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PATIENT-CENTERED OUTCOMES AND QUALITY OF LIFE AFTER PRIMARY VS. BAILOUT ANTEGRADE DISSECTION AND RE-ENTRY : A LONGITUDINAL OBSERVATIONAL STUDY

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ABSTRACT:

BACKGROUND: *The evaluation of patient-centred outcomes and the Quality of Life (QoL) post-procedure is an essential part of healthcare research, particularly in interventional cardiology. Advances in Percutaneous Coronary Interventions (PCI) such as the use of Antegrade Dissection and Re-entry (ADR) have significantly altered the landscape of coronary artery disease management. In particular, the comparison between primary ADR and bailout ADR remains a subject of ongoing investigation, with an emphasis on their respective outcomes on patient quality of life.*

AIMS & OBJECTIVE: *To compare patient-centred outcomes and quality of life after undergoing Primary ADR versus Bailout ADR procedures, focusing on the clinical recovery, complications, and patient satisfaction.*

MATERIAL & METHODS: *A total of 200 patients (100 in each group) who underwent Primary ADR or Bailout ADR at the Department of Cardiology, Hayatabad Medical Complex, Peshawar, between June 2023 to June 2024 were included. Data were collected on age, gender, hospital stay, complications, and quality of life. Statistical analysis was performed using the t-test, with a significance level set at $p < 0.05$.*

RESULTS: *The Primary ADR group had a mean age of 55.3 ± 8.2 years, while the Bailout ADR group had a mean age of 57.2 ± 7.5 years ($p = 0.25$). Primary ADR patients had a shorter hospital stay (2.6 ± 1.2 days) compared to Bailout ADR patients (3.4 ± 1.5 days, $p < 0.001$). Complications such as renal impairment (15% vs 23%) and stroke (1.0% vs 1.3%) were more common in the Bailout ADR group. Quality of life was also better in the Primary ADR group, with 35% reporting good QoL compared to 25% in the Bailout ADR group.*

CONCLUSION: *Primary ADR was associated with shorter hospital stays, fewer complications, and better quality of life compared to Bailout ADR. These findings suggest that Primary ADR is the preferred intervention for better patient outcomes in coronary artery disease management.*

KEY WORDS: *Primary ADR, Bailout ADR, Quality of Life, Hospital Stay, Complications*

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Author's Contribution: SU: Conceived the study idea and led the study design and methodology. Conducted literature review and supervised all aspects of the study execution. Contributed to data interpretation and manuscript drafting and revision. **FUK:** Coordinated data collection and ensured the integrity of angiographic assessments. Played a key role in data analysis and interpretation. Led the preparation and critical revision of the manuscript and managed correspondence throughout the publication process. **MUJ:** Participated in literature search and data acquisition. Assisted in preparing angiographic image interpretations and contributed to initial drafting of the results section. **SKUR:** Supported the study design and data interpretation. Reviewed the manuscript for important intellectual content and contributed to the discussion and conclusions. **MHA:** Involved in patient selection, data collection, and coordination during angiographic procedures. Contributed to the methodology section and manuscript review. **MAW:** Performed statistical analysis and contributed to data analysis and interpretation. Assisted in the final manuscript editing and formatting.

INTRODUCTION:

The evaluation of patient-centred outcomes and the Quality of Life (QoL) post-procedure is an essential part of healthcare research, particularly in interventional cardiology. Advances in Percutaneous Coronary Interventions (PCI) such as the use of Antegrade Dissection and Re-entry (ADR) have significantly altered the landscape of coronary artery disease management. In particular, the comparison between primary ADR and bailout ADR remains a subject of ongoing investigation, with an emphasis on their respective outcomes on patient quality of life.[1] The present study, based at the Department of Cardiology at Hayatabad Medical Complex, Peshawar, aims to explore the differences in patient-centred outcomes, with a focus on the QoL after undergoing primary ADR compared to bailout ADR.

