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RISK FACTORS FOR PROLONGED CARDIAC INTENSIVE CARE UNIT (CICU) STAY FOLLOWING OPEN HEART SURGERY IN HAYATABAD MEDICAL COMPLEX PESHAWAR

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Abstract

Background: *One of the riskiest operations is open-heart surgery, which involves a sternotomy (thoracic opening) in which the patient's chest is opened using a surgical instrument to access the patient's heart. The desired operation to correct the underlying disease or abnormality is carried out by the surgeon under direct visualization. Since the heart is the body's most vital organ and performs the vital life-sustaining function of pumping blood throughout the body, its care is also crucial. For this reason, patients are kept in a cardiac intensive care unit following surgery in order to closely monitor both the patients' and the heart's health. The length of stay in the cardiac critical care unit affects both the patient's and the heart's health. The length of time spent in the cardiac critical care unit is dependent on a few perioperative variables that can be managed and assessed prior to the procedure for improved results.*

Method: *Using a non-probability convenient sampling technique, 247 patients who had on- pump open-heart surgeries and were admitted to the cardiac intensive care unit were included in this cross-sectional descriptive study design. Group 1 consisted of patients who were in the CICU for less than 48 hours, whereas Group 2 included patients who stayed in the CICU for more than 48 hours. Between the two groups, a number of perioperative risk variables were compared.*

Results: *81% of the patients were in Group 1 (less than 48 hours in the intensive care unit), and 19% were in Group 2 (more than 48 hours in the intensive care unit). Risk factors that were found to have a significant impact on length of stay in the cardiac critical care unit included postoperative blood transfusion, re-intubation, re-operation, aortic cross-clamp time (minutes), intubation time (≥24 hours), and LVEF percentage.*

Conclusion: *Our findings suggest that preoperative left ventricular ejection fraction (LVEF), intraoperative cross-clamp time, and postoperative complications such as blood transfusion, re-intubation, and re-operation*

significantly contribute to prolonged CICU stays. While demographic factors such as age, gender, and body mass index (BMI) did not show a significant association with extended CICU stay, the presence of intraoperative and postoperative complications played a pivotal role. These results emphasize the need for proactive patient management strategies to optimize cardiac function preoperatively, minimize intraoperative complications, and enhance postoperative recovery. Implementing targeted interventions to address these risk factors could significantly reduce CICU stay durations, improving patient outcomes and optimizing resource utilization in healthcare settings.

INTRODUCTION

1.1: Background

Cardiovascular diseases are treated with many options available and one of them is open heart surgery (1).In recent years, there has been much enhancement that came into being in the cardiac surgery, but still it is standard to monitor patients closely and for that reason they are kept in CICU after the surgery(2). Cardiac intensive care units (CICUs) are specialized units that manage those with serious illnesses or patients who have undergone heart surgery (3). Complications like high in hospital-mortality and morbidity, poor long term prognosis and consequently, large cost and expenses is due to prolonged CICU stay (2). In numerous regions around the world, critical care resources remain scarce, highlighting the need for optimal resource management practices (4). A key decision-making tool is the ability to predict the extent of stay in the cardiac intensive care unit for each cardiac surgical ill individual in advance. This allows for the implementation of appropriate management strategies, such as addressing risk factors prior to surgery, utilizing fast-track anesthesia, determining optimal staffing levels, and scheduling surgeries based on the expected length of stay(4). Patients having heart surgery go through a variety of preoperative testing and investigations to ensure no surprises or consequences, the preoperative tests include pulmonary function tests (PFT), creatinine, complete blood count (CBC) , HBA1c , random blood sugar (RBS), Electrocardiography (ECG), Echocardiography (Echo) and coagulation profile (5). The heart and its blood vessels make up the cardiovascular system (6). The following four conditions are included in cardiovascular disease, also known as heart disease: coronary artery disease, often understood as coronary heart disease, cerebrovascular disease, peripheral artery disease, and aortic atherosclerosis (7);

1. Coronary artery disease (CAD), also known as coronary heart disease (CHD), is a condition with reduced myocardial perfusion that can lead to heart failure, myocardial infarction (MI), and/or angina. Approximately one-third to half of CVD cases are caused by it.

2. Cerebrovascular disease (CVD) includes stroke and transient ischemic attack (TIA).

3. Peripheral Artery Disease (PAD): Particularly arterial disease affecting the limbs, which may result in claudication.

4. Aortic atherosclerosis includes thoracic and abdominal aneurysms.

Heart procedures and surgeries;

Any surgical technique in which the chest is opened and the muscles, valves, arteries, or other parts of the heart are operated on is referred to as open heart surgery. When less invasive therapies like medication, lifestyle modifications, or catheter-based procedures are inadequate or unsuitable for the patient's condition, open heart surgery is usually advised(8). Serious cardiovascular diseases like coronary artery disease, valve problems, and congenital heart anomalies are frequently treated with it (9).

Coronary Artery Bypass Grafting (CABG);

One of the most popular forms of open heart surgery is coronary artery bypass grafting (CABG), which is done to help patients with the disease of arteries that carry blood to the muscles of the heart regain blood flow to their heart muscle(8). Reduced

blood flow and possible heart attacks result from atherosclerosis, a deposit of plaque that narrows or blocks the coronary arteries in CAD(9). To increase blood flow to the heart, a surgeon performs CABG by grafting a patent and good vessel from another part of the body—usually the thorax or upper or lower limb—onto the blocked artery, bypassing the blocked segment (10). Research indicates that patients with significant coronary artery blockages, especially those with disease of multiple vessels or left main stem disease, have higher survival rates and better quality of life after CABG (10).

Heart Valve Repair or Replacement;

When one or more of the heart valves—the tricuspid, mitral, aortic, or pulmonary—do not function properly; the valve is repaired or replaced (11). Conditions like regurgitation, or blood leaking through the valve, or stenosis, or narrowing of the valve, can cause this ("Valve Repair in Aortic Regurgitation"). In valve repair, the current valve is surgically altered to enhance its performance. In substituting valve of the heart, a mechanical or biological valve is used to replace the injured one (8). In contrast to biological valves (from pigs, cows, or human donors), which have a shorter lifespan but do not require long-term anticoagulation therapy, mechanical valves are robust but require lifelong anticoagulation therapy (12).

Aortic Aneurysm Repair;

A severe illness known as an aortic aneurysm occurs when a portion of the aorta, the massive route that transports blood from the human pump (heart) to the rest of the body, enlarges or bulges abnormally. An aortic aneurysm may burst if treatment is not received, resulting in potentially fatal internal hemorrhage (8). A synthetic graft is used to replace the damaged aortic segment during open surgery to treat an aortic aneurysm. Patients with big aneurysms need to undergo this surgery in order prevent rupture (10).

Congenital Heart Defects Repair;

Congenital heart defects are birth malformations in the structure of the heart (9). They can be as simple as a septal defect, which is a tiny hole in the heart, or as complex as TOF or switched major arteries (8). Heart chamber reconstruction, abnormal valve repair or replacement, and septal defect closure are common procedures (13).

