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Strictly Posterior Thoracotomy Incision to Repair Coarctation of the Aorta in an Adult with Chondroid Metaplasia of the Lung: A Case Report

Adomako KA[1,2,*], Tamatey MN[2], Gyan B[1], Ofosu-Appiah E[1] and Offei-Larbi G[1]

[1]Carditothoracic Unit, 37 Military Hospital, Accra, Ghana
[2]National Cardiothoracic Centre, Korle-Bu Teaching Hospital, P. O. Box KB 846, Korle-Bu, Accra, Ghana

[*]**Corresponding author:** Adomako KA, Carditothoracic Unit, 37 Military Hospital, Accra, Ghana

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Abstract

Aortic coarctation is a congenital narrowing of the aorta, usually distal to the origin of the left subclavian artery and opposite the region of attachment of the ductus arteriosus at the aortic isthmus. Varying degrees of aortic arch hypoplasia may coexist. It is usually repaired as soon as the diagnosis is made which is usually in infancy. The repair is usually done using a left postero-lateral thoracotomy with employment of any of the known repair techniques which include the following:

- Left subclavian patch angioplasty
- Left subclavian patch angioplasty
- Subclavian translocation
- Synthetic patch angioplasty

A 34-Year-old lady had prosthetic patch repair of a juxta-ductal coarctation using a strictly posterior thoracotomy (SPOT) incision, a limited thoracotomy incision. Intra operatively, she was found to have a solitary pulmonary nodule affecting the left lower lobe. It was excised and sent for histopathology. The post- operative period was uneventful and she was discharged after a week. The lesion was found to be a chondroid metaplasia of the lung which is a benign lesion and required no further intervention.

Keywords: Coarctation; SPOT

Introduction

Aortic coarctation is a congenital narrowing of the aorta, usually distal to the origin of the left subclavian artery, opposite the area of the ductus arteriosus at the aortic isthmus. Varying degrees of aortic arch hypoplasia may coexist. In the newborn, the presence of a patent ductus arteriosus will often allow adequate lower body perfusion. Repair of aortic coarctation is usually performed via a left Postero-lateral thoracotomy without cardiopulmonary bypass. There are a number of surgical techniques available to repair the coarctation, each with its own advantages and disadvantages.

These include the following:

1. Resection and end-to-end anastomosis
2. Left subclavian patch aortoplasty
3. Synthetic patch aortoplasty
4. Prosthetic interposition graft
5. Resection with extended end-to-end anastomosis

Recent advances in cardiothoracic surgery have led to emphasis on minimal incisions with the view to improving the aesthetics of patient especially the youth. In addition to the above, limited length of incisions have been found to improve morbidity and help in early return to normal activities [1]. Limited incision like strictly posterior thoracotomy incision (SPOT) have been used in procedures like ligation of patent ductus arteriosus and fashioning of modified Ballock Taussig shunt. We report the SPOT incision in an adult with Juxta ductal coarctation who intra-operatively was found to have chondroid metaplasia of the lung.

Case Report

A 34-year-old lady with a two-year history of hypertension on treatment, developed palpitations and easy fatiguability after her second child. She had history of frequent easy fatiguability as a child but was treated with local herbs by her grandmother who she was living with. Further assessment revealed she had an isolated coarctation of the aorta and had a prosthetic patch aortoplasty using a strictly posterior thoracotomy incision (SPOT), a limited incision, instead of the conventional Postero-lateral lateral thoracotomy which is the standard technique. Intra-operatively, she was found to have a solitary pulmonary nodule affecting the left lower lobe. The nodule was excised for histopathology and it was reported as a chondroid metaplasia of the lung. The post –operative period was uneventful and she was discharged on the seventh post-operative day (Figure 1).

Discussion

Coarctation of the aorta is a congenital narrowing of the descending thoracic aorta just distal to the origin of the left subclavian artery and adjacent to the ductus arteriosus. The occurrence is 0.2 – 0.6 per 1000 live birth which represents 5 to 8% of all cases of congenital heart disease [2]. It is the 8th most common congenital heart defect and is often associated with other congenital heart defects like patent ductus arteriosus, ventricular septal defect, bicuspid aortic valve and mitral valve abnormalities [3]. The classic coarctation of the aorta is located in the thoracic aorta distal to the origin of the left subclavian artery at about the level of the ductal structure. However, rarely, a coarcted segment is present in the lower thoracic or abdominal aorta. In such instances, the coarcted segment may be long and fusiform with irregular lumen; many consider these to be inflammatory or autoimmune in origin, and they may be variants of Takayasu arteritis [4]. In the past, coarctation of the aorta has been described as preductal (or infantile) type or post ductal (or adult) type, depending on whether the coarctation segment is proximal or distal to the aortic isthmus. It is now known that all coarctation are juxta ductal. Based on this, they are classified as:

