Editorial

30-day sepsis risk after laminectomy for resection of intradural extramedullary (IDEM) tumors based on NSQIP database: a critical appraisal

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The authors need to be appreciated for evaluating the 30-day risk for sepsis following spine surgeries for intradural extramedullary (IDEM) tumor resection. This unique subset of spinal tumors has not been analyzed separately in the published literature for postoperative spinal infections, despite the well-known susceptibility of solid tumor patients to infections. Likewise, this is a discrete heterogenous cohort with varying levels of tissue invasiveness combining both benign and malignant tumors, especially with a well-recognized complication related to cerebrospinal fluid (CSF) leak which again predisposes to meningitis, sepsis, and septic shock. Mo *et al.* (1) present a large volume retrospective analysis of 2,027 patients who underwent laminectomy for IDEM tumors, identified from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database. They have highlighted the risk factors that predispose a patient to sepsis, and these include etiologies, such as superficial and deep wound infections, deep vein thrombosis, pulmonary embolism, increased length of stay (>5 days), repeat surgery within 30 days, blood transfusions, higher anesthesia grade, poor pre-operative dependent functional status of the patient and longer operating time. The mean time to diagnose sepsis was 14 days, which was consistent with the published data. Of note, the laminectomy *per se* did not pose additional risk for sepsis and there was no correlation between sepsis-related complications and mortality.

The article showcased that body mass index (BMI) did not have any impact on the development of sepsis which was surprising, considering the linkage between BMI and surgical site infections (SSIs) reported in several other studies (2). However, this finding is consistent with the inference reached in certain other studies where the association of SSI was with the measure of body fat and not with BMI determined obesity (3). Spine Patient Outcomes Research Trial (SPORT) had demonstrated a non-significant difference in wound infection rates between the obese and non-obese cohorts undergoing surgical treatment for lumbar disc herniation (4).

Smoking has been associated with increased incidence of SSI in literature (5). It was interesting to note that the authors here have shown that chronic obstructive pulmonary disease (COPD), not smoking was significantly correlated with sepsis related complications. Several patients may have stopped smoking prior to the surgery, and hence the duration of abstinence from smoking in the preoperative

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period may be another useful point to be investigated in future studies, as data in this regard is scant and nebulous in current literature.

Another association which was not seen in this study was that between preoperative steroid usage and SSIs (6). It is not clear if the patients on steroids were taking them chronically for other causes or whether it was a short-term peri-operative use of steroids. Due to the limitations of the ACS NSQIP database on which the study is based, the authors were unable to comment on the incidence of meningitis in the patients who went on to develop sepsis. Similarly, the histological variants of the IDEM tumors for which the surgery was performed, and the estimated blood loss (EBL) were also not available for analysis.

One of the drawbacks of NSQIP database study maybe that the subcategorization of surgical exposure methods to the IDEM tumors [considering the extent of tissue dissection in minimally invasive surgery (MIS) *vs.* laminectomy *vs.* laminoplasty] with occurrence of SSI was not addressed. While it may be impossible to extrapolate data from other studies on numerous systemic perioperative medical factors that may result in sepsis, the most common and significant complication following surgery for IDEM tumors is CSF leakage (7). From literature we know that the incidence of this complication is around 8% in patients undergoing laminectomy for tumor excision (8). The studies about laminoplasty for excision of IDEM tumors have largely focused on their fusion rates and outcomes related to spine stability and less on the association with SSI (9). Oktay *et al.* (10) reported one case of CSF leak in a series of 62 patients (1.6%). Since this is a small patient series and the dural closure technique is similar to those in laminectomies, the complication rates with regards to CSF leaks and infections tend not to vary significantly. However, when the re-operations for tumor recurrences are performed, the epidural scarring is higher in open laminectomies, and the tissue dissection planes are more adherent leading to multiple often under-recognized dural tears, making a watertight closure difficult.

The data from MIS for IDEM tumor excision is slightly conflicting, with two studies looking at a total of 110 patients reporting only 2 cases of CSF leak, 2 SSIs and one wound dehiscence (11,12). In contrast, a more recent meta-analysis of seven studies found no significant difference with regards to the rates of surgical complications, medical complications, and gross total resection between the open surgery and MIS cases for tumor excision (7). Despite the difficulty in primary dural closure in MIS access, the lesser incidence of CSF leaks than in open surgeries is attributed to be the reduced soft tissue dissection. Although there is a steep learning curve in handling CSF leak in MIS cases, the open surgical approaches need meticulous layered closure techniques for elimination of tissue dead spaces which can reduce CSF leak and sepsis in laminectomy for intradural tumors too (8). While dural closure and wound repair techniques can vary, the strategies to reduce the incidence of CSF leaks after spine surgery, to reduce blood loss and to reduce operating time appear to be reasonable targets for future research. A shift towards MIS appears to be inevitable going forward and may contribute to an overall reduction in complications in the future.

The use of dural sealants as a reinforcement after dural closure following resection of IDEM tumors has been gaining ground in recent years. These are however, currently reserved for patients who are at a high risk for CSF leak, such as patients who have undergone previous surgery at the same level (13,14). The optimal choice of sealant is also debatable as many products like polyethylene glycol (PEG) hydrogel and fibrin sealants have been shown to cause significant focal mass effect and thecal sac compression (15). Most of these sealants function well under normal circumstances but fail in conditions with raised intracranial pressure. If this is anticipated, it may be better to use one which has demonstrated burst pressures above normal physiological intracranial pressure (Adherus, TachoSil or Duraseal) (16).

The authors have enumerated most of the general risk factors associated with SSIs and strategies to alleviate them based on previously published studies (17,18). Another relevant clinical aspect is the ambivalence regarding the utility of pre-operative nasal screening for Methicillin-resistant Staphylococcus aureus (MRSA), which has been advocated in the past, but was found to be of questionable use in a recent study referenced in this manuscript (19). Similarly, factors like perioperative measures [preoperative chlorhexidine bath, intra-wound irrigation with betadine, intra-wound vancomycin powder, redosing antibiotics, limiting traffic in the operating room (OR) etc.] and postoperative screening for systemic inflammatory response syndrome (SIRS) for early detection of sepsis need to be studied further. The nutritional, immunologic and cardiorespiratory status of the patient, excessive unintended weight loss (prior malignancy or chemotherapy) and other contributing medical risk factors must be screened preoperatively in order to identify their role in reducing the SSI.

Overall, this is an excellent study which has elicited some

crucial pointers to the prevention of sepsis in resection of spinal IDEM tumors. This critical appraisal acknowledges the strength of NSQIP database and the statistical power it offers, along with the weaknesses and limitations of its biases. This study has garnered meaningful and invaluable new evidence, and it opens multiple novel avenues for future research in ways to reduce SSI and sepsis in these patients. For example, review of various surgical approaches and closure techniques with respect to different tumor pathologies would help tailor surgical management and reduce postoperative sepsis risk IDEM tumors of the spine.

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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