



CME article

Paediatric Thoracoscopic Surgery

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EDUCATIONAL AIMS

The reader will be able to:

- Define thoracoscopic surgery.
- Outline the advantages of thoracoscopic surgery
- Outline the challenges of thoracoscopic surgery
- Discuss specific thoracoscopic procedures relevant to paediatric practice.

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SUMMARY

Thoracoscopic surgery is now an integral part of paediatric practice. The evolution of instrumentation, optics and haemostatic devices have enabled even the most complex procedures to be carried out thoracoscopically. Although randomised studies are limited in children, thoracoscopic surgery appears to offer outcomes at least equivalent to that of open operations with less post-operative pain, less scarring and a more rapid recovery. Furthermore many of the long term musculo-skeletal deformities associated with a thoracotomy are avoided. There are however several surgical and anaesthetic challenges that make the widespread application of these techniques beyond that of specialised centres difficult.

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Thoracoscopic surgery provides either a diagnostic or therapeutic intervention of intrathoracic pathology. It uses several small incisions, usually in the order of 2–5 mm for paediatric practice, to accommodate long thin instruments and telescopes (Figure 1). The surgery is then performed using similar repairs and therapeutic endpoints to open thoracic surgery, differing only in the aforementioned access to the thoracic cavity. Alternative names used are Video-Assisted Thoracoscopic Surgery (VATS), minimally invasive surgery (MIS), or minimal access surgery (MAS). The term mini-thoracotomy differs in that an incision of several centimetres is created and open surgical instruments are employed, it is thus not synonymous with thoracoscopic surgery.

Thoracoscopy as a therapeutic intervention has been described since 1910.¹ Its use, however, in children was first reported in the 1970's by Rodgers² when he described thoracoscopic use in the evaluation of intrathoracic lesions, biopsies and the management of empyema. Further progress however was impeded by the availability of appropriate sized optics, instrumentation and

haemostatic devices. In the last decade with the advent of suitable instrumentation there has been a rapid expansion of the possible therapeutic procedures that can be employed in paediatric practice using thoracoscopic techniques (Table 1)

ADVANTAGES OF THORACOSCOPIC PROCEDURES

The main advantages of thoracoscopic surgery compared with open surgery include a superior cosmetic result³ (Figure 2), and the prevention of growth deformities of the thorax,^{3–5} shoulder⁶ and spine^{7–9} which may result following open surgery. Other postulated advantages such as lower postoperative pain, fewer complications and faster recovery have been well demonstrated in the adult literature.^{10–13} In children there appears to be a shorter hospital stay reported following thoracoscopic procedures compared to open thoracotomies^{14–18} but this has not been investigated in randomised studies.

Thoracoscopy provides excellent magnification¹⁹ and an unparalleled panoramic view of the entire hemi-thorax. The exclusive view of the surgeon typical of open surgery is now available to the anaesthetist, assistant and nursing staff permitting improved communication and involvement in the case.

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Figure 1. Ports and thin 3 mm instruments for paediatric thoracoscopic surgery.

Furthermore digital storage of cases performed is now easily possible for review and teaching purposes.

CHALLENGES IN THORACOSCOPIC SURGERY

Thoracoscopic surgery carries several technical challenges that have slowed its widespread implementation beyond specialised centres.

Thoracoscopic surgery has a considerable learning curve.^{20,21} Limitation to port placement, port and instrument mobility, and the intercostal space size restricts the instrumentation that can be used especially in children. There are no data on the learning curve

of thoracoscopic procedures in children, but in adults less than 80 cases of thoracoscopic oesophagectomy predicted the risk of complications.²²

Working space, especially in neonates and infants, is limited. Some of these challenges have been overcome by advances in a new generation of products including high resolution lenses (2–5 mm), digital cameras and shorter 3 mm instruments. However technical refinement and experience is necessary to ensure suturing ability and instrument handling in the confined environment of the thorax.

Small case numbers in paediatrics further exacerbate the problem of surgeons obtaining the necessary skill set to perform many of the complex procedures which are possible in infants and children.²¹

Anaesthesia in children undergoing thoracoscopic surgery can be difficult due to the need for single lung ventilation.^{23,24} In order to visualise the area of interest collapse of the lung within the

Table 1

Paediatric Thoracoscopic Procedures.

Pulmonary
• Biopsy
• Wedge resection
• Metastasectomy
• Lobectomy
◦ Congenital cystic adenomatoid malformation
◦ Pulmonary sequestration
◦ Bronchiectasis
◦ Neoplasms
• Segmentectomy
• Extra lobar pulmonary sequestration
• Bullous resection
• Bronchogenic Cyst
Pleural
• Empyema
• Chylothorax-Thoracic duct ligation
• Pleural biopsy
• Pleurectomy
Oesophageal
• Oesophageal atresia repair
• Tracheo-oesophageal fistula repair
• Oesophagectomy
• Oesophageal replacement
• Oesophageal duplication
• Heller Myotomy
Mediastinal
• Mediastinal biopsies
• Thymectomy
• Sympathectomy for palmer hyperhidrosis
• Teratoma resection / biopsy
• Neurogenic tumour resection/ biopsy
• Pericardial cysts
• Pericardial window
Vascular
• Patent ductus arteriosus ligation
• Azygous or Superior vena cava venous access
• Division of Vascular rings
• Aortopexy for tracheomalacia
Diaphragm
• Congenital diaphragmatic hernia repair
• Diaphragmatic eventration repair/plication
• Diaphragmatic pacing
Skeletal
• Pectus excavatum repair
• Spine exposure for scoliosis surgery



Figure 2. Excellent cosmetic outcome following a thoracoscopic congenital diaphragmatic hernia repair.

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