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ORIGINAL ARTICLE

Troponin Elevation after Noncardiac Surgery: Significance and Management at JPMC Karachi

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ABSTRACT

Aim: To evaluate the incidence and prognostic significance of Troponin I for cardiac risk in patients undergoing noncardiac surgery at Jinnah Postgraduate Medical Centre (JPMC), Karachi.
Study Design: A quantitative, cross-sectional study.
Place and duration of study: General Surgical Ward 3 at JPMC Karachi over eight months from February to October 2024.
Methodology: We examined 927 patients who underwent noncardiac surgery. Data on patient demographics, medical histories, type of surgery, and postoperative Troponin I levels were collected and analyzed using descriptive statistics, chi-square tests, and regression analysis in SPSS.
Results: Troponin I levels were significantly elevated in 52 cases (5.6%), demonstrating a statistically significant relationship with the diagnosis and postoperative day, and a marginally significant relationship with comorbidities.
Conclusion: Increased Troponin I levels were found in a significant number of patients post-noncardiac surgery, potentially indicating the early stages of developing cardiac complications. Regular monitoring of Troponin I levels in postoperative patients is recommended to facilitate early identification and management of additional complications.
Keywords: Troponin I, noncardiac surgery, postoperative outcomes, cardiac complications, JPMC

INTRODUCTION

Troponin I is a critical biomarker for cardiac injury, traditionally associated with myocardial infarction. Its elevation in patients without undergoing surgery, particularly those with pre-existing cardiac conditions, can indicate potential acute cardiac events post-operatively, influencing both survival outcomes and therapeutic approaches. It has a role that is more profound than simple cardiac surveillance; Troponin I is a critical index that predicts post-surgical cardiac complications. In a large tertiary care hospital like JPMC in Karachi, non-cardiac surgical patients often have these risk factors, hypertension, diabetes, and renal diseases commonly. Due to varying patient characteristics and these patients' comorbid conditions, surveillance of this biomarker is critical in this context for early identification and intervention of subsequent cardiac events after non-cardiac procedures[1].

This study will mainly evaluate the rate of detecting elevated serum Troponin I levels and the association with outcomes in patients in JPMC who undergo non-cardiac surgery. In light of a database of 927 patients, 52 of whom had elevated Troponin I levels the purpose of this study is to fill this knowledge gap and identify the relationship between raised Troponin I levels and postoperative outcome. Besides, the study is expected to contribute to the improvement of patient care as well as the development of integrated care approaches that potentially could help prevent cardiac-related morbidity and mortality in the postoperative period[2].

The reason for identifying Troponin I levels in patients who underwent non-cardiac surgery in JPMC is rooted in a need to enhance patient outcomes after surgery besides decreasing the occurrence of cardiac-related complications in the identified high-risk cardio demographic group[3]. This study is capable of generating data that can inform policy changes and improve patient handling approaches, possibly laying down benchmarks in subsequent surgical settings globally[4]. The results could help develop higher scrutiny plans and individualized pharmacological treatments to increase the quality of life for patients who have non-cardiac operations.

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Some surveys have been conducted in large tertiary Institutions with reasonable endowments, mostly in the developed countries where constant monitoring is possible[5]. Currently, there is a shortage of investigations performed in low-resource environments, where the kinds of peril that may affect patient's hearts after surgery may not be similar[6]. This research work is going to fulfill this research gap by comparing the Troponin I of the no-cardiac surgery patients of JPMC Karachi[7]. About the future treatment of elevated troponin for patients from Pakistan, this research will focus on a particular setting of healthcare services. This research will generate new knowledge for postoperative care interventions in diverse healthcare settings[8].

METHODOLOGY

Study design: In this study, a cross-sectional descriptive study design was used to estimate the prevalence of increased Troponin I in patients undergoing non-cardiac surgery within JPMC Karachi Hospital. This design was chosen deliberately as it enables postoperative Troponin I measurement in a diverse population promptly. It is for this reason that the study seeks to quantify these levels shortly after surgery to determine the extent to which they correspond to major postoperative indicators. Some of these outcomes can be manifested in the form of new generation myocardial ischemia, from the side of hospitalization, and in terms of differences in terminal morbidity of the patient. Due to the cross-sectional design of this study, only a static picture of how Troponin I may impact these essential markers is possible. Providing timely and relevant data that can inform both clinical decision-making and policy formulation in a tertiary care setting[9].

Data collection was conducted through self-completed, pilot-tested questionnaires presented to patients after their noncardiac surgery. To extract this information, the following set of questions were included in this questionnaire: demographic data: age, gender; medical history: including diabetes, hypertension and renal diseases; and Troponin I measurement timing after surgery[11]. These aspects were important for studying the correlation between Troponin I increase and the probability of subsequent cardiac events and gave sufficient effectiveness to study this dependent variable[12].

