

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

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Abstract

Dextrocardia and situs inversus totalis are rare congenital anomalies that present technical challenges in cardiac surgery. We report a successful coronary artery bypass grafting procedure in a 58-year-old male patient with dextrocardia and situs inversus totalis, who presented with chest pain and had known cardiovascular risk factors. Coronary angiography revealed critical stenoses in the left anterior descending (LAD) artery and the obtuse marginal I (OMI) branch of the circumflex artery. Due to the patient's mirror-image anatomy, the surgeon was positioned on the left side of the table, while the cardiopulmonary bypass machine was placed in its routine position facing the surgeon. Cannulation was performed from the patient's right side, in line with the surgeon's dominant hand. The right internal mammary artery was grafted to the LAD, and a saphenous vein graft was used for the OMI branch. The operation and post-operative course were uneventful, and the patient was discharged successfully. This case highlights that, despite anatomical challenges, careful surgical planning and effective team coordination can lead to favorable outcomes in patients with rare variations such as dextrocardia and situs inversus totalis.

Keywords: Cardiac surgery; coronary artery bypass grafting; dextrocardia; rare case; situs inversus.

Situs Inversus Totalisli Bir Hastada Başarıyla Uygulanan Koroner Arter Bypass Cerrahisi

Özet

Dextrokardi ve situs inversus totalis, kardiyak cerrahide teknik zorluklara yol açabilen nadir konjenital anomalilerdir. Bu olgu sunumunda, bilinen kardiyovasküler risk faktörleri bulunan ve göğüs ağrısı şikâyetiyle başvuran, dextrokardi ve situs inversus totalis tanılı 58 yaşındaki erkek hastaya uygulanan başarılı koroner arter bypass greftleme (CABG) cerrahisi sunulmaktadır. Koroner anjiyografide sol ön inen arterde (LAD) ve sirkumfleks (CX) arterin obtus marginalis I (OMI) dalında ciddi darlık saptandı. Anatomik farklılıklar nedeniyle cerrah ameliyat masasının sol tarafına, kardiyopulmoner bypass (KPB) makinesi ise alışıldığı şekilde karşı tarafa konumlandırıldı. Kanülasyon, cerrahın el alışkanlığına uygun olarak hastanın sağ tarafından gerçekleştirildi. Sağ tarafta yer alan LAD'ye sağ internal mammarian arter (RIMA), CX-OMI dalına ise safen ven grefti kullanılarak bypass uygulandı. Ameliyat ve postoperatif dönem sorunsuz seyretti ve hasta başarılı bir şekilde taburcu edildi. Bu olgu, nadir görülen anatomik varyasyonlarda uygun cerrahi planlama ve ekip koordinasyonunun başarılı sonuçlar sağlayabileceğini göstermektedir.

Anahtar sözcükler: Kardiyak cerrahi; koroner arter bypass greftleme; dextrokardi; nadir olgu; situs inversus.

Introduction

Dextrocardia is a rare congenital anomaly characterized by the heart's location 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 the internal organs. When accompanied by dextrocardia, the condition is referred to as situs inversus totalis, with a reported prevalence of approximately 0.01–0.02% in the general population.^[1]

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These anatomical variations are usually asymptomatic and are often detected incidentally during radiological examinations performed for unrelated reasons. However, when coronary artery disease (CAD) develops in these patients, the diagnostic and therapeutic processes become considerably more challenging.^[2]

In patients with dextrocardia and situs inversus totalis, 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).^[3]

Essential surgical strategies, including the surgeon's position, graft selection, and the placement of the cardiopulmonary bypass (CPB) machine, must be carefully planned and adapted, as they differ from those used in patients with normal anatomy.^[4]

Moreover, due to the reversed vascular anatomy, the use of the internal mammary artery requires specific technical modifications. Although the literature on the surgical management of such cases is limited, most reports describe successful outcomes despite the technical difficulties encountered.^[5]

Herein, we present the successful surgical management of CAD in a patient with dextrocardia and situs inversus totalis who underwent CABG. We also discuss the unique anatomical and technical considerations of the surgical approach.

Case Report

The patient gives consent to the use of information about him in relation to the above topic for the purpose of display in a journal article or mature presentation or for the presentation of a thesis.

A 58-year-old male presented to the emergency department with complaints of chest pain. His medical history was significant for hypertension, type 2 diabetes mellitus, and a previous cerebrovascular event. On physical examination, heart sounds were heard predominantly over the right hemithorax. Electrocardiography revealed findings consistent with dextrocardia using right-sided precordial leads.

Chest radiography and thoracic computed tomography confirmed dextrocardia with situs inversus totalis by demonstrating a right-sided cardiac apex and a mirror-image arrangement of the thoracic and abdominal organs (Fig. 1). Transthoracic echocardiography demonstrated normal left ventricular systolic function with a left ventricular ejection fraction of 55%. No valvular pathology or valvular insufficiency was detected.

