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Impact of Postoperative Drain Use on Complications and Hospital Stay in Lumbar Spine Surgery: A Retrospective Comparative Study from a Middle Eastern Neurosurgical Center

Lawen B. Hama Sdiq[1,*], Varuna Sh. Mahmood[1], Ali O. Saadoon[1,2]

[1]University of Sulaimani, College of Medicine, Sulaymaniyah, Iraq

[2]Shar Hospital, Department of Neurosurgery, Sulaymaniyah, Iraq

***Corresponding Author:**

Lawen B. Hama Sdiq: Lawen.05001350@univsul.edu.iq.

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Abstract

Background: The routine use of postoperative drains in lumbar spine surgery remains controversial. Although drains are traditionally employed to prevent hematoma and wound complications, recent evidence questions their necessity, citing longer hospital stays and higher rates of non-infectious complications. Data from developing regions are scarce, limiting the generalizability of current evidence. The study aimed to evaluate whether the use of postoperative closed-suction drains in lumbar spine surgery reduces postoperative complications, including surgical site infection and hematoma formation, compared with surgeries performed without drains.

Materials and Methods: A retrospective study was conducted on 60 adult patients undergoing elective lumbar spine surgery. Demographic, intraoperative, and postoperative data were extracted from institutional records. Patients were divided into two groups: drain and no-drain. Outcomes analyzed included postoperative complications, urinary retention, weakness, surgical site infection, hematoma, and length of hospital stay. Data were analyzed using R version 4.3.1, applying descriptive statistics, t-tests, chi-square tests, and logistic regression where appropriate.

Results: Twenty patients (33.3%) underwent drain placement, while forty (66.7%) did not. Baseline demographics and operative duration were comparable between groups. The drain group showed significantly higher rates of urinary retention ($p = 0.001$) and postoperative weakness ($p = 0.008$). Length of hospital stay was also longer in the drain group ($p = 0.004$). No significant differences were observed in surgical site infection, wound drainage, or 30-day readmission rates.

Conclusion: Postoperative drain use did not reduce infection or hematoma rates but was associated with higher urinary retention, postoperative weakness, and prolonged hospitalization. Routine drainage after lumbar spine surgery may not be necessary and may contribute to avoidable morbidity. Selective drain placement, guided by intraoperative bleeding and soft-tissue dissection extent, is recommended to optimize recovery and resource use.

أثر استخدام المصارف الجراحية بعد العمليات على المضاعفات ومدة البقاء في المستشفى لدى مرضى جراحة العمود الفقري القطني: دراسة استبعادية مقارنة أُجريت في مركز متخصص بجراحة الأعصاب في الشرق الأوسط

لاوين بكر حمةصديق، فارونا شيروان محمود، علي عمر سعدون.

الملخص

المقدمه: لا يزال الاستخدام الكثير للانابيب الطصرئف الجراحيية بعد العمليات للعمود الفقري قابل للجدال. على رغم من اتخدامها تقليديا للوقاية من تشكل الاورام الدموية و مضاعفات الجروح، تشير الادلة الحديثة الى محدودية فائدتها، و هذهي الانابيب مرطبتة بزيادة مدة البقائ في المستشفى وارتفاع معدلات بعض المضاعفات الغيرالتهابية. كما ان البيانات المتوفرة من الدول المتقدمة لا تزال محدودة، مما يحد من امكانية تعميم النتائج المتوفرة. تهدف هذه الدراسة الى تقييم ما اذا كان استخدام هذه الانابيب طصريف الجراحيية بعد جراحة العامود الفقري يقلل من المضاعفات بعد العملية، بما في ذالک الاتهاب الجرح الجراحي وتكون الاورام الدموية، مقارنته بالجراحات التي اجرييت دون استخدام المصارف.

المواد و طرائق البحث: دراستنا شملت ٦٠ مريضا بالغة في السن اجريت عليهم عمليات عمود الفقري القطني اختياريا. جمعنا البيانات الديموغرافية و سجلات بعد الجراحة و بيانات داخل العملية. قسمنا المرضى الى مجموعتان، مجموعة المرضى التي استخدمت عليهم انبوب تصريف الجراحي و مجموعة التى لم يستخدم فيها الانابيب. شملت البيانات المدروسة المضاعفات بعد الجراحة بما فيهم، عجز الادرار، ضعف العضلي، التهاب الجراحي، تجمع الدم او الاورام الدموية، و مدة البقاء في المستشفى. تم تحليل البيانات باستخدام تطبيق (ار) اصدار ٤.٣.١ و اختبارات احصاية اخرى مناسبة.

