



Review Article

Do drains alter the frequency of postoperative spinal epidural hematomas (SpEH) and surgical site infections (SSI) in predominantly lumbar spine surgery? Short review/perspective

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ABSTRACT

Background: In this short review/perspective, we asked what the frequencies would be for both postoperative spinal epidural hematomas (SpEH) and postoperative surgical site infections (SSI) in predominantly posterior lumbar procedures performed with or without the placement of wound drains?

Methods: Many spine surgeons are trained to use wound drains to decrease the risk of postoperative SpEH, despite the potential increased risk of SSI. Alternatively, avoiding drains may increase the risk of SpEH but likely decrease the potential for SSI.

Results: Performing predominantly posterior lumbar procedures with or without wound drains resulted in largely comparable frequencies of postoperative spinal epidural hematomas (SpEH; range of 0.10%-0.69%) and postoperative surgical site infections (SSI; range of 0.75%-7.3%). Notably, however, two studies documented that drains increased transfusion requirements, with one study showing a prolongation of the in-hospital length of stay. Critically, these series emphasized the importance of early/emergent diagnosis (i.e., with MR) and surgical treatment of SpEH to minimize residual neurological deficits.

Conclusion: Here, we showed that patients undergoing predominantly lumbar spine surgery performed with or without wound drains demonstrated comparable frequencies of postoperative SpEH and SSI. Nevertheless, spine surgeons must assess on a case-by-case basis whether, based on their education, training, and experience, placing a wound drain is appropriate for their particular patient.

Keywords: Drain Placement, Frequency of Infection, Impact of Drains, Incidence Postoperative Spinal Epidural Hematomas (SpEH), Lumbar Spine Surgery, Morbidity, No Drains, Predominant, SSI: Surgical Site Infection, Wound Drain

INTRODUCTION

A question typically raised in spine surgery is whether or not to place a wound drain. Many spine surgeons are taught that drains likely reduce the incidence of postoperative spinal epidural hematomas (SpEH), but potentially increase the risk for surgical site infections (SSI). Alternatively, without a drain, although SSI's should typically decrease, the incidence of SpEH's

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could increase. In this short review/perspective, we asked whether placing or avoiding wound drains would result in different frequencies of SpEH and SSI for patients undergoing predominantly lumbar spine surgery [Table 1].^[1-10]

Similar Rates of Postoperative Spinal Epidural Hematomas (SpEH) and Surgical Site Infections (SSI) With or Without Drains For Predominantly Posterior Lumbar Surgery

Irrespective of whether wound drains were used, multiple series of predominantly posterior lumbar spine operations showed similar frequencies of postoperative spinal epidural

hematomas (SpEH: range 0.10%-0.69%) and surgical site infections (SSI: range 0.75% - 7.3%) [Table 1].^[1-4,6,9,10] In an analysis of 10 lumbar spine series, Waly *et al.* (2015) concluded that closed-system (CS) wound drains (WD) vs. no drains did not differentially impact the frequencies of postoperative SpEH (1.1-16.7%) or superficial (1.0-7.3%)/deep (1.0-7.1%) SSI.^[9] Glennie *et al.* found that the presence or absence of wound drains did not alter the frequency of postoperative SpEH, wound hematomas, or SSI.^[3] Following 15,562 lumbar procedures, Kao *et al.* documented 25 (0.16%) SpEH requiring reoperations.^[4] For 1333 patients undergoing 1-2 level lumbar laminectomy, Zijlmans *et al.* (2016) concluded that “routine” subfascial or subcutaneous wound

Table 1: Incidence of Postoperative Spinal Epidural Hematomas (SpEH) and Surgical Site Infections (SSI) in Predominantly Lumbar Spine Surgery.

