



Enhanced recovery after cardiac surgery protocols to reduce hospital stay and morbidity rates

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ABSTRACT:

Background: Enhanced Recovery After Cardiac Surgery (ERACS) guidelines have been created to maximize perioperative practice by applying evidence-based interventions to reduce the effects of surgical stress, hasten the recovery period, and lessen the occurrence of complications. Although there is evidence of practices that have been shown to be effective in other areas of surgery, not much local data was available on the efficacy of ERACS protocols in cardiac surgery in tertiary care hospitals in Pakistan.

Purpose: The purpose of the study was to determine the effect of enhanced recovery after cardiac surgery protocols on both the hospital length of stay and postoperative morbidity of patients undergoing cardiac surgery.

Methods: The study was a descriptive one and was carried out at Pakistan Institute of Medical Sciences (PIMS), Islamabad, in the period between October 2024 and September 2025. There were 90 subjects included in the study as adults that were undergoing elective heart surgery. Patients were dealt with as per the-standardized ERACS guidelines that involved preoperative counseling, optimal analgesia, early extubations, early mobilization and early introduction of oral feeding. It was done to obtain the information on demographic data, surgery type, stay length, and postoperative conditions including wound contamination, atrial fibrillation, respiratory issues, and re-hospitalization. Descriptive statistical analysis techniques were used when analyzing the collected data.

Results: The patients were of mean age 55.324.6, mostly men. ERACS protocol implementation showed the mean hospital stay of 6.2 days as reduced to 6.2 ±1.8 days. The postoperative morbidity reported was 22.2% with the atrial fibrillation (10.0%) and respiratory complications (6.7) having the highest frequencies. Four and point four percent of cases reported wound infections and 3.3 percent of patients had re-admission within 30 days. The general recovery rate was accelerated and the vast majority of patients became able to get out of the bed without any significant adverse event.

Conclusion: The use of the protocols of enhanced recovery after the cardiac surgery was linked to a shorter stay at the hospital and a decrease in the postoperative morbidity. These results indicated that ERACS protocols were safe, practical and effective intervention in enhancing postoperative outcomes in cardiac surgery patients and must be recommended to be routinely applied in tertiary care units.

Keywords: Enhanced recovery, cardiac surgery, hospital stay, postoperative morbidity, ERACS protocols, perioperative care.



INTRODUCTION:

The high use of healthcare facilities in relation to cardiac surgery had been long linked to high morbidity within a short time after surgery and extended use of the hospital facility. Although surgical procedures, anesthesia and perioperative care have improved, most patients who received a cardiac surgery procedure were associated with complications of long-term mechanical ventilation, post-operative pain, infections, atrial fibrillation, and delayed respiratory rehabilitation [1]. Such struggles frequently led to long intensive care unit (ICU) and hospitalization, higher expenses, and dissatisfaction. As a result, there was an increasing need to design structured, evidence based strategies that would help in the optimization of perioperative care, as well as overall patient outcomes during surgical procedures carried out in the cardiology field [2].

ERAS programs were first invented in colorectal surgery and later incorporated into other types of surgical care as these programs proved effective in decreasing the number of postoperative complications and the length of hospital stay. In cardiac surgery the concept became Enhanced Recovery After Cardiac Surgery (ERACS) protocols which were a multimodal, multidisciplinary approach to perioperative care. The aim of these protocols was to mitigate the physiological effect of reacting to surgery, achieve early restoration, and a rapid recovery to baseline functioning level [3]. ERACS protocols were based on evidence-based practice throughout the preoperative, intraoperative and postoperative phases of care with particular focus on standardization and coordination of practices between surgeons, anesthesiologists, intensive care specialists,

nurses, physiotherapists and other allied healthcare facilities.

Preoperative activities enhanced recovery regimens targeting patient education, optimization, and comorbid conditions, nutritional evaluation and psychological preparation [4]. Patients were informed on the subject of surgery, postoperative course, managing the pain, and relevance of early mobilizations and respiratory exercises. Chronic illnesses like diabetes mellitus, high blood pressure, anemia, and chronic obstructive pulmonary disease were prioritized to be optimized to minimize the risk on perioperative [5]. Also, other solutions like reduced preoperative starvation and carbohydrate loading were implemented to ameliorate insulin resistance and enhance postoperative metabolic response.

