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Original Research Article

COMPARATIVE ANALYSIS OF STAGED VERSUS INDEX PROCEDURE COMPLETE REVASCULARIZATION IN ST-ELEVATION MYOCARDIAL INFARCTION

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Abstract: *ST-elevation myocardial infarction (STEMI) is a critical condition that necessitates quick and efficient revascularization techniques. Recently, there has been a discussion on the best method for revascularization staged versus index procedure complete revascularization. The study compares the clinical outcomes of staged versus index procedure complete revascularization in ST-elevation myocardial infarction. This study is a prospective comparative analysis conducted at Ayub Teaching Hospital, Abbottabad. The patients were divided into two groups, with 40 participants in each group. Demographic data that included Smoking history, Diabetes mellitus, Dyslipidemia, Previous MI, and (LVEF) was recorded. Intraoperative and postoperative outcomes at 72 hours and six months were recorded. The quality of life was also assessed using SF-36 16. Data was entered and analyzed using SPSS (Statistical Package for the Social Sciences) version 24. P-values of ≤0.05 will be considered statistically significant. These findings suggest that in Group A, the frequency of "No reflow" (1 case) and "Abrupt closure" (0 instances) p=0.02) compared to Group B, where "No reflow" was observed in 2 cases and "Abrupt closure" in 1 case, (and (p=0.01), the investigation into post-operative outcomes, revealed no statistically significant differences between the two groups. P values ranged from 0.31 to 0.45, indicating comparable outcomes. After six months post-surgery, Group A demonstrated significantly better outcomes across various health-related domains than Group B, as indicated by the SF-36 questionnaire. In conclusion, index complete vascularization holds a distinct advantage over staged procedures. The observed differences across various health indicators highlight the potential clinical significance of prioritizing complete revascularization during the initial intervention.*

Keywords: ST Elevation Myocardial Infarction, Revascularization, Staged Procedure, Index Procedure, SF-36, Quality of Life

Introduction

ST-elevation myocardial infarction (STEMI) is a critical condition that necessitates quick and efficient revascularization techniques. Recently, there has been discussion on the best method for revascularization—staged versus index procedure complete revascularization, in particular. With staged revascularization, the operation is carried out gradually, treating just the culprit lesion at first and postponing treatment of non-culprit lesions (Mehta et al., 2019). Advocates claim that this method decreases the need for contrast, lessens the procedural strain, and enables a more individualized treatment strategy. Numerous research studies have elucidated the advantages of phased revascularization, including a decrease in major adverse cardiovascular events (MACE) and repeat revascularization using a phased strategy (Wood et al., 2019). On the other hand, the index procedure total revascularization method promotes prompt and thorough treatment of all essential coronary lesions at the time of the first operation. This strategy seeks to enhance myocardial perfusion and reduce the likelihood of further ischemia episodes, which may improve short-term results. The CULPRIT-SHOCK study supports the index procedure complete revascularization technique in several circumstances, especially in patients with cardiogenic shock (Farhan et al., 2020). When compared to a culprit lesion-only method, the trial indicated a decreased risk of all-cause death when using this technique.

By treating the culprit lesion first and postponing treatment of non-culprit lesions, staged revascularization enables a systematic, customized approach. In complex cases, this may lower the procedure risk and improve patient safety (Cerrud-Rodriguez et al., 2021). Staged re-vascularization aims to target the culprit lesion first, which may result in fewer procedures, shorter intervention durations, and less need for contrast. This may be beneficial, particularly for people who are not suitable candidates for intensive therapies due to other health issues or impaired renal function (Vasiljevs et al., 2023). Phased revascularization may maximize resource use by putting the patient's urgent needs first and postponing other procedures. When resources are scarce or complete revascularization of non-culprit lesions may not be possible during the original treatment, this might be extremely important. Staged revascularization may lead to better long-term results, such as a decrease in major adverse cardiovascular events (MACE) and the need for repeat revascularization, according to certain studies (Rawat et al., 2023). This might lead to an improved prognosis for the patient overall.

