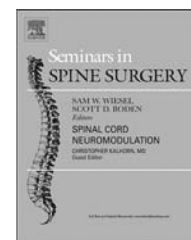


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Case selection for spine surgery in the ambulatory setting

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ABSTRACT

Advances in modern anesthetic and surgical technique as well as multimodal pain management have contributed to the ease and feasibility of performing spine surgery on an outpatient basis. Multiple considerations impact a surgeon's ability to successfully perform spine procedures outside of the traditional inpatient setting. While the expertise of the surgeon and perioperative staff plays important roles, case/patient selection is arguably the most important factor driving outcomes in ambulatory spine surgery. A standardized, multi-disciplinary approach to preoperative patient evaluation and education is paramount for any spine surgeon performing outpatient procedures.

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1. Introduction

As the era of value driven healthcare continues, a greater emphasis on perioperative cost containment has arisen across all procedurally based specialties. In spine surgery, this increased focus on cost-effectiveness has resulted in a shift toward performing procedures in the ambulatory setting. Not only are more overall spine procedures being performed on an outpatient basis, but the percentage of all spine procedures being performed in free-standing ambulatory facilities has increased significantly, with approximately one quarter of all outpatient spine surgery occurring at such centers.¹ Spine surgeons in the U.S. have embraced this trend with a recent survey of a major spine society indicating that 84% of respondents performed ambulatory spine surgery in some form.² Centers in Europe, particularly due to the financial constraints of government sponsored health systems, have also followed suit.³ Cost savings aside, the trend toward ambulatory spine surgery also offers benefits of increased patient satisfaction and a decreased risk of nosocomial

infections.^{4,5} Despite the increasing popularity and potential benefits, the decision to include outpatient spine procedures as part of one's practice should be approached with caution. Careful consideration of patient characteristics, case type, and facility capabilities is essential prior to selecting a case for the ambulatory setting.

2. Basic principles: patient selection

The ability to perform ambulatory spine procedures safely and successfully depends in large part on patient selection. Most spine surgeons are accustomed to their patients receiving postoperative care in medical centers where close monitoring is routine and consultants are readily available to assist with management of medical issues. Unfortunately, acute postoperative complications that would be easily identified and treated in the hospital environment are significantly more difficult to manage in the outpatient setting. For this reason, objective physiologic components of the patient's medical history are important to recognize. The American

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Society of Anesthesiologists (ASA) classification system is a simple tool for identifying patients at a higher risk of a perioperative complication. Mannion et al.⁶ demonstrated a nearly 3-fold (5% vs. 14.5%) increase in surgical complications and a more than 5-fold (2.9 vs. 15.7%) increase in overall complications following lumbar procedures in patients with an ASA score of 3 when compared to those with an ASA score of 1. While inexact, ASA scores above 2 should raise concern when considering a patient for ambulatory spine surgery.

Certain comorbidities have the potential to directly impact patients' risk for acute perioperative complications and should be considered carefully when selecting patients for outpatient spine surgery. Obesity has been directly linked with perioperative complications after spine surgery. A large database study of 24,196 patients undergoing lumbar surgery between 2006 and 2011 suggested that patients with a BMI greater than 25 had a longer operative time (139.0 min vs. 155.0 min, $p < 0.001$) and increased risk of deep vein thromboses (0.3% vs. 0.8% $p < 0.001$).⁷ A systematic review by Cao et al.⁸ of 12 studies comparing obese and non-obese patients undergoing lumbar surgery demonstrated that patients with a BMI greater than 30 had increased operative time (standardized mean difference -0.273 , $p < 0.001$) and blood loss (standardized mean difference -0.265 , $p = 0.001$). Furthermore, patients with obesity being considered for spine surgery also generally have other comorbidities, including diabetes and sleep apnea,⁹ which place them at higher risk for perioperative complications. Obesity itself should not be considered a contraindication for spine surgery in an ambulatory center, but surgeons should consider the increased risk profile of obese patients when determining their suitability for outpatient procedures.

