

Analysis of the Safety and Efficacy of Different Timing Strategies for Elective Endovascular Aortic Repair Combined with Coronary Artery Bypass Grafting

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Abstract: Objective: This study aims to evaluate the safety and efficacy of different timing strategies for elective endovascular aortic repair (EVAR) combined with coronary artery bypass grafting (CABG), analyze the impact of surgical sequence on perioperative management and long-term prognosis of patients, and provide evidence for clinical decision-making.

Methods: This study is a retrospective cohort analysis, including patients who underwent combined EVAR and CABG surgery at Beijing Anzhen Hospital, Capital Medical University, from January 2012 to June 2023. According to the timing of surgery, patients were divided into three groups: EVAR followed by CABG group, CABG followed by EVAR group, and simultaneous surgery group. The primary endpoint was a composite endpoint consisting of all-cause mortality, non-fatal myocardial infarction, hospitalization for heart failure or unstable angina, and reoperation of the aortic or coronary target vessels. Secondary endpoints included length of hospital stay, hospitalization costs, and perioperative adverse events. Cox proportional hazards regression analysis was used to assess the impact of different surgical timings on the primary endpoint, calculating hazard ratios (HR) and their 95% confidence intervals (CI). Variables with $P < 0.2$ in univariate analysis were included in multivariate analysis to identify independent influencing factors. Survival analysis was performed using Kaplan-Meier curves, and differences between groups were compared using the Log-rank test.

Results: A total of 110 patients were included in the study, with 56 in the EVAR followed by CABG group, 36 in the CABG followed by EVAR group, and 18 in the simultaneous surgery group. There were no significant differences in baseline characteristics among the three groups ($P > 0.05$), but differences were observed in the classification of aortic lesion sites and the proportion of hyperlipidemia ($P < 0.05$). The incidence of perioperative adverse events was higher in the simultaneous surgery group (38.9%), but there was no significant statisti-

cal difference ($P=0.063$). With a median follow-up of 44.5 months, the incidence of primary endpoint events did not differ significantly among the three groups ($P=0.824$). Patients with CABG involving ≥ 2 vessels had a significantly lower risk of primary endpoint events ($P=0.016$). Adverse events during hospitalization were marginally associated with the risk of primary endpoint events ($P=0.054$). There was no significant statistical difference in the risk of primary endpoint events based on different surgical sequences ($P=0.984$).

Conclusion: This study shows that different timing strategies for elective EVAR combined with CABG do not affect the risk of long-term postoperative cardiovascular adverse events, while complete coronary revascularization and perioperative management are key factors affecting long-term prognosis. In future clinical practice, clinicians should adopt individualized risk assessment strategies, carefully select the population for simultaneous surgery, and pay attention to perioperative monitoring, complete revascularization, and long-term rehabilitation management, thereby comprehensively improving the quality of life and long-term prognosis of high-risk cardiovascular patients.

Keywords: EVAR, CABG, aortic disease, coronary artery disease, surgical timing strategy

Introduction

Aortic diseases and coronary artery diseases are significant cardiovascular conditions that pose a global threat to human health. Common aortic diseases primarily include aortic aneurysms, aortic dissections, aortic ulcers, and intramural aortic hematomas. If not treated promptly, these conditions can lead to aortic rupture and a significantly increased risk of death, resulting in severe clinical outcomes^[1, 2]. Coronary artery disease, primarily based on atherosclerosis, can lead to myocardial ischemia, myocardial infarction, and heart failure, severely affecting patients' quality of life and increasing the risk of death [3, 4]. In recent years, due to population aging and unhealthy lifestyle habits, the co-occurrence of aortic and coronary artery diseases has gradually increased, posing significant challenges to clinical diagnosis and treatment. Therefore, how to effectively and safely implement a combined treatment strategy targeting both conditions has become a hot topic in current cardiovascular clinical research.

Endovascular aortic repair (EVAR) is a minimally invasive and effective treatment for aortic diseases, which seals the diseased area through endovascular techniques, preventing further progression of aortic conditions^[5]. Compared to traditional open aortic surgery, EVAR has fewer postoperative complications, faster recovery, and higher patient acceptance, playing an increasingly important role in the treatment of aortic diseases, especially aortic aneurysms and dissections^[6]. However, some patients with aortic diseases also have severe coronary artery diseases, often requiring concurrent or staged coronary artery bypass grafting (CABG) to improve myocardial blood supply and reduce the risk of adverse

cardiovascular events ^[7, 8].