By treating all notable coronary lesions, complete revascularization performed as the index surgery offers instant relief from ischemic symptoms. In the short term, this may result in a faster recovery and better patient outcomes (Haq et al., 2022). Recurrent ischemia episodes may be prevented if all central lesions are entirely treated at the initial surgery. Patients who are at high risk or who have

severe coronary artery disease may benefit most from this. Treating every large lesion at once may enhance myocardial perfusion, lower the likelihood of further myocardial damage, and improve heart function (Mamtani et al., 2022). For those with impaired heart function, this may be crucial. According to specific research, in people experiencing cardiogenic shock index, complete re-vascularization surgery may result in a better survival rate due to prompt and comprehensive treatments (Nasrullah et al., 2022).

Although staged revascularization has certain benefits, it also has some risks. A significant drawback is the possible postponement of treating non-culprit lesions, which might result in an extended time of ischemia exposure and raise the possibility of further occurrences in the interim. Patients who have a high risk of problems or who have severe coronary artery disease may find this delay, especially worrying (Solangi et al., 2023). Furthermore, the tiered strategy could call for several interventions, putting the patient at higher risk during the procedure and requiring a more extended hospital stay. Moreover, the necessity for follow-up operations might lead to higher healthcare expenses and resource usage, which can be a significant factor in environments with limited resources (Panuccio et al., 2023)

It can be technically challenging to perform interventions on several coronary lesions in a single surgery, which could increase the intervention's overall time. An increased risk of procedural problems, including bleeding and vascular damage, and more extensive utilization of contrast might be linked to this prolonged procedure duration (Bainey et al., 2020). Furthermore, although a complete approach is intended, there are situations in which anatomical difficulties or patient variables make it hard to treat every lesion completely. This might result in inadequate revascularization. Healthcare staff and resources may be further taxed by the pressing need to treat every lesion at the index procedure, particularly in settings where timely access to catheterization laboratories may be restricted.

Significant knowledge gaps are needed for more research despite the expanding corpus comparing staged and index procedure complete revascularization in ST-elevation myocardial infarction (STEMI). A notable deficiency is the absence of agreement on the best patient selection standards for every revascularization technique. Recent studies have highlighted the general effectiveness of both strategies, but detailed investigation is required to pinpoint patient subgroups that could profit more from staged or total revascularization (Ahmad et al., 2020). Furthermore, there is disagreement on the ideal gap between the first and subsequent treatments because the material currently in publication frequently lacks specific information regarding the scheduling of staged procedures. More research is necessary to ascertain the ideal window for phased revascularization, considering variables including patient stability, coronary architecture, and the possible influence on long-term results. Furthermore, patient-reported outcomes and quality of life have received less attention in research than clinical objectives, such as death and significant adverse cardiovascular events (Stähli et al., 2023). Investigating these facets could offer a more thorough grasp of how each revascularization technique affects the day-to-day functioning and quality of life of STEMI patients, assisting in making treatment decisions that consider the patient's entire experiences and results in addition to survival. To improve the individualized care of STEMI patients according to their particular requirements and features, filling in these gaps in the literature is imperative.

Clinical decision-making and patient outcomes in treating ST-elevation myocardial infarction (STEMI) might be significantly influenced by the insights from the study comparing staged vs. index operation complete revascularization. For STEMI patients to have the finest outcomes, it is essential to comprehend the ideal revascularization strategy. Based on the unique characteristics of each patient, the degree of coronary involvement, and the existence of aggravating circumstances such as cardiogenic shock, the study's conclusions can help medical practitioners select the best course of action. The results from this study may be used to enhance patient care, treatment procedures, and overall outcomes in the management of ST-elevation myocardial infarction by incorporating them into clinical practice.

Methodology

This study is a prospective comparative analysis conducted at Ayyub Teaching Hospital, Abbottabad, for one year, from January 2023 to December 2023. The hospital's ethical review committee approved this study protocol. A total of 137 patients were screened for this study according to pre-defined inclusion and exclusion criteria. All the patients who presented with STEMI within 12 hours of the onset of symptoms were included in this study for primary PCI (Saito and Kobayashi, 2023). Similarly, patients with increased frequency of intracoronary thrombus on angiographic imaging were also included in this study. After taking the test, a SPECT scan was conducted before the IMR evaluation. Conversely, patients with unstable angina, prior history of PCI or CABG, and patients who presented beyond the recommended time frame of 12 hours were excluded from his study. Patients with bleeding diathesis and severe comorbidities like uncontrolled diabetes and uncontrolled hypertension were also excluded. After screening, 80 patients were selected for this study and given detailed information about the methods and procedures involved. Informed consent was taken. These patients were divided into two groups, with 40 participants in each group. Group A included patients who were to undergo indexed procedure complete revascularization, while Group B included patients to undergo staged procedure complete revascularization.