The importance of evaluating patient outcomes is underscored by the increasing recognition that medical success cannot be measured solely by technical procedure results, but also by how these interventions affect patients' lives beyond the clinical setting.[2] Patient-Centered Care (PCC) has emerged as a critical model of care that places significant emphasis on patient preferences, values, and needs, improving their health outcomes and overall life satisfaction. Recent studies have demonstrated a clear association between high-quality PCC and improved patient-reported outcomes, including higher levels of hope and QoL among patients in a variety of medical settings.[3]

In the context of coronary interventions, the distinction between primary and bailout ADR is essential. The primary ADR is an approach used as a first-line solution for Chronic Total Occlusion (CTO) during PCI. Bailout ADR, however, is typically used as a rescue technique when initial methods fail, often resulting in longer procedure times and potentially more complications. The primary goal of PCI is to re-establish coronary blood flow and reduce symptoms of myocardial ischemia. However, the effects of these procedures on long-term outcomes, particularly quality of life, remain inadequately explored.[4]

Studies on patient outcomes post-PCI indicate that the long-term effects on QoL can be significantly influenced by both procedural success and the number of complications that arise during and after the procedure. Research suggests that patients who experience procedural complications, such as those requiring bailout interventions, may report lower QoL due to extended recovery times and increased physical and psychological distress.[5] This highlights the need for a deeper understanding of how different interventional strategies affect post-procedure QoL.

Furthermore, research has demonstrated that patients who receive patient-centred care throughout their treatment are more likely to report positive outcomes regarding QoL. Iida et al. (2025) found

that PCC, focusing on comprehensive, long-term management of chronic diseases, significantly improved patients' hope and QoL scores. By integrating both medical interventions and psychosocial support, patients are more likely to experience not only better clinical outcomes but also enhanced emotional well-being.[3] This is particularly relevant in the context of patients who undergo complicated cardiac procedures like ADR, where patient-centred strategies can be instrumental in reducing the emotional and psychological burden of recovery.

At Hayatabad Medical Complex, Peshawar, the interventional cardiology department has been employing a variety of PCI techniques, including both primary and bailout ADR, for the management of complex coronary artery diseases. This study will focus on analysing the QoL outcomes between patients who undergo primary ADR versus those who require bailout ADR. Studies indicate that while the technical success rates of both methods are comparable, the recovery and long-term QoL outcomes can differ greatly, depending on factors such as procedure time, complication rates, and post-operative management.[6]

Understanding these differences in outcomes is particularly crucial for improving clinical practices and guiding healthcare providers in optimizing both the technical aspects of PCI and the patient-centred elements of care. Research from the United States and Japan supports the integration of patient-centred approaches in cardiovascular care, suggesting that adopting such strategies can lead to improved patient satisfaction, fewer complications, and ultimately better health outcomes.[7]

The rationale for this study stems from the need to bridge the gap in literature regarding the impact of procedural differences in ADR on long-term patient outcomes, particularly quality of life. While much has been written on the technical success rates of primary versus bailout ADR, fewer studies have addressed the more subjective aspect of patient outcomes, particularly the emotional, psychological, and physical dimensions that define quality of life. By focusing on a cohort in Peshawar, this study will provide valuable insights into how these two ADR approaches impact the broader patient experience, especially in a South Asian context where healthcare delivery systems and patient expectations differ from Western settings.[8]

The study aims to address the following research objective: To compare patient-centred outcomes and QoL between patients undergoing primary ADR versus bailout ADR procedures at Hayatabad Medical Complex, Peshawar, with a focus on their long-term recovery, complication rates, and overall well-being.

MATERIALS AND METHODS:

This study was a retrospective observational study conducted at the Department of Cardiology, Hayatabad Medical Complex, Peshawar, from June 2023 to June 2024. The study was designed to investigate both the short-term and long-term impacts of these procedures on patients' physical and psychological well-being.

