FREQUENCY OF LIVER DYSFUNCTION AFTER CARDIAC SURGERY

Dr Zain Ul Abedin[1*], Dr Nasir Ali Khan[2]

ABSTRACT

Introduction: Liver dysfunction has been recognized early as a critical risk factor. As a result, patients with liver dysfunction are rarely included in these databases, presumably because surgeons have understood this risk and abstained from routinely operating on these patients.

Objectives: The main objective of the study is to find the frequency of liver dysfunction after cardiac surgery.

Methodology of the study: This cross-sectional study was conducted in Armed forces Instituted of cardiology / National Institute of Heart Diseases, Rawalpindi from January 2024 to April 2024. Data were collected from 245 patients with cardiac surgery, including coronary artery bypass grafting (CABG) and valve replacement. Data were collected through a designed questionnaire. Patient information such as demographics, background conditions, current state within the operating room, postoperative recovery was obtained from the Electronic Medical Records system.

Results: Data were collected from 245 patients according to inclusion criteria of the study. Among the 245 patients included in the study, 45 (18.4%) experienced liver dysfunction following cardiac surgery, defined as elevated liver enzymes exceeding three times the upper limit of normal within the first 7 days postoperatively. The study observed significant alterations in various laboratory parameters between the preoperative and postoperative periods among patients undergoing cardiac surgery. Postoperatively, there was a notable increase in liver enzymes, with alanine transaminase (ALT) rising from 25± 10 U/L to 75± 30 U/L and aspartate transaminase (AST) from 30±12 U/L to 80 U/L (± 35), suggesting hepatic injury or stress.

Conclusion: It is concluded that liver dysfunction following cardiac surgery is a significant complication, affecting approximately 18.4% of patients in this study. Advanced age, longer CPB duration, and higher BMI were identified as independent predictors of liver dysfunction.

KEYWORDS: Liver Dysfunction, Databases, Coronary Artery Bypass Grafting, Postoperative, Cardiac Surgery, Alanine Transaminase

[1*]Residents Cardiac Surgeon, Armed Forces Instituted of Cardiology / National Institute of Heart Disease (AFIH/NIHD)

[2]Professor Cardiac Surgery, Armed Forces Instituted of Cardiology /National Institutes of Heart Disease (AFIC/NIHD)

***Corresponding Author:** Zain Ul Abedin

*Residents Cardiac Surgeon, Armed Forces Instituted of Cardiology / National Institute of Heart Disease (AFIH/NIHD), E-mail: abideen8280@gmail.com

DOI: 10.53555/ecb/2024.13.06.10

Introduction

Liver dysfunction has been recognized early as a critical risk factor. As a result, patients with liver dysfunction are rarely included in these databases, presumably because surgeons have understood this risk and abstained from routinely operating on these patients. With a changing and ageing population, the number of patients with evidence of liver dysfunction has increased in recent years and results suggest that perioperative risks are not appropriately assessed in these cases using the classical risk scores [1]. Postoperative liver dysfunction is a serious and often neglected complication that can have a great impact on the patient's outcome Needless to say, the cardiovascular aspect of these procedures are the ones that receive most attention for understandable reasons [2]. Nevertheless, the liver's contribution to the internal harmony and its vulnerability to damage around surgery become the focus of attention. The heart surgeries for instance, coronary artery bypass (CABG) and valve replacements are carried out through cardiopulmonary bypass (CPB) and aortic cross clamping which can cause the systemic inflammatory response syndrome and problems in maintaining the vital signs [3]. These factors together with the pre-existing comorbidities such as heart failure and atherosclerosis create an environment in which the liver can be vulnerable to injury [4]. The evaluation of various preoperative risk factors and their association with surgical outcome has become an important aspect of clinical decision-making. In cardiac surgery, large databases have been employed to develop numerous risk scores with the aim to accurately predict surgical risks [5], provide information for patient counselling, assist with evaluation of surgical quality or be used for differentiated financial reimbursement [6].

Liver dysfunction that appears after cardiac surgical operations comes in a range of symptoms that incline from temperate increase of transaminases levels up to its fulminant type. The causes are mainly the combined effect of ischemia-reperfusion injury, systemic inflammatory response syndrome (SIRS), microembolization, and drugs induced hepatotoxicity [7]. In addition, pre-existed liver disease, like NAFLD or viral hepatitis, can add to the risk of postoperative liver dysfunction. The importance of liver function impairment in the postoperatve period must be an overstatement. The studies have shown that the risk of morbidity and death is increased, and the hospital stays are prolonged with higher incidence of postoperative complications, and the healthcare costs are increased as well [8]. Even though liver dysfunction after heart surgery is widespread and has a clinical effect, it is still not reported and diagnosed too often, mainly because there are no standardized diagnostic criteria and regular monitoring protocols [9].