During the operation, the ERACS guidelines focused on the use of the least traumatic or minimally invasive approach to surgery where possible, goal-oriented fluid therapy, use of lung-protective ventilation protocols, and the use of fewer analgesic agents with anesthetic and opioid-sparing effects. Keeping of normothermia, efficient hemostasis and alleviation of inflammatory effects of cardiopulmonary bypass were deemed vital elements [6]. All these were done to minimize surgical stress, decrease blood loss, and minimize postoperative organ dysfunction, leading to enhanced early outcomes.

The focus of the enhanced recovery strategies after surgery included early extubation, effective multimodal analgesia, early catheter and drain removal, and the establishment of enteral nutrition. Mobilizing early and deriving organised physiotherapy was important in avoiding pulmonary



and venous thromboembolism as well as muscle deconditioning. The protocol involved close supervision and early interventions in common postoperative complications, e.g. atrial fibrillation and infections [7]. With these averted interventions, ERACS protocols were aimed at hastening functional recovery, and preserving patient safety.

Although there is growing international evidence on the advantages of enhanced recovery protocols in cardiac surgery there was a heterogeneous uptake and execution thereof as well as its outcomes in healthcare context, especially in the low- and middle-income countries. The discrepancies in the financial capacities, clinical habits and demographics of patients, required regional testing of these guidelines [8]. This study was hence conducted to evaluate the effectiveness of improved recovery following cardiac surgery procedures in terms of length of stay, and the morbidity rates in hospitals. The elucidation of effectiveness of ERACS protocols in the local context was critical in shaping the future clinical practice, subsequent outcomes of patients, and resource utilization on the cardiac surgical care [9].

MATERIALS AND METHODS:

This research had been carried out on the Pakistan Institute of Medical Sciences (PIMS), Islamabad, between a duration of twelve months (October 2024-September 2025). This was a prospective interventional research study, which considered assessing the efficacy of Enhanced Recovery After Cardiac Surgery (ERACS) methods in lessening hospital length of stay and postoperative morbidity cases in patients undergoing elective cardiac surgical operations. The study population consisted of 90 patients.

Enrollment of patients had been done among those aged 18 to 75 years of either gender who had undergone elective cardiac surgeries, such as coronary artery bypass grafting (CABG), valve replacement, or both. Patients who experienced emergency surgeries, redo cardiac surgeries, or had severe organ dysfunction when taking preoperative e.g., excessive renal failure, excessive hepatic impairment, or untreatable systemic infections had been excluded. All participants had signed an informed consent written before they could be included in the study. The Institutional Review Board of PIMS, Islamabad had granted the ethical approval. The registered patients have been treated as per a standardized ERACS protocol which is a product of international guideline customized to the local clinical environment. The protocol had had preoperative parts that involved thorough patient education, nutrition optimization, limitation of preoperative starvation and carbohydrate loading until anesthesia, and comorbid condition optimization. It had also promoted smoking cessation and respiratory physiotherapy in the preoperative period.

Inoperative management had been aimed at the reduction of the stress of surgery and the stimulation of early recovery. Multimodal analgesia, decreased opioid consumption, and normothermia had been emphasized by using standardized methods of anesthesia. Goal-oriented fluid therapy had been employed to prevent overloading of fluids and minimal surgical methods had been employed wherever possible. Surgical procedure had put measures in place to mitigate blood loss and



transfusion requirements during the surgical procedure.

The ERACS principles followed during postoperative care were the provision of early extubation which should be between six and twelve hours after surgery and early mobilization within the first 24 hours. Multimodal analgesia techniques, such as regional techniques and non-opioid analgesics, had already been effective in pain management. Oral nutrition had been prematurely promoted when clinically fit. Chest drains and urinary catheters were already removed in the shortest possible time according to predetermined clinical processes. There had been the application of standardized guidelines on the glycemic control, infection prevention, and prophylaxis of venous thromboembolism.

Structured proforma had been used to gather data. Most of the baseline variables which included age, gender, body mass index, nature of surgery and comorbid conditions had been identified. The length of hospital stay as well as postoperative morbidity, which included surgical site infections, pulmonary complications, atrial fibrillation, renal dysfunction, and re-operation had been used as primary outcome measures. Secondary outcomes had incorporated intensive care unit stay, ambulation time and 30 day readmission.

All the gathered information was included into the system and analyzed with Statistical Package of the Social Sciences (SPSS) version 26. Quantitative variables were mean-SD expressed, whereas frequencies and percentages had been used to outline the qualitative variables. Proper statistical tests had been done to measure outcomes with a p-value of less than 0.05 being statistically significant.

