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Minimally Invasive Surgeries: Using a Tubular Retractor

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Abstract

During the last 10 years, minimally invasive surgery has influenced the techniques used in every specialty of surgical medicine. This development has not only led to the replacement of conventional procedures with minimally invasive ones, but has also stimulated surgeons to reevaluate conventional approaches with regard to perioperative parameters such as pain medication. However, two major drawbacks have emerged with the introduction of this new technique: firstly, the prolonged learning curve for most surgeons, in comparison with the learning process in open surgery; and secondly, increased costs due to investment in the equipment required and the use of disposable instruments, as well as longer operating times. In the various health-care systems around the world, these increased costs are not always compensated for by shorter hospital stays. This review focuses on major areas of indication for minimally invasive surgery in the gastrointestinal tract. These include functional disorders of the upper and lower gastrointestinal tract, obesity surgery, minimally invasive techniques in gastric and hepatobiliary surgery and in other solid organs, and laparoscopic colorectal surgery. The shortening of the hospitalization period has led to increasing use of outpatient laparoscopic surgery, and many centers specializing in day-care surgery are using these techniques [1]. The frontiers are being pushed even further, as the size of the instruments is reduced to achieve better cosmetic results. Clinical research has also focused on the topic of expanding the indications for minimally invasive approaches in the elderly and in high-risk patients, to take advantage of the shorter hospital stays and reduced surgical trauma that are possible. A considerable amount of basic research has been carried out on the stress response during and after minimally invasive procedures, and an improved immune response with the minimally invasive approach has been observed, leading to better results after extensive oncological procedures. Robotic surgery and telesurgery involve new computer-aided methods that allow greater precision in surgical technique, as well as offering an opportunity to supply surgical skill and expertise remotely, over long distances [2]. Minimally invasive surgical techniques are thus now fully established in routine use, and the indications are continuing to expand.

Keywords: Pneumothorax; minimally invasive procedures; video-assisted thoracoscopic surgery (VATS)

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Introduction

A minimally invasive surgical procedure should be defined as one that is safe and is associated with a lowerpostoperative patient morbidity compared with a conventional approach for the same operation. The first procedure, which prevented a previous radical operation, was the use of a cystoscope to look into and treat lesions of the bladder [3]. In 1931, Takagi of Tokyo redesigned the cystoscope and produced an arthroscope 3.5 mm in diameter. Marski Watanable, a pupil of Takagi, tenaciously pursued the development of the arthroscope, and in 1957, based on extensive experience in performing arthroscopy, he published

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an Atlas of Arthroscopy. The Ochsner Clinic has a great heritage, particularly in providing the state of the art in surgical techniques. In the early 1940s at a time when thoracic surgery was in its infancy as a surgical specialty, pulmonary resection was the most dramatic operation performed. At that time, more pulmonary resections were performed at the Ochsner Clinic than any other institution in the world. Subsequently as other operations were developed, the Ochsner Clinic competed in the forefront in technical innovations. A precursor to minimally invasive video-assisted surgery was minimally invasive direct surgery [4]. When I was a young surgeon at the Baylor College of Medicine in the late 1950s, I remember reading of the presentations of Dr. Paul DeCamp, an Ochsner Clinic staff member, who championed thoracoscopy as a minimally invasive surgical technique [5]. He expounded on the values and effectiveness of this technique in pleural and lung biopsies, lysis of pleural adhesions, pleurodesis, etc. Because of the excitement of extracorporeal circulation and open-heart surgery, it was hard for surgeons at that time to be convinced of the value of minimally invasive techniques. However, years later the development of the video camera, the demand for less traumatic procedures, and the need for cost reduction stimulated evolution of minimally invasive surgical techniques [6].

Using a Tubular Retractor

This technique involves progressive dilation of the soft tissues, as opposed to cutting directly through the muscles. By using tubes to keep the muscles out of the way, the surgeon works through the incision without having to expose the area widely. Sometimes, the surgeon will also utilize an endoscope or microscope focused down the tube to assist with performing the surgery through a minimal access strategy. Once the procedure is complete, the tubular retractor can be removed, allowing the dilated tissues to come back together. Depending on the extent and type of surgery necessary, incisions can often be small.

Percutaneous Placement of Screws and Rods

Depending on the condition of the patient, it may be necessary to place instrumentation, such as rods and screws, to stabilize the spine or to immobilize the spine to facilitate fusion of the spinal bones. Traditional approaches for placement of screws requires extensive removal of muscle and other tissues from the surface of the spine. However, percutaneous (meaning “through the skin”) placement typically involves inserting rods and screws through relatively small skin incisions without cutting or dissecting the underlying muscle. With the aid of x-ray images, guidewires are placed through the skin and into the spinal vertebrae along the desired paths for the screws. Then, screws are placed over the guidewires and follow the path of the wires. These screws have temporary extenders that extend outside of the skin and are subsequently removed after helping to guide passage of rods to connect and secure the screws. With the use of spinal navigation and robots, spinal instrumentation is being placed more safely and accurately.