Author [] Journal Year	Study	Data	Data	Data	Conclusion
Waly ^[9] Global Spine J 2015	Do CS WD vs. No WD Impact Outcomes LSS/Rev for L DJD	Databases 2015 Rev CS WD vs. No WD Studies 5 Heterog 3 RCT 2 Cohort	Lumbar OR With vs. No Drains Not Impact Rate Spinal Epidural Hematoma (SpEH) Superficial or Deep SSI	Rates -16.7% Hematoma 1.0-7.3% Superficial SSI 1.0-7.1% Deep SSI	Drains Increased Transfusion 3.5 Fold Noted Low Quality of Evidence
Glennie ^[3] J Clin Neurosci 2015	RCT/ Non-RCT Impact Postop Drains WH, AE PSS Database Rev 1969-2013	Hypothesis Drains Decrease Postop Spinal Epidural Hematoma (SpEH)	All Post SS Rev 7 Studies 10 Primary WH	Postop Drain Not Impact WH Drain Not Increase SSI Drain Not Prevent Postop Spinal Epidural Hematoma (SpEH)	Drain Use Not Impact WH or Clot Formation
Kao ^[4] Eur Spine J 2015	Sx SpEH With LSS Risks SpEH 2002-2010 15 562 pts LSS +/- Fusions 25 Reop SpEH 1st OR 0.16%	1 st OR Postop Sx 20 (80%) Loss Motor Function 14 (56%) Intractable Pain 19 (76%) Saddle Anes	Risks SpEH Preop DBP, Gelfoam, Postop Drain Output Poor Motor Fx-Major EBL-OR at Multilevel	With Postop SpEH Loss Motor Fx Correlated EBL, Lam+Fusion Level Postop Residual Motor Fx Loss or Perianal Anes Tendency Permanent Leg Weak 1 yr Later	“Early detection/ evacuation of hematoma are key to avoid neurological deterioration and have better clinical outcomes”
Zijlmans ^[10] Bone Joint J 2016	+/- WD Subfascial Subcut For LSS 8 Studies 1333 Pts Non Comp SpEH + SSI	1-2 Level NonComp LSS DJD PubMed EMBASE 2015 1-2 Level Disc/LAM DJD	OVERALL Postop SpEH (0.15%) 2 pts Wound SSI (0.75%) 10 pts	SSI 2 (0.47%) with WD 8 (0.88%) SSI without WD SpEH with WD 2 (0.47%) (423 pts) 0 SpEH No WD (910 pts)	Routine Use WD NonComp LSS Not Avoid Postop SpEH+Not Impact SSI

(Contd..)

Table 1: (Continued).