النتائج:استخدمت الانابيب في ٢٠ مريضا (٣٣،٣٪)، بينما لم يستخدم في في ٤٠ منهم (٦٦،٧٪). لم نجد اي فروق ذات دلالة احصائيية في الخصائص الاساسية الديموغرافية و العملية مابين المجموعتين. المجموعة الذي استخدمت فيهم الانابيب اضهروا عجز في الادراد بنسبة اكبر (بي ڤاليو = ٠،٠٠١)، و ضعف بعد العملية (بي ڤاليو = ٠،٠٠٤)، و زيادة في البقائ في المستشفى (بي ڤاليو = ٠،٠٠٨) مقارنتا بالمجموعة الذي لم يستخدم فيه الانابيب. ولم نلاحض فرقا ذات دلالة احصاية بارزة في معدل الالتهاب بعد الجراحة، او تشكل الاورام الدمووية، او رجوع الى المستشفى بعد ٣٠ يوما.

الاستنتاج:لم يوئدي استخدام الانابيب الصرف الجراحي بعد عمليات العمود الفقري الى تقليل معدلات الالتهاب بعد العملية و تكوين الاورام الدموية. بل ادى الى تقليل امكانية الادرار، ضعف بعد العملية، و زيادة في مدة البقاء في المستشفى. تشير هذه البتائج الى ان استخدام الروتيني للانابيب الصرفي قد لا يكون ضروريا. و تشير الى ان الاعتماد على النابيب الصرف يجب ان يكون بنائا على المعطيات الجراحية خصيصا لكل مريض لتحسين نتائج العملية و تقليل العبء على الموارد الصحية.

1. Introduction

The use of postoperative drains in spine surgery has long been debated. Drains were introduced to prevent the accumulation of blood and serous fluid at the surgical site, aiming to reduce hematoma formation, wound dehiscence, and infection (Kanayama et al., 2010; Hung et al., 2016). The theoretical rationale was that adequate evacuation of collections would prevent compression of neural elements and promote wound healing. However, with improvements in surgical hemostasis, minimally invasive approaches, and enhanced recovery protocols, the routine use of drains has been increasingly questioned (Patel et al., 2017; Buser et al., 2022; Molina et al., 2023). Clinical studies have provided conflicting results regarding the efficacy of drains in lumbar spine surgery. Several randomized controlled and observational studies have reported no significant reduction in postoperative infection or hematoma formation when drains are used, while indicating that their use may increase blood loss, transfusion requirements, and length of hospital stay (Brown & Brookfield, 2004; Walid et al., 2012; Muthu et al., 2020; Abu El-Ela et al., 2024). Other investigations have suggested that drain placement could be selectively beneficial in high-risk cases, such as those with obesity, coagulopathies, or extensive soft-tissue dissection (Choi et al., 2016; Jayakrishnan et al., 2024). Recent research has also emphasized that the duration of drainage may have a greater impact on outcomes than the presence of a drain itself. Prolonged drainage has been identified as an independent risk factor for bacterial colonization and deep surgical site infection (Rao et al., 2011; Liu et al., 2016). Early drain removal protocols have been found to shorten hospital stay and reduce complication rates without increasing infection or hematoma formation (Muthu et al., 2020; Glennie et al., 2015). These results have led many authors to suggest that the decision to use a drain should be individualized and guided by intraoperative findings, while minimizing its duration whenever possible. Systematic reviews and meta-analyses have reinforced these conclusions. Earlier reviews reported no measurable benefit of closed-suction drainage in reducing postoperative hematoma or infection (Muthu et al., 2020; Glennie et al., 2015). More recent analyses confirmed that routine drainage does not improve outcomes and may, in fact, be associated with higher transfusion rates and longer hospitalization (Buser et al., 2022; Abu El-Ela et al., 2024). Observational studies have additionally linked drain use to delayed mobilization and postoperative anemia (Molina et al., 2023; Walid et al., 2012). Although international evidence increasingly supports a selective approach, many surgeons continue to use drains routinely, often due to institutional protocols or personal preference. The absence of uniform guidelines contributes to this variability in practice (Patel et al., 2017). Furthermore, the majority of existing studies originate from high-resource countries, and there remains a lack of data from developing regions. Differences in perioperative protocols, infection control measures, and patient comorbidity profiles may influence outcomes, underscoring the need for locally generated evidence (Abu El-Ela et al., 2024; Cui et al., 2024; Chanbour et al., 2024). In this context, evaluating the outcomes of drain use in a Middle Eastern tertiary neurosurgical center is of particular significance. Regional data can help determine whether international findings apply in different surgical and healthcare environments and can support the development of context-specific recommendations. The present study aims to assess whether the use of postoperative closed-suction drains in lumbar spine surgery reduces postoperative complications, particularly surgical site infection and hematoma formation, compared with surgeries performed without drain placement.