1.2: Rationale:

Limited studies are available regarding the topic in Pakistan especially in KP as well as the current understanding of risk factors for prolonged CICU stay is insufficient; therefore, more research is needed to address this issue in different settings. Despite advances in surgical procedures and perioperative care, lengthy CICU stays are still typical following open-heart surgery.

1.3: Objectives:

i) To identify perioperative factors for protracted cardiac intensive care unit (CICU) stay (≥ 48 hours).
ii) To determine the frequency of elongated cardiac intensive care unit (CICU) stay.

2.0 Literature Review

The duration of the patient's stay in the Cardiac Intensive Care Unit following open heart surgery is largely determined by perioperative variables. The length of cardiopulmonary bypass (CPB) is a crucial consideration because longer CPB durations are linked to higher risks of organ dysfunction, coagulopathy, and systemic inflammation, all of which lengthen CICU hospitalizations (14).

The length of the CICU stay is further increased by the complexity of the surgery, such as the necessity of multiple surgeries (e.g., combined coronary artery bypass grafting and valve replacement), which extends the operating time and increases the risk of complications after the treatment (15).

Systemic illnesses, particularly respiratory and metabolic conditions like diabetes and chronic obstructive pulmonary disease (COPD), can lengthen hospital stays (5). Although the exact causes of prolonged ICU stays are unknown, several hazards, like progressed age, reduced left ventricular ejection fraction, pulmonary conditions, internal visceral failure, and repeated surgery to inspect the chest region, may have an impression(2).

Conferring to the World Health Organization (WHO), open heart operations and other surgical procedures are essential for treating serious cardiovascular problems. Cardiovascular diseases

account for about 17.9 million fatalities occur once a year throughout the world. However, the Incidence of extended stays in the cardiac critical care unit following surgery varies greatly due to differences in patient demographics, risk factors, and healthcare systems. According to WHO data, problems that lead to prolonged CICU admissions occur in approximately 15-20% of patients undergoing heart surgery in low-resource settings. These complications are frequently brought on by delayed presentation, a delayed diagnosis, or inadequate preoperative care (16).

Cardiovascular diseases (CVD) continue to rank amid the top two causes of fatality in the United States, reporting for 633,842 casualties, since 1975. The most common reason of death in 2015 was heart disease, which was followed by cancer (595,930 deaths). Probably $329.7 billion is spent on cardiovascular diseases and stroke of the brain each year in the US, both directly and indirectly. This amount comprises $199.2 billion in direct costs, which include the price of doctors and other medical professionals, hospital services (such as wards and intensive care units (ICU)), prescription drugs, and home health care; and $130.5 billion in lost future productivity, which is the result of premature mortality from CVD and stroke in 2013–2014 (indirect costs)(7).

Cardiovascular problems were self-reported by 18.9% of 34 million households in Pakistan's National Socioeconomic Registry Survey, which analyzed demographics, socioeconomic status, education, well-being, and assets. This rising trend is expected to continue as many risk factors for cardiovascular diseases are widespread. For example, 30.8% of the population has diabetes, 37% of adults have high blood pressure, around 25% of adult men smoke, and high rates of cousin marriages (58% of marriages) may increase genetic risks. These factors are likely to drive a sharp increase in CVD cases as Pakistan's young population ages. Addressing this challenge will be difficult because health spending is very low ($43 per person), with only 1.2% of GDP allocated to health, placing Pakistan among the lowest-ranked countries globally for effective universal health coverage (17).

Within 166, 43 (25.9%) had stayed greater than 6 days in CICU after the correction of congenital heart issues at the Agha Khan University Hospital, Karachi, Pakistan. Surgery for acquired congenital heart diseases can lead to complications like chest infections, arrhythmias, wound infections, and pericardial effusion, often requiring extended ICU care. This is a critical issue in resource-limited countries like Pakistan, where ICU beds are scarce (18). An inquiry did at the National Institute of Cardiovascular Diseases, Karachi, Pakistan in which Troponin levels following surgery were separated into various sets. Patients with troponin-I levels below 9ng/ml made up 61% of the total, those with levels between 9 and 18ng/ml made up 28%, and those with levels over 18ng/ml made up 11%. Patients with troponin levels less than 18ng/ml did not have different ICU stays. On the other hand, individuals with troponin levels more than 18ng/ml had longer ICU stays, lasting 48 to 72 hours (19). In Izmir, Turkey a study shows that there were 20.1% patients that stayed in CICU for longer period of time (≥48 hours)(20).

Study conducted in Tabriz Iran in which the prolonged CICU stay (>3 days) were observed in 64.9% of patients, another study conducted in Tehran Iran 34.3% patients had prolonged CICU stay (> 96 Hours) (21).

3.0 MATERIAL AND METHODS

In this cross-sectional descriptive study, we examined certain perioperative factors of 247 patients who undergone open heart surgery in cardiac rehabilitation center (CRC) Hayatabad Medical complex, Peshawar.

3.1: Study Design:

A descriptive Cross-sectional study is used.

3.2: Study Setting:

This research was carried out in the cardiac surgery, Cardiac Rehabilitation Center (CRC) Hayatabad Medical Complex, Peshawar

3.3: Study Duration:

The research study was conducted over a period of 3 month; the phases of our study were as follow:

2 weeks for literature review

1 month for data collection
3 weeks for data entry and Analysis
3 weeks for Thesis writing

3.4 Statistical Analysis:

We conducted a statistical analysis using SPSS version 27 to compare the means of continuous variables and assess associations between categorical variables. For continuous variables, we utilized an independent samples t-test to evaluate differences in their means between two groups. The analysis was performed with a confidence interval of 95% (0.95) and a margin of error of 0.05.

For categorical variables, we employed the chi-square test to determine whether there were significant associations between the variables. The chi-square test results helped identify any dependencies or relationships in the data within the specified confidence interval and margin of error.

3.4.1 Sample Size:

247 cardiac surgery patients' data was taken from department of cardiac surgery of Cardiac Rehabilitation Center, Hayatabad Medical Complex, and Peshawar.

3.4.2 Sample Size Calculation:

Sample of 247 was calculated from Cochrane sample size formula by putting P=20.1% as follow:

Prevalence (p) = 20.1% = 0.201
Confidence Interval (CI) = 95% = 1.96 (Z-score)
Margin of Error (E) = 5% = 0.05

Using the Cochrane sample size calculation formula for this study (22) n= z2 x p (1 - p)/ E2
n= (1.96)2 x 0.201 (1 – 0.201)/ (0.05)2
n= 246.78
Rounding up n≈ 247

3.4.3: Sampling Technique:

Non-Probability convenient Sampling.

3.5: Inclusions Criteria:

1) Elective surgery.
2) On-pump open heart surgeries.

3.6: Exclusion Criteria:

1) Death during surgery.
2) Unconscious Patients and those with Mental instability during Post of Period.

4.0: RESULTS

4.1Frequency of CICU stay:

In this study, out of 247 patients that were included, 200 (81.0%) were in <48 hours of CICU stay (Group 1), and 47 (19.0%) were in ≥48 hours of CICU stay (Group 2) (Table1) (Fig1)..

