Original Article

Demonstrating the feasibility of facet arthroplasty using the Total Posterior Spine System (TOPS) in the ambulatory surgery center (the TOPS outpatient experience)

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Contributions: (I) Conception and design:; (II) Administrative support:; (III) Provision of study materials or patients:; (IV) Collection and assembly of data:; (V) Data analysis and interpretation:; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

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Background: The transition to the outpatient/ambulatory setting is especially important within value-based care system. While some procedures are well supported, posterior motion-preserving technologies, such as Total Posterior Spine System (TOPS), a novel artificial facet replacement, have yet to be evaluated in an ambulatory surgery center (ASC) setting. The objective of this study is to assess the feasibility, safety and early outcomes of the TOPS device in an ASC setting.

Methods: We retrospectively reviewed 30 consecutive patients who underwent TOPS implantation at a free-standing ASC between September 2023 and December 2025. Demographics, intra-operative metrics, discharge data, 90-day events and patient-reported outcome measures (PROMs) were collected from operative/anesthesia reports and the electronic medical record.

Results: Thirty patients were included; 14 males and 16 females, with a mean age and body mass index (BMI) of 62 years and 27±5 kg/m2, respectively. Mean estimated blood loss was 278±65.2 mL and mean operative time was 206±52 minutes. All patients were discharged the same day; 63% home, 37% to an after-care facility. There were no hospital admissions. Within 90 days three revision surgeries (10%) occurred for device malposition (n=2) and seroma drainage (n=1). By six months, mean visual analog scale (VAS) back pain decreased by 61.2%, right leg VAS by 87.5%, left leg VAS by 86.2%. Oswestry Disability Index (ODI) improved by 18.5%, and patient-reported outcome measurement information system (PROMIS) physical increased by 12.1%, and PROMIS mental by 6.9%. Mean patient satisfaction rose from 7.1/10 at six months to 9.8/10 at twelve months.

Conclusions: This series demonstrates that TOPS facet arthroplasty can be safely and effectively performed in a free-standing ASC.

Keywords: Facet arthroplasty; ambulatory surgery center (ASC); motion preservation; spinal stenosis; degenerative spondylolisthesis

Submitted Nov 11, 2025. Accepted for publication Feb 06, 2026. Published online Feb 26, 2026.
doi: 10.21037/jss-2025-aw-214
View this article at: https://dx.doi.org/10.21037/jss-2025-aw-214

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Introduction

The transition from inpatient to outpatient and ambulatory settings has been a pivotal strategy in controlling rising healthcare costs and advancing value-based care. Over the past two decades, outpatient spine surgery has surged in popularity for appropriately selected patients, reflecting broader trends across surgical specialties (1). Numerous studies have demonstrated that certain cervical and lumbar fusion procedures are safe when routinely performed in outpatient settings (2-6). This has similarly been observed with the increasing utilization of non-fusion modalities that focus on motion preservation. Until recently, most motion preserving options were limited to anterior disc replacements, although some interspinous devices have also been used with mixed results and adoption (7-9). The Total Posterior Spine System (TOPS) by Premia Spine is a recent Food and Drug Administration (FDA) approved novel technology that is, in the authors' opinion, significantly propelling the shift towards motion preservation even further (10-12).

The TOPS is indicated for select patients with degenerative spondylolisthesis and spinal stenosis. It both stabilizes the spine after a complete laminectomy with bilateral facetectomies while also maintaining dynamic range of motion (10,11). While the safety and efficacy of TOPS has been established in hospital settings, to our knowledge, no studies have directly shown outcomes of this procedure when performed in an ambulatory surgery center (ASC), where factors like same-day discharge, rapid mobilization, and perioperative protocols may differ (10,11). Demonstrating the viability of TOPS in the ASC setting is critical since ASCs are frequently associated with lower cost and improved outcomes in select cases (13,14). The TOPS device has demonstrated cost-effectiveness compared to transforaminal lumbar interbody fusion (TLIF) and has been shown to be the dominant economic strategy (less cost for improved utility/quality-adjusted-life-year gained) over time (15,16). These established economic advantages when combined with ASC-derived savings may yield even higher cost benefit. The scenario is augmented further when considering patient-centered outcomes. A growing body of evidence has demonstrated that surgeries performed in an ASC are associated with reduced readmission rates and lower incidence of adverse events compared to hospital-based procedures (4-6,17,18). Furthermore, ASCs are generally associated with reduced rates of surgical site infections and high satisfaction scores among patients (19-21). However, these observed differences are likely attributable in part to differences in patient and selection and baseline characteristics rather than the ASC setting alone.

