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Case Report

Robotic Repair of Sinus Venosus Type Atrial Septal Defect with Double Patch Technique; A Case Report

Cem Arıtürk* and Cem Alhan

Department of Cardiovascular Surgery, Liv Hospital Vadistanbul, Turkey

***Corresponding Author:** Cem Arıtürk, Department of Cardiovascular Surgery, Liv Hospital Vadistanbul, Turkey.

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Abstract

Sinus venosus type atrial septal defects are not suitable for transcatheter closure and they can be treated with minimally invasive methods. Totally robotic repair of sinus venosus type atrial septal defect is presented in this study.

Keywords: *Atrial Septal Defect; Sinus Venosus; Robotic Surgery*

Introduction

Robotic surgery in cardiovascular diseases is primarily used for closure of secundum type of atrial septal defects that are anatomically not suitable for transcatheter closure. However robotic technique can also be applied for closing sinus venosus type defects by using minimal modification on the standard operation. Here, we present a patient with totally robotic repair of sinus venosus type atrial septal defect (SV - ASD) with double patch technique.

Case Report

A 34 years old man admitted us with fatigue and dyspnea ongoing for 3 years. Transthoracic echocardiography (TTE) revealed dilation of the right cardiac chambers with enlarged coronary sinus and a SV-ASD. Cardiac magnetic resonance imaging demonstrated the SV-ASD with anomalous return of the right upper pulmonary vein to superior vena cava and a persistent left superior vena cava draining into the coronary sinus which was severely dilated (Figure 1a). Robotic surgery was planned.

In the operation theater a peripheral IV cannula, a radial arterial line, central venous catheter through left internal jugular vein, defibrillator pads and a Foley catheter were placed. Intubation was achieved with double lumen endotracheal tube. Preoperative transesophageal echocardiography (TEE) showed the SV-ASD and anomalous pulmonary venous return (APVR) (Figure 1b). The anesthetic management, port placement and implementation of cardiopulmonary bypass were performed as described before [1]. The Da Vinci Surgical Cart (Intuitive Surgical, Inc, Sunnyvale, Calif.) was positioned at the operating table and docking was achieved. During single left lung ventilation pericardium was opened 3-4 cm medial to the right phrenic nerve and a large piece of pericardial patch was harvested and treated with glutaraldehyde. A Bulldog clamp was applied to occlude the inferior vena cava as described previously [1]. After aortic clamping the heart was arrested with 2 liters of Bretschneider solution given through an aortic needle placed to the ascending aorta via the working port. The right atrium was opened lateral to the right atrial appendage and the atriotomy was extended to the superior vena cava until the superior rim of the SV-ASD was identified clearly. Stay sutures and atrial retractor was placed allowing a beautiful exposure of the complete pathology. Suction cannulas were placed into the superior vena cava and orifice of the coronary sinus. Atrial septal defect was exposed and superior right pulmonary vein was identified (Figure 2a). The atrial defect was closed using a piece of glutaraldehyde-

treated pericardial patch leaving right pulmonary vein in the left atrial side (Figure 2b). The left atrium was deaired during the last few stitches. Right cavoatriotomy was repaired with the remaining pericardial patch using the above mentioned technique (Figure 2c). A 4/0 polypropylene suture was used for aortic root needle hole with both ends exteriorized from the working port and left untied. Inferior caval bulldog clamp was removed and the aortic root needle connected to the suction line was reinserted to its place. The heart was deaired under TEE guidance and aortic cross clamp was removed. Weaning from cardiopulmonary bypass was uneventful. TEE exam confirmed the successful repair (Figure 3). The cross clamp and bypass time was 73 and 144 minutes, respectively. After control for bleeding the patient was decannulated, and a chest tube was placed from the right instrument port. The incisions were closed and the patient was transferred to intensive care unit (ICU). He was extubated 2.5 hours postoperatively. ICU stay was 13 hours and he was discharged on postoperative day 3.

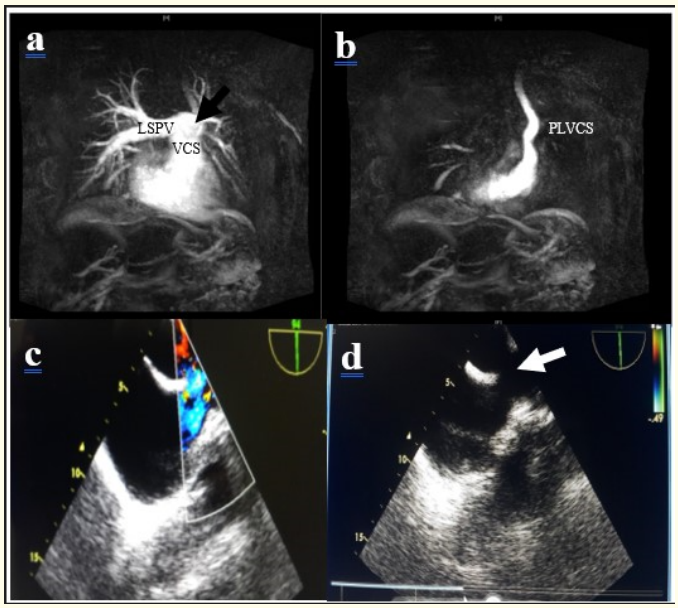

Figure 1: *a: Preoperative cardiac magnetic resonance image. b: Preoperative transesophageal echocardiography image.*