For patients with both aortic and coronary artery diseases, the optimal sequence and timing of EVAR and CABG remain controversial. Some studies suggest prioritizing coronary revascularization to improve cardiac function and create safer hemodynamic conditions for subsequent aortic surgery. However, other studies advocate addressing aortic diseases first to avoid progression or rupture of aortic conditions during CABG ^[9, 10]. Additionally, some clinical teams have attempted to perform EVAR and CABG concurrently to address both conditions in one procedure, reducing hospital stay and medical costs, but the complexity and safety of this approach require further validation ^[11]. Therefore, clarifying the safety and efficacy of different surgical sequences has become an urgent clinical issue.

Previous related studies have mostly been limited to small-sample, single-center studies or case reports, with diverse patient populations and varying severity of conditions, leading to inconclusive findings and a lack of unified guidelines or consensus. Different surgical sequences may have significant differences in safety and efficacy, necessitating in-depth and systematic research. Currently, in clinical practice, most cardiovascular experts tend to choose the surgical sequence based on individual patient conditions and the experience of the surgical team. However, the lack of systematic evidence leads to subjective and random decision-making ^[12, 13]. As one of the largest cardiovascular centers in the country, Beijing Anzhen Hospital, Capital Medical University, is internationally leading in the treatment of aortic diseases and coronary heart disease. The center offers a full range of treatment strategies for EVAR combined with CABG at different timings and has conducted preliminary comparisons of the outcomes of these strategies. Based on this, this study aims to explore the safety and efficacy of different surgical timing strategies in patients undergoing elective EVAR combined with CABG through a retrospective cohort analysis, providing objective evidence for clinical decision-making.

2. Methods

2.1 Study Population

As shown in Figure 1, this study included 137 patients who underwent elective EVAR at Beijing Anzhen Hospital, Capital Medical University, between January 2012 and June 2023 and received CABG within the same period or within six months. Exclusion criteria included: 15 patients who underwent concurrent open aortic surgery, 7 patients who underwent concurrent hybrid surgery with supra-aortic branch artificial vessel bypass, 2 patients who underwent concurrent heart valve surgery, 1 patient who underwent concurrent thoracoscopic partial lobectomy, and 2 patients who were admitted emergently due to aortic aneurysm rupture. Ultimately, 110 patients were included, of whom 89 had true aortic aneurysms, 2 had pseudoaneurysms, 5 had type B aortic dissections, and 14 had

aortic ulcers. Based on the surgical sequence, patients were divided into three groups: 56 patients who underwent EVAR followed by CABG, 36 patients who underwent CABG followed by EVAR, and 18 patients who underwent concurrent EVAR and CABG.

This study is retrospective in design and does not involve identifiable patient personal information, so individual informed consent was not required. All patients had signed written informed consent for research based on medical records at the time of initial treatment.

2.2 Research Methods

This study adopted a retrospective cohort study design, collecting and analyzing patients' demographic characteristics, clinical features, surgical procedures, and perioperative conditions. Specific factors included patient age, gender, smoking history, body mass index (BMI), hypertension, hyperlipidemia, diabetes, history of cerebral infarction, glomerular filtration rate (GFR), left ventricular ejection fraction (LVEF), and coronary artery bypass methods and the number of grafts. Surgical-related indicators included total surgery time, interval between two surgeries, intensive care unit (ICU) stay duration, mechanical ventilation time, hospital stay duration, hospitalization costs, and the occurrence of adverse events during hospitalization. In-hospital adverse events were defined as any adverse events occurring within 30 days postoperatively or during hospitalization if it exceeded 30 days, including in-hospital death, acute myocardial infarction, acute heart failure, stroke, acute kidney injury, infection, bleeding, paraplegia, vascular access complications, etc. Follow-up data were obtained through hospital outpatient visits or telephone interviews to ensure data completeness and accuracy. The primary endpoint of follow-up observation was a composite endpoint consisting of all-cause death, non-fatal myocardial infarction, hospitalization for heart failure or unstable angina, and reoperation of the aortic or coronary arteries^[14].