1. Isolated coarctation
2. Coarctation with a VSD
3. Coarctation with complicated intracardiac anomaly [5].

Most patients are usually asymptomatic but the infants and young children may present with signs of congestive cardiac failure. Older patients may present with hypertension [6]. Confirmation is by imaging techniques. Electrocardiogram may show signs of a left ventricular hypertrophy with a strain pattern. Echocardiography can detect the location and severity of the coarcted segment. A computed tomography or magnetic resonance imaging with a three-dimensional reconstruction can give a detailed anatomy of the lesion. Cardiac catheterization is required for patients with associated intracardiac anomalies [7,8]. Outcome of studies show worse morbidity and mortality in those who remain unrepaired or repaired later in life. There is also a high early mortality rate with a median age at death early in the fourth decade and 75% mortality by age 46 years [9]. Common causes of death are congestive heart failure, aortic rupture as well as endocarditis and intracranial hemorrhage [10]. Even in the more recent era, patients with repaired coarctation were found to have a limited life span, particularly if repaired after early childhood these patients have a high incidence of hypertension, and the leading causes of death include premature coronary artery disease (CAD), sudden death, and heart failure [10,11].

The indications for intervention in coarctation include a gradient that is greater than 20 mm Hg, evidence of hypertension, left ventricular dysfunction, or congestive heart failure. The development of collateral circulation is also an indication for repair [12,13]. The surgical approach to repair is through a left posterolateral thoracotomy entering the thorax through the fourth intercoastal space. The exception to this is a transmediastinal approach for patients with associated cardiac anomalies that are repaired simultaneously. There are various techniques of repair which include the following:

Resection and end-to –end anastomosis

First reported by Crafoord and Nylin and involves resection of obviously narrowed coarctation segment and a direct end-to-end circumferential anastomosis of the aorta. This is done after adequate mobilization of the aorta to prevent tension at anastomotic site. This procedure has varying mortality rate between 4-38% and re-coarctation rates between 4 – 33% [14-16].

Prosthetic patch aortoplasty

This technique was introduced to mitigate the high re-coarctation rate associated with the end-to-end anastomosis. This technique was first described by Vosschulte in 1957. Through distal portions of the coarcted segment are clamped and aorta incised longitudinally through the site of the coarctation. The incision is extended well beyond the coarctation both proximally (up to left subclavian artery) and distally. A wide circular or slightly elliptical prosthetic patch of polytetrafluoroethylene is sutured in place longitudinally along the aortotomy edge. The pleura is closed completely over the patch [17]. The advantages of this technique include [18]:

a. Avoids extensive dissection and prolonged cross-clamp time which may be required in the end-to-end technique.
b. Collateral vessels are preserved.
c. Allows simultaneous enlargement of isthmic hypoplasia if necessary.
d. Anastomosis is always tension free and easy to perform.

e. The posterior aortic wall and a hypoplastic aortic arch will grow after the repair [19].

The main late complication of this technique is aneurysm formation on the posterior aortic wall opposite the patch which is due to violation of intimal layer during resection of the coarcted site and altered haemodynamics arising from the different tensile strengths of the prosthetic patch and the posterior aortic wall [18].

Prosthetic interposition graft

First described by Robert Gross in 1951, this technique uses a homograft or a Dacron prosthesis and is most useful in adults with associated aneurysm or a complex long –segment coarctation or a recurrent coarctation. It is also useful during resection and end-to-end anastomosis if it appears the anastomosis will be under tension or more extensive resection of the aorta is required during surgery. The main disadvantage is patient prosthetic mismatch in growing children thus, making the procedure more applicable in adults [18,20].

Subclavian flap aortoplasty

This technique was introduced in 1966 by Waldhausen and Nahrwood. The aortic arch, subclavian artery, isthmus and descending aorta are exposed and dissected. The aorta is clamped proximal to the left subclavian artery as well as distal to the coarctation. The left subclavian artery is ligated at the origin of the vertebral artery and opened along its lateral margin and divided. The incision is extended through isthmus across the coarctation into the area of the poststenotic dilation. The subclavian artery is folded down onto the incision in the aorta and the flap sutured in place with continuous fine polypropylene suture and the clamps are released [18]. The advantages of this technique include its simplicity, short cross-clamp time, avoidance of prosthetic material, easy anastomotic haemostatic control and increased anastomotic growth [21]. The main disadvantage is ischaemia and growth restriction of the left upper limb as well as formation of false aneurysms [18].