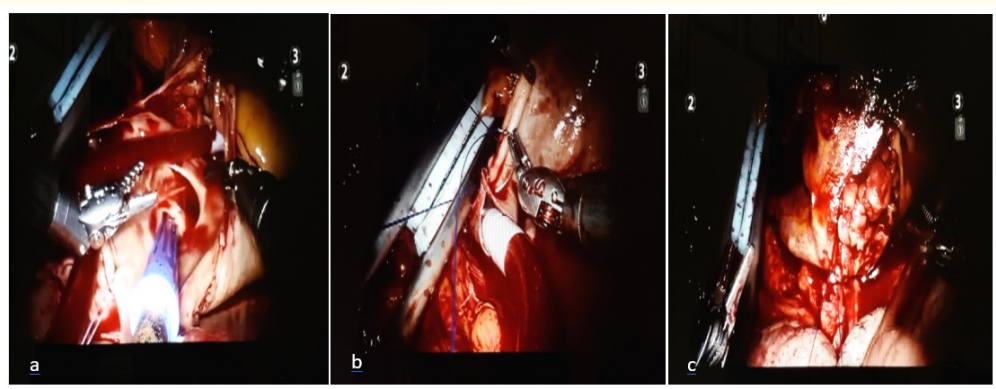

Figure 2: *Intraoperative sight of atrial septal defect. a: Right atriotomy was performed. b: Atrial septal defect was closed with pericardial patch leaving the pulmonary vein in the left atrium. c: Right cavoatriotomy was closed with pericardial patch.*

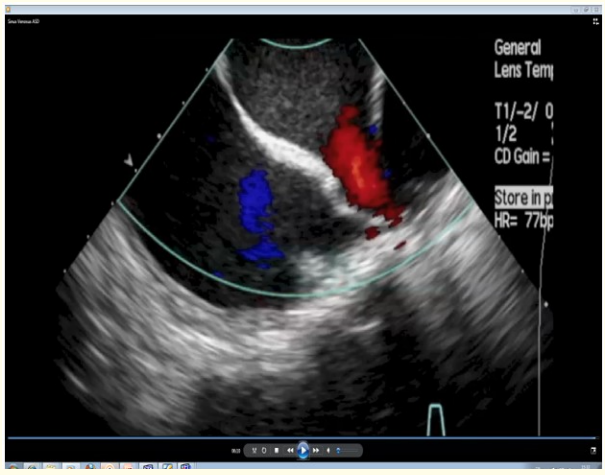

Figure 3: *Postoperative transesophageal echocardiography image.*

Discussion

Conventional surgical treatment of atrial septal defects (ASD) through midline sternotomy offers patients low operative risk, low morbidity and mortality, short hospital stays, relatively low cost, and an excellent long-term result [2].

However the similar clinical benefits can be provided with minimally invasive methods. Besides the long, vertical incision of sternotomy which is prone to cause wound healing problems, postoperative pain and discomfort, can leave an unsightly scar in the chest that may cause psychologic problems and dissatisfaction for the patients. Better cosmetic results are possible with the operations performed minimally invasively with similar clinical results compared with traditional surgical techniques in adult patient subsets [3].

Transcatheter approaches for ASD closure have been an option for the last decade. Some large series were reported about this treatment modality but 8,65% major and minor complication rate and embolisation/malposition of closure devices (3,5%) are the most important questionable issues for this option [4] to be chosen instead of surgical approaches with low morbidity rates and perfect long term results. Besides this technique is not applicable in sinus venosus type ASD's.

Currently robotic techniques provides the closure of ASD' in a totally endoscopic fashion. It provides closure of the defect by using an autolog pericardial patch and avoids the patient from the risk of embolus/thrombosis of the closure devices. Moreover, irrespective of the size or the anatomy; the defect can be closed surgically in contrast to transcatheter technique in which the unsuitable anatomy and large size defect is two of the contraindication.

Argenziano., *et al.* [5] demonstrated that ASD closure in adults can be performed safely and effectively using the da Vinci™ surgical system. As many of these procedures were done in young, physically active patients, the robotically assisted, totally endoscopic approach of ASD closure offers the tangible benefits of decreased pain, sternal stability, less bleeding and wound complications and improved cosmesis.

Regarding to the operative technique several points should be handled in a different way when compared to the robotic closure of secundum type defects. Firstly; the aortic cross clamping with Chitwood thoracic clamp may complicate the exposure of the defect which is usually near by the superior cavoatrial junction. This problem may be solved by reverse positioning of the clamp. This maneuver provides an extended working area. Secondly the superior caval clamp may not be positioned well due to the anatomic localizastion of the defect. In this sceniario the tip of superior caval cannula should be located more distally from the cavoatrial junction. In some cases it may still not be possible to place the clamp, in this case a simple vent can be positioned through the superior vena cava from the atrial incision.

Conclusion

In conclusion; robotic repair of sinus venosus type atrial septal defects are feasible. A similar technique used during the robotic closure of secundum type ASD is applied, but some modificationsregarding to the aortic and caval clamping as explained before may be needed. This approach may widen the applicability of robotics in cardiac surgery; offering a totally endoscopic method for closure of sinus venosus type ASD's.

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