**Discussion**

This study compared postoperative outcomes between minimally invasive direct coronary artery bypass (MIDCAB) and full sternotomy CABG in patients with multi-vessel coronary artery disease (CAD). Our findings indicate that, while some intraoperative and postoperative parameters differed significantly between the two groups, both surgical approaches showed comparable efficacy regarding major outcomes, including ICU stay, total hospital stay, and incidence of major complications such as blood loss exceeding 1000 ml without reoperation and stroke.

Both groups had a similar prevalence of chronic conditions, such as diabetes and hypertension, known to influence surgical outcomes. The matching process minimized bias from these factors, allowing a more direct comparison of the surgical approaches. Interestingly, the MIDCAB group exhibited a higher prevalence of stenosis in the first obtuse marginal branch. This suggests that MIDCAB may be a favorable choice in cases involving this vessel, offering sufficient revascularization even with limited exposure. Additionally, right coronary artery stenosis was notably higher in sternotomy patients, though this difference approached but did not reach statistical significance. MIDCAB is often preferred for specific vessel involvements, particularly when the left anterior descending (LAD) artery is affected, due to the LAD's accessibility via a left anterior thoracotomy, allowing effective revascularization with limited exposure (1).

No significant difference in surgery duration was observed between the MIDCAB and full sternotomy CABG groups, possibly reflecting advancements in minimally invasive techniques. However, the significantly higher postoperative serum creatinine levels in the full sternotomy group suggest increased renal stress associated with the more invasive approach. This renal stress could be attributed to factors such as the greater blood loss observed in sternotomy cases, necessitating higher fluid and blood product replacement, which may impact renal function. A retrospective cohort study by Sellin et al. (2) with propensity score matching found no difference in renal outcomes between the two groups, corroborating prior studies that highlight an increased bleeding risk with sternotomy, potentially exacerbating postoperative renal impairment.

Postoperative arterial blood gas (ABG) analysis during ICU admission showed notable differences between groups, with higher pH levels in the MIDCAB group (p = 0.002) and elevated lactate levels in the full sternotomy CABG group. These findings suggest that minimally invasive approaches may reduce metabolic stress, enhancing recovery and minimizing complications associated with the body's metabolic response to surgery. Elevated lactate in sternotomy cases may indicate a higher metabolic burden due to prolonged tissue manipulation or ischemia from the larger incision. Kilger et al. (3) similarly found higher lactic acid levels in the full sternotomy group, supporting our results.

These findings support MIDCAB as a viable alternative to full sternotomy CABG for selected patients with multi-vessel CAD, particularly those at higher risk for renal or respiratory complications. The reduced invasiveness of MIDCAB may offer quicker recovery times and potentially lower certain postoperative risks. Future research should evaluate long-term outcomes, such as graft patency and quality of life, to further clarify the benefits and limitations of MIDCAB compared to traditional CABG. Additionally, exploring MIDCAB's applicability in more anatomically complex cases could expand its potential use for multi-vessel disease.

This study's retrospective design and relatively small sample size may limit the generalizability of our findings. Larger prospective studies are warranted to confirm these results and explore outcomes across diverse patient subgroups. Additionally, variations in surgical technique or operator experience were not controlled in this study, which could influence results and may warrant further investigation.

**Conclusion**

In conclusion, MIDCAB appears to be a promising alternative to full sternotomy CABG, particularly for multi-vessel CAD patients whose anatomical and clinical profiles align with minimally invasive approaches. Both methods provide effective revascularization, though MIDCAB may reduce certain postoperative risks, especially in patients with renal vulnerabilities and a lower risk of bleeding.

**References**

1. Van Praet KM, Kofler M, Shafti TZN, et al. Minimally invasive coronary revascularization surgery: a focused review of the available literature. Interventional Cardiology Review. 2021;16.
2. Sellin C, Laube S, Demianenko V, Balan R, Dörge H, Benoehr P. Renal Outcome in Patients Undergoing Minimally Invasive Total Coronary Revascularization via Anterior Minithoracotomy Compared to Full Median Sternotomy Coronary Artery Bypass Grafting. Journal of Clinical Medicine. 2024;13(18):5418.
3. Kilger E, Pichler B, Weis F, et al. Markers of myocardial ischemia after minimally invasive and conventional coronary operation. The Annals of Thoracic Surgery. 2000;70(6):2023-2028.