Coronary angiography revealed approximately 90% stenosis of the left anterior descending artery (LAD) and 80% stenosis of the first obtuse marginal (OM1) branch of the left circumflex artery (LCx). Based on these findings, elective CABG was planned.

After completion of the pre-operative evaluation, the patient was transferred to the operating room. The surgical setup was modified according to the patient's mirror-image anatomy; the primary surgeon was positioned on the left side of the operating table, instead of the conventional right side. However, the CPB machine remained in its usual place, opposite the surgeon on the right side of the table. Standard cannulation tubing lengths were maintained.

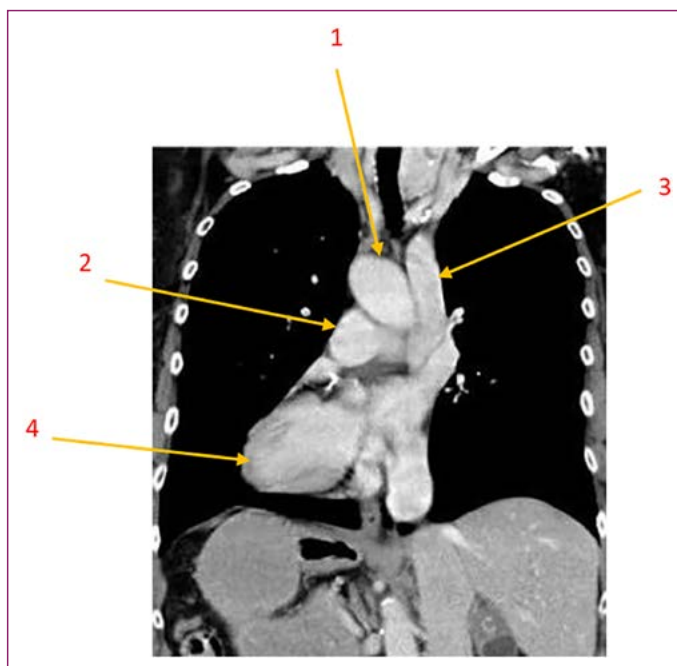


Figure 1. Thoracic computed tomography demonstrating dextrocardia and situs inversus totalis. The arrows indicate: (1) aorta, (2) pulmonary trunk, (3) inferior vena cava, and (4) right-sided cardiac apex.

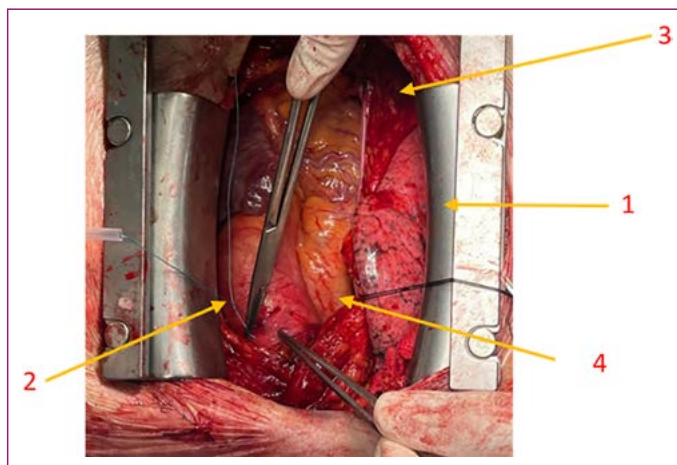


Figure 2. Cardiac exploration. The primary assistant is positioned on the patient's right side. The heart is located in the right hemithorax, and the vessels are in reversed positions. Intraoperative photograph demonstrating the mirror-image cardiac anatomy in a patient with situs inversus totalis. The arrows indicate: (1) right internal mammary artery (left internal mammary artery) located on the left side, (2) ascending aorta, (3) right-sided cardiac apex, and (4) pulmonary trunk.

Median sternotomy confirmed the heart's location in the right hemithorax, and the mirror-image orientation of the great vessels (Fig. 2). The saphenous vein graft and the right internal mammary artery (RIMA) were harvested. Cannulation of the ascending aorta and right atrium was performed with the surgeon positioned on the patient's right side, consistent with the standard technique. Subsequently, the surgeon moved to the left side, and CPB was initiated. Mild hypothermia was induced by cooling the patient to 32°C. Aortic cross-clamping was applied, and antegrade blood cardioplegia was administered.