Direct Lateral Access Routes

In some cases, especially those involving the lumbar spine, approaching the spine from the side of the body results in reduced pain, due to the limited amount of muscle tissue blocking the way. This approach is typically performed with the patient on his or her side. Then, a tubular retractor docks on the side of the spine to enable access to the spine’s discs and bones.

Thoracoscopic Access Route

Depending on the patient's condition, it may be necessary to access the front portions of the thoracic spine, located in the chest and surrounded by the heart and lungs. Traditional access approaches often involve opening the chest through large incisions that may also require removal of one or more ribs. However, thoracoscopic access relies on multiple small incisions, through which working ports and cameras can be inserted to facilitate surgery.

Types of minimally invasive surgery

Adrenalectomy to remove one or both adrenal glands, Brain surgery, Colectomy to remove parts of a diseased colon, Gallbladder surgery (cholecystectomy) to relieve pain caused by gallstonesHeart surgery, Hiatal hernia

repair, sometimes called anti-reflux surgery, to relieve gastroesophageal reflux disease (GERD), Kidney transplant, Nephrectomy (kidney removal), Spine surgery, plenectomy to remove the spleen.

Minimally invasive surgery uses smaller surgical incisions, and it's generally less risky than traditional surgery. But even with minimally invasive surgery, there are risks of complications with anesthesia, bleeding and infection.

Materials and Methods

23 patients (Group A) with a mean age 38.2 years with single-level spondylodiscitis between T4-T11 treated with video-assisted thoracoscopic surgery (VATS) involving anterior debridement and fusion and 15 patients (Group B) with a mean age of 32.5 years who underwent minimally invasive posterior pedicle screw instrumentation and mini open posterolateral debridement and fusion were included in study. The study was conducted from Mar 2003 to Dec 2009 duration. The indication of surgery was progressive neurological deficit and/or instability. The patients were evaluated for blood loss, duration of surgery, VAS scores, improvement in kyphosis, and fusion status. Improvement in neurology was documented and functional outcome was judged by oswestry disability index (ODI).

Results

The mean blood loss in Group A (VATS category) was 780 ml (330-1180 ml) and the operative time averaged was 228 min (102-330 min). The average preoperative kyphosis in Group A was 38° which was corrected to 30°. Twenty-two patients who underwent VATS had good fusion (Grade I and Grade II) with failure of fusion in one. Complications occurred in seven patients who underwent VATS. The mean blood loss was 625 ml (350-800 ml) with an average duration of surgery of 255 min (180-345 min) in the percutaneous posterior instrumentation group (Group B). The average preoperative segmental (kyphosis) Cobb's angle of

three patients with thoracic TB in Group B was 41.25° (28-48°), improved to 14.5°(11°- 21°) in the immediate postoperative period (71.8% correction). The average preoperative segmental kyphosis in another 12 patients in Group B with lumbar tuberculosis of 20.25° improved to –12.08° of lordosis with 32.33° average correction of deformity. Good fusion (Grade I and Grade II) was achieved in 14 patients and Grade III fusion in 1 patient in Group B. One patient suffered with pseudoarthrosis/ doubtful fusion with screw loosening in the percutaneous group.

Discussion

Minimally invasive surgery has become increasingly popular among both spine surgeons and patients. Since the early 2000s, MIS technology (i.e., retractors, instrumentation, interbody cages, pedicle and facet screws) has advanced at a rate that has exceeded the literature on the topic. The fundamental premise of MIS surgery is that it is better for the patient because it reduces the amount of tissue trauma associated with open procedures. Certainly, short-term results indicate a benefit for patients following decompression and fusion surgery in regard to narcotic use and hospital stays. However, there is a paucity of articles that define long-term outcomes. Many studies have demonstrated that open midline spine approaches are associated with paraspinal muscle damage, and proponents of MIS surgery use this as a springboard to promote MIS techniques. However, there is currently a lack of evidence that substantiates less soft tissue damage with MIS techniques. Simple observation may lead one to believe that MIS causes less tissue damage, but this has not been quantified and remains an aspect of MIS surgery that needs to be defined further.

Conclusion

Good fusion rate with encouraging functional results can be obtained in caries spine with minimally invasive techniques with all the major advantages of a minimally invasive procedures including reduction in approach-related morbidity.

Acknowledgement

None

Conflict of Interest

None

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