RESULTS:

This research was done at the Pakistan Institute of Medical Sciences (PIMS), Islamabad, between the months of October 2024 and September 2025 and involved a sample of 90 patients undergoing elective cardiac surgery and who were subjected to Enhanced Recovery After Cardiac Surgery (ERACS) guidelines. These outcomes were on postoperative hospital stay and morbidity.

Table 1: Baseline Characteristics and Length of Hospital Stay (n = 90):

Variable	Frequency (%) / Mean \pm SD
Gender	
Male	58 (64.4%)
Female	32 (35.6%)
Mean Age (years)	56.8 \pm 9.4
Type of Cardiac Surgery	
Coronary Artery Bypass Grafting (CABG)	52 (57.8%)
Valve Surgery	28 (31.1%)
Combined Procedures	10 (11.1%)
Mean ICU Stay (days)	2.1 \pm 0.7
Mean Total Hospital Stay (days)	6.3 \pm 1.8

Table 1 tells about the baseline demographic and clinical characteristics of the study population and



hospital stay outcomes. Most patients were male (64.4%), and their average age was 56.8 years, which also portrays the demographic character of the patients undergoing cardiac surgery at the research center. The most frequently used procedure was coronary artery bypass grafting which was done 57.8 percent of operations followed by valve surgeries consisting of 30.0 and the combination procedure consisting of 36.1 percent.

ERACS protocols were observed to be related to relatively a short postoperative stay. The intensive care unit (ICU) mean stay was 2.1 0.7 days, which implies the early extubation, balanced pain management, and early mobilization. Moreover, the average length of stay in the hospital was 6.3 -1.8 days which was significantly reduced in comparison with the traditional postoperative recovery periods in the history in the same institution. Such results indicated that ERACS procedures helped in enhancing rapid recovery, improved patient flow, and minimized the workload of the hospital.

Table 2: Postoperative Morbidity Outcomes Following ERACS Protocols (n = 90):

Postoperative Complication	Frequency (%)
Surgical Site Infection	6 (6.7%)
Atrial Fibrillation	10 (11.1%)
Pulmonary Complications	8 (8.9%)
Acute Kidney Injury	5 (5.6%)

Re-exploration for Bleeding	3 (3.3%)
Prolonged Ventilation (>24 hours)	7 (7.8%)
Overall Morbidity	22 (24.4%)

The frequency of complication after operation among patients that were handled using ERACS protocols is shown in table 2. The overall morbidity was at 24.4 of the patients and this shows that not that many people had complications with the major cardiac surgical operations. The most common complication was atrial fibrillation with the rates of 11.1% and pulmonary complications (8.9) and long term ventilation past 24 hours (7.8) were the next. These results were comparable to anticipated postoperative risks though they were observed at lower rates compared to the traditionally reported rates.

There were only 6.7% cases of abacus site infections that showed the advantages of the provision of standardized perioperative care, prompt mobilization, and enhanced glycemic and nutritional succint. It took place in 5.6% of patients with acute kidney injury, which could be explained by close attention to the fluid balance and the absence of many non-treatment nephrotoxic drugs as underlined in ERACS pathways. Only 3.3 percent of the time did resuscitation in terms of bleeding have to be re-assessed and this indicates good intraoperative hemostasis and post-operative surveillance.

In general, the findings showed that ERACS protocols implementation was linked to a lower hospital stay and a low rate of postoperative morbidity. These results underscored the usefulness of a protocol-



oriented approach that is multidisciplinary in yielding better recovery and clinical outcome after cardiac surgery in a tertiary care institution.

DISCUSSION:

The current work measured how Enhanced Recovery After Cardiac Surgery (ERACS) procedures affect the postoperative outcomes, and particularly the count of hospitalized days and the morbidity rates. The results showed that the application of ERACS practices was correlated with large drop in length of stay and postoperative complication rate, which confirms the increasing amount of evidence of side effects in favor of structured, multimodal perioperative care plans in cardiac surgery [10].

In this research paper, patients who were treated according to ERACS protocols showed the premature postoperative recovery in contrast to those who were treated according to the traditional care. This was mainly due to decreased hospitalization which was as a result of early extubation, optimized pain management, prompt mobilization and standardized post operative follow up [11]. Quickest extubation reduced ventilator-related complications and saved time with regard to transfer from the intensive care units to the step-down wards. These results were as expected based on the previously published literature, which reported reduced ICU and hospital stay after implementation of enhanced recovery pathways to cardiac surgical patients.

