CASE REPORT

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Successful Coronary Artery Bypass Surgery in a Patient with Situs Inversus Totalis

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What is known on this subject?

Situs inversus totalis and dextrocardia are rare congenital conditions characterized by a mirror-image arrangement of thoracic and abdominal organs. Although coronary artery disease may occur with a similar frequency as in the general population, cardiac surgical procedures—particularly coronary artery bypass grafting (CABG)—pose technical challenges due to reversed anatomical orientation. Previous reports have demonstrated that CABG can be performed safely in these patients; however, modifications in surgical positioning, conduit selection, and operative strategy are often required to accommodate the mirrored anatomy.

What this study adds?

This case report demonstrates that successful CABG can be achieved in a patient with situs inversus totalis and dextrocardia through meticulous preoperative planning and intraoperative adaptation. The surgeon's positioning on the left side, tailored cannulation strategy, and the use of the right internal mammary artery for left anterior descending artery revascularization highlight practical technical considerations. This report contributes to the limited literature by emphasizing that standardized cardiopulmonary bypass setup may be preserved while adapting the surgical approach, ultimately leading to favorable clinical outcomes.

ABSTRACT

Dextrocardia and situs inversus totalis are rare congenital anomalies that pose unique technical challenges in cardiac surgery. We report a successful coronary artery bypass grafting in a 58-year-old male patient with dextrocardia and situs inversus totalis who presented with chest pain and multiple cardiovascular risk factors. Coronary angiography demonstrated a right-dominant coronary circulation, with a tubular 90% stenosis in the mid-segment of the left anterior descending (LAD) artery and an 80% focal lesion in the obtuse marginal 1 (OM1) branch of the circumflex artery. Preoperative transthoracic echocardiography revealed preserved left ventricular systolic function (ejection fraction: 55–60%) without significant valvular pathology. Due to the mirror-image anatomy, the surgeon was positioned on the left side of the patient, while the cardiopulmonary bypass machine remained in its conventional position. Cannulation was performed on the patient's right side. The right internal mammary artery was anastomosed to the right-sided LAD, and a saphenous vein graft was used for the OM1 branch. The operation was completed without intraoperative complications. The postoperative course was uneventful, and follow-up echocardiography confirmed preserved ventricular function. This case highlights that detailed preoperative planning, appropriate graft selection, and intraoperative adaptation to anatomical variations are essential for achieving successful outcomes in patients with dextrocardia and situs inversus totalis.

Keywords: Dextrocardia, situs inversus, coronary artery bypass grafting, cardiac surgery, rare case

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Introduction

Dextrocardia is a rare congenital anomaly characterized by placement of the heart in the right hemithorax. This condition may occur in isolation, but it is more commonly associated with situs inversus totalis. Situs inversus refers to the mirror-image reversal of internal organ positioning. When accompanied by dextrocardia, it is termed situs inversus totalis, with a reported prevalence of approximately 0.01–0.02% in the general population (1). These anatomical variations are usually asymptomatic and are often incidentally detected during radiological examinations performed for other reasons. However, when coronary artery disease (CAD) develops in these patients, the diagnostic and therapeutic processes can become considerably complex (2). In patients with dextrocardia and situs inversus, the orientation of the coronary arteries, the position of the heart, and the surgical access routes are completely altered, posing significant technical challenges, particularly during coronary artery bypass grafting (CABG) procedures (3). Essential surgical strategies—including the surgeon's position, graft selection, and placement of the cardiopulmonary bypass machine—must be carefully planned and adapted, differing from those used in routine cases (4). Moreover, due to the reversed vascular anatomy, the use of the internal mammary artery requires specific modifications. Although the literature on surgical management of such cases is limited, most reports describe successful outcomes despite the technical difficulties encountered (5). Herein, we present a case of successful coronary bypass surgery for CAD in a patient with dextrocardia and situs inversus totalis and provide a detailed discussion of the unique aspects of the surgical approach.

Case Report

Informed consent was secured from the patient for the publication of this case and the accompanying images.

A 58-year-old male presented to the emergency department with chest pain. His medical history included hypertension, type 2 diabetes mellitus, and a previous cerebrovascular event. On physical examination, heart sounds were auscultated over the right side of the chest. Electrocardiography (ECG) demonstrated findings consistent with dextrocardia using standard lead placement, and appropriate right-sided lead placement confirmed the diagnosis. Chest radiography and thoracic computed tomography revealed dextrocardia and situs inversus totalis. Preoperative transthoracic echocardiography demonstrated preserved left ventricular systolic function with an ejection fraction of 55–60%, without significant valvular disease or structural abnormalities.

