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Pediatric Surgical Associates is now on-line! Visit us at www.pedisurgdfw.com where you will find information you can share with your patients including maps to our various locations, facts regarding surgical conditions affecting children, and even a little about who we are. Parents are encouraged to download and print our standard office registration forms, which they can complete at home and bring with them to their child's office visit, saving time. Back issues of this newsletter, "Your Surgical Consultant" may also be found there. Check back regularly for frequent updates. Feel free to email us at psafw@yahoo.com with any ideas regarding items which you or your patients would find useful!

MINIMALLY INVASIVE SURGERY: THORACIC

Last month we presented an overview of laparoscopic surgery, or minimally invasive surgery (MIS), applied to abdominal conditions in children. But pediatric thoracic surgery has also benefited from advances in MIS through a technique called thoracoscopy.

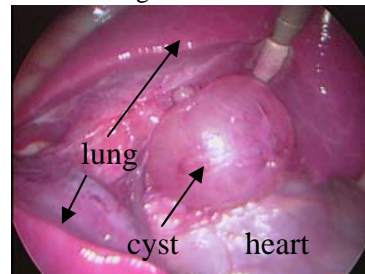
Thoracoscopy is technically easier than is laparoscopy. Thoracoscopy generally requires no carbon dioxide insufflation since the chest is relatively rigid; instead, the lung on the affected side is allowed to collapse, creating a space in which to maneuver. Furthermore, not having to divide the chest muscles or to spread the ribs apart forcefully, procedures which are required with a standard thoracotomy, results in much less morbidity and pain, and a faster recovery.

One of the earliest applications of thoracoscopy was in **diagnostic lung biopsy**. Small linear stapling devices allow the removal of peripheral lung tissue, but these are best employed for biopsy purposes when diffuse rather than localized disease is present. The lack of tactile feedback makes the removal of discrete masses hidden within the lung parenchyma difficult because precise localization is difficult, although CT localization may help in some situations. Open resection is often necessary unless a combination of open and MIS techniques, e.g., Video-Assisted Thoracic Surgery (VATS) is employed. VATS combines the advantages of

MIS with a reduced open technique; through an incision larger than the usual MIS port site but smaller than the standard open thoracotomy incision, the surgeon's finger may be inserted to "assist" in the thoracoscopic resection.

The techniques employed in diagnostic lung biopsy are further utilized in the therapeutic **resection of damaged or otherwise abnormal portions of the lung**. A spontaneous pneumothorax usually occurs in asthenic adolescent men whose pulmonary apices may contain thin-walled blebs. Resection of these abnormal areas is generally curative. The apices are difficult to resect through an open thoracotomy but are much more accessible through the thoracoscope.

As surgeons became more facile with thoracoscopic



techniques, **resection of bronchogenic cysts, mediastinal cysts and mediastinal masses** including the thymus became more commonplace. Excellent visualization of these structures due to video magnification and crystal-clear imaging allows very precise dissection and tissue manipulation. Members of our group have

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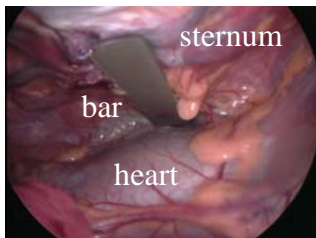
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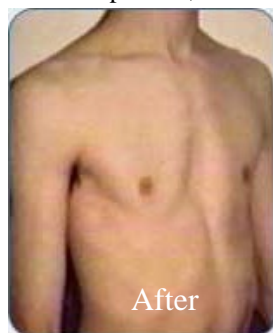
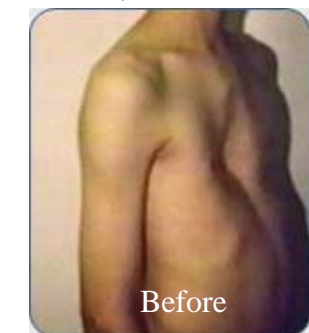
performed thoracoscopic thymectomy for myasthenia gravis, resection of bronchogenic cysts, and resection or biopsy of other types of mediastinal masses including tumors.

Repair of pectus excavatum has received much attention lately with the introduction and popularity of the Nuss technique. Traditional reparative procedures, performed since the 1930s, usually employ a long transverse thoracic incision, resection of the deformed cartilages, a sternal osteotomy, and various forms of internal fixation, usually in the form of a sternal bar. This standard procedure takes several hours, causes significant blood loss, and results in a stiff and poorly compliant chest wall which may contribute to thoracic chondrodystrophy when applied to younger patients. Failure rates up to 36 percent have been reported.