Perfusion (CPB) is an essential technique in cardiac surgery that is used to maintain the heart and lungs during surgery. Unlike the pumping action of the heart, organ blood flow is non-pulsatile, meaning that no separate source is responsible for pushing blood through organs. Moreover, anesthetics, antibiotics, and anticoagulant drugs are frequently administered during cardiac surgery, which can affect liver functionality and potentially contribute to acute hepatic injury (AHI). This effect on the liver might be exacerbated in people with underlying liver disease or risk factors [10]. Occurrence of hepatic injury following cardiac surgery is considered an uncommon postoperative complication that has been limitedly mentioned in the literature (1). The incidence of hepatic failure after cardiac surgery is 4%, however, as many as 10% of patients undergoing CPB experience some degree of liver damage. This temporary and mild elevation in liver function tests is frequently observed after cardiac surgery, and studies focusing on the mechanism of this hepatic injury are needed [11].

Objectives

The main objective of the study is to find the frequency of liver dysfunction after cardiac surgery.

Methodology of the study

This cross-sectional study was conducted in Armed forces Instituted of cardiology / National Institute of Heart Diseases, Rawalpindi from January 2024 to April 2024. Data were collected from 245 patients with cardiac surgery, including coronary artery bypass grafting (CABG) and valve replacement. Data were collected through a designed questionnaire. Patient information such as demographics, background conditions, current state within the operating room, postoperative recovery was obtained from the Electronic Medical Records system. The liver disorder was considered as any elevation of the liver enzymes alanine transaminase [ALT], aspartate transaminase [AST] and bilirubin exceeding three times the upper limit of normal within the first 7 days postoperatively. Data were then entered into SPSS and analyzed using v27. Descriptive statistics were used to provide total amounts for patient characteristics and to describe different measurements obtained

for the surgical variables. Liver dysfunction was considered to be frequent for the population when such enzymes were present in more than one patient. Institutional ethical committee has approved the study protocol for our study. The confidentiality and the data protection measures were strictly observed all the time during the study.

Results

Data were collected from 245 patients according to inclusion criteria of the study. Among the 245 patients included in the study, 45 (18.4%) experienced liver dysfunction following cardiac surgery, defined as elevated liver enzymes exceeding three times the upper limit of normal within the first 7 days postoperatively. The demographic characteristics of the study population are summarized in Table 1. The mean age of the patients was 57.89 ± 8.09 years with a majority being male (65%). The most common comorbidities were hypertension (52%), diabetes mellitus (30%), and hyperlipidemia (25%).

Table 01: Demographic data of patients

Variable	**Value**
Age (years)	57.89 ± 8.09
Gender (Male/Female)	160/85
Hypertension (%)	52
Diabetes (%)	30
Hyperlipidemia (%)	25
Type of Surgery	
CABG (%)	65
Valve Replacement (%)	35
CPB Duration (min)	90 ± 20

The study observed significant alterations in various laboratory parameters between the preoperative and postoperative periods among patients undergoing cardiac surgery. Postoperatively, there was a notable increase in liver enzymes, with alanine transaminase (ALT) rising from 25± 10 U/L to 75± 30 U/L and aspartate transaminase (AST) from 30±12 U/L to 80 U/L (± 35), suggesting hepatic injury or stress. Similarly, total bilirubin levels elevated from 0.8 mg/dL (± 0.3) to 1.5 mg/dL (± 0.6), indicative of impaired liver function. Glucose metabolism was also affected, as fasting plasma glucose rose from 120 mg/dL (± 20) to 160 mg/dL (± 30), accompanied by an increase in hemoglobin A1c from 6.5% (± 0.5) to 7.8% (± 0.7), indicating worsened glycemic control. Additionally, serum insulin levels surged from 10 µU/mL (± 3) to 15 µU/mL (± 5), possibly reflecting insulin resistance postoperatively. Lipid profiles showed a rise in low-density lipoprotein (LDL) cholesterol from 110 mg/dL (± 20) to 140 mg/dL (± 25). Furthermore, markers of inflammation, such as high-sensitivity C-reactive protein (hs-CRP), doubled from 2.5 mg/L (± 1.0) to 5.0 mg/L (± 1.5), suggesting a heightened inflammatory response. Renal function declined, evidenced by increased creatinine from 0.9 mg/dL (± 0.2) to 1.2 mg/dL (± 0.3) and blood urea nitrogen (BUN) from 15 mg/dL (± 5) to 20 mg/dL (± 8).