2.0 RESULTS

2.1 Frequency of CICU stay:

In this study, out of 247 patients that were included, 200 (81.0%) were in <48 hours of CICU stay (Group 1), and 47 (19.0%) were in ≥48 hours of CICU stay (Group 2) (Table1) (Fig1).

Table 1. Frequency of CICU stay:

	N	%
Group 1 (<48 Hours CICU stay)	200	81.0%
Group 2 (≥48 Hours CICU stay)	47	19.0%

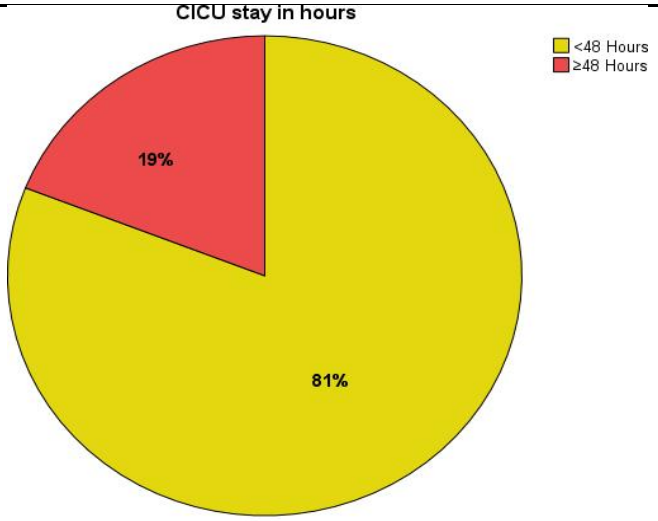

Figure1

This above pie chart shows the percentage of CICU stay for patients in group 1 (<48 hours CICU stay) and group 2 (≥48 hours of CICU stay) which is 81 % and 21% respectively.

2.2 Frequency of types of open-heart procedures: Looking into the type of open-heart surgery; 153 (61.9%) underwent CABG surgery, 54 (21.9%) undergone Valve procedure (either repair or replacement), 12 (4.9%) had CABG + Valve surgeries, and 28 (11.3%) were others procedures (congenital, aortic root replacement and removal of myxoma) (table 2) (Fig 2).

CABG	153	61.9%
Valve	54	21.9%
CABG + Valve	12	4.9%
Others	28	11.3%

Table 2. Frequency of different type of open-heart surgery

Note; CABG: Coronary Artery Bypass Grafting

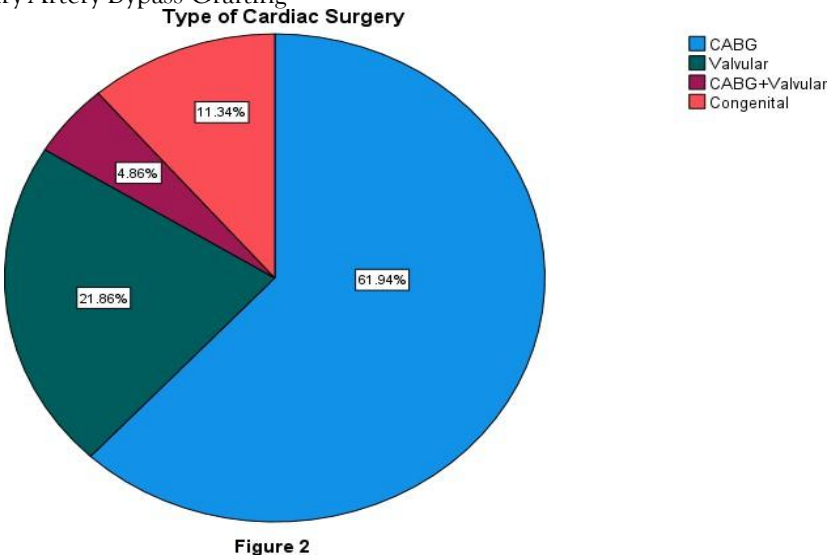

Figure 2

Above pie chart shows the percentage of each type of open-heart surgery performed in the department of cardiac surgery in HMC for our particular sample size.

For the ease of understanding we divided the analysis into five categories and compare them with the CICU stay and taken p value <0.005 as a significant, e.g.

1) Patients demographics (Age, Gender and BMI)
2) Comorbidities (Hypertension, diabetes mellitus and COPD)
3) Pre-operative risk factors (LVEF, Creatinine level, previous cardiac surgery)
4) Intra-operative risk factors (cross clamp time, CPB time and intubation time)
5) Post-operative risk factors (blood transfusion, atrial fibrillation, inotrope use in CICU, re-intubation and re-operation).

2.3 Patients Demographics:

Regarding patients' demographic data, the mean age cardiac surgical individuals in Group 1 and Group 2 were 51.3±14.3 and 51.2±10.8 years respectively, and no significant difference were seen (p= 0.059). There was no such significant difference observed concerning BMI and Gender (p= 0.605 and p= 0.482 respectively) as shown in the following;

Table 3. Demographic Data of Patients

Variables	Group 1 (CICU stay <48h)	Group 2 (CICU Stay ≥48h)	P Value
Age (year)	51.3 ± 14.3	51.2 ± 10.8	0.059
BMI (kg/cm^2)	27.3 ± 5.2	26.6 ± 4.9	0.605
Gender (m/f)	143/57	36/11	0.482

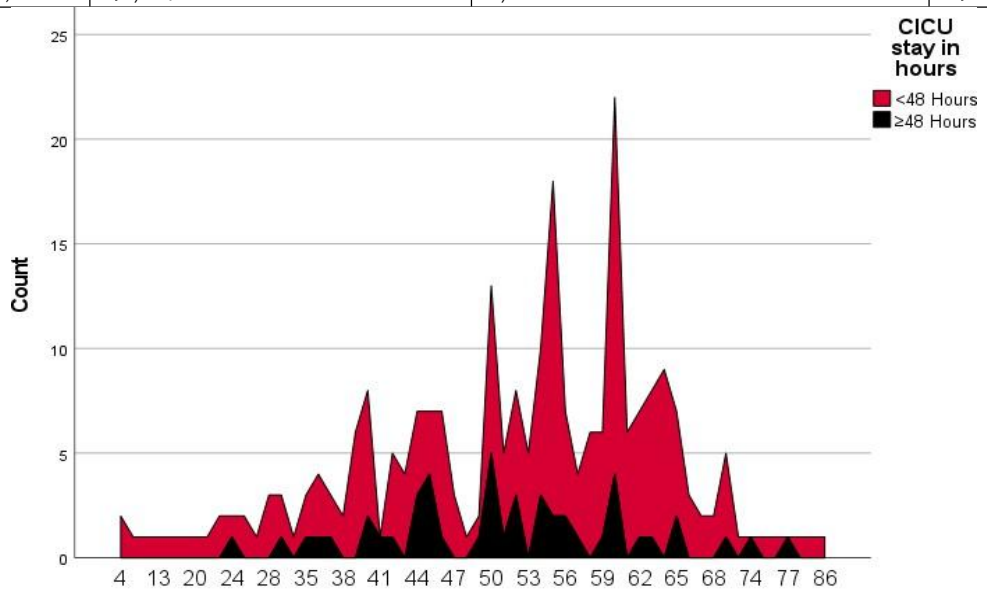

Figure 3.1; Age in years

The majority of patients with both shorter and longer stays fall between the ages of 47 and 62, with a peak around 59 years, suggesting a concentration of cases in this age range.