These findings suggest that broader adoption of the TOPS system as well as its use in the outpatient ASC setting could drive further improvements in patient outcomes, cost efficiency, and overall healthcare delivery. In this study, we report on the perioperative and post-operative outcomes as well as offer procedural insights from TOPS implantation performed in a stand-alone ASC. In doing so, we aim to illustrate the feasibility and safety of outpatient TOPS surgery. We present this article in accordance with the STROBE reporting checklist (available at https://jss.amegroups.com/article/view/10.21037/jss-2025-aw-214/rc).

Highlight box

Key findings

- Report here about the key findings of the study.

What is known and what is new?

- Report here about what is known.
- Report here about what this manuscript adds.

What is the implication, and what should change now?

- Report here about the implications and actions needed.

Methods

A retrospective review was conducted of all consecutive patients who underwent facet arthroplasty using Premia's TOPS in a free-standing ASC over a 2-year period. The ASC is predominantly staffed by two board-certified neurosurgeons who perform the majority of the operative cases at this facility. Both surgeons have extensive experience in posterior lumbar instrumentation and a cumulative experience of more than seven years with the TOPS device. One surgeon and corresponding author served as a principal investigator in the original FDA Investigational Device Exemption (IDE) clinical trial for TOPS, and at last investigator update at the time of this submission, had completed more TOPS surgeries than anyone else in the USA.

The TOPS device is indicated for patients between 35 and 80 years of age with lumbar spinal stenosis and either thickening of the ligamentum flavum and/or scarring of the facet joint capsule at one level from L3 to L5, although off-label use to include L1 through S1, hybrid constructs

with posterolateral fusions, and even two-level contiguous TOPS have been done by some providers. Surgically, pedicle screws are placed under specific trajectories using standard fluoroscopic guidance, guided by the company's proprietary pendulum attachment to the gear shift. All cases were performed fluoroscopically without the use of additional O-arm navigation, or robotic assistance. Near-perfect alignment on fluoroscopy is recommended for biomechanics and equal load sharing. A complete laminectomy with bilateral facetectomies are completed to ensure adequate decompression of both the exiting and traversing nerve roots at the operative level. We take special care to shave down the superior articular process, ensuring almost parallel bony cuts, bilaterally, to account for intended interpedicular motion, particularly on extension. The trial tool is then used to determine overall size prior to placing the TOPS device. It is critical that the set screws are final tightened prior to releasing the spring-loaded inserter. A hemovac drain is always left subfacially.

Postoperative protocol followed a structured outpatient pathway that included same-day discharge, multimodal analgesia focusing on non-opiate enhanced recovery after surgery (ERAS) modalities and erector spinae plane blocks with long acting anesthetics (i.e., liposomal bupivacaine), outpatient lymphatic massage, and outpatient physical therapy. The latter included an early mobilization protocol focusing on range and in stark contrast to the typical post-operative fusion paradigm of no "bending, lifting, twisting". Discharge disposition (home versus aftercare facility) was determined preoperatively based on patient preference rather than medical necessity, with the aftercare facility serving as optional post-discharge lodging with nursing support for patients seeking additional assistance based on prior experiences with postoperative pain or home support needs.

Patients were rigorously screened preoperatively to exclude those with significant comorbidities or other risk factors including high-grade and/or lytic spondylolisthesis, presence of extruded disc herniation at the index level, scoliosis greater than 10 degrees by major Cobb angle, morbid obesity defined as a body mass index (BMI) greater than 40 kg/m^2, osteoporosis, and known allergies to polyetheretherketone (PEEK), titanium, and/or polyurethane. Patients with significant comorbidities that could increase perioperative risk were not offered TOPS surgical intervention. Because this study was a retrospective review of operative cases, patients who did not meet eligibility criteria were not captured in the dataset, and the number of patients screened but not treated could not be reliably determined.

Preoperative demographics were recorded, including age, gender, BMI, and tobacco use. Intraoperative metrics including estimated blood loss (EBL), operative time, and complications were obtained, as well as post-operative metrics including discharge location, time to discharge, number of revision surgeries, number of unplanned hospital admissions, and number of post-operative medical complications. Postoperative clinical follow-up occurred according to a standardized protocol at approximately six weeks, 3, 6, and 12 months. No minimum follow-up duration was required for inclusion in this study. Patient-reported outcome measures (PROMs) were collected and analyzed preoperatively and at these same postoperative timepoints when available. These consisted of visual analog scale (VAS) for back and leg pain, Oswestry Disability Index (ODI), patient satisfaction, and patient-reported outcome measurement information system (PROMIS) scores for Mental and Physical Health. Data were collected from operative reports, anesthesia charts, and the electronic medical record.