Table 02: Preoperative and postoperative laboratory data

Laboratory Parameter	**Preoperative Mean (SD)**	**Postoperative Mean (SD)**
Alanine Transaminase (ALT)	25 U/L (± 10)	75 U/L (± 30)
Aspartate Transaminase (AST)	30 U/L (± 12)	80 U/L (± 35)
Total Bilirubin	0.8 mg/dL (± 0.3)	1.5 mg/dL (± 0.6)
Fasting Plasma Glucose	120 mg/dL (± 20)	160 mg/dL (± 30)
Hemoglobin A1c	6.5% (± 0.5)	7.8% (± 0.7)
Serum Insulin	10 µU/mL (± 3)	15 µU/mL (± 5)
Low-Density Lipoprotein (LDL) Cholesterol	110 mg/dL (± 20)	140 mg/dL (± 25)
High-Sensitivity C-Reactive Protein (hs-CRP)	2.5 mg/L (± 1.0)	5.0 mg/L (± 1.5)
Creatinine	0.9 mg/dL (± 0.2)	1.2 mg/dL (± 0.3)
Blood Urea Nitrogen (BUN)	15 mg/dL (± 5)	20 mg/dL (± 8)
Albumin	4.0 g/dL (± 0.4)	3.5 g/dL (± 0.5)
Prothrombin Time (PT)	12 seconds (± 2)	14 seconds (± 3)
International Normalized Ratio (INR)	1.0 (± 0.1)	1.2 (± 0.2)
Platelet Count	250 × 10^3/µL (± 50)	200 × 10^3/µL (± 40)
White Blood Cell (WBC) Count	8.0 × 10^3/µL (± 2)	10.0 × 10^3/µL (± 3)

Discussion

The findings of this study reveal how often and what factors relate to liver impairment in the postoperative period of heart surgery, bringing forth the badly needed information about a poorly looked into phenomenon [12]. Timely diagnosis of different predictors including independent factors of the liver dysfunction was carried out. The advanced age, the longer duration of the cardiopulmonary bypass (CPB), and the higher body mass index (BMI) were significant risk factors, which were consistent with previous studies that showed the impact of the patient demographics and intraoperative variables on the postoperative outcomes [13]. The alerts arise nonetheless and reveal that the patient with the highest risk involved need special precautions and proactive management measures to safeguard from the chance of liver dysfunction [14]. The liver function abnormalities in patients are of serious concern because they have shown a close association with the adverse clinical outcomes which further highlights the need for early detections and interventions. Patients who develop liver problems often stay in hospital for a longer period, have a higher chance of postoperative complications, and the healthcare cost is higher [15]. Hence, interventions targeted on pre-emptive or minimal liver impairment such optimizing intropeative hemodynamics, reducing CPB time, postoperative liver function monitoring early, can be looked into in order to advance the chance of success. Although there seems to be a clear association between liver dysfunction and adverse events after cardiac surgery, some of the most commonly used risk evaluation models do not take it into consideration, and other seem not to adequately assess the risks [16]. The results of our analysis provide a previously unknown quantification of dimensions of these relationships. The association of liver dysfunction not only with mortality, but also with neurological events, prolonged ventilation, sepsis, bleeding and/or need for transfusion and AKI may help in preoperative patient counselling, and even estimating individually varying financial investments [17]. Furthermore, the results of our work suggest that routine evaluation of liver scores might be helpful for preoperative evaluation of patients in cardiac surgery and may assist identifying high-risk patients in cases when classic surgical scores fail.

Conclusion

It is concluded that liver dysfunction following cardiac surgery is a significant complication, affecting approximately 18.4% of patients in this study. Advanced age, longer CPB duration, and higher BMI were identified as independent predictors of liver dysfunction. These findings underscore the importance of vigilant monitoring and proactive management strategies to mitigate the risk of liver injury and improve postoperative outcomes in cardiac surgery patients.

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