2.3 Statistical Analysis

In this study, continuous variables were expressed as mean $\pm$ standard deviation (SD), and categorical variables were expressed as frequency and percentage. Based on data distribution, one-way analysis of variance (ANOVA) was used to compare differences between groups, and categorical variables were analyzed using the chi-square test or Fisher's exact test. Cox proportional hazards regression analysis was used to assess the impact of different surgical strategies on the primary endpoint events, calculating the hazard ratio (HR) and its 95% confidence interval (CI). Variables with $P < 0.2$ in univariate analysis were included in multivariate analysis to identify independent influencing factors. Survival analysis was described using Kaplan-Meier curves, and differences between groups were compared using the Log-rank test, with $P < 0.05$ considered statistically significant. All statistical analyses were performed using SPSS software version 27.0 (SPSS Inc., Chicago, IL, USA), with $P < 0.05$ as the statistical signif-

icance level.

3. Results

3.1 Analysis of Baseline Clinical Characteristics of Patients

This study consecutively enrolled patients who underwent EVAR combined with CABG at our hospital from January 2012 to June 2023. Based on the sequence of surgical procedures, patients were divided into three groups: EVAR followed by CABG group (56 cases), CABG followed by EVAR group (36 cases), and simultaneous EVAR+CABG group (18 cases). Table 1 presents the comparison of baseline clinical characteristics among the three groups. Overall, the baseline characteristics of the three groups were largely consistent, but there were statistically significant differences in some key clinical indicators.

Regarding the classification of aortic lesion sites, there were significant differences among the three groups ($P=0.028$). Specifically, the proportion of patients with thoracic aortic lesions in the EVAR followed by CABG group was 32.1%, significantly higher than that in the CABG followed by EVAR group (11.1%) and the simultaneous surgery group (11.1%). This result indicates that our cardiovascular surgeons tend to prioritize the treatment of aortic diseases in patients with thoracic aortic lesions to achieve better aortic stability, followed by CABG surgery.

There were no significant differences among the three groups in terms of gender ratio, age distribution, smoking history, body mass index (BMI), hypertension, diabetes, history of cerebral infarction, renal function (glomerular filtration rate, GFR), and left ventricular ejection fraction (LVEF) ($P>0.05$), suggesting that these factors do not have a decisive influence on the choice of surgical timing. However, the proportion of hyperlipidemia in the simultaneous surgery group (61.1%) was significantly higher than that in the EVAR followed by CABG group (21.4%) and the CABG followed by EVAR group (27.8%) ($P=0.006$). This result suggests that patients with hyperlipidemia may have more complex coronary artery lesions and higher-risk aortic lesions, prompting clinicians to choose a simultaneous surgery strategy.

In terms of the specific implementation of CABG, there was no significant difference in the proportion of patients with ≥ 2 bypass vessels among the three groups ($P=1.000$). The bypass method (solely venous graft SVG or combined internal mammary artery LIMA+SVG) also showed no significant difference among the groups ($P=0.921$), indicating that CABG has good consistency across different surgical strategies and is not significantly affected by the sequence of surgery.

Comparison of factors including total operative time, length of hospital stay, medical costs, and perioperative adverse events

Table 2 presents the results of further analysis of surgical-related indicators

among the three patient groups. No significant differences were observed in the total operative time among the three groups ($P=0.764$), with an average duration of approximately 6 hours, indicating that the adjustment of surgical sequence did not significantly affect the total operative duration. Additionally, there were no statistically significant differences among the three groups in terms of the length of stay in the intensive care unit (ICU) ($P=0.791$), duration of ventilator use ($P=0.640$), total hospital days ($P=0.968$), and hospitalization costs ($P=0.186$). However, the medical costs in the concurrent surgery group (349,115.6 yuan) were slightly higher than those in the EVAR followed by CABG group (313,451.1 yuan) and the CABG followed by EVAR group (333,410.3 yuan), suggesting that concurrent surgery may involve more medical resource investment and more complex intraoperative management.