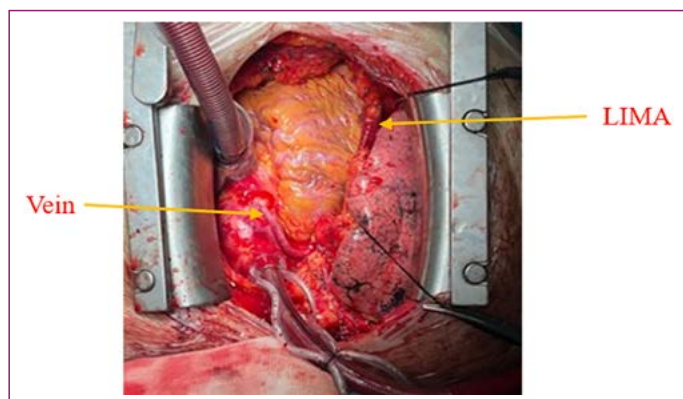


Figure 3. Intraoperative image after completion of the left internal mammary artery and saphenous vein anastomoses.

Because the LAD was located on the right side, the RIMA was selected instead of the left internal mammary artery (LIMA) for revascularization of the LAD. The OMI branch of the LCx was bypassed using a saphenous vein graft. Distal anastomoses were performed using 7–0 polypropylene sutures. During the rewarming phase, the aortic cross-clamp was removed, and the proximal anastomosis of the saphenous vein graft to the ascending aorta was completed (Fig. 3).

CPB and aortic cross-clamp times were 61 min and 42 min, respectively. No intraoperative complications occurred. The post-operative course was uneventful, and the patient was discharged in good condition on post-operative day 7.

Discussion

Dextrocardia and situs inversus totalis are rare congenital anomalies characterized by the mirror-image reversal of internal organs. The incidence of situs inversus totalis in the general population is reported to be approximately 0.01–0.02%.^[1] In this condition, the heart is located in the right hemithorax with the cardiac apex pointing to the right. The reversed anatomical arrangement in patients with dextrocardia poses significant diagnostic and surgical challenges. Awareness of these anomalies is especially critical during surgical revascularization procedures for CAD.^[2] CABG in patients with situs inversus and dextrocardia presents unique technical difficulties. One of the most important considerations is the positioning of the surgeon and the CPB machine during the operation.^[3] While the primary surgeon typically stands on the patient's right side in normal anatomy, in these patients, the surgeon is positioned on the left side of the table – opposite to the usual – due to the heart's right-sided location. This arrangement provides the surgeon with a more ergonomic working field, while the CPB machine remains in its conventional location opposite the surgeon on the right side of the table. This approach optimizes the surgeon's access to the heart while maintaining familiar machine setup for the CPB technician. Although this positioning strategy is infrequently reported in the literature, it is important for surgical comfort and success.^[3]

Due to the mirror-image orientation of the vessels, graft selection was also modified during surgical planning. While the LIMA is typically preferred for grafting the LAD artery, in this case,

the LAD was located on the right side; therefore, the RIMA was used. In addition, a saphenous vein graft was applied to the CX OMI branch. No complications occurred during the entire surgical procedure, and the post-operative course was uneventful.

Various surgical planning approaches have been reported in the literature for CABG in patients with dextrocardia and situs inversus totalis. Some studies describe the surgeon maintaining the standard right-sided position based on their dominant hand preference, using additional retractor systems or tilting the operating table to optimize cardiac exposure.^[4] Others report that the surgeon's position on the left side of the table allows direct access to the heart located in the right hemithorax, providing a more ergonomic technique.^[5] In our case, the surgeon was positioned on the left side to facilitate easier visualization of coronary targets and safer anastomoses. The CPB machine was kept in its usual place opposite the surgeon to preserve team coordination. Moreover, the use of the RIMA graft instead of LIMA, due to the right-sided location of the LAD, enhanced anatomical compatibility. This approach improved both surgical comfort and procedural safety, resulting in a successful outcome.

Reports on surgical revascularization in patients with dextrocardia and situs inversus complicated by CAD remain scarce. Most of these cases emphasize surgical difficulties, particularly the necessity for surgeons to adapt to an unfamiliar anatomical orientation.^[5] Some publications note the preference for RIMA over LIMA, and in certain instances, the use of bilateral internal mammary arteries. Our case is significant as it demonstrates the successful CABG surgery in a patient with the rare anomaly of situs inversus totalis. Furthermore, technical details such as surgical equipment positioning and graft selection are critical considerations in the management of such cases.

Conclusion

The presence of dextrocardia and situs inversus totalis represents rare conditions that require unique technical planning in 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 post-operative recovery of the patient demonstrate that appropriate strategies and effective team coordination are key factors in managing such complex cases.

Disclosures

Ethics Committee Approval: This is a single case report, and therefore ethics committee approval was not required in accordance with institutional policies.

Informed Consent: The patient gives consent to the use of information about him in relation to the above topic for the purpose of display in a journal article or mature presentation or for the presentation of a thesis.

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