VIDEO-ASSISTED THORACIC SURGERY IN CHILDREN: OUR INSTITUTIONAL EXPERIENCE

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ABSTRACT:

Video-assisted thoracic surgery (VATS) is used commonly for diagnostic and therapeutic procedures in children. Eleven (11) patients which included newborn, infants, children, and adolescents underwent VATS procedures between April 2006 and February 2008. There were 8 boys and 3 girls with an age range of 2 days to 17 years. VATS was performed for lung cyst (n=4) which included hydatid cyst lung (n = 1), encysted traumatic haemopneumothorax (n = 1), inflammatory lung cyst (n=1) infected lung cyst (n=1), decortication of empyema (n=4), congenital diaphragmatic hernia (n = 2), lung biopsy (n=1) and VATS was efficacious for therapeutic purposes in all 11 cases. Overall 1 case of VATS required conversion to open thoracotomy. Average length of thoracostomy tube drainage was 5 days, and average length of stay was 7.1days. Complications included prolonged air leak (>7 days) in 1(hydatid lung).There were no bleeding, complications or deaths related to VATS. VATS is a safe and effective procedure in children resulting in a short length of chest tube drainage and shorter length of hospital stay

***MesH words**: Thoracoscopy, video-assisted thoracic surgery*

INTRODUCTION:

Minimally invasive thoracic surgery has gained increased acceptance over the past decade coincident with the increasing popularity of minimally invasive abdominal surgery. With the advent of smaller endoscopic instruments and improvement in video technology, more VATS procedures are being performed in children. Thoracoscopy or video-assisted thoracic surgery (VATS) involves performance of intrathoracic procedures through several small thoracostomy openings without a thoracotomy. Advantages include less pain, lower postoperative narcotic requirement, shorter hospital stay and smaller incisions with resultant improved cosmesis [1].

CASE REPORT:

Eleven patients which included newborn, infants, children, and adolescents underwent VATS procedures between April 2006 and February 2008. There were 8 boys and 3 girls with an age range of 2 days to 17 years. VATS was performed for hydatid cyst lung (n = 1), encysted traumatic haemopneumothorax (n = 1), infected lung cyst (n = 1), lung biopsy (n = 1) inflammatory lung cyst (n = 1), empyema thoracis (n = 4) and congenital diaphragmatic hernia (n = 2).

TECHNIQUE:

All children received a general anesthesia. Selective ventilation of the right or left bronchus was used in some older children to allow ipsilateral lung collapse. In the operating room, each patient received peri-operative antibiotics. An arterial line and adequate intravenous access was established. The patients were positioned laterally similar to that for thoracotomy.

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A 5-mm or l0-mm skin incision was made and the subcutaneous tissue divided. A clamp was used to spread the chest wall and intercostal muscles and penetrate the parietal pleura. A reusable or disposable trocar was introduced into the thoracic space. Carbon dioxide (<l0 mm Hg) was used selectively as needed to provide lung collapse. Two additional working ports were used generally. All patients were monitored by electrocardiography, pulse oximeter, temperature and end-tidal CO2 monitor.

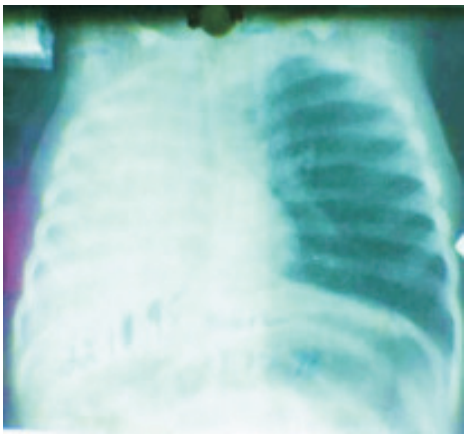

Fig. 1 : Right sided pleural effusion (Empyema thoracis)

In patients with empyema (Fig.1) requiring decortication thin fluid was aspirated with suction cannulas, and more solid fragments were removed with graspers. The fissures were always opened completely, and the lung was mobilized from the mediastinum anteriorly and posteriorly and from the diaphragm. The pleural space was debrided and lung expansion confirmed before closing the chest. Tube thoracostomy was used (Fig. 2).

In CDH (Fig.3) pre and postductal oxygen saturation monitors were placed. Insufflation pressures were initiated at 5 mm Hg. Two additional trocars were inserted under direct visualization in the fifth or sixth intercostal space posteriorly and in the intercostal space below the nipple. Using insufflation and laparoscopic instruments, the herniated intestine, omentum, and spleen were easily

Fig. 2. Postoperative X-ray for empyema thoracis right side with good lung expansion.