Results

A total of 30 patients (14 males, 16 females) underwent TOPS implantation in an ASC from September 2023 to December 2025. *Table 1* provides an overview of patients included in the study. Mean age was 62 years with a mean BMI of 27±5 kg/m^2. None reported current or prior tobacco use. Mean EBL was 278±65.2 mL, and mean operative time was 206±52 minutes. There was one intraoperative complication consisting of a durotomy with primary repair.

All patients (100%) were successfully discharged on the day of surgery, with an average discharge time of 206±62 minutes (*Table 2*). Sixty-three percent were discharged directly home, while 37% were discharged to an aftercare acute rehab facility (hotel with nursing support). There were no unplanned hospital admissions. Within the 90-day postoperative period, one medical complication was reported which involved a contained pseudomeningocele that resolved spontaneously by the subsequent follow-up visit. Three revision procedures were performed in three separate patients, and were captured as postoperative complications.

Two revisions were prompted by screw-related issues identified postoperatively. In one case, revision was required due to set screw disengagement following increased patient

Table 1 Patient demographics

Characteristic	Value
Number of patients	30
Male	14
Female	16
Age, years	62 [36–74]
BMI, kg/m^2	27 [19–39]

Data are presented as n or mean [range]. BMI, body mass index.

Table 2 Intraoperative and post-op statistics

Parameter	Value
Intraoperative	
Intraoperative complications	1 [3]
Overall EBL, mL	278 [150–500]
Operative time, min	206 [133–351]
Post-op	
Time to discharge, min	206 [133–368]
Discharge directly home	19 [63]
Discharge to aftercare facility	11 [37]
Repeat surgery	3 [10]
Revision surgery to fusion	0 [0]
Unplanned hospital admit	0 [0]
Post-op medical complications	4 [13]

Data are presented as n [%] or mean [range]. EBL, estimated blood loss; post-op, post-operative.

activity, resulting in progressive back pain; there was no evidence of initial TOPS device malposition. In the second case, revision was necessitated by a pedicle screw causing a small undetected inferior break in the inferior aspect of the caudal pedicle resulting in new radiculopathy and was identified on postoperative computed tomography (CT) imaging. In both cases, the TOPS device was reimplanted in the otherwise same anatomic position within two weeks of the index procedure. The third revision addressed a symptomatic postoperative seroma requiring drainage. All revision surgeries were performed at the same standalone ASC as the index procedures.

Patient-reported outcomes

Based on available PROMs, mean VAS back scores decreased by 61.2% from preoperative assessment to the 6-month follow-up and by 67.3% from preoperative assessment to 12 months postoperatively (*Table 3*). A similar trend was observed for radicular pain, with VAS right leg and left leg scores decreasing by 87.5% and 86.2%, respectively, at the 6-month timepoint, and remained improved at 12 months, with reductions of 93.8% and 58.6% relative to baseline. ODI scores improved by 18.5% at six months and by 71.5% at 12 months postoperatively. PROMIS Physical scores demonstrated a 27.6%% increase by 12 months, while PROMIS mental scores increased by 13.8% over the same interval, reflecting improvements in both physical and mental health domains. Patient satisfaction was favorable, with an average rating of 7.1 out of 10 at 6 months and 9.8 out of 10 at 12 months postoperatively.

Discussion

To the authors' knowledge, this study is the first to report on the viability and patient outcomes of the TOPS artificial facet replacement procedures performed in a free-standing ASC. The safety and efficacy of other outpatient spinal procedures has been previously established (18,22-26). Helseth *et al.* prospectively evaluated 1,449 microdecompression patients, reporting a 99.8% same-day discharge rate with low overall complication and admission rates of 3.5% and 1.5%, respectively (25). Karukonda *et al.* showed similar findings in their analysis of 18,078 laminectomies, which revealed significantly fewer postoperative complications in outpatient versus inpatient procedures (26). Furthermore, CuÉllar *et al.* reported on the safety of anterior lumbar surgeries in ASCs, with only 2% unplanned hospital admissions and zero surgical site infections in their 51-patient series (22). In a later comparative analysis of 226 cases, Cuellar *et al.* showed favorable trends for ASCs in 90-day reoperation and complication rates compared to inpatient settings (18).