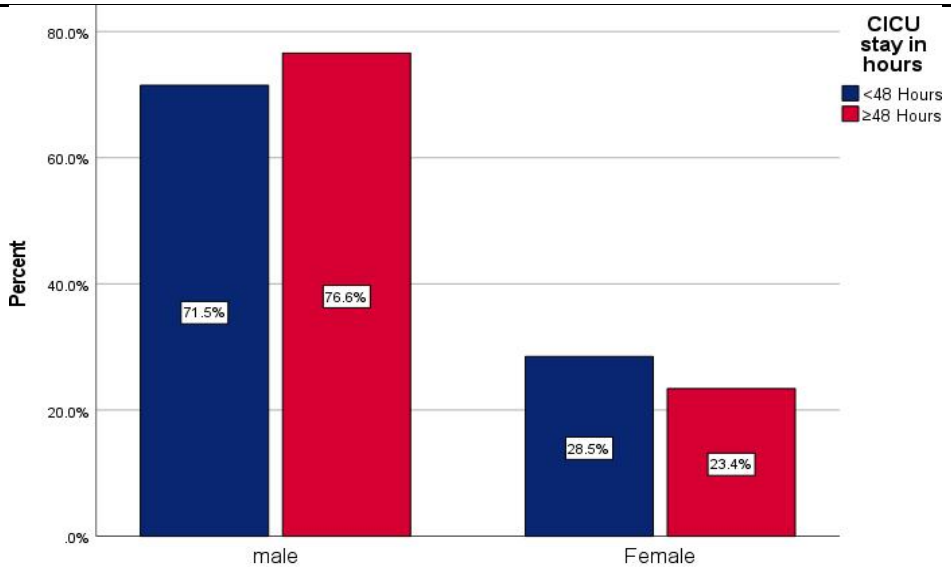

Figure 3.2: Gender

Out of 47 patients who stayed in CICU for ≥48 hours, 36 (76.6%) were male and 11 (23.4%) were female.

2.4 Patients' comorbidities and History of smoking:

History of smoking and comorbidities (hypertension, diabetes and COPD) of patients were also not significant. (Table 4)

Table 4. History of the comorbidities of the patients

Variables	Group 1 (CICU stay <48h)	Group 2 (CICU Stay ≥48h)	P Value
Smoking (yes/no)	34/166	10/37	0.491
Hypertension (yes/no)	115/85	27/20	0.995
Diabetes (yes/no)	106/94	24/23	0.811
COPD (yes/no)	1/199	0/47	0.627

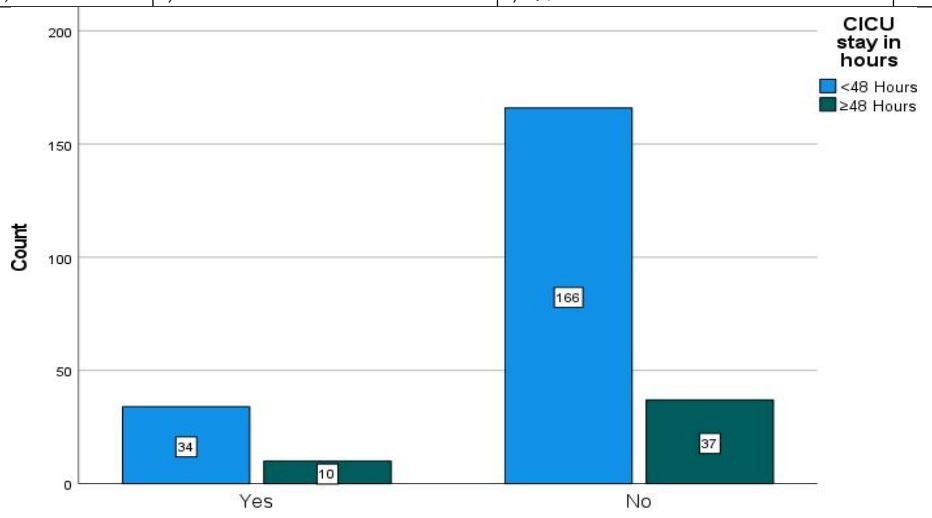

figure 4.1: History Of Smoking

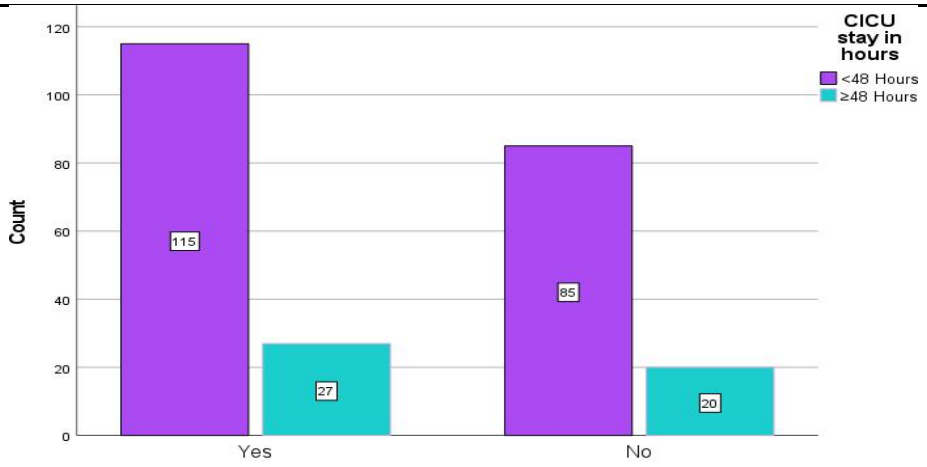

figure 4.2: Hypertension Bar Chart

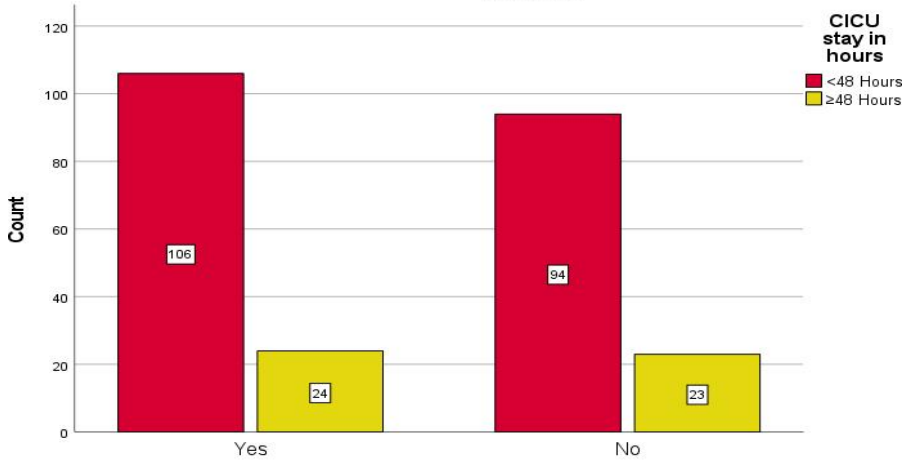

figure 4.3: Diabetes Mellitus

This bar chart (Fig 4.3) shows the relationship between diabetes mellitus and CICU stay duration between group 1 and group 2(<48 hours and ≥48 hours) respectively. Most patients had diabetes (106 in <48 hours and 24 in ≥48 hours). Similarly, among non-diabetic patients, the group 1(<48 hours) had 94, which are much more than the 23 in group 2 (≥48 hours).

