Comparative Analysis of Incidental Dural Tear Rates in Uniportal versus Biportal Endoscopic Lumbar Surgery

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INTRODUCTION: The adoption of full-endoscopic spine surgery represents a paradigm shift in minimally invasive spinal care, with both uniportal and biportal endoscopic lumbar techniques routinely employed. However, comparative data evaluating their respective risks for incidental dural tears remain limited. This study's objective was to systematically compare the incidence of incidental dural tears in uniportal vs biportal endoscopic lumbar surgery, and to examine associated perioperative outcomes.

METHODS: A systematic review was performed under PRISMA guidelines, querying PubMed/MEDLINE, Google Scholar, and the Cochrane Library up to October 2024. Inclusion criteria comprised original studies reporting incidental dural tear rates in uniportal or biportal endoscopic lumbar surgery cohorts. Data on patient demographics, surgical variables, and outcomes were extracted. Meta-analyses calculated pooled incidence rates and heterogeneity indices. Statistical significance was determined by chi-square and p-values; confidence intervals were reported.

RESULTS SECTION: Sixty-seven studies (n = 10,491; biportal: 4,657; uniportal: 5,834) met inclusion criteria, with comparable group demographics. Dural tears were more frequent in biportal endoscopy (3.16%, 152/4,657) than uniportal (1.69%, 100/5,834), $p < 0.001$. Meta-analysis of 25 studies revealed pooled dural tear rates of 1.4% (uniportal, 95% CI: 0.3–2.4%) and 1.1% (biportal, 95% CI: 0.6–1.7%), with no statistically significant difference ($p = 0.42$). Biportal techniques displayed narrower confidence intervals and homogeneity. Operative time was shorter with biportal technique (85.3 vs 90.2 min, $p = 0.03$), while blood loss and functional outcomes were comparable. Uniportal cases had shorter hospital stays (2.1 vs 2.4 days, $p = 0.04$).

DISCUSSION: Although biportal endoscopy demonstrated a higher overall incidence of incidental dural tears, meta-analytic findings in high-quality studies indicated no significant difference between techniques, suggesting technical and study design heterogeneity. Both approaches achieved similar clinical outcomes. Limitations include inter-study variability, reporting heterogeneity, and a limited meta-analysis subset. Future trials with standardized complication data are warranted.

SIGNIFICANCE/CLINICAL RELEVANCE: Both uniportal and biportal endoscopic lumbar surgery are safe with low dural tear rates and effective clinical outcomes, but technique selection and meticulous surgical practice remain crucial to minimize risk and optimize patient recovery.

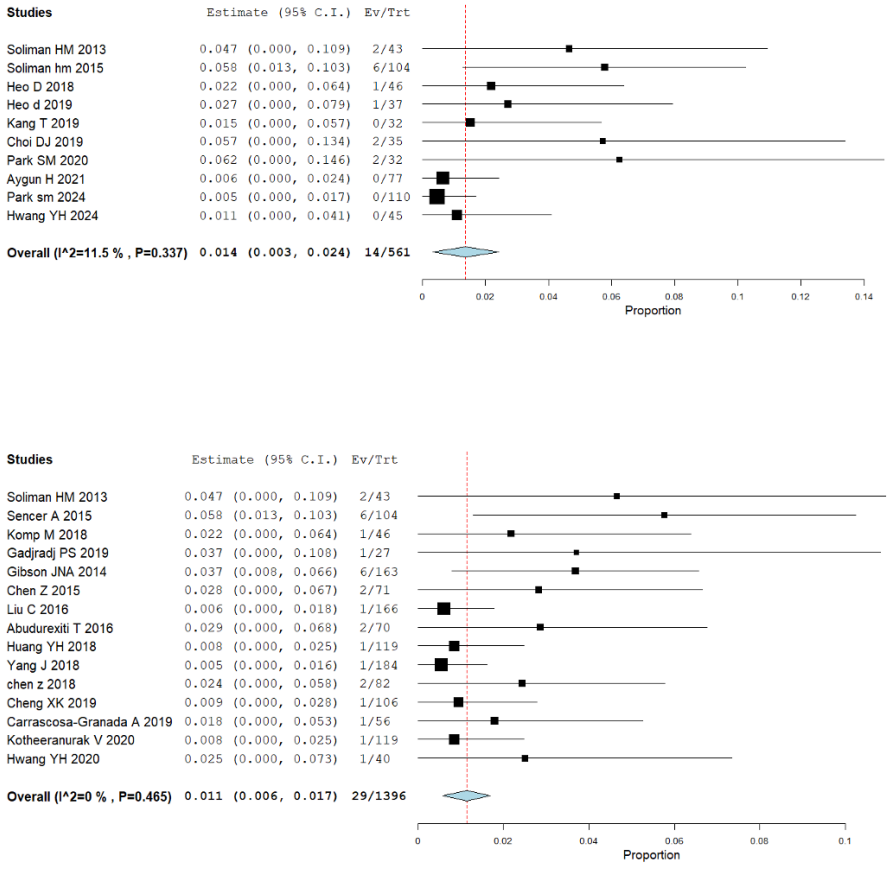

Figure 1. Meta-analysis of Incidental Dural Tear Rates in Uniportal and Biportal Endoscopic Lumbar Surgery.
Top: Uniportal pooled dural tear incidence.
Bottom: Biportal pooled dural tear incidence.