Abstract:
Dextrocardia is a rarely seen cardiac malposition, often associated with multiple and complex congenital cardiac anomalies. In this era of device closure of septal defects, atrial septal defects requiring surgical closure in dextrocardia with situs inversus is rare. Surgeons require a prospective strategy for handling problems such as adequacy of exposure for appropriate cannulation and difficulty in comprehending the intra cardiac anatomy due to the mirror imaging. Here we present a case of atrial septal defect with dextrocardia and situs inversus who had undergone the surgical closure of the same under bicaval cannulation. Femoral venous cannulation recommended by some authors is best avoided due to the possible variation in major venous anatomy. We also recommend that the operating surgeon stands on the left side of the patient to improve exposure.

Keyword: Cardiopulmonary bypass, Dextrocardia, Situs inversus, Atrial septal defect

INTRODUCTION:
Dextrocardia is a rare congenital anomaly in which the base-apex axis of the heart is directed towards the right and caudally (Figure 1). This cardiac malposition can occur with situs solitus, situs inversus or situs ambiguous. The importance of diagnosing the situs anomaly in an adult is to prevent errors in surgical operations, emergency procedures or interventional procedures. This anatomic malposition affects all
technical aspects of cardiac surgery, from the establishment of cardiopulmonary bypass (CPB) to exposure and repair of the defect. The case is described of a patient with dextrocardia and situs inversus, illustrating the anatomic issues and operative considerations peculiar to this type of atrial septal defect.

**CASE REPORT:**
A four year-old boy presented to our hospital with a history of accidental detection of an atrial septal defect.

![Image](image1.png)

**Figure 2: Chest x-ray showing dextrocardia**
Electrocardiogram showed a right ventricular hypertrophy and right axis deviation in the dextroposed heart. The echocardiogram revealed 28 mm atrial septal defect with left to right shunt, unsuitable for device closure because of the deficient inferior and aortic rims. Hence surgical closure of the defect was planned.

Abdominal sonography revealed an abdominal situs inversus with 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 of the same into the right atrium located on the left side were noted.

**THE OPERATIVE STRATEGY:**

The patient underwent atrial septal defect closure through a standard median sternotomy. Intra operatively, the heart was seen rotated and directed to the right along the horizontal plane, positioning the left atrium anterior to the right atrium. The CPB was established by cannulating the ascending aorta, the superior vena cava, and the inferior vena cava (Figure 3A). The cannulation of the inferior vena cava is challenging since it was much to the left and posterior to the heart. Under moderate hypothermia, antegrade cold blood cardioplegia was administered to arrest the heart.

**Figure 3A : Peroperative view of heart showing bicaval cannulation.**
Exposure of the inter atrial septum was accomplished by a left-sided right atriotomy. An incision made at the base of the right atrial appendage allowed a direct examination of the atrial septal defect. The defect was located on the right side of the coronary sinus antero superior to tricuspid valve. This is exactly in a mirror image fashion of the levocardiac anatomy (Figure 3B).
Surgeon stood on the left side of the patient and started closing the defect from 8'o clock position with Dacron fabric patch using 5-0 prolene continuous sutures. The position of the atrioventricular node and the bundle of His were also deciphered out, since the triangle of Koch was also lying in a mirror imaged fashion superior to tricuspid valve. After routine de-airing maneuvers and atrial closure, the patient was uneventfully weaned from CPB, without any conduction abnormalities. The total CPB time was 42 minutes with the aortic cross-clamp time of 17 minutes. A intra operative trans esophageal echocardiogram showed the integrity of the patch with no residual shunt (Figure 4). The postoperative course was uncomplicated and the patient was discharged on the fifth post-operative day.

**DISCUSSION:**

Dextrocardia, a rare cardiac malposition, is defined as positioning of the heart in the right hemithorax, with the apex pointing to the right. This was first described by Fabricius in 1606. 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 viscerocordial concordance. Situs inversus totalis with dextrocardia is a congenital anomaly occurring with an incidence of 1 per 10000–50000 births (1).

As dextrocardia is often associated with congenital cardiovascular anomalies, detailed investigations are required to study the defects, if any in all such cases. Interruption of inferior vena cava in the intra hepatic part, often seen in these patients will require modification of the venous cannulation techniques. This defect however, was not present in our patient. Open-heart surgery in patients with a cardiac malposition is technically demanding and surgeons are required to make certain modifications to their routine surgical techniques while operating on such patients. Since the first report of coronary artery bypass grafting in patients with dextrocardia by Abensur et al. in 1988, very few further reports have been made of cardiac surgery on these types of patients (3). In cases of dextrocardia, it is difficult to initiate the CPB by the routine venous cannulation because both the vena
cavae and the right atrium are situated more posteriorly than normal. St. Rammos et al. reported that they first established CPB through aortic and left common femoral venous cannulae and then adding a superior vena caval cannula after emptying the heart (4). Femoral cannulation can cause various problems if the patient has abnormal visceral arrangement and in cases of situs inversus totalis, the varying venous configuration may complicate the venous cannulation process(6).

Some authors have recommended the surgeon standing at the left side of the operating table, which not only provides an excellent exposure but also makes the procedure relatively easy(5).

CONCLUSION:
In patients with dextrocardia requiring cardiac surgery, it is important to diligently plan the appropriate cannulation technique and the surgical strategy to avoid major errors due to the variable anatomy and the mirror imaging of the structures. Avoiding femoral venous cannulation and the surgeon standing on the left side of the patient will further improve the ease of surgery.

BIBLIOGRAPHY
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