Resection with Extended End-to-End Anastomosis

Done in neonates and infants and utilizes a left posterolateral thoracotomy or a median sternotomy. Exposure is like for the other procedures and ductus arteriosus is ligated and divided. The descending aorta is dissected and mobilized almost to the diaphragm, usually the first intercoastal vessels are ligated and divided. The proximal clamp is placed between the left common carotid and the left subclavian arteries while the distal clamp is placed well below the coarctation. The entire coarcted segment is completely excised including a portion of the undersurface of the aortic arch. Proximally a long incision is made on the inferior surface of arch up to the proximal cross-clamp. Distally the descending aorta is incised laterally. The anastomosis is performed using a polypropylene suture [22,18]. The advantage is that all coarctation tissue is completely resected and corrects hypoplasia of the distal aortic arch, isthmus and transverse arch. It also avoids prosthetic material [18].

Our patient was an adult and we chose the prosthetic patch aortoplasty technique. The conventional incision is a left posterolateral incision but we decided to utilize a minimal incision approach called the strictly posterior thoracotomy incision. This approach is well practiced in our centre and has been published [1], it is also used routinely in our centre to perform procedures like fashioning of modified Blalock Taussig shunt and ligation of patent ductus arteriosus.



Figure 1: *Angiogram of the patient showing the coarctation.*

Strictly Posterior Thoracotomy (Spot)

Definition

Strictly posterior thoracotomy in an adult is a 7 to 10 cm crescent incise f on made between the scapular spine and the posterior axillary line about 2 cm parallel to the vertebral border of the scapula.

Position

The patient was given general anaesthesia with double lumen intubation and placed in the right lateral decubitus position with the elbow flexed and positioned on an arm rest. The position was maintained using pads between the thighs and strapped across the hips in a standard fashion (Figure 2).

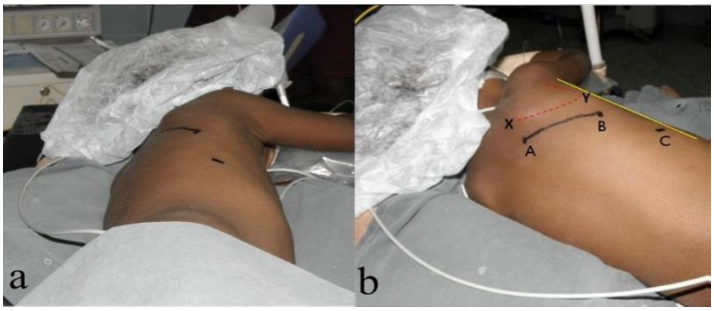


Figure 2: *Black marker indicates proposed skin incision and chest drain site; b) The incision runs from A to B; C – chest drain site; yellow line – posterior axillary line; dashed line – outline of scapula (X – spine; Y – angle).*

Incision

The incision is kept strictly posterior to the posterior axillary line. It begins from the level of the base of the scapular spine (T3 vertebra) and extended 7 to 10 cm towards the angle of the scapula being about 2cm parallel to the posterior border of the scapula as shown below (Figures 3,4).

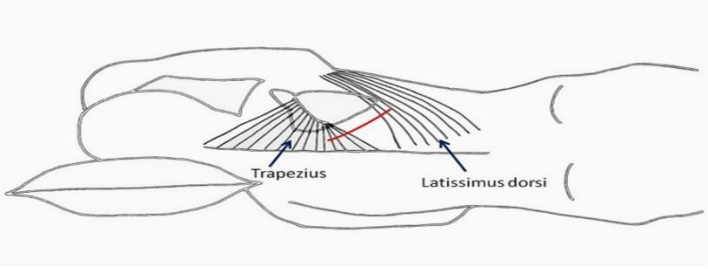


Figure 3: *Scapular spine (T3 vertebra) and extended 7 to 10 cm towards the angle of the scapula being about 2cm parallel.*



Figure 4: *The SPOT incision which is limited to the back of the patient. The trapezius and latissimus dorsi are divided (w) in the line of the incision (red line).*

The incision is carried down through the skin and the subcutaneous tissue to the fasciae overlying both latissimus dorsi and trapezius muscles which is incised. The posterior border of the latissimus dorsi was divided 1 cm across its width while sparing the serratus anterior. The inferior border of the trapezius is also divided for about 1cm across its width. The chest is entered through the fourth inter-coastal space and the left lung collapsed. Routine inspection revealed a pulmonary nodule on the lower lobe. The lung was retracted antero- inferiorly to expose the mediastinum whose pleura was incised over the descending thoracic aorta to expose the structures at the isthmus as well as the coarcted portion of the aorta. The portions of the aorta proximal and distal to the coarctation as well as an intercoastal artery given off at coarcted segment were all mobilized and encircled with vessel loops, they were clamped and the coarcted segment incised and a prosthetic patch aortoplasty done using a polytetraflouroethelyne graft. The mediastinal pleura was repaired and the solitary nodule excised for pathology.