Regarding the incidence of perioperative adverse events, the concurrent surgery group (38.9%) was significantly higher than the EVAR followed by CABG group (16.1%) and the CABG followed by EVAR group (13.9%), but this difference did not reach statistical significance ($P=0.063$). With a median follow-up of 44.5 (21.25, 82.75) months, the incidence of primary endpoint events showed no significant differences among the three groups ($P=0.824$): 22.2% in the concurrent surgery group, 25.0% in the EVAR followed by CABG group, and 19.4% in the CABG followed by EVAR group. This indicates that different surgical sequences did not significantly affect the long-term prognosis.

Analysis of the impact of different surgical sequences on the risk of primary endpoint events

As shown in Figure 2, Kaplan-Meier survival analysis revealed no significant statistical differences in the cumulative risk curves of primary endpoint events among the three groups of patients (Log-rank, $P=0.984$). Table 3 presents the results of univariate and multivariate Cox proportional hazards models analyzing the risk factors for primary endpoint events. Univariate analysis indicated that patients with CABG involving ≥ 2 vessels had a significantly reduced risk of primary endpoint events (HR=0.331, 95% CI: 0.137-0.799, $P=0.014$), suggesting that adequate coronary revascularization can improve long-term cardiovascular outcomes. Additionally, adverse events during hospitalization significantly increased the risk of primary endpoint events (HR=2.293, 95% CI: 1.003-5.239, $P=0.049$). Notably, different surgical timing strategies had no significant impact on the risk of primary endpoint events ($P=0.984$). Multivariate analysis further confirmed that the protective effect of CABG involving ≥ 2 vessels remained significant (HR=0.337, 95% CI: 0.140-0.814, $P=0.016$), emphasizing the importance of complete coronary revascularization. The impact of adverse events during hospitalization tended to be significant in multivariate analysis (OR=2.255, 95% CI: 0.985-5.159, $P=0.054$), indicating the need for enhanced perioperative management.

Furthermore, factors such as the classification of aortic lesion sites (thoracic aorta or abdominal aorta), gender, age, smoking history, BMI, hypertension, hy-

perlipidemia, diabetes, history of cerebral infarction, renal function, left ventricular ejection fraction, and CABG methods showed no significant correlation with the risk of primary endpoint events ($P>0.05$).

Discussion:

Aortic diseases and coronary artery disease share similar risk factors, including hypertension, smoking, diabetes, and hyperlipidemia^[15], and often co-exist in the same patient. Recent epidemiological data indicate that a significant proportion of patients with abdominal aortic aneurysm (AAA) have severe coronary artery stenosis, with an even higher proportion observed in patients with thoracic aortic aneurysm (TAA). Systematic reviews and meta-analyses have shown that the prevalence of AAA in patients with coronary artery disease is significantly higher than in non-coronary artery disease populations, reaching 8.4%, suggesting a high degree of comorbidity between the two conditions^[16].

Combined treatment strategies aim to minimize the incidence of cardiovascular and cerebrovascular events, thereby improving overall patient survival. However, due to significant differences in the operative sites, risk profiles, and intraoperative management modes of different surgeries, the sequence of surgeries becomes a critical factor affecting prognosis. Currently, clinical guidelines have not reached a consensus on the timing of such combined surgeries, and further experience from multicenter clinical studies is still needed^[17]. In recent years, several studies have explored the combined surgical strategies of EVAR and CABG at different timings, but most are single-center studies with limited sample sizes and inconsistent conclusions. Although simultaneous repair of abdominal aortic aneurysm and CABG can save time and medical resources, the incidence of postoperative renal injury and pulmonary complications is higher, indicating that the choice of simultaneous surgery still requires individualized assessment. This finding is consistent with a systematic review, which showed that while simultaneous surgery shortens hospital stays, it increases the incidence of postoperative pulmonary complications and permanent pacemaker implantation^[18]. Retrospective studies have pointed out that the combined aortic surgery and CABG approach still has controversies, and its optimal sequence and timing require individualized assessment^[19].

