The Current Status of Awake Endoscopic Surgery: A Systematic Review and Meta-Analysis

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INTRODUCTION:
The use of local anesthesia in spine surgery has demonstrated a number of benefits as compared to general anesthesia. This may be especially true when coupled with minimally invasive endoscopic techniques. While a number of studies report positive outcomes following awake spine endoscopic surgery, a systematic review of the literature is needed to evaluate the full extent of its advantages.

METHODS: This systematic review was completed utilizing the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Figure 1). Pertinent studies were identified through Embase, Pubmed, Google Scholar, and Cochrane databases using the search string (Endoscopic spine surgery OR Awake spine surgery OR local anesthesia) AND (lumbar fusion OR lumbar transforaminal interbody fusion OR lumbar discectomy OR cervical discectomy OR laminectomy OR anterior cervical discectomy and fusion OR ACDF OR dorsal column stimulator). Included were adult patients (>18 years), percutaneous endoscopic spine procedures using local/awake anesthesia, and reporting patient (patient-reported outcome measures) and surgical outcomes (complication rates, length of stay). Excluded were non-awake spine studies, not reporting outcomes or adverse events, studies in a language other than English, non-human studies, studies published prior to 2011, and articles classified as reviews, book chapters, single case reports, or small case series (n<15 patients). Patient-reported outcomes and incidence of adverse events were pooled and meta-analysis performed using a random effects model. Subanalysis of comparative studies used the same model to determine the effect of awake spine surgery on length of stay and complication rate. Heterogeneity (I²) was calculated for all studies with a significant level defined as an I²>75.0%. Quality of interventional case series were evaluated using the NIH quality assessment tool scoring system whereas comparative studies were evaluated using the Newcastle-Ottawa Scale (NOS) scoring system, and the Cochrane Risk of Bias scoring system for randomized control trials.

RESULTS: Our initial query returned 527 articles. After removing duplicates, titles and abstracts were screened by two independent reviewers, resulting in identification of 40 full text articles. Following full text review, a final 26 articles were included. Four of the 26 included comparison of general anesthesia to local anesthesia in spine surgery. The final study cohort had 2,113 patients, who underwent fusion, decompression, discectomy or dorsal stimulator procedures. (Table 1) Of the 2,113 patients, 1,873 underwent spinal procedures using local anesthesia and 240 patients with general anesthesia. The overall complication rate was 8.05%, surgical complication rate was 43.5%, major medical complication rate was 13.5%, and minor medical complication rate was 42.9%, with 1.0% undergoing a subsequent revision procedure (Table 2). Four (0.21%) awake spine patients were converted to general endotracheal anesthesia intraoperatively. Significant improvements were seen in pain (p<0.001; I²=99.6) and disability scores (p<0.001; I²=98.9) (Table 3; Figure 2). Studies with MacNab scores revealed that 96% of patients rated their postoperative satisfaction as excellent to good. Subanalysis of comparative studies demonstrated reduced risk of surgical (p= 0.388; OR=0.46; I²=0.00) and major medical (p= 0.213; OR=0.270; I²=23.51) complications, and a slight increase in risk for minor medical complications (p= 0.990; OR= 1.011; I²= 68.66) among awake spine patients (Figure 3). Length of stay was shorter for local anesthesia (p= 0.088; I²= 99.27) (Figure 3). Quality assessment revealed overall high quality with a mean score of 8.4/9 for the NIH quality score, 7.2/8 for the NOS score, and a low and unclear risk of bias for the two randomized control trials.

DISCUSSION AND CONCLUSION: This systematic review and meta-analysis demonstrates that local anesthesia is a safe and effective alternative to general anesthesia among different endoscopic spinal procedures. Although awake spine surgery is associated with decreased risk of severe complications, lower revision rates, and higher postoperative satisfaction, more robust studies involving larger patient cohorts are needed to evaluate the true impact of awake spine surgery on outcomes.