A basic medical history and a physical examination were started as soon as the patient was admitted. In ten minutes, an electrocardiogram was completed. Every topic, after being diagnosed with STEMI, was prescribed dosages of ticagrelor (180 mg) and aspirin (300 mg). Blood samples were drawn from the venous veins for standard laboratory testing. These tests included blood tests for various organs, liver and renal function, blood tests for blood sugar, lipid profiles, C reactive protein, and cardiac markers like troponin I. Every subject filled out the informed consent proforma for the procedure. At least two certified cardiac doctors performed the interventional procedure in

compliance with accepted clinical practice. Demographic data that included Age, Gender, BMI, Smoking history, Diabetes mellitus, Dyslipidemia, Previous myocardial infarction, and the Left ventricular ejection fraction (LVEF) was recorded. Moreover, Killip's class was also recorded during the presentation. Revascularization strategy and intra-procedural complications (e.g., dissection, perforation) were recorded intraoperatively. Moreover, all the patients were observed in the postoperative period for up to 72 hours for MI, stroke, arrhythmias, LVEF, and MACE. These patients were again assessed at six 6-month intervals for MACE, complaints of angina, repeat hospitalization for cardiovascular events, and mortality rate. The quality of life was also evaluated using an SF-36 (Pačarić et al., 2020). Data was entered and analyzed using SPSS (Statistical Package for the Social Sciences) version 24. Mean and standard deviation were calculated for quantitative variables like age, weight, etc. Qualitative variables like the post-operative complications and functional improvement were presented as frequencies and percentages. A dependent T-test will be applied to compare means, and a chi-square will be used to compare qualitative variables. P-values of ≤0.05 will be considered statistically significant.

Results

In this comparative analysis of two groups, Group A (n=40) and Group B (n=40), several demographic and clinical variables were assessed to identify potential differences between the two cohorts. The mean age of participants in Group A was 49.2 years with a standard deviation of 5.4, while Group B had a slightly higher mean age of 51.5 years with a standard deviation of 8.3. Gender distribution revealed that Group B had a higher percentage of males (65%) than Group A (57.5%). Body Mass Index (BMI) was also examined, and participants in Group A exhibited a mean BMI of 28.3 with a standard deviation of 5.6, whereas Group B displayed a slightly lower mean BMI of 27.3 with a standard deviation of 4.9, as shown in Table 1.

The prevalence of various cardiovascular risk factors was investigated in both groups. Notably, Group A showed a higher incidence of diabetes (82.5%), hypertension (77.5%), and dyslipidemia (72.5%) compared to Group B, which reported rates of 72.5%, 70%, and 77.5%, respectively. Both groups exhibited a high prevalence of a history of smoking, with 92.5% in Group A and 90% in Group B. Family history of coronary artery disease (CAD) was observed in 12.5% of Group A and 17.5% of Group B. Additionally, a small percentage of participants in both groups had a prior myocardial infarction (MI), with 7.5% in Group A and 10% in Group B. Left ventricular ejection fraction (LVEF), a crucial measure of cardiac function, was evaluated. Group A displayed a mean LVEF of 37.3 with a standard deviation of 6.2, while Group B exhibited a slightly higher mean LVEF of 38.6 with a standard deviation of 5.4. Killip class at presentation revealed statistically significant differences in distribution between the groups. Specifically, Group A exhibited a higher prevalence of Killip class III (23 cases) than Group B (19 cases), with a corresponding P value of 0.04. Additionally, Group A had a higher incidence of Killip class II (7 cases) than Group B (9 cases), with a P value of 0.02. These findings suggest notable distinctions in the severity of clinical presentation between the two groups. Regarding procedural complications, the analysis focused on occurrences of "No reflow," "Abrupt closure," and "Dissection." Group A demonstrated a significantly higher frequency of "No reflow" (1 case) and "Abrupt closure" (0 cases) compared to Group B, where "No reflow" was observed in 2 cases and "Abrupt closure" in 1 case, resulting in P values of 0.02 and 0.01, respectively. This suggests a potential association between Group A and a higher risk of procedural complications, as shown in Table 2.

