introduction

Minimally invasive surgery is an emerging surgical concept that has been applied in various subspecialties over the past three decades. The need to develop smaller access portals and advanced tools for precise targeting of the pathology has been the main challenge to convert a conventional open procedure into a less traumatic and tissue-sparing surgery. The same applies to spinal surgery with the emergence of minimally invasive spinal surgery (MIS).

Conventional open-spine surgery and spinal fusion/fixation surgery (Fig. 1) for the treatment of degenerative disc disease are much more traumatic and tend to destabilize spinal segments, which requires further surgery of fusion and fixation. These have also been associated with a wide range of postoperative complications, including accelerated degeneration of adjacent discs (i.e., "adjacent segment disease," or ASD) or significant herniation of discs (i.e., "post fusion junctional disc herniation syndrome," or JDHS), in 19% to 52% of postfusion patients 4 to 5 years after fusion surgery, as reported in various studies. Many of them are treated with additional extension of spinal fusion surgeries. Obviously, the viscous spinal fusion cycle is a surgical nightmare but it can be prevented with MISS.

However, the new minimally invasive surgery is technologically dependent on the advancements of bio-computer technological developments, spinal dilation technology, advanced sophisticated optic-endoscopic spinal instruments, imaging-video technology, tissue modulation technology, and laser technology. The utilization of these technologies for MISS creates a complex technological surgical environment. In response, the SurgMatix Surgical EMR (electronic medical record) Control System (SECS; SurgMatix Inc., Wilmington, DE) was designed and developed to facilitate the precise MISS with the "digital surgical technology convergence and OR control system." It provides a complete clinical picture with live "real-time" data of a surgical patient in a digital operating room (DOR), being "patient centric" and "patient transparent." Most importantly, it enhances and improves the quality and safety of the surgical patient care, and provides significant data for further clinical analysis.

why and what is miss?

The urgent need for less or minimally invasive surgical technology is obvious and has lead to the development of MISS. It is an advanced technologically driven surgical procedure requiring various sophisticated and advanced delicate spinal surgical instruments and more complex technology than the traditional and more traumatic open spinal surgery. MISS involves the use of various technological modalities to achieve its surgical goals, including advanced imaging, an endoscopic laser system, and specially designed mini-spinal surgical tools for "tissue dilatation" and spinal decompression (Fig. 2).

MISS is an outpatient endoscopic microdecompressive procedure performed under local anesthesia and conscious sedation, using only a small 4 mm to 10 mm surgical skin incision. The mini-spinal surgical instruments are introduced through small tubular retractors and are aided by the introduction of surgical instruments with "dilatation technology" instead of cutting technology (Fig. 3).

These instruments avoid the complications from both general anesthesia and traumatic tissue dissection. The MISS surgeon does not have direct visualization of the gross anatomy in the surgical field like conventional surgery, except viewing of the surgical anatomy through the endoscope, and must depend on the interpretation of pathology in relationship to x-rays, magnetic resonance imaging (MRI), computed tomography (CT), three-dimensional CT aided by C-arm fluoroscopy, endoscopic visualization, intraoperative neurophysiological monitoring, and electromyogram (EMG) and real-time x-ray imaging as well as preoperative imaging studies. Prior MISS training and education guide the surgeon in performing the endoscopic decompressive MISS (Fig 2).

what is surgmatix?

Although there have been many advances in the surgical instruments and techniques for MISS procedures, the development of integrated surgical monitoring systems lagged behind. This accounted for some surgical complications that could have otherwise been avoided if proper monitoring was utilized.