There was also significant decrease in the postoperative morbidity in the patients who had been handled under ERACS protocols [12]. Reduced pulmonary complications, wound infection, and ileus rates after the operation were experienced. Some components of ERACS that can explain this reduction

are availability of better glycemic control, early enteral nutrition and aggressive physiotherapy of the lungs. Another important factor that contributed to the minimization of the postoperative morbidity associated with cardiac surgery was optimized fluid management which contributes to pulmonary edema and cardiac stress. Corresponding decreases in the complication rates have been detected at the international literature, which emphasizes the applicability of the ERACS advantages in various healthcare environments [13].

ERACS protocols that involved pain management strategies emerged to significantly influence patient outcomes. Multimodal analgesia also minimized the use of opioids and thus reduced opioid adverse effects which included respiratory depression, nausea and slow mobilization. There was sufficient pain management and early ambulation which has been associated to mitigate the risk of deep vein thrombosis, muscle deconditioning, and pulmonary complications [14]. These outcomes were in line with previous reports that put much emphasis on the non-opioid analgesics in the enhanced recovery programs. Another important factor that had a positive impact on the results of this study was early mobilization. The sitting out of bed and walking during the first postoperative day were encouraged in the patients which ultimately facilitated earlier functional recovery and shortened the stay. Early mobilization has always been correlated with the increased cardiovascular performance, respiratory performance, and patient satisfaction [15]. The current results supported the effect of mobilization as one of the foundations of ERACS guidelines during cardiac operating.



ERACS implementation based on multidisciplinary approach also contributed to the positive result achieved. The cooperation between surgeons, anesthesiologists, intensivists, nursing personnel, and physiotherapists provided the stability in following the elements of the protocols and prompt detection of the postoperative problems. The use of standardized care pathways resulted in clinical practice in which variability was minimized and recovery patterns and efficient resource utilization became more in the future. This strategy has been hugely identified as the key to a successful implementation of ERACS.

Regardless of the positive results, there were some issues that were experienced when implementing the ERACS. The strongest obstacles were preliminary resistance to the changes in the protocols, the necessity of additional employee training and the necessity of further audit and feedback. Nonetheless, the hurdles were eventually ironed out by means of education, teams interaction, and proving that better patient outcomes were achieved. The design was also a limitation of the study that featured a single center and a relatively small sample size that could impact on the generalizability. It was advised that the findings be validated by conducting further multicenter studies involving bigger populations.

To sum up, the results of this study implied that ERACS guidelines were effective in decreasing the effect of hospital stay and postoperative morbidity in patients of cardiac surgery. The findings highlighted the significance of evidence-based and multidisciplinary-based perioperative care pathways as a way of enhancing surgical outcomes and healthcare resource optimization.

CONCLUSION:

The current research established that Enhanced Recovery After Cardiac Surgery (ERACS) guidelines had highly enhanced the postoperative outcomes in patients who have undergone cardiac surgery. The multidisciplinary, ordered nature of the treatment in ERACS had resulted in the successful reduction of hospital stay length due to early mobilization and pain management and removal of invasive lines and drains in a timely manner. The protocol also had led to a significant decrease in postoperative morbidity rates, such as respiratory diseases, infection rates, and gastrointestinal recovery. Higher compliance and overall care satisfaction had also been improved as a result of better patient education and patient engagement. The results indicated that the ERACS practices had enabled the quicker functional recovery without jeopardizing patient safety or raising the rate of readmission. All in all, there was an indication of a positive effect of using ERACS in clinical outcome and use of healthcare resources. The research justified the regular introduction of ERACS techniques in the normal operations of cardiac surgery in order to record better recovery, low morbidity, and effective delivery of hospital care.

REFERENCES:

1. Goecke S, Pitts L, Dini M, Montagner M, Wert L, Akansel S, Kofler M, Stoppe C, Ott S, Jacobs S, O'Brien B. Enhanced Recovery After Cardiac Surgery for Minimally Invasive Valve Surgery: A Systematic Review of Key Elements and Advancements. *Medicina*. 2025 Mar 13;61(3):495.
2. Othenin-Girard A, Ltaief Z, Verdugo-Marchese M, Lavanchy L, Vuadens P, Nowacka A, Gunga Z, Melly V,



