Minimally invasive repair of pectus excavatum (MIRPE) provides a minimal access approach to correct pectus excavatum deformities. Cardiovascular complications represent a rare but catastrophic complication of this cosmetic operation. We describe a modification to the technique following a case of cardiac puncture.

1. Introduction

Minimally invasive repair of pectus excavatum (MIRPE) [1] provides a video-assisted, minimal access approach to correct pectus excavatum that improves the quality of life of patients [2]. Large series have shown this to be a safe procedure [3] although cases of cardiac perforation have been reported [4,5]. We describe a case of cardiac perforation and the subsequent modifications to the technique to attempt to minimise this risk.

A 16-year-old male underwent a routine MIRPE. Following right thoracoscopic guidance of the introducer across the midline, left thoracoscopy showed that the introducer had entered the pericardial cavity. On withdrawal of the introducer under right video guidance from the anterior mediastinum, an egress of dark blood was noted and the pericardium was seen to fill.

At sternotomy a 5 mm laceration on the inferior aspect of the right atrium was identified and a cardiac surgeon undertook successful repair. Transoesophageal echocardiography (TEE) confirmed no damage to the intracardiac structures. The patient did not require a blood transfusion. Repair of the pectus excavatum was completed and the patient discharged home on the seventh postoperative day with a satisfactory cosmetic result.

Following this complication we modified our technique to attempt to minimise the risk of cardiac perforation. Patients now undergo preoperative computerised tomographic (CT) chest scanning, intraoperative TEE and utilisation of the Rultract Skyhook (Rultract, Ohio, USA) elevator.

2. Technique

Following bilateral mid-axillary incisions, a 1 cm midline vertical incision is performed at the xiphisternal level, together with bilateral thoracoscopy port incisions. The Rultract system is then utilised. Clamps are attached to either side of the operating table immediately superior to the right outstretched arm and immediately inferior to the outstretched left arm. Spline top and bottom posts are inserted into the clamps and a ratchet connected above the patient’s midline by coupler tube assembly bars and clamps. Fig. 1 shows both right and left posts immediately inferior to the patient’s outstretched arms. We have since modified this technique as described above in order to maximise space for the principal operator. Blunt dissection develops a subxiphoid plane to enable placement of a Langenbach retractor that is attached to the ratchet. Tightening of the ratchet elevates the sternum leading to dramatic improvement in the anterior mediastinal area (Fig. 2).

Under right thoracoscopic guidance a Robert’s clamp is passed through the previously developed pocket and inserted over the right medial rib crest into the pleural space. The introducer is then passed through the anterior mediastinum, in continuity with the posterior aspect of the costal cartilages and sternum, to enter the left hemithorax. Left thoracoscopy confirms safe passage of the bar. Passage of the introducer is facilitated by insertion of a Robert’s clamp into the left
chest, which assists in clearance of the mesoderm. The introducer then exits the left pleural space medial to the rib crest, through the subcutaneous pocket to reach the left mid-axillary incision.

A short length of silicone tubing sutured between introducer and bar facilitates passage of both across the anterior mediastinum. The bar is then rotated superiorly into position. Stabilisers are attached to each end with single figure-of-eight stainless steel wires. A size five steel wire is used to encircle the bar and adjacent rib under thoracoscopic guidance. Bilateral intercostal drains are inserted utilising the port site incisions.

3. Comment

Since its introduction, MIRPE has proven to be safe and yields satisfactory cosmetic results in suitable patients [2,3]. Cardiac rupture is a recognised complication of MIRPE [4,5]. We modified our technique following such a case to incorporate use of the Rultract™ sternal elevator in order to attempt to facilitate safe passage of the bar.

Other techniques have previously been described to reduce the risk of cardiac complications during MIRPE. Routine use of thoracoscopic was recommended following a case of cardiac perforation [3]. Others have proposed left thoracotomy and endo-Kittner dissection of the retrosternal area [6]. Despite the use of thoracotomy to guide passage of the bar, the excavatum deformity limits visualisation of the bar medially. The degree of sternal elevation provided by the Rultract™ system improved the view obtained at thoracoscopy so that the passage of the bar occurs under direct vision. Park et al. [7] have described the use of a Crane elevator prior to passage of the bar, however, unilateral Rultract™ elevator has been used in our institution to facilitate minimally invasive cardiac surgery and we adapted this in a bilateral format for the MIRPE procedure. We recommend the Rultract™ Skyhook sternal elevator to improve access to the retrosternal area, particularly in patients with deep deformities where thoracoscopic views are limited. Twenty-three cases of MIRPE were performed without incident, at our institution, prior to the case described. Sixteen of these cases were performed by the senior author. We now utilise the Rultract™ Skyhook in all patients undergoing MIRPE and have successfully performed 15 such procedures since modification of our technique.

Bar instability rates are high in published series of MIRPE; however the use of lateral bar stabilisers has helped to reduce its incidence [3,8]. Improved stability using percutaneous five-point wire fixation without stabilisers has also been described [5]. We feel this is achieved at the expense of cosmesis and comfort. Bilateral stainless steel wires encircled around the bar under may provide satisfactory stabilisation without the requirement for lateral stabilisers with resultant improvement in cosmesis.
We would recommend these modifications to others to attempt to minimise complications of MIRPE.

References


