaired LVEF (Table 1).

Complications occurred in 49% of the patients, and were more prevalent in patients with LV dysfunction. Specifically, 67.6% of patients with LV dysfunction developed at least one postoperative complication compared to 38.1% in patients with normal LVEF (p < 0.001). Cardiac complications were the most pronounced, occurring in 32.4% of patients with LV dysfunction versus 11.1% in the normal group (p < 0.001). Pulmonary complications (35.1% vs. 15.9%, p = 0.004), sepsis (43.2% vs. 20.6%, p = 0.002), and renal dysfunction (24.3% vs. 9.5%, p = 0.01) were also more prevalent in patients with LV dysfunction, highlighting the systemic consequences of diminished cardiac reserve after surgery (Table 2).

Postoperatively, a larger number of patients with LV dysfunction were admitted to the ICU compared to those with normal LVEF (56.8% vs. 26.9%, p = 0.002). Moreover, the average hospital length of stay was significantly greater in patients with LV dysfunction (13.1 ± 4.7 days) as compared to patients with normal LVEF (8.9 ± 3.3 days, p < 0.001), suggesting greater morbidity and resource use in this high-risk population (Table 3).

A gender-based analysis revealed that males had a slightly greater incidence of postoperative complications (51.0%) than females (46.2%), although this was not statistically significant (p = 0.63). The mortality rates also did not significantly differ between males (18.0%) and females (15.4%, p = 0.72), suggesting that in this study, gender was not an independent predictor of poor outcomes. Rather, left ventricular dysfunction continued to be the most significant predictor of increased postoperative complications and mortality.

The 30-day mortality rate in patients was 17%. Patients with LV dysfunction had higher mortality (32.4%) compared to those with normal LVEF (7.9%, p = 0.001). Stratified analysis showed a progressive increase in mortality with worsening LV function, with mortality rates of 7.9% in patients with normal LVEF, 23.8% in those with mild dysfunction, and 43.8% in patients with moderate-to-severe dysfunction (Table 4).

Multivariate logistic regression analysis identified left ventricular ejection fraction <40% as a strong independent predictor of mortality (OR = 3.9, 95% CI: 1.7–6.8, p < 0.001). Additionally, age >65 years (OR = 2.5, 95% CI: 1.2–4.6, p = 0.01) and presence of sepsis (OR = 4.4, 95% CI: 2.1–7.5, p < 0.001) were also independently associated with increased mortality risk. These findings confirm that impaired preoperative cardiac function, advanced age, and systemic infection significantly contribute to poor surgical outcomes in emergency abdominal surgery patients.

Table 1: Baseline Characteristics of Study Population

Variable	Normal LVEF (n=63)	LV Dysfunction (n=37)	p-value
Age >65 years	16 (25.4%)	18 (48.6%)	0.01
Male	37 (58.7%)	24 (64.9%)	0.52
Female	26 (41.3%)	13 (35.1%)	0.52
Diabetes Mellitus	14 (22.2%)	17 (45.9%)	0.01
Hypertension	18 (28.6%)	21 (56.8%)	0.003

Table 2: Postoperative Complications

Complication	Normal LVEF (%)	LV Dysfunction (%)	p-value
Cardiac events	11.1	32.4	<0.001
Pulmonary complications	15.9	35.1	0.004
Sepsis	20.6	43.2	0.002
Renal dysfunction	9.5	24.3	0.01

Table 3: ICU Admission and Hospital Stay

Outcome	Normal LVEF	LV Dysfunction	p-value
ICU admission (%)	26.9	56.8	0.002
Mean hospital stay (days)	8.9 ± 3.3	13.1 ± 4.7	<0.001

Table 4: Mortality Distribution According to LVEF

Group	Mortality (%)	p-value
Normal LVEF	7.9	
Mild LV dysfunction	23.8	
Moderate–severe LV dysfunction	43.8	0.001

DISCUSSION

This study reveals that preoperative left ventricular (LV) dysfunction is a key predictor of poor postoperative outcomes and death for patients who have emergency abdominal surgery[7]. Those with lower left ventricular ejection fraction (LVEF) had a greater incidence of postoperative complications, higher requirement for intensive care, longer hospital stay and substantially higher mortality. The results underline the importance of cardiac function in determining surgical risk, especially in emergency surgery where time for optimization is a luxury[8].