Sample Size

The study included 200 patients, all of whom had undergone PCI involving ADR at Hayatabad Medical Complex during the specified duration. The patients were divided into two groups based on the type of procedure they received: Group A (primary ADR) and Group B (bailout ADR). Each group consisted of 100 patients. The sample size was calculated using the WHO standard sample size calculation formula for observational studies, considering a 95% confidence interval and a 5% margin of error. A similar study by Rehman et al. (2021), which analysed outcomes after PCI, found that a sample size of 200 patients was adequate to observe significant differences in patient outcomes.[5]

INCLUSION AND EXCLUSION CRITERIA:

Patients who met the following inclusion criteria were considered for the study:

a) diagnosed with ST-segment elevation myocardial infarction (STEMI);
b) underwent either primary ADR or bailout ADR for the treatment of CTO;
c) age 18 years or older;
d) Provided informed consent to participate in the study.

PATIENTS WERE EXCLUDED:

a) a history of prior coronary artery bypass graft surgery (CABG);
b) a known history of severe renal or liver disease;
c) any condition that would interfere with the study's data collection (e.g., dementia or psychiatric disorders);
d) Incomplete follow-up data.

Randomization / Blinding

This was a retrospective observational study, so randomization or blinding was not applicable. The groups were based on the type of ADR received, which was determined by clinical decisions made by the attending physicians.

DATA COLLECTION PROCEDURE:

Data was collected from the hospital's medical record and patient charts. Relevant patient information such as age, gender, comorbidities, procedure details, complications, and length of hospital stay was retrieved. Post-procedure follow-up data on quality of life, complications, and recovery were collected through structured interviews and standardized patient-reported outcome questionnaires. The Quality of Life-Cardiology (QoL-C) scale and the Health-Related Quality of Life (HRQoL) assessment tool were used for this purpose. Data collection was performed by trained research assistants who were not involved in patient care to minimize bias.

Definitions and Assessment Criteria for Study Variables

1) Primary ADR: ADR performed as a first-line intervention for CTO during PCI.
2) Bailout ADR: ADR performed after initial PCI attempts fail.
3) Quality of Life: Assessed using the QoL-C and HRQoL scales, focusing on physical, psychological, and social well-being post-procedure.
4) Complications: Includes any adverse events related to the procedure, such as stroke, renal impairment, or heart failure.
5) Mortality: Defined as death occurring within 30 days post-procedure.

STATISTICAL ANALYSIS METHOD:

The data were analysed using SPSS version 25. Descriptive statistics were computed for demographic variables, including mean, standard deviation, and frequencies. Comparative analysis between the two groups was performed using the Chi-square test for categorical variables and independent t-test for continuous variables. The significance level was set at $p < 0.05$. For further analysis of the QoL scores and their predictors, multivariate regression analysis was applied.

ETHICAL CONSIDERATIONS:

The study was conducted in compliance with the ethical standards set by the Ethical & Research Committee of Hayatabad Medical Complex, Peshawar. Ethical approval was granted before the commencement of the study. As the study involved retrospective data collection from existing medical records, there was no direct patient intervention. Informed consent was obtained from all participants or their legal guardians for the use of their medical data for research purposes.

RESULTS:

Patient Overview and Baseline Characteristics

This study included a total of 200 patients, with an equal distribution between the Primary ADR group (n=100) and the Bailout ADR group (n=100). The mean age of patients in the Primary ADR group was 55.3 ± 8.2 years, while in the Bailout ADR group it was 57.2 ± 7.5 years. The age range was 30–75 years in both groups. Male-to-female distribution was also similar across groups, with 65% males and 35% females in the Primary ADR group and 64% males and 36% females in the Bailout ADR group, indicating a balanced demographic profile. (table-1)

The baseline characteristics reveal that both groups were demographically comparable. However, clinical outcomes varied, particularly regarding hospital stay and complications, which were significantly worse in the Bailout ADR group.