4.5 Patients' data before surgery:

Preoperative factors were compared with the CICU stay as shown in Table 5, only left ventricular ejection fraction (LVEF) were significant in which the mean values in Group 1 (CICU stay <48h) and Group 2 (CICU stay ≥48h) were 57.4 ± 4.8 and 47 ±11 respectively, with the p value <0.001.

The frequency of LVEF in Groups 1 and Group 2 are shown in figure 5.

Table 5. Pre-operative risk factors

Variables	Group 1 (CICU stay <48h)	Group 2 (CICU stay ≥48h)	P Value
LVEF (%)	57.4 ± 8.4	47 ± 11	< 0.001
Blood Creatinine Level (mg/dl)	0.86 ± 0.63	0.92 ± 0.24	0.729
Previous Cardiac Surgery (yes/no)	20/180	15/32	0.429
Type of Surgery			0.122
- CABG	126	27	
- Valve	42	12	
- CABG + Valve	7	5	
- Others	25	3	

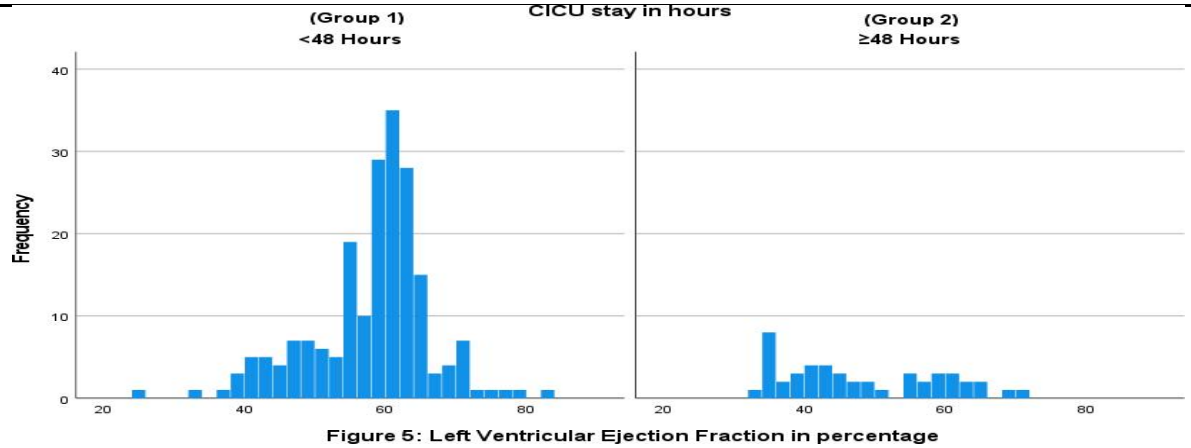

Figure 5: Left Ventricular Ejection Fraction in percentage

The above figure 5 compares percentages of left ventricular ejection fraction between two groups depending on their length of stay in the Cardiac Intensive Care Unit (CICU): Group 1 (less than 48 hours) and Group 2 (greater than or equal to 48 hours).

In Group 1, majority of patients have an LVEF ranging from 50% to 70%, with a peak of approximately 60%, indicating normal or mildly impaired cardiac function. In Group 2, most patients have an LVEF of 30% to 50%, with fewer cases surpassing 50% and few below 30%, suggesting more severe cardiac dysfunction.

This shows that patients with shorter CICU stays had higher cardiac function, whereas those with longer stays had lower LVEF, indicating a possible link between lower LVEF and delayed CICU recovery.

2.5 Patients' data during the surgery:

Among intraoperative risk factors the cross-clamp time and time of intubation were significantly different among two groups, mean value for cross clamp time (minutes) Group 1 (CICU stay <48h) and Group 2 (CICU stay ≥48h) were 89 ± 18 and 96 ±28 respectively, with the p value 0.002, and for Intubation time (hours) the p value was calculated as <0.001 and was significantly different. As shown in Table 6, Figure 6.1 and 6.2**Table 6.** Intraoperative Risk Factors

Variables	Group 1 (CICU stay <48h)	Group 2 (CICU stay ≥48h)	P Value
Cross Clamp Time[a] (min)	89 ± 18	96 ± 28	0.002
CPB Time (min)[b]	159 ± 36	167 ± 34	0.640
Intubation Time (hours)			<0.001
a) < 24 hours	187	29	
b) ≥ 24 hours	13	18	

Note; CPB: Cardiopulmonary Bypass, ([a]): Aortic Cross Clamp, ([b]): Minutes, Intubation Time: the time period between intubation to extubating.

The following figure 6.1 shows the distribution of cross-clamp periods (in minutes) for patients according to their CICU stay duration. Patients in group 1 (<48 hours) are visualized in red, and those in group 2 (≥48 hours) are displayed in black. Cross-clamp periods in the stacked area chart vary from 60 to 100 minutes, with a peak around 80-98 minutes. Patients with longer CICU stays are more likely to have longer cross-clamp times, indicating that lengthy surgical procedures may have a relation with longer CICU stay.

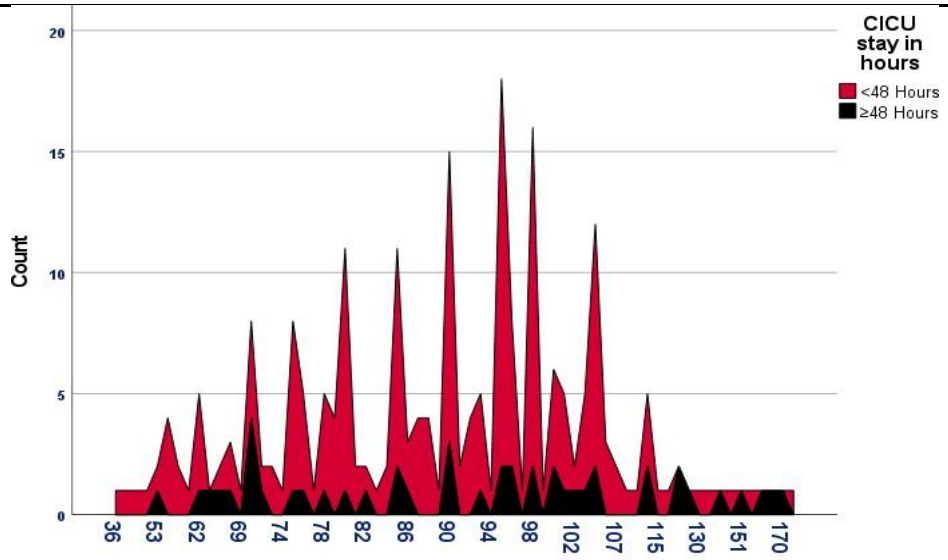

Figure 6.1: Cross Clamp time (min)