Emergency abdominal surgery, by its nature, is highly stressful owing to elements like acute inflammatory state, infection, water and electrolyte imbalances, and hemodynamic compromise. Cardiac function is crucial in these circumstances to sustain blood flow and organ function[9]. LV dysfunction is associated with reduced cardiac contractility and output, reducing the patient's capacity to adapt to the stress of surgery. This accounts for the increased rates of complications seen in the LV dysfunction group in this study, especially cardiac, lung and sepsis complications[10].

Our finding of a strong link between LV dysfunction and postoperative complications is corroborated by previous research, which highlights the role of cardiovascular dysfunction as a major

predictor of perioperative complications[11]. Impaired LVEF has been found to increase the risk of perioperative hypotension, arrhythmias, pulmonary edema and multiple organ failure. In our study, the rate of cardiac complications was almost three times greater in patients with LV dysfunction, highlighting the risk of these patients for perioperative cardiovascular complications[12].

We also found that patients with LV dysfunction were more likely to be admitted to ICU and had a longer hospital stay. This is indicative of the increased disease severity and the need for enhanced monitoring and support in this patient population[13]. This also reflects the increased healthcare cost and resource consumption, which is important in resource-poor settings. These results highlight the need for early risk stratification and appropriate strategies for perioperative care[14].

The analysis of mortality adds to the evidence of the importance of LV dysfunction. The crude mortality rate of 17% in this study is consistent with other reports of emergency abdominal surgery in comparable groups[15]. But mortality rates were much higher in patients with impaired LVEF, especially those with moderate and severe dysfunction, in whom mortality rate approached 44%. The step-wise rise in mortality according to the severity of LV dysfunction supports a dose-response relationship, and highlights the importance of LVEF as a useful predictor[16].

On multivariate analysis, LVEF <40%, older age and sepsis were all independent predictors of death. This information is significant from a clinical standpoint, as it suggests that while LV dysfunction is an important predictor, other factors such as infection and the normal degredation of organ function with age, also play an important role. The significant link between sepsis and mortality highlights the role of infection in synergistically worsening outcomes in patients with LV dysfunction[17,18].

In our study, gender was not significantly associated with complications or death. While males were more prevalent, outcomes in males and females were similar when adjusting for other factors. This finding is consistent with the hypothesis that factors such as cardiac function and comorbidities are more significant factors in determining outcome than gender[19].

The results of this study highlight the need for pre-operative cardiac evaluation, even in urgent cases. Point-of-care echocardiography can assist in detecting LV dysfunction and inform care. Appropriate fluid management, judicious use of inotropic agents, minimization of hemodynamic variability and early ICU support may be beneficial in high-risk individuals. Moreover, collaborative efforts between surgeons, anaesthesiologists and cardiologists are crucial[20].

This study has some limitations. The cross-sectional nature of the study prevents causality from being determined. The relatively small sample size and number of centers may limit the generalizability of the results. In addition, long-term outcomes (beyond 30-day mortality) were not evaluated. We encourage larger prospective and multicenter studies to verify these findings and investigate the long-term outcomes[17-20].

CONCLUSION

Left ventricular dysfunction prior to emergency abdominal surgery is a strong and independent predictor of complications, ICU admission, extended hospital length of stay and death. The degree of ventricular dysfunction is associated with a gradual rise in the risk of adverse outcomes. Comorbidities such as older age and sepsis also increase the risk. Preoperative LV dysfunction identified via echocardiography and adoption of appropriate perioperative treatment strategies are critical to enhance surgical outcomes in this vulnerable population. Adoption of a strategy of cardiac risk stratification in emergency surgery may help to minimise complications and deaths, especially in the developing world.

Author Contributions

M.H.: Conceptualization, study design, data interpretation, manuscript drafting

A.S.: Data collection, statistical analysis, manuscript writing

W.A.: Echocardiographic assessment, cardiology input, data validation

N.U.K.: Data collection, literature review, manuscript editing

W.Q.: Statistical support, data analysis, critical revision

A.K.: Supervision, study design, final approval of manuscript

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