Double Valve Replacement In A Patient With Situs Inversus And Dextrocardia

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INTRODUCTION

Dextrocardia is a rare congenital anomaly in which the base-apex axis of the heart is directed towards the right, and caudally. This cardiac malposition can occur with situs solitus, situs inversus or situs ambiguous (1). The importance of diagnosing a situs anomaly in an adult is to prevent errors in surgical operations, emergency procedures or interventional operations. This anatomic malposition affects all technical aspects of cardiac surgery, from the establishment of cardiopulmonary bypass (CPB) to exposure of the valves. Surgeons require a prospective strategy for handling problems such as poor exposure of the cannulation site and diseased valve. The case is described of a patient with dextrocardia with situs inversus, illustrating the anatomic issues and operative considerations peculiar to aortic and mitral valve surgery in patients with this condition.

CASE REPORT

A 66-year-old male patient presented to our clinic with complaints of palpitation and dyspnea. His anamnesis was unremarkable and there was no surgical history. Atrial fibrillation with a ventricular rate of 88 beats per minute and counter clockwise rotation was detected by electrocardiography (ECG). Chest X-ray showed dextrocardia, and echocardiography revealed significant aortic valve stenosis and mitral valve insufficiency. Aortic and mitral valve surgery was recommended based on the current echocardiography and clinical findings. The ascending and arcus aorta and coronary arteries were found to be mirror image and also normal in the coronary angiography performed prior to surgery (Figure 1A and 1B). Abdominal tomography revealed an abdominal situs inversus (the liver on the left side of the abdomen, the spleen on the right and the inferior vena cava on the left of the aorta). Continuity of the inferior vena cava without any interruption and drainage into the right atrium located on the left side were noted.

Figure 1

(A) The ascending and arcus aorta and (B) coronary arteries were found to be mirror image in the coronary angiography.

Operative strategy and technique

The patient underwent double valve replacement via a standard median sternotomy. The heart was rotated and directed to the right along the horizontal plane, such that the left atrium was positioned anterior to the right atrium. The CPB was established by cannulating the ascending aorta, the superior vena cava, and the inferior vena cava (Figure 2A).
Moderate hypothermia was applied. Antegrade cold blood cardioplegia was administered intermittently with the removal of intraaortic air at each infusion to maintain cardiac arrest.

**Figure 2**
(A) Intraoperative view of dextrocardia with situs inversus. The left atrium was positioned anterior to the right atrium (B). Exposure of the mitral valve was via a left-sided left atriotomy.

Exposure of the mitral valve was accomplished readily via a left-sided left atriotomy. An incision made at the base of the left atrial appendage allowed a direct examination of the mitral valve. The mitral valve was exposed by placing retractor to the walls of the left atrium (Figure 2B). The mitral valve was rotated 900 from its normal position, such that the anterior leaflet was positioned on the right side, and the posterior leaflet on the left side. An examination of the mitral valve revealed rupture of the chordae tendineae at the posteromedial aspect of the posterior leaflet. Severe calcification as seen not only in the mitral annulus but also in the posterior leaflet; this would have made it very difficult to excise and repair the diseased portion of the leaflet. Consequently, the decision was taken to perform MVR rather than repair.

Following complete excision of the aortic and mitral valve leaflets, a 23 mm St. Jude Medical mechanical prosthesis was implanted in aortic position and, a 27 mm St. Jude Medical mechanical prosthesis was implanted in mitral position using 2-0 polyester everting mattress sutures. The patient was uneventfully weaned from CPB, without any conduction abnormalities. The total CPB time was 94 min, and the aortic cross-clamp time 77 min. The patient’s postoperative course was uncomplicated, and he was discharged from the hospital on post-operative day 9.

**DISCUSSION**

Dextrocardia, a rare cardiac malposition, is defined as positioning of the heart in the right hemithorax, with the apex pointing to the right, and was first described by Fabricius in 1606 (1). Dextrocardia may occur with atrial situs solitus, situs inversus, or situs ambiguous. Situs inversus totalis is a reverse isomeric form of the thoracic and abdominal viscera or complete mirror image. As in our case, the liver is located on the left and the stomach is on the right, the morphologic right atrium is on the left and the morphologic left atrium is on the right. This condition is also called visceroatrial concordance. Situs inversus totalis with dextrocardia is a congenital anomaly occurring with an incidence of 1 per 10000–50000 births (2).

As dextrocardia cases may be associated with additional risks due to cardiovascular anomalies, a detailed investigation is required. The possibility of anomalies in the inferior vena cava should definitely be examined since these patients may have an interruption of the inferior vena cava in the intrahepatic part and venous cannulation via the inferior vena cava is performed in patients undergoing open-heart surgery (2,3). We performed abdominal computerized tomography to search for an interruption of the inferior vena cava.

Open-heart surgery in patients with a cardiac position anomaly is technically demanding, and surgeons are required to make certain modifications to their normal surgical techniques when operating on patients with dextrocardia. Since the first report of coronary artery bypass grafting in patients with dextrocardia by Abensur et al. in 1988 (3), very few reports have been made of cardiac surgery on this type of patient. In cases of dextrocardia, it is difficult to initiate the CPB because both the vena cavae and the right atrium are situated more posteriorly than normal. Previously, St. Rammos et al. reported that they first established CPB through aortic and left common femoral venous cannulae, after which they added a superior vena cava cannula while the heart was empty (4). Some authors have recommended standing at the left side of the operating table, which not only provides an excellent exposure but also makes the procedure relatively easy (5).

On a routine basis, the left atrium is opened vertically from the right side, to expose the mitral valve. Normally, mitral valve exposure is achieved through an incision in the left atrium from the right side, or via a trans-septal approach. In the present patient with dextrocardia, the left-sided approach from the left atrium provided an excellent exposure of the mitral valve.

In conclusion, in patients with dextrocardia requiring cardiac surgery, it is important to consider the appropriate surgical strategy. The pathology has to be defined clearly during the preoperative period because operative problems may arise...
due to situs inversus. Proper surgical planning is necessary to prevent potential complications.

References
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