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Essay

Why Endoscopic Spine Surgery?

Woo-Keun Kwon[1], Se-Hoon Kim[2,*]

[1]Department of Neurosurgery, Korea University Guro Hospital, Korea University College of Medicine, Seoul, Korea
[2]Department of Neurosurgery, Korea University Ansan Hospital, Korea University College of Medicine, Ansan, Korea

Corresponding Author
Se-Hoon Kim
https://orcid.org/0000-0001-7516-7372

Department of Neurosurgery, Korea University Ansan Hospital, Korea University College of Medicine, 123 Jeokgeum-ro, Danwon-gu, Ansan 15355, Korea
Email: sean1049@gmail.com

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*President of Korean Minimally Invasive Spine Surgery Society (KOMISS).

INTRODUCTION

Various spinal diseases and related pain is a very common phenomenon, and it is reported that more than two-thirds of the population experience these spine related symptoms during their lifetime.[1] These diseases already have become a great socioeconomic burden,[2] and as we are living in an aging society, it is obvious that we will encounter more of these patients in our daily practice and will inevitably have to manage more spinal disease cases in the near future.

It is very well accepted that nonsurgical treatment should be the first line therapy for most pain related spinal disorders. Nonetheless, surgical decompression with or without fusion procedures continue to be the treatment of choice for those who fail to improve from nonsurgical therapy. The primary goals of spinal surgery are relieving symptoms, enhancing quality of life while preserving the function of the spine. To reach this goal and optimize the outcome of spinal surgery with respect to clinical, functional, patient self-reported, and cost-effectiveness, development and advancement of new surgical techniques are critical.

Just like the introduction of laparoscopes or robot surgeries was an evolution for abdominal general surgery,[3] utilization of endoscopic spine surgery (ESS) has revolutionized the surgical treatment of spinal diseases. This cutting-edge technique is now gaining great popularity recently with significant evidence.[4] Despite the relatively steep learning curve for the acquisition of its techniques,[5-7] ESS has carved an important niche in the armamentarium of the spinal surgeon. This is owed to the proven safety and efficacy of endoscopy in surgery of the degenerative spine as compared to open surgery or other conventional minimally invasive techniques.[8-10]

The *Neurospine* organized a North American Spine Society (NASS)/*Neurospine* ESS special issue subtitled; The road to expansion and standardization of ESS, and we believe it will be a great opportunity to share our thoughts on ESS with a brief overview on the existing evidence in this short essay.

DEVELOPMENT AND UTILIZATION OF ESS

ESS was first introduced and developed by several pioneers who had great enthusiasm for minimally invasive spine surgery (MISS) techniques. Drs. Kambin and Sampson[11] presented a successful percutaneous removal of disc material via the famous "Kambin's triangle" in the 1980s, and Dr. Yeung[12] reported his great early results of disc removal under visualization using the novel ESS device of his own in the late 1990s. Although the relatively

steep learning curve and technical barriers behaved as barriers for the rapid adoption of ESS in the early days, steady groundwork for more than 20 years supported the development of ESS and finally it emerged as a novel cutting-edge major MISS technique.

Transforaminal approach to the lumbar spine pathologies allowed spinal surgeons to reach the whole nerve root route starting from the extraforaminal – foraminal to the intra canal space without necessity of excessive bone/joint or ligament sacrifice. Interlaminar approach mirrors the traditional microscopic techniques as they resemble the very same approach that most spinal surgeons are familiar with. While this approach has advantage in terms of familiarity, it also has greater benefit with improved visualization and more tailored targeting owing to the greater maneuverability and availability of greater range of visualization with angled cameras.[8] Utilization of biportal ESS systems has also brought diversity to the field of ESS and offers greater degree of surgical variety by persistently widening the range of diseases that can be treated by ESS.

Nowadays, the benefit zone of ESS is getting wider starting from relatively low complexity procedures such as simple lumbar microdiscectomies, laminotomies or lateral recess decompressions, up to more complex procedures such as cervical or thoracic decompressions or even spinal fusion procedures.

GAINING EVIDENCE AND POPULARITY

Following the wide acceptance of ESS throughout the globe, the surgical technique as well as technical development have been extensively researched and the number of research related to ESS have also greatly increased. While the annual number of publication related to ESS were sparse in the early 2000s, the number surged up starting from the mid 2010s and recently more than 200 publications are being reported annually.[4] China, South Korea, USA, and Germany are noted as top countries contributing to publication in the field of ESS, representing the worldwide popularity and interest from various regions and continents.[4,13] Various globally recognized scientific peer-review journals are presenting large number of articles related to ESS, reflecting the significant impact of ESS in the field of spinal surgery. These journals include but are not limited to orthopedic journals, neurosurgical journals, pain journals, and general medical journals.[13]

The utilization of ESS has gained great interest worldwide and has now become an increasingly popular procedure, and global effort unifying the nomenclature has also been made as it is critical to delineate a united nomenclature among ESS surgeons.[14] There are many places in the globe where ESS has already become an major surgical option like the aforementioned countries, and at the same time there are many other parts of the globe that are at the beginning of adopting the new technology.[15,16] It is obvious that ESS is a widely accepted and scientifically proven technique for various spinal pathologies, and with advancement of the technique itself and related technology, the use will be more adopted in the near future.

UTILIZING MODIFIED TECHNIQUES AND FUTURE APPLICATIONS

The development and universalization of ESS naturally leads to modification of the techniques in order to optimize the procedures for each different clinical situation. Contralateral interlaminar approach can be utilized to reach and decompress the contralateral lateral recess and the foramen without being blocked by the facet joint.[17] The lower lumbar extraforaminal stenoses including the caudal most lumbosacral spine, Bertolotti's syndromes can be successfully decompressed by modified interlaminar approaches.[18,19] By modifying the interlaminar endoscopic unilateral laminotomy for bilateral decompression, bilateral lateral recesses can be decompressed via single approach and even sparing the midline ligamentum flavum for selective cases.[9]

Several complex clinical scenarios such as pseudoarthrosis, revisional surgery, calcified thoracic discs, or fusion techniques were once considered as relative contraindications for ESS. However, experienced ESS surgeons have presented good surgical, clinical outcome for these cases utilizing full-endoscopic techniques,[8,20] proving that modification of techniques can be applied for more complex cases. Most notably, the use of ESS in fusion surgery is becoming popular. Both full-endoscopic ESS and biportal ESS are showing very good clinical and radiologic results for lumbar fusion surgeries.[21,22] Recent reports are even presenting favorable outcomes for spinal infectious diseases or oncologic problems, suggesting the possibility of even wider range of ESS application.[23-25]

CLOSING – WHY ENDOSCOPIC SPINE SURGERY?

As previously described, since the introduction of ESS, it has consistently developed to this day built on the endless endeavor of the pioneers. It provides a minimally invasive approach to

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various spinal pathologies with greater benefit to patients with similar or even better outcomes compared to conventional techniques. Scientific evidence of its efficacy, safety and cost-effectiveness is accumulating and subsequently its utilization is becoming popular worldwide. Modification of the techniques and utilization of them are amplifying the range of diseases that can be treated by ESS, and ceaseless effort of applying new technology will further enhance the ability of ESS surgeons. There is no doubt ESS will be an essential part in the field of spinal surgery. Here's our answer to "why endoscopic surgery?"

- **Conflict of Interest:** The authors have nothing to disclose.

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