Opinion

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Minimally Invasive Spinal Surgery for Intradural Tumors

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About the Study

Open laminectomy is the traditional approach for resection of intradural spinal tumors, which provides a large, bilateral exposure to the vertebral column. However, so as to attain this exposure, the surgeon must strip the bilateral musculature from the posterior bony anatomy and disrupt the posterior ligamentous complex. Other potential detrimental effects are disruption of the facet joint complex and potential for disconnection of the pars interarticularis. Such an exposure may result in significant postoperative pain and iatrogenic instability. Minimally Invasive Spinal Surgery (MISS) has gained popularity with the introduction of the tubular retractor and Micro Endoscopic Discectomy (MED) and with the subsequent application of the microscope. MISS approaches utilizing tubular retractors have been applied to all levels of the spinal canal for the performance of micro discectomy, laminectomy, for amniotomy and fusions.

The philosophy of MISS is to minimize trauma and disruption of the native anatomy. In this manner, MISS aims to depart the smallest operative footprint possible, while still achieving similar operative goals as traditional open approaches. The hypothesized advantages of such MISS techniques over open procedures include decreased postoperative pain and fewer postoperative narcotic uses, faster recovery and return to daily activity, shorter hospitalization, less intraoperative blood loss, smaller incisions, fewer overall complications and fewer iatrogenic instability.

Patient selection is of the utmost importance for the success of MISS techniques. As such, a radical patient history and physical examination and careful study of the imaging are necessary to recognize patients who will benefit from an MISS approach versus a traditional open approach. Work up should include advanced imaging, which at minimum should include magnetic resonance imaging with and without contrast to evaluate the tumor. Two main factors are considered while making the determination on a tubular retractor approach versus an open approach, tumor size and tumor location. In general, non- tubular retractors of at least 24 mm diameter for intradural tumor resection is utilized. When considering the dimensions of a tumor amenable to an MISS approach. Tumors that can be accessed via a single level laminectomy and that fit within the diameter of the tubular retractor are ideal.

The location of tumor is also crucial for selecting an MISS approach to ensure safe resection and minimal risk of nerve or spinal cord injury. Location refers to both the location of the tumor within the thecal sac and the level of the spinal column. IDEM tumors within the cervical and thoracic spine require a high degree of preoperative examination. Small IDEM tumors located dorsal or dorsolateral could also be considered for an MISS approach. It is preferred to perform open resection when operating at the level of the spinal cord to minimize any risk of injury to normal spinal cord tissue. Tumors that lie ventral aren't recommended to be resected via an MISS approach because of concerns regarding manipulation of the spinal cord so as to access and resect the tumor. These tumors are more safely approached using an open technique to permit the surgeon a good lateral to medial working trajectory to avoid spinal cord injury and permanent neurologic deficit. There do exist in the literature reports of MISS resection of cervical and thoracic IDEM tumors, at all locations within the thecal sac, however, in general such tumors are not selected for an MISS approach. With regard to IM tumors, it is not practiced to perform resection through a tubular retractor due to the limited space for maneuvering instruments within the spinal cord safely and the higher risk or inadvertent injury to normal spinal cord tissue

Intraoperative neuromonitoring (IOM) is employed for all intradural tumors regardless if approached via MISS versus open. For IDEM tumors at the level of the spinal cord, motor evoked potentials (MEP), somatosensory evoked potentials (SSEP) and triggered electromyography (tEMG) are utilized. For lumbar tumors below the extent of the conus medullaris, only tEMG is employed. For IM tumors, MEPs, SSEPs and epidural MEP (D-Wave) are utilized. There are several instruments that are critical for resection of intradural spine tumors through a tubular retractor to allow adequate visualization of the target anatomy. Such as operative microscope, Bayoneted bipolar electrocautery, Bayoneted instruments, Non-Expandable tubular retractor set, curved extended shaft, high speed drill and MIS dural closure set. Additionally, some key instruments that assist with IM tumor resection are ultrasonic aspiration for tumor resection and ultrasound for lesion localization.

Conclusion

All intradural spinal tumors are accessed via a unilateral laminotomy through a tubular retractor. There are many types of tubular retractors on the market, including specular retractors, expandable blade retractors, expandable and non-expandable tubular retractors. In general, the microsurgical principles and techniques for the definitive tumor resection are consistent between MISS and open procedures. It is the approach and

dural exposure and dural closure that have got to be adapted for MISS.

Safe and effective tumor resection should always be the main goal of surgery. Therefore the edge to perform resection of an IM spinal cord tumor through an MISS approach should be much higher. Concern includes the limited ability to maneuver within the vertebral canal safely and therefore the higher risk of inadvertent injury to normal spinal cord tissue. Additionally, ultrasound cannot be used to determine the exact location of dural opening or midline myelotomy because the ultrasound cannot fit down the tubular retractor. Another hurdle to adopt MISS technique for IM tumor resection is that current ultrasonic aspiration devices on the market aren't amenable to MISS because the current designs do not allow surgeon visualization down the tubular retractor while using the devices. Resection of small lesions or biopsies is considered using MISS technique however, for the above mentioned reasons open laminectomy is generally preferred for IM tumors.