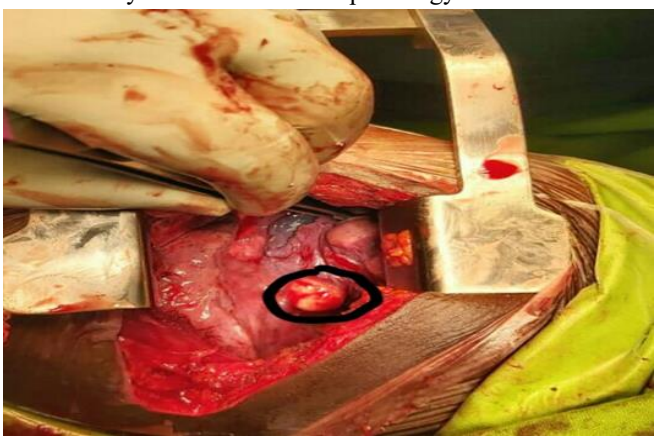


Figure 5: *Intra-operative picture of the chondroid metaplasia in a black circle.*



Figure 6: *The excised lesion from the left lower lobe.*

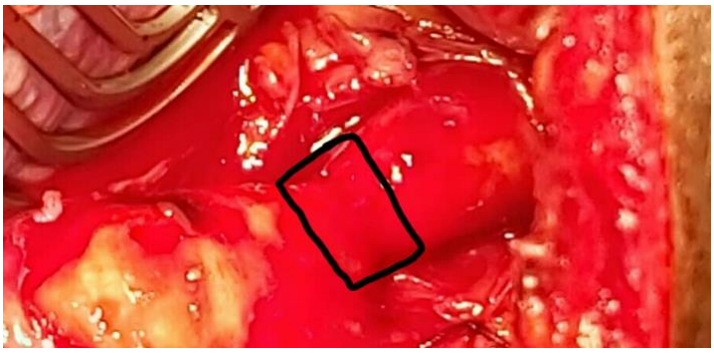


Figure 7: *Coarcted segment of the aortic isthmus.*

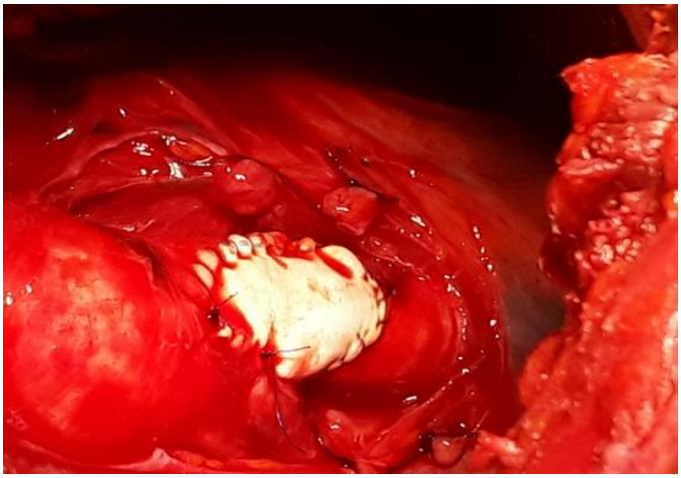


Figure 8: *Repair using PTFE prosthesis.*

A chest tube was inserted, the lung inflated and the chest closed routinely. Patient was extubated on table and sent to the intensive care unit in a stable condition. She was discharged after 7 days on admission (Figures 5-8). The report of the excised solitary nodule was a chondroid metaplasia of the lung which is a hamartoma and refers to a non-neoplastic disordered collection of benign tissue normally present in a particular organ, forming a nodule. It appears, however, that pulmonary hamartomas are benign mesenchymal neoplasms. Chondroid metaplasia are frequently encountered among benign nodules removed from the lung. These tumors are more often peripheral than central, with an endobronchial location in fewer than 10% of cases. The most common presentation is a solitary nodule, and most cases are smaller than 4 cm with an average of 1.5 cm. They are often easily removed from surrounding parenchyma and vary in color depending on their cellular composition. Hamartoma is seen more commonly in men (M/F, 2:1), and is not usually encountered in pediatric patients [23].

Conclusion

Co-existence of chondroid metaplasia of the lung with coarctation of the aorta in an adult is rare. The surgical repair utilizes a posterolateral thoracotomy and employment of any of the recognized procedures. It is however possible to repair the coarctation and excise the pulmonary nodule using a strictly posterior thoracotomy incision which is a minimal access procedure with equally good exposure and surgical outcome.

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