

# Dextrocardia with Situs Inversus Totalis: Off-Pump Coronary Bypass Surgery in a 63-Year-Old Male Patient

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## ABSTRACT

Dextrocardia is a rare cardiac disorder in which the heart is located in the right hemithorax, and the apex axis is oriented to the right. Dextrocardia with situs inversus totalis can manifest primary ciliary dyskinesia (Kartagener syndrome) caused by DNAI1 and DNAH5 gene mutations. Coronary artery bypass grafting (CABG) in patients with dextrocardia (right side) is more challenging than in patients with levocardia (left side). This article represents a case of off-pump CABG surgery in a 63-year-old male patient.

**Keywords:** Dextrocardia; off-pump coronary surgery; situs inversus totalis.

## INTRODUCTION

**D**extrocardia with situs inversus is characterized by abnormal position of the heart (dextrocardia) and abdominal organs. In people with dextrocardia, the heart points to the right side of the chest instead of the left.<sup>1</sup> Situs inversus totalis is a mirror image inversion of the organs in the thoracic and abdominal cavities. A small percentage of affected individuals also have congenital heart defects such as transposition of the great vessels. Dextrocardia with situs inversus may also be associated with primary ciliary dyskinesia (also known as Kartagener syndrome).<sup>2</sup>

Coronary artery bypass grafting (CABG), particularly off-pump CABG, is challenging for cardiac surgeons in patients with dextrocardia because of the location of the heart and magistral vessels. This article describes the case of a patient with dextrocardia and situs inversus totalis who underwent an off-pump coronary artery bypass graft (CABG) at the Department of Cardiovascular Surgery, Tbilisi Heart Center, Ltd., Georgia.

## CASE REPORT

A 63-year-old male patient with retrosternal chest pain at rest was admitted to the Cardiovascular Surgery Department. The patient had a history of angina pectoris and uncontrolled type 2 diabetes mellitus.

The specific ECG changes on admission, such as the inverted P wave in leads I, II, and aVL and the positive P wave in leads III, aVF, and aVR, were relevant to dextrocardia.

The chest radiograph (Fig.1) and echocardiography (together with septal hypokinesia and left ventricular

hypertrophy) confirmed the diagnosis. Situs inversus totalis was detected by an abdominal ultrasound.

**FIGURE 1.** The chest X-ray of 63-year-old male patient with dextrocardia

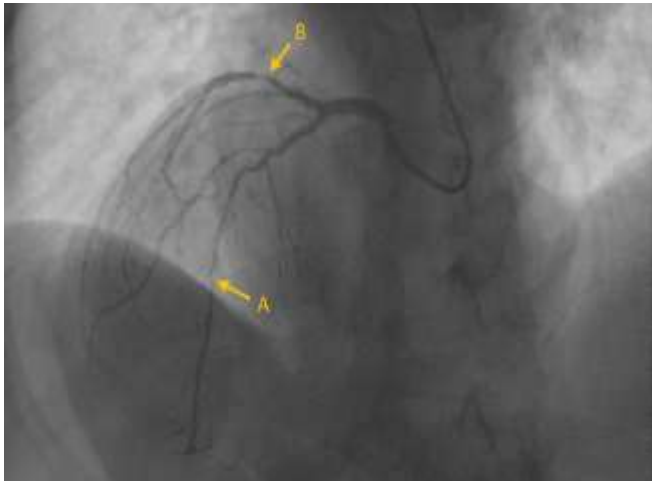


Laboratory test results were within normal limits, except for elevated cardiac troponin I. Based on the results of coronary angiography, which showed critical stenosis of the left anterior descending artery (LAD) (Fig.2A), the marginal branch of the circumflex artery (MCx) (Fig.2B), and the right coronary artery (RCA) (Fig.3), it was decided to perform an off-pump coronary artery bypass surgery.