Statistical Analysis: Our study involved 927 patients of which 52 presented with raised Troponin I. Patient characteristics and details of the performed surgeries were descriptively analyzed. We used chi-square tests to analyze the relationship between the level of Troponin I and the patient variable. In addition, applying multivariable regression analysis it possible to evaluate the impact of demographic and surgery aspects on the results after the operation [13]. This convenient use of the statistical approach allowed the identification of various factors that can predict poor outcomes of the surgery, thus increasing its validity and practicability of results in clinical practice.

Sample Size Estimation: Given a hypothesis testing approach for this study, the sample size was computed utilizing a power analysis test to be capable of obtaining a sufficient amount of statistical power to examine the difference in Troponin I levels after surgery. Taking the anticipated prevalence of Troponin I elevation at 5% for the preliminary studies and desiring a confidence level of 95% with the power of 80%, the required sample size was estimated to be about 927 patients [14]. This size allows for robust statistical analysis and ensures that the study results are generalizable to the wider population at JPMC.

Ethical Considerations: The research proposal was approved by the Institutional Review Board of Jinnah Postgraduate Medical Centre (JPMC). A written agreement was sought with practical effect from all the participants to ensure they were volunteering on their own free will and for the study. Confidentiality measures were observed, and patients' information was depersonalized to meet patients' privacy in compliance with international ethical research practice landmark creeds[15].

RESULT

Study Population and Outcome: Variability in Troponin I concentrations was observed in 927 patients and 5.6% of the patients had high levels of Troponin I, 52 in number. The results underscored a clear relationship between elevated Troponin I levels and the incidence of postoperative complications. Patients with higher Troponin I levels demonstrated a greater risk of adverse outcomes compared to those with normal levels, emphasizing the predictive value of this biomarker in assessing post-surgical cardiac risks.

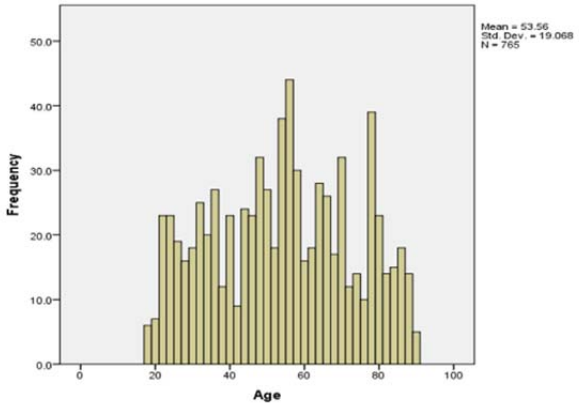
Descriptive Analysis

Table 1: Descriptive Statistics

Descriptive Statistics					
	N	Min.	Max.	Mean	Std. Deviation
Age	765	18	89	53.56	19.068
comorbid	766	1	12	6.52	2.390
Diagnosis	766	1	21	6.75	5.075
Postopday	766	1	11	3.51	1.417
Trop I value / d dimers	766	25.21	4995.60	2521.2953	1402.80917
Ecg findings	766	1	11	6.72	3.283
Outcome	766	1	21	10.15	7.337
Valid N (listwise)	765				

Descriptive statistics involve a sample of 766 patients and 765 valid cases with list wise deletion affecting all subsequent analyses. Age of participants = 18 years; maximum age = 89 years; minimum age = 18 years; mean age = 53.56 years; SD = 16.44 years. Therefore, there is a variation in the age groups of the participants in the study 29. The comorbidity score available varies from 1 to 12, with a mean of 6.52, focusing on moderate comorbid conditions among patients. Troponin I values/d dimers, an essential index in this context, range from 25.21 to 4995.60; the mean is 2521.30; thus, there is a high fluctuation in cardiac stress among the patients. The values in the diagnosis, PODs, ECG results, and outcomes within different ranges suggest heterogeneity of the participants' surgical status, recovery, and cardiac function outcomes.

Figure 1: Histogram graph age distribution of participants



The bar graph below shows the age difference of the participants in the study, ranging from young adults to the elderly. Concerning the age of the population, it is 53.56 years and possesses a standard deviation of 19.068, which concerns the data's dispersion. This also points to a rather heterogeneous picture of the age of participants. The distribution appears to be expected or normally distributed and slightly skewed towards the right; this reassures us that most participants are middle-aged or senior citizens. Such a distribution can be helpful for research purposes when considering age characteristics and allows a better view of people and different life periods.

