



Commentary



Commentary on “Complications in Minimally Invasive Spine Surgery in the Last 10 Years: A Narrative Review”

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See the article “Complications in Minimally Invasive Spine Surgery in the Last 10 Years: A Narrative Review” via <https://doi.org/10.14245/ns.2448652.326>.

Minimally invasive spine surgery (MISS) has revolutionized spine surgery by pushing the boundaries of minimal invasiveness while providing comparable, if not superior, outcomes to traditional open surgery. Nevertheless, with any group of surgical techniques comes a unique set of potential complications, and MISS is no exception. For this reason, it is vital that all spine surgeons have up-to-date information on potential MISS complications to best avoid them in their practice.

The narrative review titled *Complications in Minimally Invasive Spine Surgery in the Last 10 Years: A Narrative Review* by Boadi et al.¹ offers a comprehensive exploration of the complications associated with MISS over the past decade, highlighting both the advancements in technology, challenges that emerged, and the challenges that remain. The review thoroughly outlines the literature, including 137 published studies between 2013 and 2024. The authors brilliantly organized the review by spinal region and surgical technique, providing a clear and comprehensive understanding of how different approaches impact outcomes in specific areas of the spine.

Key Findings

The review summarizes the significant benefits of MISS, including reduced blood loss, shorter hospital stays, and lower costs. These advantages have been consistently demonstrated in several studies, such as a cohort study comparing biportal endoscopic lumbar decompression and open lumbar discectomy which found less postoperative pain, less opioid consumption, and shorter hospital stays.² Furthermore, the integration of technological advancements such as tubular retractors, intraoperative computed tomography, 3-dimensional stereotactic cameras, endoscopy, as well as navigation and robotics, have expanded the use of MISS in a diversity of complex cases, such as thoracic pathologies and adult scoliosis.³⁻⁵

One of the most critical points made in the review is the variability of complications across different spinal regions and surgical approaches. For example, cervical MISS is associated with complications such as transient nerve root palsy and hematomas, while lumbar MISS presents more frequently with dural tears and recurrent disc herniation. The authors emphasize that the choice of approach—whether tubular, uniportal, or biportal—affects both the complication profile and patient outcomes. For example, transient nerve palsies were only reported in 1.2% of 162 patients undergoing biportal cervical intervention, but 5.3% of 38 patients undergoing uniportal surgery.^{6,7} This reinforces the need for individualized surgical planning and careful technique selection to mitigate risks.



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Nerve Injuries and Dural Tears

Despite the advancements in MISS, nerve injuries and dural tears remain significant concerns. As the review notes, while MISS reduces anatomical disruption compared to open surgery, the smaller working field can lead to an increased risk of nerve damage. Nerve injuries, particularly in cervical and lumbar MISS, can result in postoperative weakness, pain, or numbness, with the potential for both transient and permanent deficits.

Durotomies are another complication highlighted in the review. The review's findings suggest that dural tears are more common in lumbar MISS compared to cervical or thoracic procedures. However, when compared to open surgery, it has been shown that MISS is associated with a lower incidence of dural tears.⁸ Interestingly, the use of intraoperative neuromonitoring (IONM) and advanced navigation technologies has been shown to reduce the incidence of such complications, although they are not foolproof.^{9,10}

The Role of Technology in Reducing Complications

One of the review's most promising aspects is the discussion of how technological advancements have contributed to minimizing complications in MISS. The integration of intraoperative navigation, robotics, and neuromonitoring has been particularly beneficial in reducing the incidence of hardware misplacement and nerve injuries. For example, the review cites studies showing that navigated MISS pedicle screw systems have achieved over 90% accuracy in screw placement. Studies such as Charles et al.¹¹ similarly found that augmented reality navigation improves the accuracy of pedicle screw placement. However, the review also mentions that all technology should not be blindly adopted. Instead, the authors suggest that the adoption of these technologies requires extensive training and can be associated with steep learning curves.

Conclusion

While the review provides a comprehensive analysis of MISS complications, the analysis of retrospective studies inherently introduces selection bias and limits causal inferences. Variability in patient populations, surgical techniques, and outcome measures complicates direct comparison of complication rates.

Overall, the authors presented the data in this review with commendable clarity and organization, effectively underscoring the significant advancements in reducing MISS complication rates while addressing areas that still pose challenges. By structuring the review according to spinal region and surgical techniques, they provided a comprehensive comparison of com-

plication rates that makes the findings easy to interpret. Their integration of recent technological advancements, such as IONM and augmented reality, is particularly commendable, offering valuable insights into how these tools contribute to improving patient outcomes. Overall, the review article is an excellently structured and informative tool to summarize the literature on complications of MISS during the past decade.

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