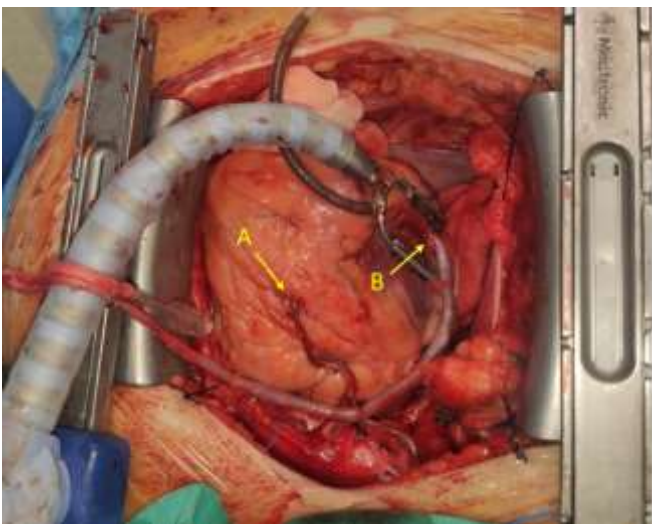


After a standard induction according to protocol, ECG leads were placed on the right side of the chest, with the patient lying on the right side due to dextrocardia. A median sternotomy with the opening of the pericardial cavity and harvesting of the right internal mammary artery (RIMA) was performed. RIMA was anastomosed with the left anterior descending artery (LAD) (Fig.4). The 35-cm-long great saphenous vein (SVG) graft was harvested from the left lower extremity and anastomosed to the median portion of the right coronary artery (Fig.5).

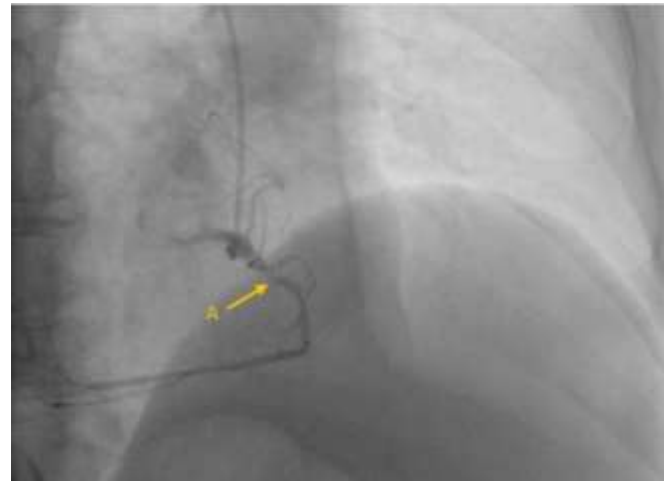
**FIGURE 2.** The coronary angiography images of a 63-year-old male patient with dextrocardia: A. Stenosis of the left anterior descending coronary artery (LAD); B. Stenosis of the marginal branch of the circumflex coronary artery (MCx)



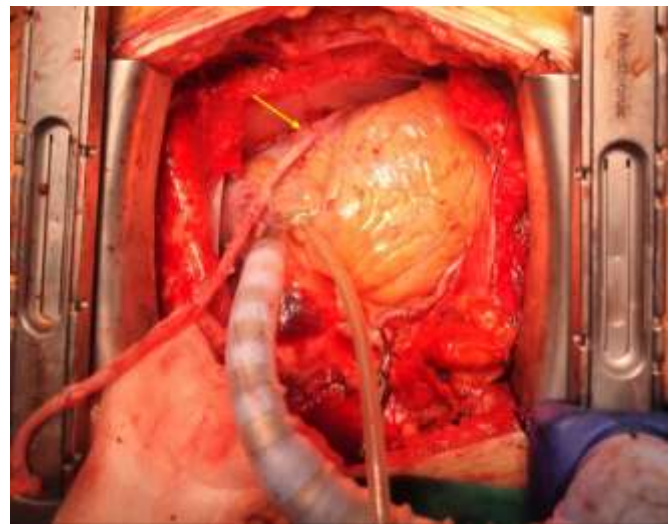
**FIGURE 4.** A. Distal anastomosis of the left coronary artery (LAD) and the right internal mammary artery (RIMA); B. Distal anastomosis of the marginal branch of the circumflex artery (MCx) and the great saphenous vein



**FIGURE 3.** The coronary angiography images of a 63-year-old male patient with dextrocardia: stenosis of the right coronary artery (RCA)