Author [] Journal Year	Study	Data	Data	Data	Conclusion
Liu^[6] J Orthop Surg Res 2016	WD in Posterior SS Meta-An CS Drains PubMed Medicine Embase Databases	RCT and Non RCT CS WD vs. No WD Posterior SS	4 RCT and 4 Non RCT Findings No Sig Difference SSI, SpEH Neuro Injury EBL	No Significant Difference Dry/Moderate Wound Drainage More Saturated Dressing without Drains	No Evidence To Support Placing CS Drains for Posterior SS Limited Quality Evidence
Tan^[8] Spine J 2020	Proph Decrease SSI-Rev Meta-An 41 Studies 9 RCT 32 Cohort LD/LFS	PubMed EMBASE Cochran Database6 mos Postop Care	Preincision AMP vs. Postop AMP Not Reduce SSI with LD/LFS	Rx AMP > 48 hrs Not Reduce Risk SSI Continuing AMP Until Drain Out Not Reduce SSI D/Sup TLF/AIS	Wound Drain LS Spine/ AIS Not Change Rate SSI No Consensus Optimal Rx To Prevent SSI in SS
Leroy^[5] Orthop Traumatol Surg Res 2021	Rx Postop SpEH SS Highest ML Suits q17 mos per Surgeon	Major AE SpEH France Rev ML 2011-2018 68 Cases 14 SpEH	1 Failure Timely OR (Rev 11 d) 2 Liability Nurses Failed Contact Surgeon	Other 11 cases, 79% of SpEH was Not the Fault of the Surgeon Drain Not Impact Outcomes	Critical Time Between Sx+Reop Import of Drain Not Assessed
Reier^[7] Cureus 2022	Drains in SS For DJD No Present Guidelines Drain Use DJD	Literature Rev When to Use Drains PubMed 44 Articles	Most Studies Using Drains Not Result in Better Outcomes	Longer Use of Drains Increased Risk SSI Drains Resulted: >EBL, >>Transfusions, Longer LOS	Drains Overused in SS for DJD Exposes Pts to Higher Risks Minimal Benefits
Djurasovic^[2] Orthop Clin N Am 2022	SpEH Rare 0.10% -0.69% Risks SpEH Older Age, CoagDef Multilevel Lam	Proph Drains Not Reduce SpEH Most Occur 24-28 Hrs postop	<u>Symptoms/ Signs</u> >Pain, >Rad, >Motor+Sphincter Fx Loss	Clinical+Emergent MR Critical Diagnose SpEH+OR ASAP	Recovery Depends Time To Diagnose + Surgery. Proph Drains Not Reduce SpEH
Butler^[1] Clin Spin Surg 2022	SpEH Lumbar Spine AE -May Cause Rapid Neural Deteriorate	Literature Subfascial Drains Do Not Prevent SpEH	Literature Suggest DVT Proph May>Risk	Most Common Sx SpEH Motor Weak Acute LBP Need MR Confirm Diagnosis SpEH	Rx; Emergent Hematoma Removal Delay Reop Causes Poor Neural Recovery

RCT=Randomized Controlled Trial, Non-RCT, PSS=Posterior Spine Surgery, AE=Adverse Events, WH=Wound Healing, WD=Wound Drains, Postop=Postoperative, Post=Posterior, SS=Spine Surgery, Rev=Review, SSI=Surgical Site Infection, Meta-An, LS=Lumbosacral, AIS=Adolescent Idiopathic Scoliosis, AMP=Antimicrobial Prophylaxis, LD=Lumbar Decompressive Surgery, LFS=Lumbar Fusion Surgery, D=Deep, Sup=Superficial, TLF=Thoracolumbar Fusion, Rx=Treatment, DJD=Degenerative Disc Disease, Degenerative Lumbar Disease, EBL=Estimated blood Loss, LOS=Length of Stay, pts/Pts=Patients, Symptomatic Postop Epidural Hematoma (SpEH), CoagDef=Coagulation Deficit/Coagulopathy, Lam=Laminectomy, ASAP=As Soon as Possible, ML=Medicolegal, q=every, mos=Months, yr/yrs=Years, d=days, wk=weeks, OR=Operation, Deteriorate=Deterioration, DVT=Deep Venous, hrs/Hrs=Hours Thrombosis/Thromboembolism, Proph=Prophylaxis, LBP=Low Back Pain, Weak=Weakness, Sx=Symptoms, Fx=Function, CS=Closed Suction, L=Lumbar, Heterog=Heterogenous Studies, L=Lumbar, NonComp=Non Complex, Subcut=Subcutaneous, BP=Blood Pressure, Intraop=Intraoperative, Sig=Significant, Anes=Anesthesia, DBP=Diastolic Blood Pressure, Neuro-Neurological, SpEH=Spinal Epidural Hematoma

drains did not significantly alter the frequencies of SpEH or SSI; with drains, 2 (0.47%) of 423 patients developed SpEH vs. 0% of 910 patients without drains, while with drains 2 (0.47%) patients developed SSI vs. 8 (0.88%) instances

of SSI without wound drains.^[10] Liu *et al.* (2016) found; “No evidence to support placing closed system drains for posterior spine surgery.”^[6] Djurasovic *et al.* (2022) and Butler *et al.* (2022) similarly observed comparable frequencies of SpEH following spinal procedures performed with or without drains.^[1,2]