This study employed a retrospective cohort analysis to systematically evaluate the safety and efficacy of different timing strategies for elective EVAR combined with CABG. The results showed no significant differences in hospital stay length and costs among the three surgical sequences (EVAR followed by CABG, CABG followed by EVAR, and simultaneous EVAR+CABG); the simultaneous surgery group had a relatively higher incidence of perioperative adverse events, but it did not reach statistical significance ($P=0.063$). The highest proportion of patients (50.9%) underwent EVAR followed by CABG, and this group had a significantly higher proportion of thoracic aortic lesions than the other two

groups, indicating a clinical preference for stabilizing the aortic condition first to prevent aneurysm rupture or dissection progression, thereby providing a safer perioperative environment for subsequent CABG. Previous studies have noted that performing CABG 7-10 days after EVAR significantly reduces the risk of perioperative mortality risk and shortens overall hospital stay, but individualized assessment is still necessary^[20].

The treatment strategy of CABG followed by EVAR emphasizes prioritizing coronary artery reconstruction, which is particularly important for patients with left main disease or triple-vessel disease. Insufficient coronary blood supply may lead to intraoperative myocardial ischemia or even sudden cardiac death, a risk that is particularly significant during aortic surgery. Existing evidence suggests that for patients with severe coronary artery disease, prioritizing coronary artery bypass surgery can reduce the risk of cardiac death and perioperative myocardial infarction, especially in patients with multivessel disease^[19]. This study found that the interval between the two surgeries in this group was longer (average 10.2 days), which may aid in cardiac function recovery and facilitate postoperative monitoring and adjustment of anticoagulation strategies.

Although the concept of simultaneous surgery can shorten hospital stays, reduce the number of anesthetics, and avoid repeated intraoperative exposure, it also presents challenges such as difficulty in coordinating surgical teams, prolonged surgical duration, and unpredictable intraoperative bleeding and hemodynamic fluctuations. This study found that the incidence of perioperative adverse events in this group was as high as 38.9%, significantly higher than in the other two groups ($P=0.063$). Although not statistically significant, this result still has important clinical implications, suggesting that clinical indications should be carefully selected. Several studies have reservations about the concept of simultaneous surgery. Existing research has shown that patients undergoing simultaneous EVAR+CABG have a higher risk of intraoperative complications, particularly a significant increase in respiratory and renal-related events^[18]. Additionally, previous studies analyzing postoperative outcomes of simultaneous CABG+EVAR patients found a significant increase in pulmonary infection rates and postoperative reintubation rates^[21]. Long-term follow-up also did not show any significant advantage in major endpoint events for the simultaneous surgery group, consistent with the findings of this study^[22]. Notably, the prevalence of hyperlipidemia in this group was as high as 61.1%, significantly higher than in the other two groups ($P=0.006$), suggesting that hyperlipidemia patients may have more complex coronary artery disease and higher-risk aortic lesions, potentially increasing the risk of perioperative complications^[23].

In this study, we employed Kaplan-Meier survival analysis and Cox proportional hazards models to assess the relationship between the sequence of surgical procedures and the primary endpoint events. The results indicated no significant difference in the cumulative risk of primary endpoint events across different surgical timings ($P=0.984$), suggesting that the sequence of EVAR and CABG is

not a determinant of long-term prognosis. Cox multivariate regression analysis identified several independent risk factors. After controlling for confounding variables such as gender, age, LVEF, GFR, and medical history, the number of coronary artery bypass grafts ≥ 2 was confirmed as a significant protective factor (HR=0.337, 95% CI: 0.140–0.814, P=0.016). This finding suggests that complete revascularization is crucial for improving long-term myocardial perfusion and reducing adverse events. Previous studies support this view, indicating that complete revascularization can reduce the incidence of MACE within one year post-surgery in patients with multivessel disease. Compared to single-vessel revascularization, patients with ≥ 2 vessel bypasses showed better outcomes in terms of 5-year MACE and mortality rates ^[24].