Fig 3 : Left sided congenital diaphragmatic hernia

Fig 4: 40 day's old infant with repaired left sided CDH (minithoracotomy scar)

reduced into the abdomen. Brief increase in insufflation pressure to 10 mm Hg often aided the reduction. Elements of bowel malrotation and the arrangement of the intestine within the abdomen after reduction could not be evaluated with this technique. Once the intestine was reduced into the abdomen, the diaphragmatic defect was examined and the diaphragmatic defect was repaired primarily. Due to technical difficulties in suturing the lateral edge of the defect mini thoracotomy (Fig. 4) had to be done for suturing the remaining defect. In the second case of newborn diaphragmatic hernia which had an associated thin sac, the sac was excised and the diaphragmatic defect well defined and closed with interrupted non absorbable mattress sutures. Fig.(5).

Fig 5 : VATS repair left sided CDH

Hydatid cyst (Fig. 6) was aspirated and exocyst was opened using an electric cautery then the endocyst was excised and extracted using a 10-mm endobag that was introduced through the lower port site. A chest tube was placed through the lower port site. Minimal air leak resolved within 7 days, and the chest tube was removed on the 8th postoperative day. Child was started on oral albendazole preoperatively and was continued for three weeks postoperatively.

Fig. 6 : Right sided Hydatid lung lesion

Table 1 : Indications and Results for VATS

S.No.	Diagnosis		Number (n = 11)	Age	Chest drainage	Length of stay
1	Empyema thoracis		4	3months-16 years	5days(4-6)	6days(5-7)
2	LUNG CYST(n = 4)	Hydatid cyst lung	1	12 years	7 days	9 days
		Encysted traumatic haemothorax	1	13 years	4 days	5 days
		Infected lung cyst	1	24 days	3 days	14 days
		Inflammatory lung cyst	1	16 years	4 days	5 days
3	CDH		2	2days-40 days	5 days	7 days
4	Lung Biopsy		1	11 years	2 days	4 days
	Average		-	-	5 days	7.1days

In case of loculated haemopneumothorax a 2-cm incision was placed directly over the site of the loculated collection as determined from the CT scan. A suction cannula was inserted into the loculated collection, and as much of the pleural fluid and clotted blood removed. Fluid and blood clots were sent for microbiologic assessment. A 10-mm trocar with the telescope was introduced into the loculated cavity. Another 2-cm incision was placed 8 to 10 cm away from the initial incision, along the same intercostals space, and the suction cannula was introduced through this incision. Further evacuation of the pleural contents was performed under direct vision with the camera. Thus, the procedure was performed from within the loculated collection, gently releasing the adherent lung from the chest wall toward normal lung. Once all the pleural fluid and fibrin was evacuated, adequate lung expansion was observed by ventilating the ipsilateral lung. Chest tube was placed postoperatively into the port site.

Endoloop was prepared with Vicryl and mounted on 5 mm knot pusher, using a 5mm atraumatic grasper, biopsy site of the lung was grasped through the endoloop, endoloop was tightened and the lung biopsy taken after cutting with endoscissors.The specimen was removed through 5mm port. Biopsy site was inspected for bleeding and air leak. ICD was placed and removed after 48 hours.

In a case of infected CCAM involving the the left upper lobe, multiple abscess cavities were drained, using gentle suction, chest tube was kept for 3 days and pus culture reported pseudomonas statzeri.

Lung cyst which was measuring 7 x 7 cms containing pus and altered blood was excised, which was adherent to the parietal pleura, thin septae were broken down using blunt dissection. Instrument commonly used was the tip of the suction cannula. Biopsy was suggestive of inflammatory lung cyst.

All patients were transferred to a high-care unit; a chest radiograph was obtained, blood for arterial blood gas taken, and routine monitoring of vital signs performed. All patients received physiotherapy twice daily.

The only postoperative complication was prolonged air leak in 1 patient. There were no bleeding, complications or deaths related to VATS.