Symptom Onset and Factors Causing/Contributing to Postoperative SpEH

Two studies identified early symptomatic complaints and risk factors causing/contributing to postoperative SpEH [Table 1].^[2,4] In Kao *et al.* (2015) series of 25 (0.16%) SpEH out of 15,562 lumbar operations, typical symptoms of SpEH included; 20 (80%) loss of motor function, 14 (56%) onset of intractable pain, and 19 (76%) instances of saddle anesthesia.^[4] Risk factors likely causing/contributing to SpEH included; preoperative elevated diastolic blood pressures, intraoperative application of Gelfoam (Pfizer, *Kalamazoo, Michigan*), and increased postoperative drainage. Djurasovic *et al.* (2022) similarly found patients with SpEH exhibited increased pain, radicular/motor deficits, and sphincter dysfunction; additionally, older age, coagulation deficiencies, and multilevel lumbar laminectomies contributed to SpEH.^[2] Butler *et al.* (2022) also documented that patients experiencing the onset of SpEH developed increased motor deficits, and more back pain.^[1]

Wound Drains in 2 Spine Series Increase Estimated Blood Loss (EBL)/Transfusion Requirements, and In One Study, Prolonged the Length-of-Stay.

Two studies highlighted that placing wound drains for spinal procedures increased estimated blood loss, and transfusion requirements [Table 1].^[7,9] For Waly *et al.* (2015) 10 lumbar series, drains did not change the frequency of SpEH or SSI but did increase transfusion requirements by 3.5-fold.^[9] Reier *et al.* also found drains did not improve outcomes, but did result in greater blood loss/transfusion requirements while also prolonging the hospital lengths-of-stay.^[7]

With SpEH, Early Diagnosis (i.e., with MR) and Emergent Treatment Critical to Minimize Residual Neurological Deficits

Multiple studies documented that early diagnosis of SpEH with MR scans and emergent treatment were critical to minimize residual neurological deficits/maximize recoveries [Table 1].^[1,3-5] For Kao *et al.* 25 patients (0.16%) with SpEH, greater blood loss, multiple levels of laminectomy/fusions, and the timely diagnosis/treatment determined the extent of residual postoperative motor dysfunction.^[4] In France, Leroy *et al.* (2021) performed a medicolegal analysis of 14 SpEH; in one case, the surgeon failed to operate in a timely fashion,

in 2 cases, the nurses failed to alert spine surgeons about the onset of paraparesis, while 11 were considered to be “no fault” of the surgeon.^[5] The authors also highlighted the import of early diagnosis and surgery. Djurasovic *et al.* (2022) also emphasized the import of emergent appropriate MR studies to diagnose/document SpEH that should be decompressed acutely to improve outcomes.^[2] Butler *et al.* (2022) similarly concluded that emergent MR scans and surgery enhanced postoperative neurological recovery.^[1]

Postoperative Use of Drains for Spinal Surgery for Did Not Decrease Incidence of SSI

Two series highlighted that placing wound drains for lumbar spine procedures did not impact or alter the risk of SSI [Table 1].^[7,8] In their meta-analysis, Tan *et al.* (2020) observed; “...prophylactic utilization of wound drains for Lumbar Spine Surgery (LSS), Thoracolumbar Fusions (TLF), or Adolescent Idiopathic Scoliosis Surgery (AIS) surgery did not decrease the incidence of postoperative SSI.”^[8] Further, the postoperative continuation of antibiotics for over 48 h or until drains were removed also did not reduce the frequency of SSI. Of interest, Reier *et al.* (2022) concluded that drains were “overused” in spine surgery and warned they posed a heightened risk for SSI.^[7]

CONCLUSION

In this short review/perspective, we showed that, with or without wound drains, patients undergoing predominantly lumbar spine surgery demonstrated similar frequencies of postoperative SpEH and SSI [Table 1]. Nevertheless, spine surgeons must assess their patients on a case-by-case basis, based on their education, training, and experience, to determine whether or not wound drainage is indicated in *their particular patient*.

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