Endoscope Assisted Minimally Invasive Surgical Closure of Multiplane Secundum Atrial Septal Defect: A Case Report

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Abstract

Atrial Septal Defect (ASD) is one of the commonest congenital anomalies in our population. In the era of percutaneous closure of ASD minimally invasive ASD repair technique in selected, indicated cases seems an appealing alternative. We had successfully completed one ASD closure/repair with the assistance of 3D endoscope, which is the first of its kind in the whole country. Patient was discharged at 5th post-op day with satisfactory outcome and no residual shunt.

Key words: Atrial septal defect; Endoscopic ASD repair/closure; Endoscopic cardiac surgery; Minimally invasive cardiac surgery; MICS ASD repair/closure.

Introduction

The prevalence of Congenital Heart Disease (CHD) is globally increasing and very nearly, nine out of every thousand newborns are born with CHD.[1] Among the CHD, Atrial Septal Defect (ASD) is one of the most common acyanotic congenital heart disease detected in the premature, and or mature newborns, as well as in the undiagnosed adults, which accounts for 10-15% of all types of cardiac malformations.[2] With all the advancement of technology, diagnosis and treatment of ASD has a wide range of approaches, ranging from percutaneous intervention to variable surgical closures. Surgical modalities include median sternotomy, partial median sternotomy to sternal sparing thoracotomy approaches, endoscope assisted and robotic assisted correction of ASD.[3] Minimally invasive approaches are gaining popularity amongst patients as well as the surgeons, although these approaches need advanced technological support and innovative surgical skills. Countries whether developed or developing (Like ours), are also showing remarkableinterest in the minimal invasive surgical corrections and thus advancement in the surgical fields.

Surgical correction of ASD is usually done in childhood, and within the fourth decade for the adults, minimal invasive sternal sparing approach leaves an opportunity for the future surgical procedure rather than through full median sternotomy. We successfully performed 3D Endoscope Assisted MICS ASD closure on her. Finally, the patient left the hospital with few small scars including the chest drain and the one for peripheral cannulation. Many centers like us are trying to excel and attain superior surgical skills like endoscope assisted ASD closure and to our best knowledge from the published articles this is the first case of its kind in our country.

Case Presentation

Mrs. Y, 31-year-old mother of four, normotensive, non-diabetic pleasant lady got admitted to Square Hospitals Limited on september, 2024 as a diagnosed patient of secundum Atrial Septal Defect (ASD) to undergo Surgical closure. She complained of suffering from exertional shortness of breath with frequent palpitation for the last 3 years. She then consulted a nearby cardiologist for the breathlessness and her thorough cardiac evaluation was done. There she was diagnosed of having small ASD secundum and the cardiologist suggested her a device closure for ASD. Consequently, she visited different other institutes and her Trans-Esophageal Echocardiogram (TEE) showed multiplane ASD secundum. As a result,

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device closure was not attempted and she was suggested to undergo surgical intervention. Then she got admitted under our care for further management.

On admission blood picture revealed no abnormality except Hb%- 10.5 g/dl, hematocrit-30.6%. Preoperative Transthoracic Echocardiogram showed:

i) Two ASD secundum (10mm and 12mm) with left to right shunt
ii) PASP- 35mmHg
iii) Dilated RA, RV
iv) No gross regional wall motion abnormality
v) Normal LV systolic function (EF-55%)
vi) Mild MR
vii) Normal RV function
viii) No pericardial effusion/ intracardiac thrombus seen.

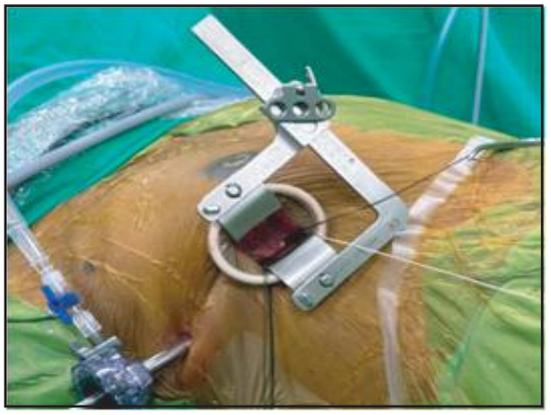

Figure 1 Working port (White arrow) and endoscope (White arrow) in-situ

Figure 2 Working port (White arrow) and endoscope (White arrow) in-situ

Operative Procedure

Under all aseptic precautions, under general anesthesia, after proper painting and draping, a 4 cm incision was made at the right sub-mammary fold. Mammary tissues were dissected and retracted carefully. Thoracic cavity was explored through 4th ICS, which was used as the working port. Soft tissue retractor was used to minimize trauma to the tissues. Another 10mm port was inserted through the 3rd ICS behind the anterior axillary line which was used for introducing the endoscope to the thoracic cavity. Simultaneously, right femoral vessels were exposed through linear skin crease incision at the inguinal region. Femfem cannulation done under TEE guidance by modified Seldinger technique. CPB was established after heparinization and achieving of ACT. Pericardiotomy was done 2 cm parallel to the right phrenic nerve under direct endoscopic vision. Pericardial patch was taken and prepared with 0.6% glutaraldehyde. Pericardial stay sutures were taken to get better exposure of SVC and IVC. CP cannulation was done on ascending aorta. SVC and IVC tapes taken and snugged after applying aortic X-clamp and cardioplegia. Right atriotomy was done. Fenestrated ASD secundum was found. There was fenestration in the eustachian valve of the IVC. Pericardial patch closure of the ASD (15 x 15mm) was done after excision of the fenestrated septal tissues. RAtomy was closed. X-clamp was released after proper de-airing. Heart weaned from CPB to normal sinus rhythm. Endoscope withdrawn from thoracic cavity. Protaminization and decannulation done. Chest wound was closed in layers by using ethibond and braided absorbable sutures after hemostasis. An intercostal drain was kept in the pericardial cavity through the right 5th ICS. Femoral wound was closed in layers using absorbable sutures. Dressing applied. Patient was then shifted to ICU and put on mechanical ventilator. No inotropic support was needed after transferring to the ICU. She was extubated after four hours on the same day with stable hemodynamic parameters and minimum chest drain collection. Postoperative recovery of the patient was uneventful and usual pain management protocol for the mini thoracotomy approach, was used. Postoperative Echocardiogram showed: S/P surgical closure of ASD