Our present results are similarly illustrative, advocating the safe and effective practice of TOPS artificial facet replacement surgery in the outpatient ASC setting. In our series, all patients were successfully discharged the same day, and zero patients required hospital admission or treatment

Table 3 PROMs

Outcome measure	Preop mean (n=8)	6-month mean (n=7)	12-month mean (n=4)	6-month % change (improvement), %	12-month % change (improvement), %
VAS back†	4.3	1.6	1.6	–61.2	–67.3
VAS right leg	1.6	0.2	0.1	–87.5	–93.8
VAS left leg	2.7	0.2	1.2	–86.2	–58.6
ODI	29.6	22.3	8.5	–18.5	–71.5
PROMIS physical	11.8	13.5	14.8	12.1	27.6
PROMIS mental	13	14.3	14.8	6.9	13.8
Overall satisfaction [0–10]	–	6.6	9.8	–	–

†, VAS back pain had variable sample sizes (preoperative, n=28; 6-month, n=13; 12-month, n=6). ODI, Oswestry Disability Index; Preop, preoperative; PROMIS, patient-reported outcomes measurement information system; PROMs, patient-reported outcome measures; VAS, visual analog scale.

escalation. Although complications were observed, their nature and management are instructive. We report a single intraoperative durotomy, which was promptly recognized and repaired without apparent downstream consequences, consistent with prior reported incidences of incidental durotomy for lumbar procedures in hospital settings (27,28). Postoperative events were limited to four complications, including three cases requiring revision and one contained pseudomeningocele that resolved spontaneously. Importantly, all revision procedures were managed successfully at the same ASC without escalation of care, underscoring that postoperative issues, when anticipated and appropriately triaged, do not inherently necessitate inpatient care.

The observed 10% revision rate in the expanded cohort warrants careful interpretation. Revision surgery remains an acknowledged risk of motion-preserving technologies, particularly during early adoption phases, and should not be attributed solely to the ambulatory setting. Rather, these findings likely reflect factors such as surgeon experience, procedural familiarity, and the learning curve associated with introducing novel technologies into new care environments. Within this context, the ability to recognize, address, and resolve complications entirely in an outpatient setting reinforces the viability of ASC-based TOPS implantation.

Patient-reported outcomes corroborate the safety findings with meaningful improvements in pain, function, and quality of life. VAS scores demonstrated substantial reductions in both back and radicular pain, while ODI scores reflected notable improvements in disability. In addition, PROMIS physical and mental health domains both improved during the first six months by 6–12% and demonstrated sustained improvement of 13–27% at the 12-month follow-up, highlighting not only symptomatic relief but also broader gains in physical and psychological well-being. Patient satisfaction was favorable, averaging 7.1 out of 10 at 6 months and rising to 9.8 out of 10 at 12 months, suggesting durable and clinically relevant benefits. While these patient-reported outcomes primarily reflect the effects of the TOPS rather than the ASC setting itself, they provide supportive evidence that the procedure can be safely and effectively performed in an outpatient environment.

This study should be considered in the context of several limitations. First, the small sample size limits the generalizability of our findings to a broader population. Second, although postoperative clinical follow-up followed a standardized protocol, PROMs were not completed by all patients at every scheduled timepoint, resulting in fragmented longitudinal PROM data. Third, as a single-center, single-arm, observational study without a control group, the design is susceptible to bias and does not allow adjustment for potential confounders. Finally, although all patients underwent comprehensive chart reviews and postoperative follow-up assessments with both the first and senior authors, it is possible that minor complications or adverse events went unreported and therefore undetected.

The authors contend, however, that this series provides

valuable insight into the ability to safely and efficaciously perform a TOPS, artificial facet replacement procedure, in an ASC. As our indications for outpatient surgery continue to expand, even when under the auspices of cost containment and patient outcomes, surgeons must remain diligent, ensuring that careful, almost algorithmic or dogmatic patient selection protocols are always adhered to. Primum non nocere.

Acknowledgments

The authors would like to sincerely thank Zoe Searles for her assistance with manuscript preparation, data organization, and editorial support throughout the development of this study.

Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://jss.amegroups.com/article/view/10.21037/jss-2025-aw-214/rc

Data Sharing Statement: Available at https://jss.amegroups.com/article/view/10.21037/jss-2025-aw-214/dss

Peer Review File: Available at https://jss.amegroups.com/article/view/10.21037/jss-2025-aw-214/prf

Funding: None.

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jss.amegroups.com/article/view/10.21037/jss-2025-aw-214/coif). The authors have no conflicts of interest to declare.

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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Cite this article as: Ament JD, Petros J, Gardner C, Bergman EA, Vokshoor A. Demonstrating the feasibility of facet arthroplasty using the Total Posterior Spine System (TOPS) in the ambulatory surgery center (the TOPS outpatient experience). J Spine Surg 2026. doi: 10.21037/jss-2025-aw-214