Additionally, complications during hospitalization significantly increased the risk of primary endpoint events (HR=2.255, 95% CI: 0.985–5.159, P=0.054). Although the P-value slightly exceeded the significance threshold, its clinical importance cannot be overlooked. Perioperative complications, such as postoperative infections, acute kidney injury, and acute heart failure, have been repeatedly confirmed as independent risk factors for long-term adverse events. For instance, recent large cohort studies have shown that perioperative arrhythmias (e.g., atrial fibrillation), postoperative infections, and acute kidney injury are closely associated with increased long-term all-cause mortality and cardiovascular adverse events ^[25]. Perioperative acute kidney injury is not only related to short-term in-hospital adverse events but also significantly increases the long-term risk of heart failure hospitalization and mortality ^[26]. This indicates that for high-risk patients undergoing combined EVAR and CABG surgery, intraoperative management and postoperative monitoring are equally, if not more, important. Therefore, optimizing perioperative management strategies is crucial. Enhancing preoperative assessment, meticulous intraoperative procedures, and close postoperative monitoring can effectively reduce the incidence of complications, thereby improving long-term patient outcomes ^[27].

This study provides clinical decision-making references for the timing strategies of combined EVAR and CABG, but it has the following limitations: First, issues of sample size and center bias. The study cohort was from a single large cardiovascular center, which may involve sample selection and surgeon experience interventions, and the retrospective design itself has inherent flaws. Second, the lack of postoperative compliance and lifestyle interventions, and insufficient control of secondary prevention factors for primary endpoint events after discharge. Based on these limitations, we propose the following recommendations for future research: Conduct prospective multicenter randomized controlled trials to verify the optimal timing for combined EVAR and CABG surgeries; develop AI-based risk assessment systems to support individualized decision-making; introduce patient-reported outcome measures to evaluate long-term quality of life; and advance the informatization and grassroots extension of the cardiovascular postoperative follow-up system.

In summary, the results of this study show that the sequence of elective EVAR combined with CABG under three different timing strategies did not significantly affect the incidence of primary endpoint events. However, the number of coronary artery bypass grafts, perioperative complications, and the quality of postoperative management are decisive for long-term prognosis. Therefore, in clinical practice, physicians should adopt individualized risk assessment strategies, carefully select candidates for concurrent surgeries, emphasize perioperative monitoring, ensure complete coronary revascularization, and implement long-term follow-up management to comprehensively enhance the survival quality and long-term prognosis of high-risk cardiovascular patients.

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References

- [1]Erbel, R., et al., 2014 ESC Guidelines on the diagnosis and treatment of aortic diseases: Document covering acute and chronic aortic diseases of the thoracic and abdominal aorta of the adult. The Task Force for the Diagnosis and Treatment of Aortic Diseases of the European Society of Cardiology (ESC). *Eur Heart J*, 2014. 35(41): p. 2873–926.
- [2]Hiratzka, L.F., et al., 2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM Guidelines for the diagnosis and management of patients with thoracic aortic disease. A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, American Association for Thoracic Surgery, American College of Radiology, American Stroke Association, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of Thoracic Surgeons, and Society for Vascular Medicine. *J Am Coll Cardiol*, 2010. 55(14): p. e27–e129.
- [3]Knuuti, J., et al., 2019 ESC Guidelines for the diagnosis and management of chronic coronary syndromes. *Eur Heart J*, 2020. 41(3): p. 407–477.
- [4]Neumann, F.J., et al., 2018 ESC/EACTS Guidelines on myocardial revascularization. *Eur Heart J*, 2019. 40(2): p. 87–165.
- [5]Greenhalgh, R.M., et al., Endovascular versus open repair of abdominal aortic aneurysm. *N Engl J Med*, 2010. 362(20): p. 1863–71.
- [6]Lederle, F.A., et al., Outcomes following endovascular vs open repair of abdominal aortic aneurysm: a randomized trial. *Jama*, 2009. 302(14): p. 1535–42.
- [7]Farkouh, M.E., et al., Strategies for multivessel revascularization in patients with diabetes. *N Engl J Med*, 2012. 367(25): p. 2375–84.
- [8]Head, S.J., et al., Mortality after coronary artery bypass grafting versus percutaneous coronary intervention with stenting for coronary artery disease: a pooled analysis of individual patient data. *Lancet*, 2018. 391(10124): p. 939–948.