Coronary angiography showed a right-dominant coronary system with a tubular 90% stenosis in the mid-LAD and an 80% focal stenosis in the obtuse marginal 1 (OM1) branch of the circumflex artery (Figure 1). Elective CABG was planned. The operating room setup was modified according to the patient's mirror-image anatomy. The primary surgeon stood on the left side of the patient, while the cardiopulmonary bypass (CPB) machine remained in its routine position on the opposite side. Following median sternotomy, the heart was confirmed to be located in the right hemithorax with reversed vascular orientation (Figure 2). The right internal mammary

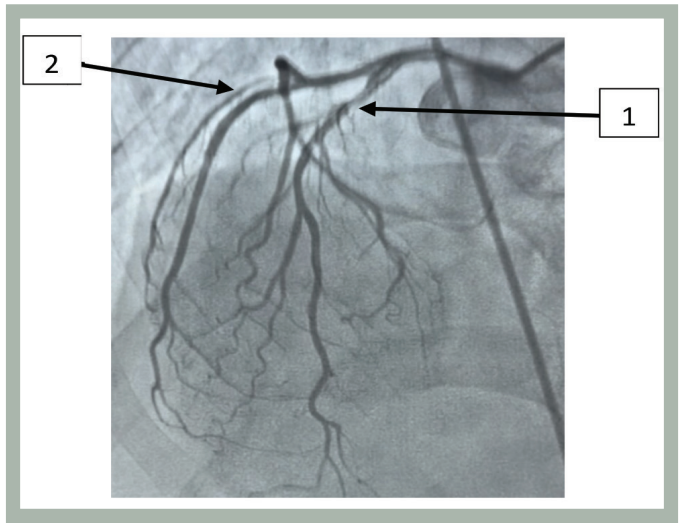

Figure 1. Coronary angiography showed a right-dominant coronary system, with a tubular 90% stenosis in the mid-LAD (1) and an 80% focal stenosis in the OM1 (2) branch of the circumflex artery
LAD: Left anterior descending, OM1: Obtuse marginal 1

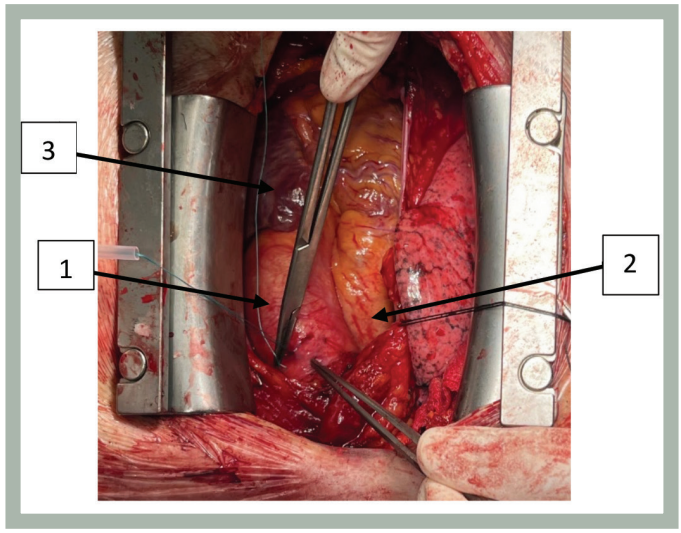

Figure 2. Cardiac exploration. The primary assistant is positioned on the patient's right side. The heart is located in the right hemithorax, and the vessels are in reversed positions. 1) Ascending aorta, (2) pulmonary trunk, (3) left atrial appendage

artery (RIMA) and a saphenous vein graft were harvested. Cannulation of the aorta and right atrium was performed via the patient's right side, consistent with the surgeon's usual technique. After the patient was repositioned to the left side, CPB was initiated. Mild hypothermia (32 °C) was achieved. Aortic cross-clamping and antegrade blood cardioplegia were applied. One of the main intraoperative challenges was the mirror-image anatomy, which required adaptation in hand movements and spatial orientation. Standard surgical maneuvers became less intuitive, particularly during distal anastomoses. Given that the left anterior descending (LAD) was located on the right side, the RIMA was selected for grafting to ensure a tension-free and anatomically appropriate conduit. The OM1 branch was bypassed using a saphenous vein graft. Distal anastomoses were performed with 7/0 polypropylene sutures. During rewarming, the aortic cross-clamp was removed, and the proximal anastomosis of the vein graft to the aorta was completed (Figure 3). CPB and cross-clamp times were 61 and 42 minutes, respectively. No intraoperative complications occurred. The postoperative course was uneventful. Follow-up echocardiography confirmed preserved ventricular function with no new wall motion abnormalities. The patient was discharged on postoperative day 7.

Discussion

CABG in patients with dextrocardia and situs inversus totalis presents unique technical challenges due to mirror-image anatomy. One of the most critical aspects is the positioning of the surgeon (2). While conventional CABG is performed with the surgeon on the patient's right side, a left-sided position provides better exposure and ergonomic comfort in these cases.