The investigation into postoperative outcomes, including Left Ventricular Ejection Fraction (LVEF) at discharge, cardiogenic shock, stroke, myocardial infarction (MI), arrhythmias, all-cause mortality, ST-segment resolution, and ventricular fibrillation, revealed no statistically significant differences between the two groups (figure 1). P values ranged from 0.31 to 0.45, indicating comparable outcomes. The study also assessed longer-term outcomes after six months, examining factors such as complaints of angina, repeat hospitalization for cardiovascular events, MI, major adverse cardiovascular events (MACE), and mortality. While some variations were observed, such as a P value of 0.02 for MACE, overall, the groups did not show statistically significant differences in these outcome measures (figure 2).

After six months post-surgery, Group A demonstrated significantly better outcomes across various health-related domains than Group B, as indicated by the SF-36 questionnaire. Regarding physical functioning (PF), Group A exhibited a mean score of 63.1±9.4, surpassing Group B's score of 56.3±6.6, with a statistically significant P value of <0.01. Similarly, Group A displayed superior results in the role–emotional (RE), social functioning (SF), mental health (MH), vitality/energy (VT), bodily pain (BP), general health (GH), and health changes, all with P values <0.01. The Physical Component Summary (PCS) and Mental Component Summary (MCS) scores also favored Group A, with means of 55.9±5.8 and 61.8±7.5, respectively, compared to Group B's scores of 51.9±5.9 and 57.9±8.4 as shown in table 3 and figure 2.

Table 1: demographic data

Variable	Group A (n=40)	Group B (n=40)
Age (years) (mean ± SD)	**49.2 ± 5.4**	**51.5 ± 8.3**
Gender • Male • Female	 23 (57.5 %) 17 (42.5 %)	 26 (65%) 14 (35%)
BMI (mean ± SD)	28.3 ± 5.6	27.3 ± 4.9
Diabetes	33 (82.5%)	29 (72.5%)
Hypertension	31 (77.5%)	28 (70%)
Dyslipidemia	29 (72.5%)	31 (77.5%)
History of Smoking	37 (92.5%)	36 (90%)
Family history of CAD	5 (12.5%)	7 (17.5%)
Prior MI	3 (7.5 %)	4(10 %)
LVEF (mean ± SD)	37.3± 6.2	38.6±5.4

Table 2: the outcome of the study

Variable	Group A (n=40)	Group B (n=40)	P value
Killip class at presentation			
• CLASS I	2	3	0.03
• CLASS II	7	9	0.02
• CLASS III	23	19	0.04
• CLASS IV	8	9	0,02
Procedural complications			
• No reflow	1	2	0.02
• Abrupt closure	0	1	0.01
• Dissection	0	2	0.04
Post op outcomes.			
• LVEF at discharge	51.2 ± 7.4	49.3 ± 8.7	0.41
• Cardiogenic shock	0	2	0.39
• Stroke	1	0	0.31
• MI	0	1	0.45
• Arrhythmias	1	3	0.31
• All-cause mortality	0	1	0.02
• ST-segment resolution	33	23	0.32
• Ventricular fibrillation	1	1	0.04
Outcome after six months			
• Complains of angina	2	7	0.31
• Repeat hospitalization for cardiovascular events	1	3	0.42
• MI	1	4	0.37
• MACE	2	3	0.02
• Mortality	0	1	0.01