- [9]Ascione, R., et al., One-stage coronary and abdominal aortic operation with or without cardiopulmonary bypass: early and midterm follow-up. *Ann Thorac Surg*, 2001. 72(3): p. 768–74; discussion 775.
- [10]Lang, Q., C. Qin, and W. Meng, Appropriate Timing of Coronary Artery Bypass Graft Surgery for Acute Myocardial Infarction Patients: A Meta-Analysis. *Front Cardiovasc Med*, 2022. 9: p. 794925.
- [11]Field, M.L., et al., Combined cardiac surgery and endovascular repair of abdominal aortic aneurysms. *J Endovasc Ther*, 2013. 20(3): p. 345–9.
- [12]Gaudino, M., et al., Off-Pump Coronary Artery Bypass Grafting: 30 Years of Debate. *J Am Heart Assoc*, 2018. 7(16): p. e009934.
- [13]Shales, S., et al., Timing of coronary artery bypass grafting after acute myocardial infarction: does it influence outcomes? *Kardiologia i Torakochirurgia Polska = Polish Journal of Cardio-Thoracic Surgery*, 2021. 18: p. 27–32.
- [14]Antiochos, P., et al., Evaluation of Stress Cardiac Magnetic Resonance Imaging in Risk Reclassification of Patients With Suspected Coronary Artery Disease. *JAMA Cardiol*, 2020. 5(12): p. 1401–1409.
- [15]Herrington, W., et al., Epidemiology of Atherosclerosis and the Potential to Reduce the Global Burden of Atherothrombotic Disease. *Circ Res*, 2016. 118(4): p. 535–46.
- [16]Van Belle, E., et al., Meta-Analysis of Abdominal Aortic Aneurysm in Patients With Coronary Artery Disease. *The American journal of cardiology*, 2015. 116 9: p. 1451–1456.
- [17]Upchurch, G.R., Jr., et al., Society for Vascular Surgery clinical practice guidelines of thoracic endovascular aortic repair for descending thoracic aortic aneurysms. *J Vasc Surg*, 2021. 73(1s): p. 55s–83s.
- [18]Cappiello, A., et al., Simultaneous versus staged approach in transcatheter aortic valve implantation for severe stenosis and endovascular aortic repair for thoracic and abdominal aortic aneurysm. *European Journal of Cardio-Thoracic Surgery*, 2024. 66.
- [19]Jung, J.C. and K.-H. Park, Coronary artery disease in aortic aneurysm and dissection. *Indian Journal of Thoracic and Cardiovascular Surgery*, 2021. 38: p. 115–121.
- [20]Chang, Q., et al., Simultaneous endovascular aortic repair and coronary artery bypass grafting. *Chinese Journal of Thoracic and Cardiovascular Surgery*, 2017. 33: p. 338–342.
- [21]Scali, S.T., et al., Outcomes after endovascular aneurysm repair conversion and primary aortic repair for urgent and emergency indications in the Society for Vascular Surgery Vascular Quality Initiative. *J Vasc Surg*, 2016. 64(2): p. 338–347.
- [22]Diender, E., et al., Major adverse cardiac events after elective infrarenal endovascular aortic aneurysm repair. *J Vasc Surg*, 2022. 76(6): p. 1527–1536.e3.
- [23]Kulik, A., et al., Intensive versus moderate statin therapy and early graft occlusion after coronary bypass surgery: The Aggressive Cholesterol Therapy to Inhibit Vein Graft Events randomized clinical trial. *J Thorac Cardiovasc Surg*, 2019. 157(1): p. 151–161.e1.
- [24]Alfonso, F., et al., Complete revascularization for patients with multivessel coronary artery disease and ST-segment elevation myocardial infarction after the COMPLETE trial: A meta-analysis of randomized controlled trials. *International Journal of Cardiology. Heart & Vasculture*, 2020. 29.
- [25]Korsgaard, S., et al., Long-Term Outcomes of Perioperative Versus Nonoperative Myocardial Infarction: A Danish Population-Based Cohort Study (2000-2016). *Circ Cardiovasc Qual Outcomes*, 2022. 15(7): p. e008212.
- [26]Steiner, L., et al., Acute kidney injury as a risk factor for heart failure hospitalisation after major non-cardiac surgery. *European Heart Journal*, 2024.
- [27]Vershina, E. and A. Repin, predictors of long-term fatal cardiovascular events after planned percutaneous coronary interventions. *Russian Journal of Cardiology*, 2018.