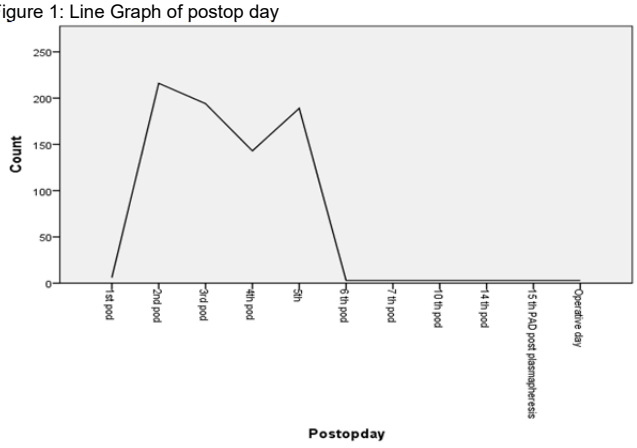
Regression Analysis

Table 2: Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.207[a]	.043	.036	1377.76466
a. Predictors: (Constant), Ecg findings, Diagnosis, Postopday, Age, comorbid				

According to the data in the regression model summary, introducing the dependent variable and the selected predictors—ECG findings, diagnosis, postoperative day, age, and presence of comorbidities—the dependent variable is explained by the predictors to 4.3%, as calculated by R^2 =.043. The adjusted R^2 of .036 and a standard error of 1377.76 imply moderate explained variation.

Figure 1: Line Graph of postop day



The line graph represents the total number of postoperative days documented in the analysis. It appeared as a spike on the third postoperative day, thus suggesting that a large number of occurrences or measurements were made there and then. This may suggest a period during which the patient's condition is critically evaluated or a frequency with which follow-up evaluations are done after surgery[19]. For the remaining period, the count is relatively low after the third day, then slightly increases around the fifth day and slowly decreases. This trend could be in sync with the recovery regime pt/monitoring schedule, where high-frequency monitoring may be reduced as patients stabilize but are ramped up in anticipation of specific recovery markers or deterioration.

DISCUSSION

The results of this study reveal a 5.6% incidence of elevated Troponin I levels among patients undergoing noncardiac surgery at Jinnah Postgraduate Medical Centre (JPMC), Karachi. This is important because Troponin I is an acknowledged sign of myocardial damage and may potentially indicate a higher risk of post-surgical cardiac events [16]. Compared to similar previous research, the prevalence established in our study is slightly lower than research conducted in comparable settings in developed countries. For example, Shetty, Devereaux, and colleagues in their conducted work such as that of Devereaux et al, have found elevated rates of Troponin elevation, which could be attributed to demographic variances and differing baseline cardiac risks in populations (Devereaux et al., 2011).There was no relationship between Troponin I levels and age, unlike some earlier works that have labeled age a decisive factor for PMI[17] and therefore, for the substantial elevation of postoperative Troponin I levels. This could mean that factors like the type and length of surgery or patient conditions like diabetes and hypertension could be stronger predictors in our patient population at JPMC.

The actual changes in Troponin I might be skewed by differences in surgical procedures as well as procedural protocols. For example, local anesthesia techniques and perioperative care which vary widely between different geographical locations might be the reason for these differences. Such variations, again, stress the need for site-level research involving local modes and population densities while determining postoperative cardiac risk. Based on the findings of the present study the following suggestions have methodological and clinical implications. Firstly, surveillance of cardiac biomarker, Troponin I in patients before and after noncardiusurgical procedures could be beneficial in the identification of patients with apparent cardiac risks[18]. In addition, such an approach may require changes in the management plans of patients after surgery, especially those with elevated Troponin levels. Of course, there are still limitations to this study. The cross-sectional study design further limits the drawing of causal relationships between Troponin I and future long-term cardiac outcomes because the actual occurrences were utilized to assess prevalence. The study could be extended in the future by following up with the patients for a longer period to gain a better understanding of the trends in the Troponin level about the patient's long-term health status. Our study can provide useful data for understanding the frequency and further outcome in patients with post-NSAID Troponin I elevation after noncardiac surgery[19]. It draws attention towards increased monitoring and individualized postoperative management to reduce cardiac risk; especially in a similar environment like JPMC. Future researches are needed to identify all the potential contributing factors to increasing Troponin I concentration after operation and to confirm the present findings in different patient samples.

CONCLUSION

This work also found that out of the operated patients in JPMC Karachi 5.6% had elevated Troponin I levels which suggests the possibility of cardiac compromise during noncardiac surgery. The results call for serial measurements of Troponin I in such patients so that care can be taken to address potential cardiac complications. This research adds knowledge on postoperative cardiac risks in noncardiac surgeries and stresses the need for individual measures in postoperative care to enhance patient outcomes in similar healthcare facilities. More research needs to be conducted to expand the given relation.

Author Contributions

IA: (Corresponding Author) has participated and remains involved in the study conception, design, and delivery. He also guided the preparation and editing of the manuscript as well.

ZM participated in the design of the study and assisted in the interpretation of the results in this study and reviewing this final manuscript and offered various physical feedbacks.

KS helped in developing the literature that formed the basis of the study and in the formulation of the discussion part of the manuscript.

FN: was responsible for overseeing data collection and ensuring the accuracy and completeness of the dataset.

SAM: assisted significantly in the collection of data and contributed to the organization of the research process.

TH: played an essential role in data collection, ensuring consistency and reliability throughout the process.

Each author contributed to the writing of the paper and all provided their final approval of this version.

Competing interests: The authors declare that there is potentially no conflict of interest related to the article.

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