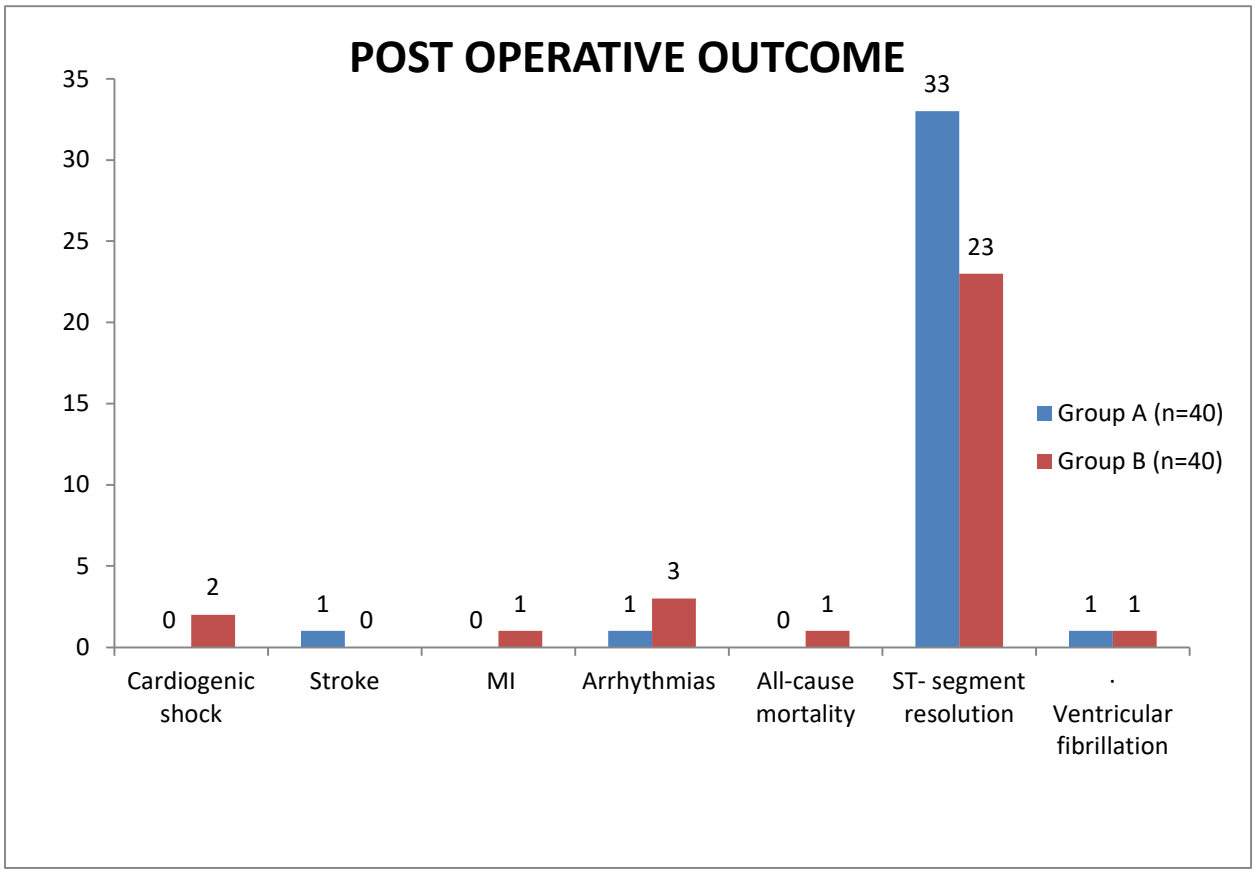

Figure 1: Post-op outcomes.