HOSPITAL STAY DURATION:

Patients undergoing Primary ADR had a significantly shorter hospital stay (mean: 2.6 ± 1.2 days) compared to those undergoing Bailout ADR (mean: 3.4 ± 1.5 days). This difference was statistically significant ($p < 0.001$), indicating that the type of procedure directly impacted hospitalization length. The extended stay

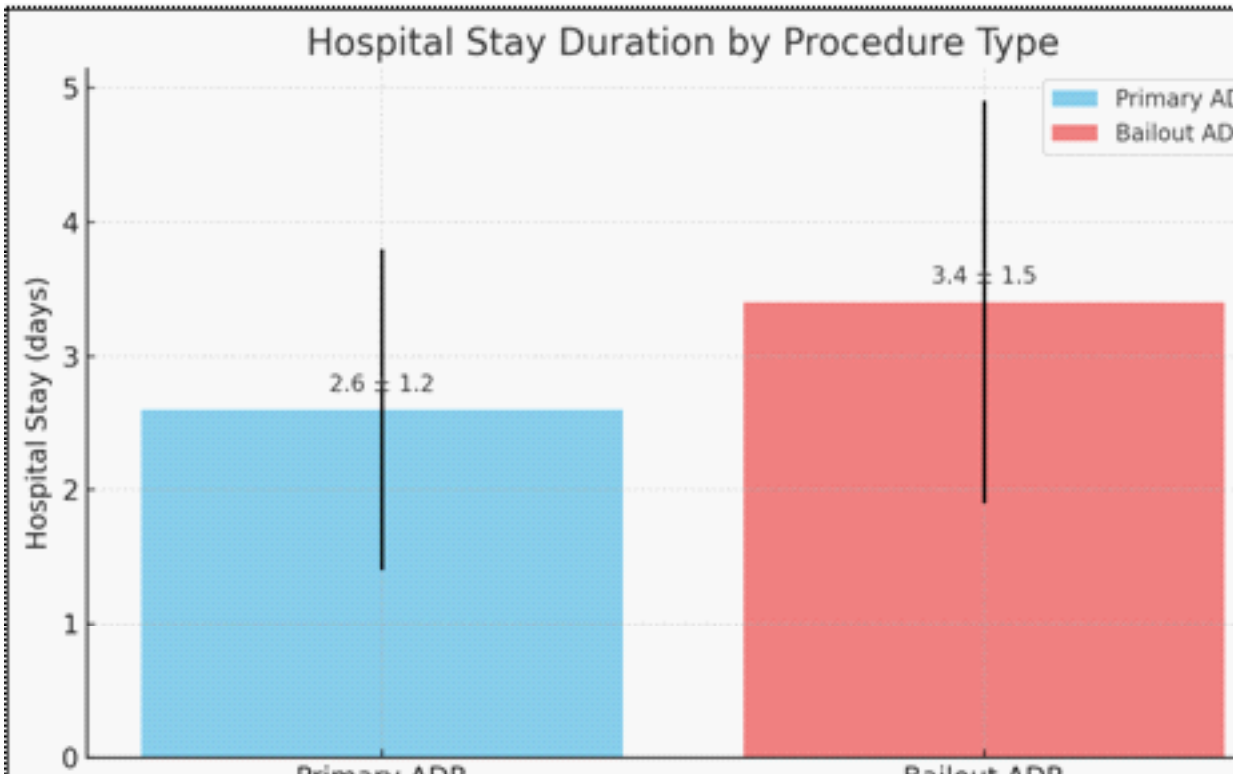

Figure 1: Hospital stay by procedure type

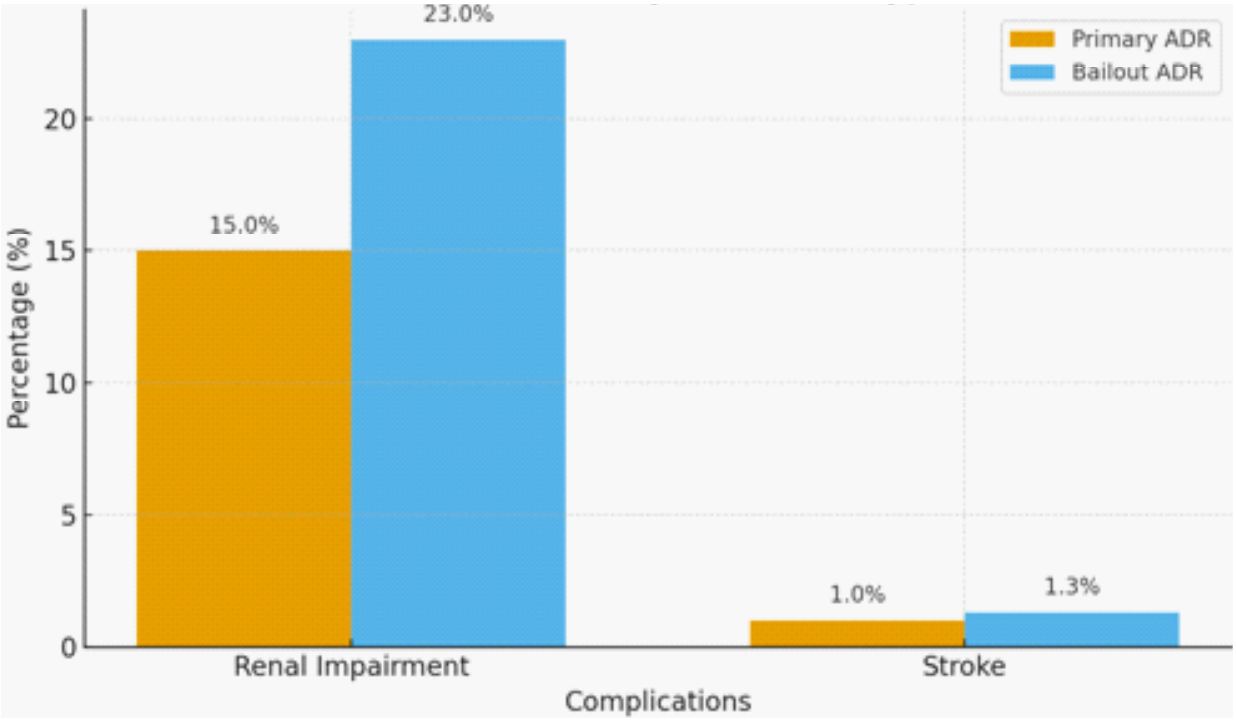

Figure 2: Complications by procedure type

Table 1 Demographic and Clinical Characteristics by Procedure Type		
Parameter	Primary ADR (n=100)	Bailout ADR (n=100)
Mean Age (years)	55.3 ± 8.2	57.2 ± 7.5
Age Range (years)	30 – 75	33 – 74
Male/Female Ratio	65 / 35	64 / 36
Hospital Stay (days)	2.6 ± 1.2	3.4 ± 1.5
Renal Impairment (%)	15%	23%
Stroke (%)	1.0%	2.2%
Good QoL (%)	35%	25%
Poor QoL (%)	15%	30%

Table 2 Comparison of Age and Hospital Stay between Groups			
Parameter	Primary ADR (n=100)	Bailout ADR (n=100)	P-Value
Mean Age (years)	55.3 ± 8.2	57.2 ± 7.5	0.25
Hospital Stay (days)	2.6 ± 1.2	3.4 ± 1.5	< 0.001

in the Bailout ADR group is attributed to higher post-procedural complications.