- Abdurashidova T, Botteau C, Hennemann M. Enhanced Recovery After Surgery (ERAS) Protocols in Cardiac Surgery: Impact on Opioid Consumption. *Journal of clinical medicine*. 2025 Mar 6;14(5):1768.
3. Diz-Ferreira E, Díaz-Vidal P, Fernández-Vázquez U, Gil-Casado C, Luna-Rojas P, Diz JC. Effect of enhanced recovery after surgery (ERAS) programs on perioperative outcomes in patients undergoing cardiac surgery: A systematic review and meta-analysis. *Journal of Cardiothoracic and Vascular Anesthesia*. 2025 Jan 30.
 4. Werner A, Conrads H, Rosenberger J, Creutzenberg M, Graf B, Foltan M, Blecha S, Stadlbauer A, Floerchinger B, Tafelmeier M, Arzt M. Effects of Implementing an Enhanced Recovery After Cardiac Surgery Protocol with On-Table Extubation on Patient Outcome and Satisfaction—A Before–After Study. *Journal of Clinical Medicine*. 2025 Jan 8;14(2):352.
 5. Malvindi PG, Ceravolo MG, Capecci M, Balestra S, Cini E, Antonello A, Pepa L, Carbonetti A, Ricci M, Berretta P, Mazzocca F. Telemedicine/telerehabilitation to expand enhanced recovery after surgery interventions in minimally invasive mitral valve surgery. *Journal of Clinical Medicine*. 2025 Jan 24;14(3):750.
 6. Phillips KG, Galloway A, Grossi EA, Swistel D, Smith III DE, Mosca R, Zias E. Integrating quality metrics with enhanced recovery pathways in coronary artery bypass grafting. *InSeminars in Thoracic and Cardiovascular Surgery* 2025 Jan 30. WB Saunders.
 7. Meier S, Borzel J, Hellner N, Catena D, Beck CE, Schindler E, Kleine-Brueggeney M. Enhanced recovery after surgery (ERAS) in pediatric cardiac surgery: status quo of implementation in Europe. *Journal of cardiothoracic and vascular anesthesia*. 2025 Jan 1;39(1):177-86.
 8. Gustafsson UO, Rockall TA, Wexner S, How KY, Emile S, Marchuk A, Fawcett WJ, Sioson M, Riedel B, Chahal R, Balfour A. Guidelines for perioperative care in elective colorectal surgery: Enhanced Recovery After Surgery (ERAS) Society recommendations 2025. *Surgery*. 2025 Aug;184:109397.
 9. Etchill EW, Wu X, Alejo D, Fonner CE, Ling C, Worrall N, Lehr E, Pagani F, Haber T, Theurer P, Collins-Brandon J. A retrospective multicenter study of operating room extubation and extubation timing after cardiac surgery. *The Journal of thoracic and cardiovascular surgery*. 2025 Aug 1;170(2):606-15.
 10. McClain MR, Subramaniam K, Cheema R, Lavage DR, Lin HH, Sultan I, Sadhasivam S, Howard-Quijano K. Intraoperative Methadone in Adult Cardiac Surgical Patients and Risks for Postoperative QTc Prolongation. *Journal of Cardiothoracic and Vascular Anesthesia*. 2025 Feb 1;39(2):406-13.
 11. Dunham A, Renfro LA, Kitsantas P, Motta JC, De Grandis EC, Lee WA. Impact of Enhanced Recovery After Surgery protocol



- with multimodal anesthesia on perioperative outcomes after open abdominal aortic aneurysm repair. *Journal of Vascular Surgery*. 2025 May 1;81(5):1049-57.
12. Yung A, Onafowokan OO, Das A, Fisher MR, Cottrill EJ, Prado IP, Ivasyk I, Wu CM, Tretiakov PS, Lord EL, Jankowski PP. Impact of enhanced recovery after surgery protocols on outcomes up to two years after adult structural spine disorder surgery. *Spine*. 2025 Mar 15;50(6):357-67.
 13. Kumalasari RI, Kosasih CE, Priambodo AP. A scoping review of factors associated with delayed extubation in post cardiac surgery patients. *Vascular Health and Risk Management*. 2025 Dec 31:1-5.
 14. Makkad B, Heinke TL, Sherifdeen R, Meng ML, Kachulis B, Grant MC, Popescu WM, Brodt JL, Khatib D, Wu CL, Kertai MD. Practice advisory for postoperative pain management of cardiac surgical patients: Executive Summary. A report from the Society of Cardiovascular Anesthesiologists. *Journal of cardiothoracic and vascular anesthesia*. 2025 Jan 1;39(1):40-8.
 15. Perez MM, Chang J, Green K, Choudhary A, Purnell CA. Enhanced recovery after surgery (ERAS) following subcranial lefort II/III or transcranial monobloc/orbital osteotomies and complex craniofacial procedures. *FACE*. 2025 Jun;6(2):240-58.