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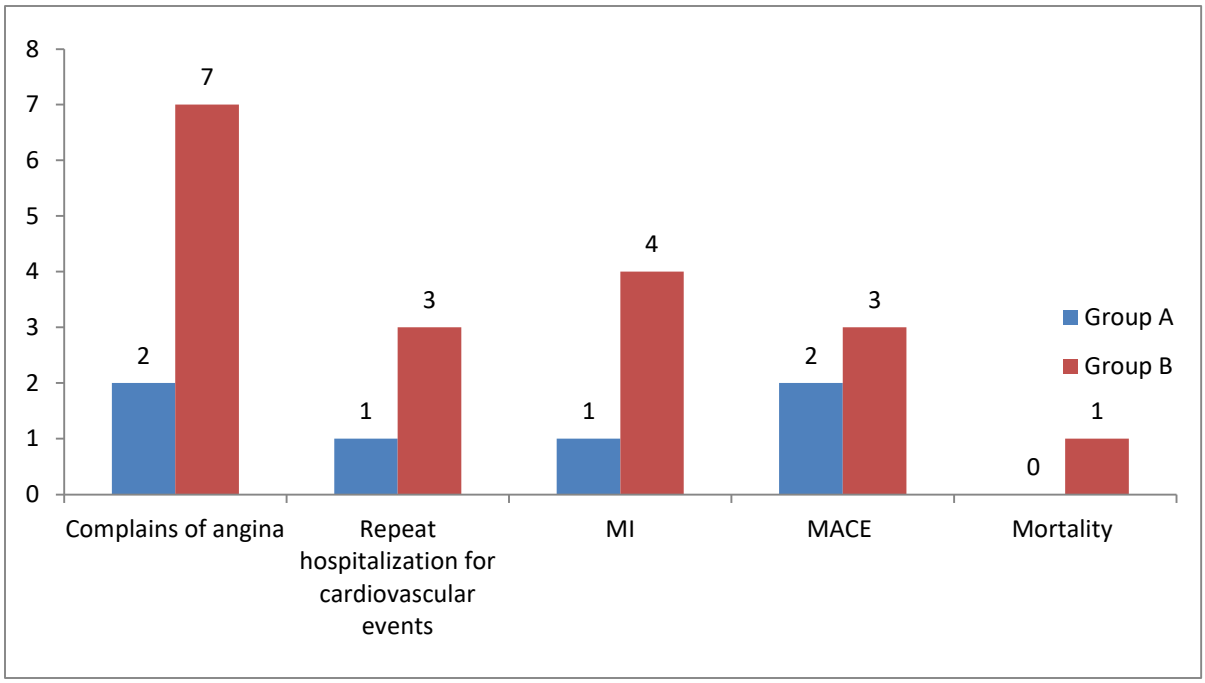

Figure 2: Outcomes after 6 Months

Table 3: assessment of quality of life

SF-36	After surgery at six months in Group A	After surgery at six months in Group B	*P value*
Physical functioning (PF)	63.1±9.4	56.3±6.6	<0.01
Role–emotional (RE)	59.2±7.5	54.9±6.5	<0.01
Social functioning (SF)	57.4.±8.2	56.8±7.4	<0.01
Mental health (MH)	60.4±6.9	55.9±6.7	<0.01
Vitality/ energy (VT)	55.7±6.2	53.8±8.2	<0.01
Bodily pain (BP)	59.3±7.9	51.7±6.3	<0.01
General health (GH)	52.4±7.3	50.3±5.4	<0.01
Health changes	56.9±6.7	52.7±6.7	<0.01
Physical component summary (PCS)	55.9±5.8	51.9±5.9	<0.01
Mental component summary (MCS	61.8±7.5	57.9±8.4	<0.01

Discussion

In comparing the characteristics of Group A (n=40) and Group B (n=40), several parameters were assessed in this study. The mean age in both groups was within a similar range, with Group B demonstrating a slightly higher average age than Group A. Gender distribution revealed variations. Still, both groups comprised a mix of male and female participants. Body Mass Index (BMI) values indicated slight differences, with Group A having a marginally higher mean BMI than Group B. The prevalence of diabetes, hypertension, and dyslipidemia was observed in both groups, with Group A generally exhibiting slightly higher percentages. Notably, a substantial majority in both groups had a history of smoking. Additionally, a modest disparity in the prevalence of a family history of coronary artery disease (CAD) was noted, with Group B showing a slightly higher occurrence. Both groups demonstrated relatively comparable left ventricular ejection fraction (LVEF) values when considering cardiac factors. In summary, while some variations exist, the overall profiles of Group A and Group B share similarities across multiple demographic and health-related parameters.