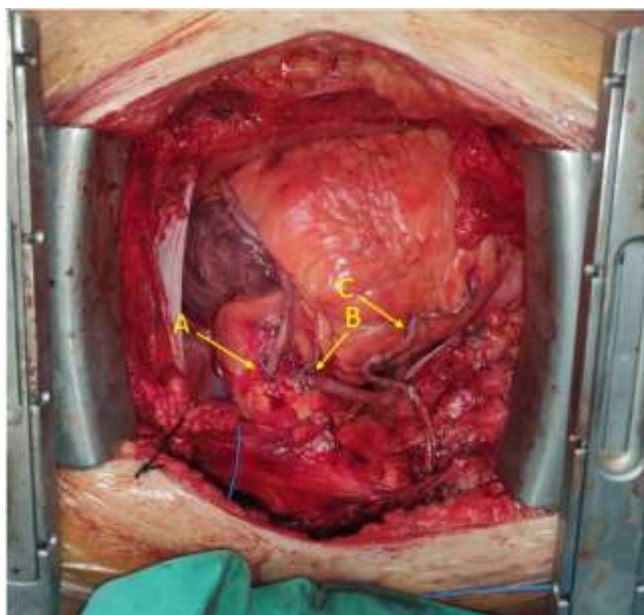
**FIGURE 5.** Distal anastomosis of the right coronary artery (RCA) and the great saphenous vein



Finally, the distal anastomosis was formed between the marginal branch of the circumflex artery (MCx) and the saphenous vein graft (SVG) (Fig.6). The two arteriovenous veins were sutured proximally to the aorta.

After successful surgery, the patient was transferred to the postoperative intensive care unit and extubated after four hours of mechanical ventilation.

**FIGURE 6.** A. Proximal anastomosis of the right coronary artery (RCA) and the great saphenous vein; B. Proximal anastomosis of the marginal branch of the circumflex artery (MCx) and the great saphenous vein; C. Right internal mammary artery (RIMA)



## DISCUSSION

The first case of dextrocardia was described by Hieronymus Fabricius in 1606, followed by the first description of situs inversus totalis in 1643 by Marco Aurelio Severinus.<sup>3</sup> The first CABG surgery on a dextrocardia patient was performed in 1980.<sup>4</sup>

Dextrocardia is a rare cardiac disorder in which the heart is located in the right hemithorax, and the apex axis is directed to the right. In some cases, dextrocardia with situs inversus totalis is a manifestation of primary ciliary dyskinesia (Kartagener syndrome), which can be caused by DNAI1 and DNAH5 gene mutations.

According to the epidemiological data, dextrocardia is 1 case per 12,000 pregnancies with no gender or ethnic differences.<sup>5</sup> Kartagener syndrome occurs on average in 1 in 30,000 live births. In contrast, situs inversus totalis occurs in about 50% of patients with primary ciliary dyskinesia. Isolated dextrocardia has been observed in 0.6% of patients with primary ciliary dyskinesia.<sup>6,7</sup>

Dextrocardia per se (also called isolated dextrocardia) is asymptomatic, whereas dextrocardia with situs inversus and Kartagener syndrome may present a variety of symptoms depending on the accompanying abnormalities.<sup>8-10</sup>

Symptoms may include cyanosis, dyspnea, failure to thrive, fatigue, jaundice, pallor, decreased exercise tolerance, recurrent infections of the sinuses or lungs, hydrocephalus, cardiac arrhythmias, conduction disorders (especially atrioventricular blocks), or intestinal obstruction.

Physical examination of a patient with dextrocardia may reveal cyanosis, clubbing, a marked apical impulse on the

right side of the chest, and readily audible heart sounds on the right side. The patient described above had none of the listed symptoms.

## CONCLUSION

Performing CABG in patients with dextrocardia (right-sided) is more complex than in patients with levocardia (left-sided) CABG. First, grafting from the left side may be uncomfortable for right-handed surgeons when performed from the right side. The LAD is located on the anterior side of the heart and does not pose a significant technical problem during grafting. Because of the location of the heart, surgeons should use the RIMA (right internal mammary artery). The left circumflex artery (CX) and right coronary artery (RCA) are located on the inferior and lateral surfaces of the heart. Orientation is challenging, and the heart is elevated from the right side. Placement of the tissue stabilizing device is also challenging.

The procedure in dextrocardia patients is comprehensive and can be successfully performed with extensive preoperative preparation and the necessary intraoperative and postoperative care.

## INFORMED PATIENT CONSENT

The authors acknowledge receiving all appropriate informed consent forms from the patient, permitting publication of images and other clinical information in this article. The patient was assured that his name and initials would not be published and that every effort would be made to conceal his identity.

## AUTHOR AFFILIATION

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