DISCUSSION:

Thoracoscopy has advanced significantly since the 1970s when Rodgers et al[1] introduced the technique for diagnosing intrathoracic pathology in children. The safety and efficacy of the VATS technique were subsequently proven for this indication[2]. Retained hemothorax reportedly occurs in 1% to 20% of patients with chest trauma. Using a protocol based on Vigorous physiotherapy and early withdrawal of tube thoracostomy in 1845 patients, retained hemothorax and empyema rates of 2.7% and 0.5%, respectively, were reported by[3]. The complications of entrapped lung and empyema following inadequately drained pleural blood has traditionally been managed by thoracotomy. Video-assisted thoracoscopic surgery (VATS) has been revitalized with the advent of improved imaging technology and the evolution of endoscopic instrumentation. The current role of VATS in trauma includes evaluation and control of continued chest tube bleeding, early evacuation of retained hemothorax, evacuation and decortication of post traumatic empyema, evaluation and limited treatment of suspected diaphragm injuries, evaluation and treatment of persistent air leaks, and evaluation of mediastinal injuries. The use of VATS in the early evacuation of post traumatic retained hemothorax has been well documented. In a review analyzing the role of thoracoscopy in retained hemothorax, identified eight studies with a total of 99 patients.

Evacuation by VATS was successful in 89 of 99 patients (90%)[4]. Technical failures during VATS evacuation occurred as a result of poor visualization from incomplete lung deflation, dense adhesions or clotted blood. Despite the 10% failure rate, all the studies recommended early VATS evacuation to avoid complications of fibrothorax and empyema. In a series of 24 patients with residual hemothorax, thoracoscopic evacuation was successfully performed in 22 of their patients (92%)[5].

The conventional treatment of hydatid cysts in all organs is surgical. Medical treatment with benzimidazole compound (albendazole) is also effective in properly selected patients. The response of the therapy differs according to age (children and adults), cyst size, cyst structure (presence of daughter cysts inside the mother cysts and thickness of the pericystic capsule allowing penetration of the drugs), and localization of the cyst. In children, small cysts with thin pericystic capsule localized in the brain and lung respond favourably[6]. Percutaneous therapy in the form of puncture, aspiration, injection, and reaspiration is another option to treat hydatid disease. But the need for prolonged hospital stays or repeated visits and development of spillage and abscess formation have limited its widespread use.

In adult, some authors have reported the successful use of thoracoscopic procedures for the treatment of pulmonary hydatid disease. In paediatrics, only 2 similar reports were found: one in the French literature and the other in the English literature. Both have confirmed the feasibility of the thoracoscopic approach in children with pulmonary hydatid cysts. It follows the same principles of the open technique, which include sterilization of the cyst with scolicidal agents (eg. hypertonic saline), complete excision of the endocyst, and closure of bronchial fistula, if present[7].

Thoracoscopy offers the possibility of good visualization and cleansing of the empyema chamber by the use of video techniques and establishes efficient drainage even in patients with advanced stages of the disease. Thoracoscopy enables collection of material not only for bacteriologic, but also

for histopathology examination[8]. This is important to establishing the precise cause of empyema. The described method is minimally invasive, and the complication risk is comparable with that for classical thorax drainage[9].

From an anatomic perspective, we reasoned that the optimal neonatal candidate for a thoracoscopic CDH repair would be one in whom the diaphragm could be repaired primarily.

Given the clinical fragility of patients with CDH, we also sought to use physiologic criteria to select healthier CDH neonate who would have adequate pulmonary reserve to tolerate the operation and expected compromise in postoperative pulmonary function[10]. Neonate in this report had good pre-operative pulmonary function (peak inspiratory pressure (PIP) limit of 24 mm Hg) and no clinical evidence of pulmonary hypertension. Comparing the thoracoscopic approach to the laparoscopic approach for CDH repair, the operation from the chest would appear to be easier. Insufflation helps to reduce the intestine into the abdomen.

The simple use of blunt retractors in a hand-over-hand motion achieves gentle intestinal reduction. We have not found that the chest wall imposes limits on suturing ability if the working ports are placed in appropriate positions[11] which we too appreciated in our study new born. A laparoscopic approach may be hampered by the constant tendency of the bowel to herniate back into the chest. Higher insufflation pressures may also be required, which could be transmitted to the thoracic cavity and adversely affect ventilation. A single disadvantage of the thoracoscopic approach is that one cannot evaluate for intestinal malrotation and arrange the bowel in the abdomen in an orderly fashion from the chest[12].

Neonatal thoracoscopic repair of CDH is feasible and safe in appropriately selected patients. With the refinement in the endoscopic surgery and the introduction of endoscopic stapling instruments, VATS lung biopsy is better alternative to thoracotomy[13]. As the technology improves the indications are further widened which will include lobectomies, complicated cyst excision and Mediastinal tumour excision[14].

CONCLUSION:

We conclude video assisted thoracoscopic surgery is a valuable technique in the management of selective thoracic conditions. It is safe, offers the advantages of less pain, rapid recovery, long-term morbidity and good cosmesis.

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