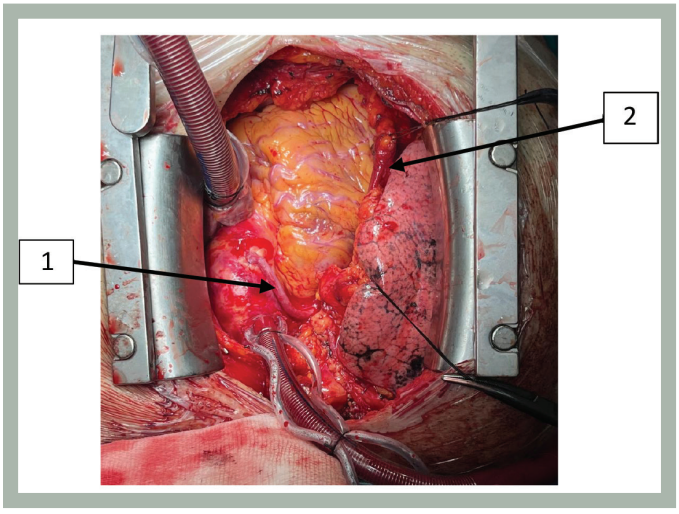

Figure 3. Intraoperative image after completion of the RIMA and saphenous vein anastomoses. 1) Saphenous vein graft, (2) RIMA graft
RIMA: Right internal mammary artery

In our case, positioning the surgeon on the left side improved visualization of coronary targets and reduced technical difficulty during anastomosis. The CPB machine was kept in its standard position to maintain familiarity for the perfusion team (3).

The mirror-image orientation also introduces intraoperative challenges. Hand-eye coordination and spatial perception must be adapted, as routine movements may become counterintuitive. This is particularly relevant during distal anastomoses.

Graft selection is another important consideration. Although the left internal mammary artery (LIMA) is generally preferred for LAD revascularization due to its superior long-term patency, the right-sided location of the LAD in this case made the RIMA a more suitable option. The use of RIMA allowed a shorter, tension-free graft with favorable geometry, which may contribute to long-term patency (5).

From an anesthetic perspective, dextrocardia requires modifications to ECG lead placement and careful interpretation of intraoperative monitoring. In addition, central venous catheterization and transesophageal echocardiography require awareness of reversed anatomy.

Postoperative outcomes in such cases are generally favorable with appropriate planning. In our patient, early postoperative echocardiography confirmed preserved ventricular function and the absence of complications.

Previous reports have described various strategies for CABG in dextrocardia. Some surgeons maintain their conventional position, while others adopt a mirrored approach (Figure 4). Similarly, both LIMA and RIMA grafts have been used

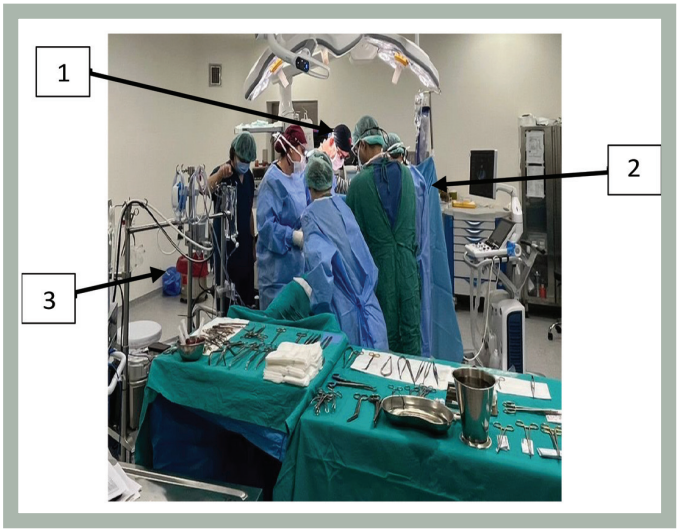

Figure 4. Intraoperative image. The primary surgeon (1) is positioned on the left side of the operating table, the primary assistant (2) is positioned on the right side, and the cardiopulmonary bypass machine (3) is on the routine right side of the table

successfully. Our approach aligns with reports suggesting that left-sided surgeon positioning and the use of RIMA for right-sided LAD provide optimal surgical conditions.

Conclusion

Dextrocardia and situs inversus totalis are rare conditions that require unique technical planning for coronary artery surgery. This case highlights the critical importance of thorough preoperative preparation and intraoperative adaptation by the surgical team in overcoming technical challenges. The successful operation and smooth postoperative recovery of the patient demonstrate that appropriate strategies and effective team coordination are key factors in managing such complex cases.

Ethics

Informed Consent: Written informed consent was obtained from the patient.

Footnotes

Authorship Contributions

Surgical and Medical Practices: Z.G., O.T., E.A., Concept: Z.G., C.K., E.A., Design: Z.G., O.T., C.K., E.A., Data Collection or Processing: Z.G., O.T., C.K., E.A., Analysis or Interpretation: Z.G., O.T., C.K., E.A., Literature Search: Z.G., C.K., E.A., Writing: Z.G., O.T., C.K., E.A.

Conflict of Interest: No conflict of interest was declared by the authors.

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