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Minimally Invasive Surgical Closure of Atrial Septal Defects via a Right Anterior Thoracotomy

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ABSTRACT

Background: Surgical closure of the atrial septal defect (ASD) is a low-risk operation with little post-operative morbidity involved. The standard approach to ASD closure is via a median sternotomy. However the post-operative midline scar is cosmetically undesirable.

Patients: We report our experience with four female patients who have undergone closure of ASD through a right anterior thoracotomy and a left groin incision for femoral cannulation.

Results: Post-operative recovery was uneventful. The cosmetic results of their operations were good.

Conclusion: Closure of ASD via a right anterior approach is a safe method and should preferably be used in young female patients, as better cosmetic results are expected.

Keywords: atrial septal defect, right anterior thoracotomy, femoral cannulation

INTRODUCTION

Surgical closure of the atrial septal defect (ASD) has been performed successfully since 1952 and long-term follow-up of these patients has shown excellent results[1]. In this current era, the operation is a low-risk operation and patients are free from medical interventions following their operations. Presently, post-operative aesthetic considerations have become more significant. Median sternotomy, though remaining the standard approach for ASD closure, leaves a cosmetically undesirable scar. An alternative method of surgical closure is via a right anterior thoracotomy which is not easily visible if placed under the right submammary crease[2,7]. We report here four cases of minimally invasive direct closure of the ASD performed at our institution from March 1997 to April 1997 under a single surgical service.

MATERIALS AND METHODS

Between 7 November 1996 and 2 July 1997, 4 female patients underwent repair of ASD of the secundum type at our institution under a single surgical service. Their ages ranged from 21 to 24 years (mean 22 years). Two-dimensional echocardiography confirmed the diagnosis of an ostium secundum type ASD with the presence of a left to right shunt in all. The patients were scheduled for elective minimally invasive closure of their ASD via a right anterior thoracotomy.

Operative technique

The patient was placed in a 30° right-side up supine position. The chest and groin were draped and prepared for left femoral artery cannulation. After induction of general anaesthesia, a skin incision was made along the right submammary groove between the parasternal and mid-axilliary lines (Figs 1 & 2). The breast and pectoralis major muscle were dissected en bloc from the chest wall, which was entered in the fourth intercostal space. In 2 cases, difficulty was encounted as the superior vena cava was too far down from the incision for cannulation, and the third intercostal space was entered for better access. Electrocautery was used with caution and was limited to the sources of bleeding. The right lung was retracted posteriorly. The pericardium was opened longitudinally 2 cm anterior to the phrenic nerve. Femoral artery cannulation was performed via a

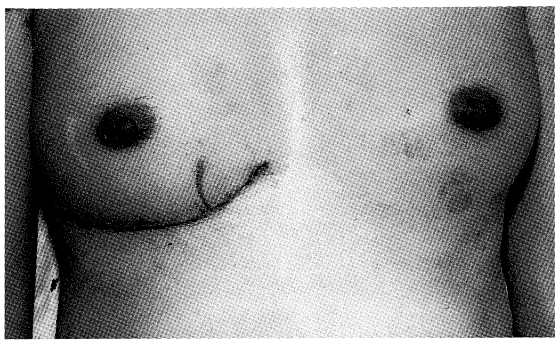

Fig 1 – Right submammary skin incision between the parasternal and mid-axilliary lines used for closure of ASD.

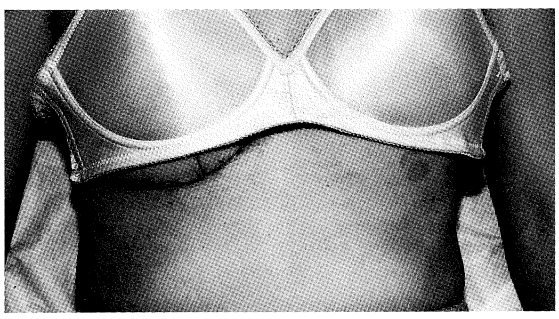

Fig 2 – Right submammary skin incision easily concealed by clothing.