While there was no significant difference in age between groups ($p = 0.25$), hospital stay duration was markedly longer in the Bailout ADR group ($p < 0.001$), reflecting a direct association between procedural complexity and patient recovery time. (table-2) (figure-1)

POST-PROCEDURAL COMPLICATIONS:

Complications were notably more frequent in the Bailout ADR group compared to the Primary ADR group. Specifically, renal impairment occurred in 23% of patients in the Bailout ADR group versus 15% in the Primary ADR group. Stroke was observed in 1.3% of the Bailout ADR patients, compared to just 1.0% in the Primary ADR group. These increased complication rates likely contributed to the longer hospital stays and delayed recovery in the Bailout ADR group. (Fig-2)

QUALITY OF LIFE ASSESSMENT:

The QoL outcomes were better among patients undergoing Primary ADR, with 35% reporting good QoL, 50% fair, and 15% poor. In contrast, the Bailout ADR group had only 25% reporting good QoL, while 45% reported fair and a significant 30% reported poor QoL. These findings suggest that the procedural method impacts not just immediate recovery, but also longer-term patient-reported outcomes.

This boxplot illustrates that Bailout ADR patients had a wider distribution and higher median for hospital stay compared to Primary ADR patients, reinforcing the statistical findings and visualizing the burden of complications.

STATISTICAL SUMMARY:

Statistical analysis using independent t-tests confirmed that the difference in hospital stay between groups was highly significant ($p < 0.001$), while the difference in age was not statistically significant ($p = 0.25$). This analysis supports the study's objective of comparing patient-centred outcomes, highlighting that Primary ADR offers a clinically safer and more efficient recovery pathway with fewer complications and shorter hospital stays.

DISCUSSION:

This study investigated the differences in patient-centred outcomes and QoL between patients undergoing Primary ADR versus Bailout ADR procedures. Bailout ADR procedures were associated with longer hospital stays (mean: 3.4 ± 1.5 days) compared to Primary ADR procedures (mean: 2.6 ± 1.2 days).

The incidence of complications was significantly higher in the Bailout ADR group, with stroke and renal impairment being the most prevalent adverse events. QoL outcomes were also worse in the Bailout ADR group, with 30% of patients reporting poor QoL, compared to 15% in the Primary ADR group. The differences in hospital stay duration and complications were statistically significant, with p-values

< 0.001 for hospital stay and $p < 0.05$ for complications.

This study contributes original insights into the comparison of Primary ADR and Bailout ADR outcomes, particularly in the context of PCC and quality of life. While international studies have explored complications and clinical outcomes in similar populations, our study is one of the first to focus specifically on Pakistan, a country where cardiac interventions are increasingly common, but patient-centred research remains scarce.

Research comparing Primary ADR and Bailout ADR is limited, particularly in the context of long-term patient outcomes such as QoL and complications. Studies from countries like the United States and Europe focus primarily on technical success rates and short-term procedural outcomes.[4]

Some studies conducted within Pakistan have explored bailout thrombectomy and other similar interventional techniques, but they have not specifically analysed the patient-centred outcomes, particularly QoL after the intervention. For example, Rehman et al. (2021) analysed bailout thrombectomy outcomes but focused primarily on mortality and reinfarction, without considering post-procedural QoL.[5]

There is limited local literature examining primary vs. bailout ADR from the patient-centred outcomes perspective. This study, therefore, fills a significant gap in understanding the impact of these interventions on QoL in Pakistani populations, offering a fresh perspective for healthcare policy and clinical practices.

Similar studies conducted in Europe and the United States have found that bailout interventions are associated with increased hospital stay durations and higher rates of complications, which align with the findings of this study. For instance, a study by Yang et al. (2024) showed that primary ADR had a higher procedural success rate and a significantly shorter operation time compared to bailout ADR, which had longer operation times and higher radiation exposure.[4]

The impact of dissection re-entry techniques. This study evaluates the long-term outcomes of using dissection and re-entry strategies for CTO PCI, finding that ADR strategies provide a low one-year adverse event rate, with no significant difference between ADR and wire-based techniques.[9] The use of a modified subintimal tracking and re-entry (STAR) technique guided by intravascular ultrasound (IVUS), focusing on its role as a bailout strategy for successful PCI in CTOs.[10] The long-term effects of bailout stenting during PCI and identifies predictors associated with these interventions.[11]

Studies from the US and Europe frequently focus on the efficiency and technical success of interventions, with less emphasis on long-term patient-centred outcomes such as QoL and psychosocial impact. This study, by focusing on QoL, addresses a broader and more patient-centric view, which is increasingly emphasized in global healthcare literature.