Carefully assessing patients' risk for cardiovascular complication is also critical in the outpatient setting as the management of cardiac or cerebrovascular events generally requires immediate intervention at a tertiary care center. Fineberg et al. studied the risk of cardiopulmonary complications in patients undergoing both lumbar and cervical spine surgery. In a lumbar cohort of 578,457 patients, the incidence of cardiac events was 6.7 per 1000 cases.¹⁰ Patients who suffered an intraoperative or postoperative cardiac events were more likely to have a history of congestive heart failure, electrolyte abnormalities, or anemia (OR 4.8, 3.4, and 2.6, respectively). In a cervical cohort of 214,900 patients, the incidence of cardiac events was 4 per 1000 cases.¹¹ Like the lumbar cohort, regression analyses demonstrated that such patients were more likely to have congestive heart failure, electrolyte disorders, or anemia (OR 6.5, 4.4, and 3.6, respectively). Similarly, a separate database study by Marquez-Lara et al.¹² evaluated 264,891 lumbar fusions and their postoperative course between 2002 and 2011. Their results suggested that patients who experienced postoperative cerebrovascular accidents were more likely to have preexisting congestive heart failure (odds ratio 2.1, $p = 0.001$) or electrolyte abnormalities (OR 2.0, $p < 0.001$). Although preoperative medical evaluation by an internist or cardiologist is a routine part of preoperative preparation for any spine surgery, this process becomes all the more important when selecting patients for ambulatory procedures. Ideally, the facility's anesthesia providers will be involved in the preoperative evaluation of these patients and

communicate directly with the spine surgeon and the patient's medical physicians. Those patients at any increased risk of cardiac complication are best cared for in the hospital setting.

A history of chronic high dose opioid use represents a significant challenge when selecting patients for outpatient spine surgery. Postoperative pain is typically difficult to control in opioid tolerant patients.¹³ If a patient's pain is unlikely to be controlled on the first postoperative day with oral medications alone, they are likely a poor candidate for outpatient spine surgery. Beyond making pain control challenging, high dose opioid therapy also increases patients risk of post-operative urinary retention (POUR).^{14,15} POUR poses an obstacle in ambulatory cases as treatment often requires continuous intermittent catheterization or indwelling catheter placement. The incidence of POUR ranges from 5 to 20% following lumbar procedures and is increased in patients with diabetes, increasing age, male sex, and depression.^{16,17} Intraoperative administration of phenylephrine and neostigmine has been shown to be associated with increased rates of POUR and should be minimized.¹⁷ Preoperative evaluation should include a thorough history to identify patients with POUR following previous procedures.¹⁵ Patients at high risk for POUR should not be excluded from outpatient procedures on this basis alone but should be counseled regarding their risk and informed as to what the management of this condition involves.

Lastly, patients being selected for outpatient spine surgery should demonstrate a well-functioning support system. Available family members can facilitate postoperative communication and may aid in recognition of complications that occur after the patient is discharged. If patients are likely to require significant help with activities of daily living (ADLs) beyond what family members can provide, they are best treated as an inpatient. With advances in technology, mobile applications are being developed to facilitate postoperative monitoring after discharge.³ Patients are often accustomed to regular interaction with hospital staff after surgical procedures and the enhanced communication/monitoring offered by these new technologies may serve to reassure both patient and surgeon following outpatient spine surgery.

While multiple studies have demonstrated the safety and efficacy of outpatient spine surgery, it is critical to note that the existing literature focuses almost exclusively on a young, healthy patient population.^{5,18} Surgeons considering outpatient procedures should carefully scrutinize the health status of any patient they feel may be a candidate for the ambulatory setting. Ideal patients for outpatient spine surgery are have an ASA score of 2 or less, live with available and able-bodied family members, and are opioid naive. As this area of the field continues to evolve, further research is needed regarding the safety of ambulatory spine surgery in patients with a mild to moderate comorbidity profile.

3. Basic principles: case selection

Equally important as choosing the appropriate patient for ambulatory surgery is selection of appropriate case types to be performed in the non-hospital setting. Procedure

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