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vertical incision initially and a transverse incision above the groin grease. Pericardial stay sutures were put on traction, thus elevating the mediastinal structures into the operative field. Superior vena cava purstrings were placed either through the right atrial appendage or direct to the SVC. The inferior vena cava was cannulated via the lower right atrium. Cardiopulmonary bypass was initiated with systemic cooling to 28°C. Electrical fibrillation was induced with an electrical fibrilator once the nasal temperature reached 2°C. A right atriotomy was performed. The ASD was inspected and the findings were noted. The secundum type ASD was closed with direct 4/0 prolene sutures and the atriotomy was closed in two layers with 4/0 continuous prolene. Systemic rewarming was started, the heart was defibrillated and a 21 gauge needle was placed in the ascending aorta to expel any air that might have been introduced on cardiotomy. Cardiopulmonary bypass was discontinued after adequate rewarming. The pericardium was closed and the lung was inflated. One chest tube was placed in the right chest. Two patients were extubated on the table and 2 on the same day in the ICU.

RESULTS

The mean duration of the operation was 3 hours. The mean stay in the Intensive Care Unit was 2.3 days (range 2 to 3 days) and the mean postoperative hospital stay was 6.7 days (range 5 to 8 days). Mean cardiopulmonary time was 57 minutes and the mean fibrillation time was 24.3 minutes. Postoperative recovery was uneventful in three patients. One patient developed a right pneumothorax. Mean length of follow-up was 1.5 months and all the patients were found to be well with no residual shunt or any wound infection.

DISCUSSION

Operative closure of the ASD has been performed successfully since 1952, with excellent long-term results in the patients on follow-up. Presently, surgical closure of the ASD is considered an extremely safe procedure. Median sternotomy has been found to give the quickest and the most adequate exposure of the surgical site and is used as a standard approach for ASD closure. However the resulting scar from the procedure is cosmetically unsatisfactory. It tends to widen with time and may be conspicuous with normal female clothing. Hence in recent years, more attention is directed to the post-operative aesthetic results.

Variations in the approach have been reported such as the use of the transsternal cross-bow incision[3]. However the disadvantages of entering both pleural spaces has restricted its use. Other methods that have been described include the transverse submammary skin incision combined with a median sternotomy[4] and also a bilateral submammary incision combined with a vertical sternotomy[5] which was later modified by Willman and Hanlon. Complications of the approach have been described and included, such as wound healing and occurrence of hematomas after prolonged periods of cardiopulmonary bypass with resultant disorders in coagulation. In addition, necrosis, breast maldevelopment and loss of sensation in the central area may also develop.

Chang[2] et al described a right anterior mini-thoracotomy with video-assisted endoscopic techniques. Right anterior thoracotomy is a good alternative surgical approach. The exposure yields excellent visualisation of the intracardiac anatomy and direct aortic cannulation can be performed safely. Closure of the ASD via this approach can be achieved readily and is cosmetically superior compared to the median sternotomy. Postoperative discomfort is also reduced in patients who undergo this approach. The advantages are achieved without sacrificing its efficacy. However, certain precautions have to be taken in this approach. Induction of fibrillation, for example, raises some concern but laboratory evidence has suggested that if the induction is carried out under certain conditions like mild hypothermia and acceptable perfusion with a total fibrillation time of less than 30 minutes, no demonstrable decline in the myocardial function or myocardial damage will result. Selection of the correct intercostal space is also important for obtaining adequate exposure.

Others have reported experiences similar to ours. Massetti[6] et al reported their experience in closure of ASD via a right anterolateral thoracotomy and a right submammary incision in 56 young patients. Evaluation using questionnaires were given to 41 of them who gave positive feedbacks on the cosmetic results postoperatively. Rosengar[7] reported on 54 patients with repair of ASD through a right thoracotomy and concluded that this approach is a safe and effective alternative to a median sternotomy incision. From our experience, we believe that the surgical closure of ASD via a right anterior thoracotomy is a viable alternative to median sternotomy. It is a safe and efficacious method offering adequate exposure to the site of surgery and producing satisfactory cosmetic result which is superior to that of the median sternotomy.

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