The minimally invasive Nuss technique exploits the pliability and remodeling capacity of the pediatric thorax. This thoracoscopically guided procedure involves making a small incision laterally on either side of the chest and passing a pre-curved steel bar beneath the sternum at the point of maximal deformity, immediately correcting it. The bar is then left in place for two to three years to allow gradual reconfiguration of the chest wall, similar to applying braces to teeth. Results of the Nuss procedure have been very good with over 10 years of follow-up; blood loss is minimal, the recurrence rate is about 10 percent, and chest



wall compliance is normal. Modifications of the technique have reduced the risk of bar displacement to less than 6%.



Some cases of pneumonia result in a pleural effusion, which may become infected resulting in an **empyema**. An empyema is best managed by removal of the infected material, a procedure known as decortication. This procedure was formerly accomplished by open thoracotomy and manual extraction of the infected material. Thoracoscopic decortication is now the standard approach and leaves the child with two or three tiny scars, a much shorter recovery period and less likelihood of requiring other invasive procedures.

A variety of etiologies result in a paralyzed and flaccid hemi-diaphragm, or a **diaphragmatic eventration**. This is recognized on a chest radiograph by a high arching hemi-diaphragm and is verified by the lack of diaphragmatic movement on ultrasonography. Plication of a diaphragmatic eventration is accomplished by placing sutures into the diaphragm to "gather" the redundant tissue, tightening the muscle and allowing the ipsilateral lung to expand to a normal size; accessory muscles of respiration can then provide adequate chest wall movement. The plication of an eventra-

tion is fairly easily accomplished through the thoracoscopic approach since it involves only the placement of sutures with minimal dissection and no cutting or removal of tissue.

A recent application of thoracoscopic techniques has been in the treatment of **hyperhidrosis** (excessive sweating), a common disorder which generally begins in adolescence. The most frequent form of hyperhidrosis involves the hands, but foot, underarm and facial sweating are also common. Hyperhidrosis is thought to be due to over-activity of the sympathetic nervous system. The non-surgical treatment of this always embarrassing and often incapacitating condition is difficult and inconsistent; these include anti-perspirants, medications such as anticholinergics and propranolol, iontophoresis (electrical stimulation), and Botox. All have side effects and none are reliable. Surgical removal of axillary sweat glands does nothing to treat palmar hidrosis, a usually much more incapacitating condition. Bilateral thoracoscopic thoracic sympathectomy, or surgical interruption of the responsible sympathetic nervous tissue, is a reliable treatment for hyperhidrosis, and most patients experience an immediate reversal in underarm, facial and palmar sweating immediately after surgery. A few experience an improvement in pedal hidrosis as well. Surgery may involve a brief overnight hospital stay. Side effects consist of compensatory sweating, usually involving the trunk, a mild decrease in heart rate, and rarely chronic pain. As with any procedure, a careful evaluation of associated risks and benefits is critical, particularly when the objective is, as in this case, the preservation of life-style and not of life itself. Nevertheless, most patients, particularly adolescents, are thrilled with the dramatic improvement in their self-confidence and social ease.

The ability to perform more complex procedures such as **repair of esophageal atresia** is also developing rapidly, and such procedures are now being performed at certain centers around the world. Further refinements in instruments and techniques and in the use of robotic assistance will likely be needed before such procedures become routine.

In summary, many pediatric surgical procedures have been improved by applying minimally invasive techniques. Patients benefit through shorter hospital stays, less pain, and the earlier return of bowel function and normal activities. The cosmetic benefit is difficult to quantify but is important to a child who must live with his scars for a lifetime. Further advances in technologies such as robotics and microchips, and the ingenuity of pediatric surgical pioneers, promise to make the future of pediatric MIS exciting and fruitful.

We at **Pediatric Surgical Associates of Fort Worth** have performed all of the above procedures, all of the laparoscopic procedures discussed last month, and many other less common laparoscopic and thoracoscopic procedures with a high degree of success and patient satisfaction. **As the only pediatric surgeons in Tarrant County who perform all of these procedures, we welcome the opportunity to benefit your patients with our expertise.**

Disclaimer: All material is intended for informational purposes only and is not intended, and should not be used, to replace medical advice offered by a qualified physician. We are always available and willing to discuss questionable conditions with you and we invite your request for our assistance.

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