i) ASD patch intact, no residual flow seen
ii) PASP~26mmHg
iii) No gross regional wall motion abnormality
iv) Normal LV systolic function (EF-55%)
v) Mildly dilated RA, RV
vi) Normal RV function
vii) No pericardial effusion/ intracardiac thrombus seen.

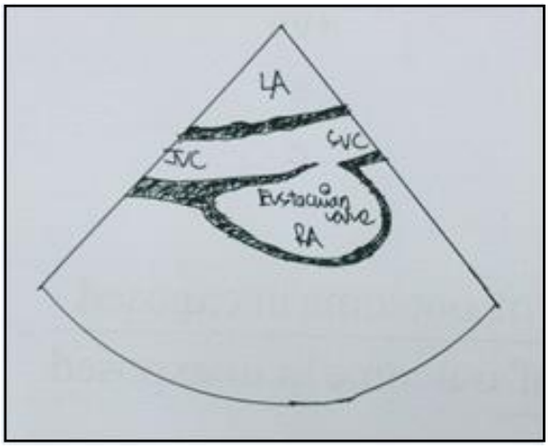

Figure 3 Schematic diagram showing ASD defect (Black arrow) with giant Eustachian valve (EV).[4]

Discussion

In minimally invasive endoscopic technique, a 3 to 4 cm incision is usually performed in the 3rd or 4th ICS which act as the working port. Another 5 to 10 mm stab incision is needed for the aortic X-clamp. In case of endoscope assisted ASD closure, one more 10 mm port is created for the insertion of the telescope through the 3rd ICS at or behind the anterior axillary line.[5] Although direct vision minimally invasive ASD closure has been a day-to-day practice in our center for several years now, endoscope assisted closure of ASD secundum is a new addition for us. Endoscope helps to reduce inadvertent injury to the surrounding structures like phrenic nerve, SVC, IVC and aorta, also helps in hemostasis after completion of the procedure. Due to a magnified 3D vision, surgical field, structural details, suture details, were better obtained in this technique that allowed more precision during the surgical closure. Endoscopic assistance provided some extra benefit in this particular case, by confirming the multiple fenestrations of the septum and identification of a large fenestration in the Eustachian valve (Remnant of embryological sinus venosus).[6] Fenestrated Eustachian valve was excised along with the septal fenestrations before the surgical closure of the ASD secundum. Sometimes, inadvertent suturing of the large Eustachian valve with the septum during the closure of the ASD might cause diversion of right atrial blood to the left atrium resulting in iatrogenic right to left shunt.[7]

Figure 4 After closure skin incision with measuring scale

For endoscope assisted closure of the ASD of this patient, we used one extra 10 mm port other than the incisions used for mini thoracotomy ASD closure, which reduced our incision of the working port to 4cm. Operative time including the X-clamp time and CPB were not increased by the technique. TEE was used to aid the cannulation, to check the aftermath of the procedure and for proper de-aeration before X-clamp was released. CO_2 insufflation over the surgical field was used at the rate of 2L/min for de-aeration. ICU stays and hospital stays were similar in this patient,as the mini thoracotomy patients. She was feeling quite well postoperatively and has been discharged symptom free on 5th POD. All wounds were healthy. Everyone including the patient, surgical team members and other care givers were highly contented with the outcome and the scars.

Limitations

This is a case report, so it's very early to reach a conclusion about the feasibility of such stdy and the procedure.

Conclusions

Endoscope assisted correction of ASD, in indicated and feasible cases is possible, even in our setup, where procurement of robot is a matter of financial concern. It provides superior patient recovery and early return to work in most of the patients. Like all other endoscopic procedures certain learning curve will be there but, with regular use of endoscopes, the operating time will be reduced and working port size will be minimized and less remarkable scars will be left after the surgery.

Recommendation

Multi-centric, larger sample sized study is required to validate Endoscope assisted ASD closure in indicated cases, in the era of percutaneous ASD closure.

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Contribution of authors

SDG-Conception, drafting, reference, citation & final approval.

NA-Drafting, citing references & final approval.

SNE-Data collection, critical revision & final approval.

MRC-Drafting, citing references & final approval.

MH-Conception, critical revision & final approval.

PKC-Data collection, citing references & final approval.

Informed Consent

Patient was informed about possible publication of this report, necessity of such publication and informed consent was taken from him.

Ethical Clearance

Ethical clearance for publishing this report was taken from the institutional ethics review board.

Disclosure

All the authors declared no conflict of interest.

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