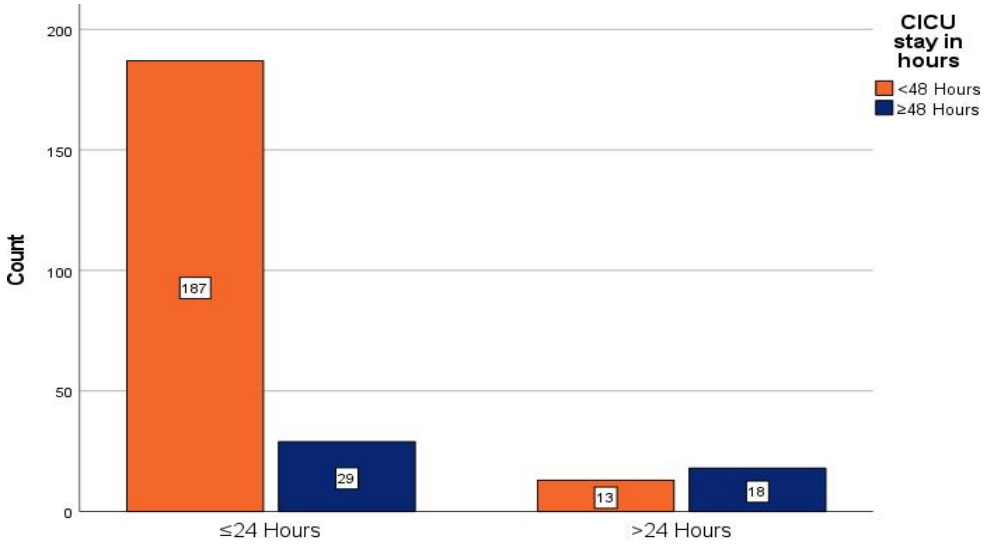

Figure 6.2: Intubation time (hours)

2.6 Patients' data after the surgery:

Following postoperative risk factors for prolonged CICU (≥48 hours) were evaluated as shown in Table 7, in which blood transfusion in CICU, Re-intubation and Re-operation to secure postoperative bleeding was significantly different when weigh against CICU stay <48h and CICU stay ≥48h, while the Atrial fibrillation and inotrope use in CICU were not significantly different (p=0.077 and p=0.954 respectively).

Table 7. Postoperative risk factors

Variables	Group 1 (CICU stay <48h)	Group 2 (CICU stay ≥48h)	P Value
Blood Transfusion (yes/no)	5/195	14/33	<0.001
Atrial Fibrillation (yes/no)	11/189	6/41	0.077
Inotrope Use in CICU			0.954
a) 0	3	1	
b) 1	35	8	

c) ≥2	162	38	
Re-intubation (yes/no)	7 /193	13/34	<0.001
Re-operation (yes/no)	5/195	15/32	<0.001

Note; CICU: Cardiac Intensive Care unit, Inotrope: Drugs used to increase contractility of the heart

The above data were visualized in the following in the form of cluster Bar charts e.g. Figure 7.1, 7.2 and 7.3.