Research from countries like Japan and the United States has explored PCC and its impact on QoL, particularly among elderly populations or those with chronic conditions. For instance, Iida et al. (2023) examined how PCC influences QoL and hope among patients in home care settings.[3] This study, while not focused on cardiac interventions, emphasizes the significant role of personalized care in enhancing patients' life satisfaction, which supports the findings of this study regarding the importance of patient-centred outcomes in ADR procedures.

While several studies have been conducted globally comparing Primary ADR and Bailout ADR, there is a notable lack of such patient-centred research in Pakistan. Most Pakistani studies have focused primarily on technical outcomes, such as mortality, stroke, and reinfarction, without addressing the impact on long-term recovery and QoL post-procedure. This study is among the first to focus on patient-reported outcomes after Primary vs. Bailout ADR, filling an important gap in Pakistani cardiac care literature.

A few studies from Pakistan have examined aspects related to coronary interventions and bailout techniques, including PPCI with bailout thrombectomy.[8] These studies,

while valuable, have largely neglected the long-term QoL post-intervention. The findings of this study, which focus on PCC and the psychosocial impact of cardiac procedures, add a new dimension to the local literature.

The use of device-based ADR for CTO PCI showed no difference in in-hospital complications and mid-term MACE as compared with parallel wire technique (PWT), despite higher procedure complexity in ADR group.[12] The CrossBoss/Stingray system was independently associated with lower risk of MACE on follow-up, as compared with wire-based ADR techniques.[13] ADR was used in more complex lesions and was associated with lower technical success and higher major adverse cardiac events compared with non-ADR cases.[14]

STUDY LIMITATIONS:

Several limitations should be considered in this study. First, the retrospective design limits the ability to establish causal relationships. Second, the study was conducted at a single institution, which may limit the generalizability of the results to other settings in Pakistan or internationally. Third, while the study included a comprehensive analysis of patient-centred outcomes, there was no standard mental health assessment (e.g., anxiety or depression), which could have provided more insights into the psychological impact of the procedures.

FUTURE DIRECTIONS:

Future studies should focus on prospective designs to validate the findings of this study and expand the sample size to include multiple centres for better external validity. Additionally, incorporating psychosocial assessments could provide a deeper understanding of the mental health implications of cardiac interventions. Further research could also explore the cost-effectiveness of Primary ADR versus Bailout ADR, integrating both clinical outcomes and patient-reported outcomes in a holistic framework.

CONCLUSION:

Primary ADR is associated with shorter hospital stays, fewer complications, and better QoL compared to Bailout ADR. The significant differences observed in hospital stay duration and complications (renal impairment and stroke) highlight the advantages of Primary ADR in terms of both clinical outcomes and recovery. Primary ADR is more efficient approach in enhancing both clinical recovery and patient satisfaction.

In conclusion, Primary ADR is preferable over Bailout ADR, especially considering its positive impact on patient-centred outcomes. Bailout ADR, while clinically viable, results in longer recovery times and increased complication rates.

FUTURE RECOMMENDATIONS

Future research should focus on prospective studies across multiple centres to validate these findings and explore mental health impacts such as anxiety and depression post-procedure. Additionally, a broader patient cohort should be included to increase the generalizability of the results. Integrating cost-effectiveness analyses into future studies will also provide a more comprehensive evaluation of these interventions in real-world settings.

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