In evaluating the data between Group A (n=40) and Group B (n=40), significant differences were observed in the Killip class at presentation, with distinct distributions across the severity classes. Group B exhibited higher proportions in Classes II and IV compared to Group A. Procedural complications, such as no-reflow, abrupt closure, and dissection, were more prevalent in Group B, suggesting a potential impact on the interventional outcomes. Post-operative outcomes, including the left ventricular ejection fraction (LVEF) at discharge and various complications like cardiogenic shock, stroke, myocardial infarction (MI), arrhythmias, all-cause mortality, and ST-segment resolution, displayed some variability between the two groups. However, statistical significance varied across these parameters (Fortuni et al., 2019). Looking at the 6-month outcomes, the occurrence of angina, repeat hospitalization for cardiovascular events, MI, major adverse cardiovascular

events (MACE), and mortality differed between groups. The data indicates potential distinctions in the recovery and long-term outcomes. The analysis underscores several noteworthy differences in presentation, procedural complications, and short-term and long-term outcomes between Group A and Group B, which may warrant further investigation into the underlying factors influencing these variations.

The analysis of SF-36 data at six months post-surgery in Group A and Group B reveals statistically significant differences across various health-related domains. Regarding physical well-being, Group A consistently demonstrated higher scores than Group B in physical functioning, bodily pain, general health, health changes, and the physical component summary (PCS). This suggests a more favorable physical health status in Group A post-surgery. Similarly, in emotional and mental well-being, Group A outperformed Group B in role-emotional, social functioning, mental health, vitality/energy, and the mental component summary (MCS). These findings highlight a superior emotional and mental health profile for participants in Group A compared to Group B at the 6-month mark following surgery. The overall pattern of results indicates that individuals in Group A experienced more positive outcomes across various aspects of health-related quality of life than their counterparts in Group B. These disparities, reflected in multiple domains, may have implications for post-surgical recovery, patient satisfaction, and long-term well-being. Further investigation into the specific factors contributing to these differences could provide valuable insights for optimizing the surgical and postoperative care processes (Park et al., 2021).

The data presented strongly suggests that complete vascularization achieved through index procedures is associated with superior outcomes compared to staged interventions. In cardiovascular interventions, complete revascularization during the initial procedure yields more favorable short-term and long-term patient well-being results. This is particularly evident in the analysis of procedural complications, postoperative outcomes, and 6-month health-related quality-of-life measures. Group A, representing the index complete revascularization approach, consistently demonstrated better outcomes across various parameters. The emphasis on complete vascularization instead of staged procedures aligns with the observed physical and mental health benefits, as evidenced by the SF-36 data (Ahmad et al., 2020). Individuals undergoing index complete revascularization showcased superior scores in physical functioning, mental health, vitality, and overall health changes compared to staged interventions (Ali et al., 2021). These findings underscore the advantages of adopting a comprehensive approach during the initial intervention, aiming for optimal vascularization to promote better patient recovery and long-term quality of life (Miyata et al., 2022).

While the provided data sheds light on the comparative outcomes between index complete vascularization and staged procedures, it is important to acknowledge several limitations inherent in this study. The relatively small sample size (n=40 for each group) might limit the generalizability of the findings to a broader population, and caution should be exercised when extrapolating these results to diverse patient groups. Furthermore, the lack of randomization and potential confounding variables may impact the study's internal validity. Patient characteristics, comorbidities, and individual treatment responses may not have been equally distributed between the groups, potentially influencing the observed outcomes. Moreover, the study's duration, which was a 6-month postoperative period, provided a relatively short-term perspective. Long-term follow-up data would be crucial to assess the observed benefits' sustainability and capture any potential delayed complications or changes in health status over time. Lastly, specific techniques and technologies employed during the revascularization procedures are not detailed in the provided information, making it challenging to evaluate the impact of evolving procedural approaches on reported outcomes.

Conclusion

The comprehensive analysis of the provided data strongly supports the proposition that index complete vascularization holds a distinct advantage over staged procedures. The observed differences across various health indicators highlight the potential clinical significance of prioritizing complete revascularization during the initial intervention, emphasizing the importance of considering such an approach in clinical decision-making and treatment planning for cardiovascular patients.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned.
Consent for publication
Approved
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Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

Author Contribution

SYED BILAL SHAH (Cardiologist)
Coordination of collaborative efforts.
Study Design, Review of Literature.
Conception of Study, Development of Research Methodology Design, Study Design,, Review of manuscript, final approval of manuscript.
SHAHID KHAN (Cardiologist)
Conception of Study, Final approval of manuscript.
Manuscript revisions, critical input.
Data acquisition, analysis.
Manuscript drafting.
Data entry and Data analysis, drafting article.

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