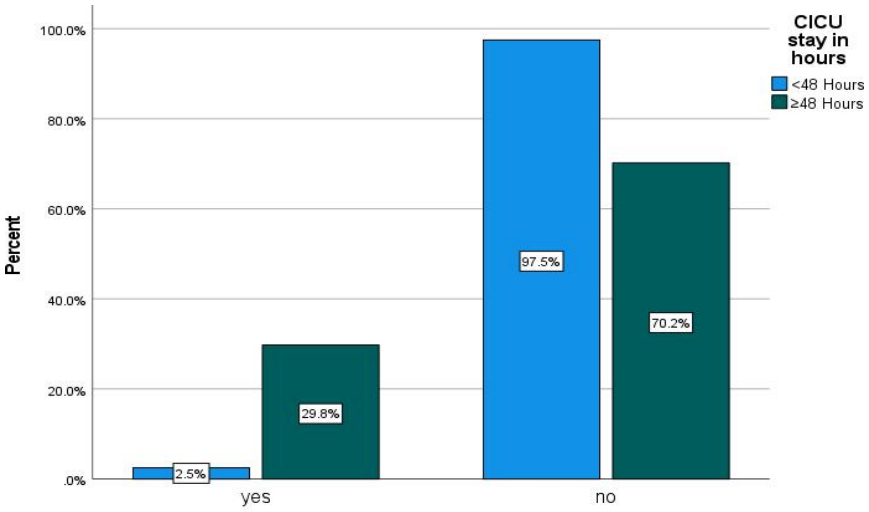

Figure 7.1: Blood transfusion in CICU

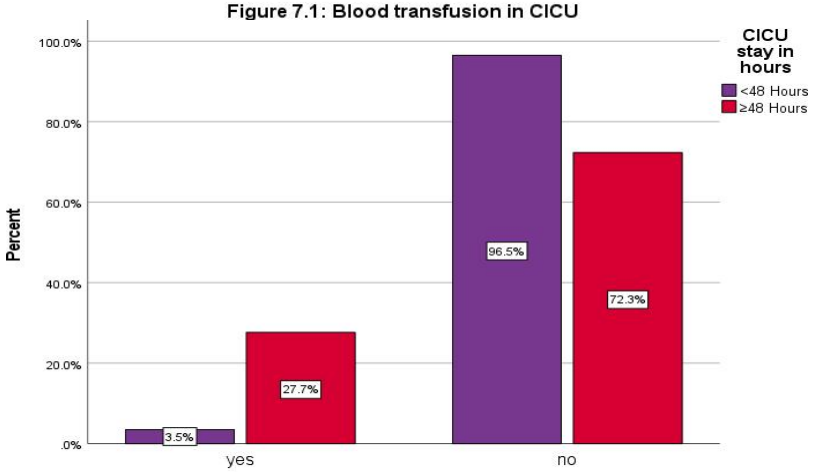

Figure 7.2: Frequency of Re-intubation

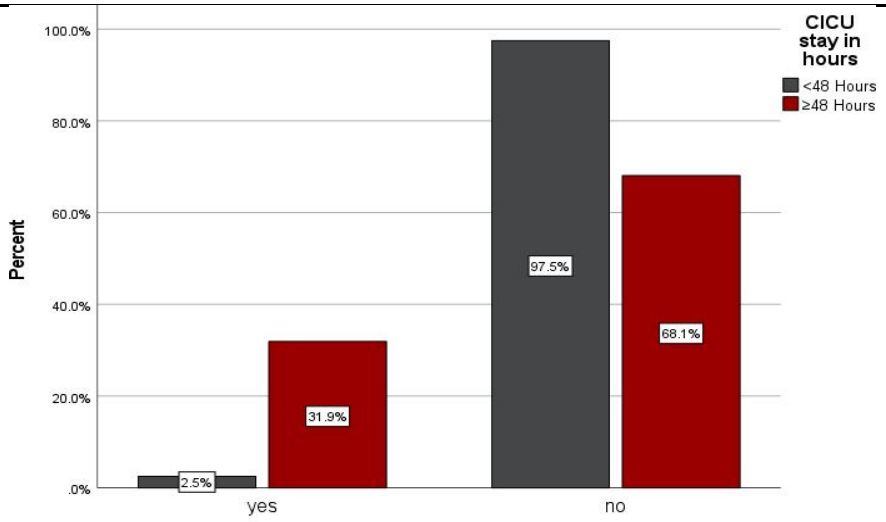

Figure 7.3: Re-operation

In above cluster bar chart (Fig 7.3), it is depicted as the group 1(<48 hours) has re-operation percentage of 2.5% which is much lower than in group 2 (≥48 hours) which is 31.9%. This indicates that there is significant relationship between the re-operation and CICU stay.

DISCUSSION

The current treatment for heart disease includes surgical procedures. Among open heart surgeries, the most frequent surgery is CABG which is 153 (61.9%) followed by valve surgery 54 (21.9%) in our study, this supports the claim of previously published study where the most prevalent surgery was CABG followed by valve procedure (5). Due to differences in sittings and situations where studies have done on finding causative factors for prolonged CICU stay after cardiac surgeries yield different factors as influencing, therefore it is hard to predict risk factors from a single study (21).

In our cross sectional study, the frequency of prolonged CICU was 19%, in previous study the incidence of lengthy ICU stay were in between 3.5% and 45%; the definition of stay was 48 hours to >10 days(1). In our study low LVEF (%), intubation time (≥24 hours), blood transfusion in CICU, Re-Intubation and reoperation for bleeding were identified as risk factors for prolonged CICU stay. According to studies, individuals who get blood transfusions during or after surgery have a greater risk of developing postoperative problems such as renal failure, infections, and longer hospital admissions (23).

Advanced age was predicted as a influencing factor in a previous studies while in our study no such relation is present (24). In our study, BMI shows no significant association with prolonged CICU stay but it did show significant relation in a study conducted in United Kingdom (25). As people age, their capacity to withstand the stress of surgery and other perioperative factors may decline due to an increase in concomitant disorders and other physiological changes(2). In this study gender is not identified as risk factor which contradicts the result of study conducted previously, in which being female was predicted as a concerning factors for longer ICU stay (26).

Concerning comorbidities of patients (Hypertension, Diabetes Mellitus and COPD) our study concludes that there is no significant relation observed, conversely studies done in multiple countries suggested that patients having comorbidities except COPD, had lengthy ICU stay compared to patients having no comorbidities(27). Our study resembles certain other studies regarding the association of low LVEF (%) as pre-operative factors that increase the stay duration in CICU (28). In our study increased cross-clamp and intubation times were significant predictors, confirming the hypothesis that lengthy surgery and intubation durations might lead to systemic stress and delayed recovery, these results matched with the studies conducted in certain other sittings(29).

Blood transfusion, re-intubation, and re-operation significantly influenced prolonged CICU stays. These findings are consistent with research showing that transfusion-related immunomodulation and surgical re-interventions increase the risk of infection and other complications, extending ICU dependency. However, inotrope use and atrial fibrillation, though notable, were not statistically significant, suggesting variability in the impact of these factors across populations and care protocols (1).

Conclusion

This study highlights critical perioperative factors influencing the length of stay in the Cardiac Intensive Care Unit (CICU) following open-heart surgery. Our findings suggest that preoperative left ventricular ejection fraction (LVEF), intraoperative cross-clamp time, and postoperative complications such as blood transfusion, re-intubation, and re-operation significantly contribute to prolonged CICU stays. While demographic factors such as age, gender, and body mass index (BMI) did not show a significant association with extended CICU stay, the presence of intraoperative and postoperative complications played a pivotal role. These results emphasize the need for proactive patient management strategies to optimize cardiac function preoperatively, minimize intraoperative complications, and enhance postoperative recovery. Implementing targeted interventions to address these risk factors could significantly reduce CICU stay durations, improving patient outcomes and optimizing resource utilization in healthcare settings.

Recommendations

1. Preoperative Optimization: Comprehensive preoperative assessments, including echocardiographic evaluations of LVEF, should be emphasized to identify patients at risk of prolonged CICU stay. Early interventions, such as cardiac rehabilitation and medication adjustments, may improve cardiac function before surgery.

2. Surgical Efficiency: Surgeons should aim to minimize aortic cross-clamp and cardiopulmonary bypass times while maintaining meticulous hemostasis to reduce postoperative bleeding and the need for reoperations. Strict adherence to surgical protocols and continuous intraoperative monitoring can enhance surgical outcomes.

3. Multidisciplinary Team Approach: Ensuring well-trained and adequately staffed surgical, anesthesia, perfusion, and nursing teams is essential. A coordinated approach can enhance intraoperative efficiency and postoperative care, reducing the risk of complications leading to prolonged CICU stays.

4. Postoperative Monitoring and Early Intervention: Close monitoring of patients in the CICU with timely interventions for complications such as bleeding, respiratory distress, and hemodynamic instability can prevent the need for prolonged mechanical ventilation and additional surgical interventions. Enhanced postoperative care protocols, including early extubation strategies and blood conservation techniques, should be implemented.

5. Future Research and Data Collection: Additional studies with larger, multicenter datasets should be conducted to confirm the generalizability of these findings. Expanding the scope of research to include variables such as renal failure, cerebrovascular events, and multi-organ dysfunction could provide a more comprehensive understanding of factors influencing CICU stay duration.

Limitations

Despite the valuable insights provided by this study, certain limitations must be acknowledged. Firstly, the study was conducted at a single center, which may limit the generalizability of findings to broader populations with diverse healthcare settings and surgical techniques. Additionally, several relevant variables, such as NYHA Functional Classification, respiratory complications, cerebrovascular events, hemodialysis, renal failure, myocardial infarction, and multi-organ failure, were not included due to data unavailability. Future studies incorporating these variables with larger sample sizes and multicenter data collection are recommended to validate and expand upon these findings. Moreover, long-term postoperative outcomes and readmission rates were not assessed, which could provide further

insight into patient recovery beyond the initial CICU stay. Addressing these limitations in future research will contribute to a more comprehensive understanding of the determinants of prolonged CICU stays and inform more effective clinical strategies for patient management.

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Appendixes

MTI - HAYATABAD MEDICAL COMPLEX	Doc. No:	HMC-QAD-F
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Hospital Research and Ethical Committee (IREB)		

APPROVAL CERTIFICATE

The Ethical Review Board of the Hayatabad Medical Complex has reviewed the under mentioned Synopsis/Article in accordance with the declaration of Helsinki (2013) and found it to meet the requirements and be approved.

Approval No:	2233.
Synopsis / Research Article	Risk factors for prolonged cardiac intensive care unit stay following open heart surgery.
Investigators / Authors	Kashif Khan, Muhammad Hassan, Muhammad Bilal Afridi and and Jibran Afridi.
Approval Date	4.11.2024.
IREB Decision	Approved.

Standard conditions of Approval Apply.

The Principal Researcher is required to notify the Secretary of the Ethical Committee about:

- Any significant change to the project and the reason for that change, including an indication of Ethical implication (if any).
- Serious adverse effects on participants and actions are taken to address those effects.
- Any other unforeseen events or unexpected developments that merit notification.
- The inability of the Principal Researcher to continue in that role, or any other change in research personnel involved in the project
- Provide the progress report / Final report / discontinuation report.

Chairman IREB / Secretary

Professor Dr. Wajid Ali Akhunzada
Chairman
Institutional Research & Ethical Board
Hayatabad Medical Complex Peshawar

Note: For the collection of data from the hospital, you need permission from the concerned department.

This document is internal and confidential. The format and version of this document is controlled, in case of any need for amendment please coordinate with Respective DQL / QA Department.	Page 1/1101

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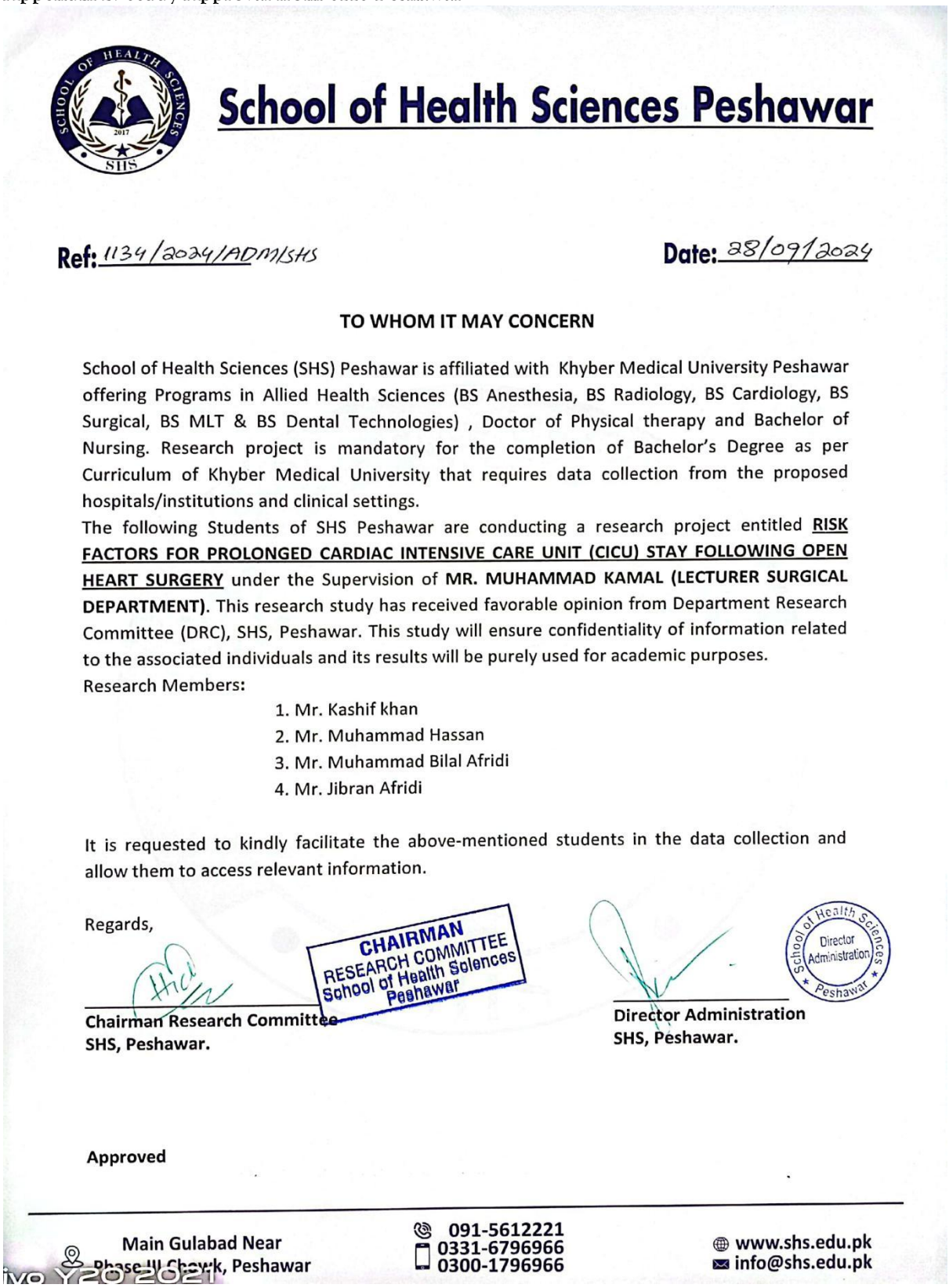
Appendix 1: Study Approval from HMC Peshawar

Appendix 2: Study Approval from SHS Peshawar



School of Health Sciences Peshawar

Ref: 1134/2024/ADM/SHS Date: 28/09/2024

TO WHOM IT MAY CONCERN

School of Health Sciences (SHS) Peshawar is affiliated with Khyber Medical University Peshawar offering Programs in Allied Health Sciences (BS Anesthesia, BS Radiology, BS Cardiology, BS Surgical, BS MLT & BS Dental Technologies) , Doctor of Physical therapy and Bachelor of Nursing. Research project is mandatory for the completion of Bachelor's Degree as per Curriculum of Khyber Medical University that requires data collection from the proposed hospitals/institutions and clinical settings.

The following Students of SHS Peshawar are conducting a research project entitled **RISK FACTORS FOR PROLONGED CARDIAC INTENSIVE CARE UNIT (CICU) STAY FOLLOWING OPEN HEART SURGERY** under the Supervision of **MR. MUHAMMAD KAMAL (LECTURER SURGICAL DEPARTMENT)**. This research study has received favorable opinion from Department Research Committee (DRC), SHS, Peshawar. This study will ensure confidentiality of information related to the associated individuals and its results will be purely used for academic purposes.

Research Members:

1. Mr. Kashif khan
2. Mr. Muhammad Hassan
3. Mr. Muhammad Bilal Afridi
4. Mr. Jibran Afridi

It is requested to kindly facilitate the above-mentioned students in the data collection and allow them to access relevant information.

Regards,

CHAIRMAN RESEARCH COMMITTEE School of Health Sciences Peshawar

Chairman Research Committee
SHS, Peshawar.

School of Health Sciences Director Administration Peshawar

Director Administration
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Approved

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