It also aims to analyze the association between drain use and other postoperative outcomes, including urinary, neurological, and systemic complications, and to explore clinical and demographic factors associated with

postoperative outcomes. Through this approach, the study seeks to generate regionally relevant evidence to guide postoperative management and improve decision-making in lumbar spine surgery.

2. Materials and Methods

2.1.Study Design and Setting

This study was designed as a retrospective comparative analysis conducted at the Department of Neurosurgery, Shar Teaching Hospital, Sulaymaniyah, Iraq. The study evaluated patient records from January 2021 to December 2023 to determine the effect of postoperative closed-suction drain placement on surgical outcomes following lumbar spine surgery. Ethical approval was obtained from the institutional ethics committee before data collection.

2.2.Study Population

The study included 60 patients who underwent elective lumbar spine surgery, either fixation or decompression, during the study period. All procedures were performed by consultant neurosurgeons using standard posterior midline approaches. Patients were divided into two groups based on whether a closed-suction drain was placed at the end of surgery (drain group, n = 20) or not placed (no-drain group, n = 40). The decision to use a drain was at the discretion of the operating surgeon. When the use of a drain was deemed necessary, a closed-suction subfascial drain was placed. Drains were typically removed within 24–48 hours postoperatively based on output and clinical judgment.

2.3.Inclusion and Exclusion Criteria

Patients aged 18 years and older who underwent single- or multilevel lumbar decompression or fixation were included. Cases with intraoperative dural tears, preexisting infection, revision surgery, tumor, or traumatic etiology were excluded to minimize confounding factors.

2.4.Data Collection

Data were collected retrospectively from operative notes, anesthesia records, and postoperative follow-up files using a structured data collection sheet. Recorded variables included:

1. Demographic data: age, gender, occupation, and body mass index (BMI).
2. Preoperative variables: presence of comorbidities such as diabetes mellitus, hypertension, cardiovascular disease, anemia, depression, and anxiety.
3. Intraoperative variables: type of surgery (fixation or decompression), number of levels operated, surgical position, estimated blood loss, and use of drain.
4. Postoperative variables: fever, urinary tract infection (UTI), urinary retention, surgical site infection (SSI), wound hematoma, wound drainage, postoperative weakness, length of hospital stay (LOS), and 30-day readmission.

2.5.Statistical Analysis

All statistical analyses were performed using R software (version 4.3.1; R Foundation for Statistical Computing, Vienna, Austria). Data were initially cleaned and verified for completeness before analysis. Continuous variables such as age, body mass index (BMI), and length of hospital stay (LOS) were assessed for normality using the Shapiro–Wilk test. Normally distributed variables were summarized as mean ± standard deviation (SD) and compared between groups using the independent-samples t-test. Non-normally distributed data were reported as medians with interquartile ranges (IQR) and analyzed using the Mann–Whitney U test. Categorical variables, including

demographic features, comorbidities, and postoperative complications, were expressed as frequencies and percentages. Between-group comparisons were conducted using the Chi-square test or Fisher's exact test when expected frequencies were less than five. To explore associations between length of stay and clinical parameters such as age, BMI, and comorbidities, Spearman's rank correlation and Mann–Whitney U tests were applied, as appropriate. Subgroup analyses were performed to evaluate potential variations in outcomes between patients undergoing fixation and decompression procedures. To identify independent predictors of surgical site infection, a binary logistic regression model was constructed, incorporating drain use, hypertension, diabetes mellitus, and LOS as covariates. The strength of association was expressed as odds ratios (ORs) with corresponding 95% confidence intervals (CIs). All tests were two-tailed, and a p-value < 0.05 was considered statistically significant. Figures and summary tables were generated using the ggplot2, dplyr, and tidyverse packages in R for visualization and data presentation.

3. Results

A total of 60 patients who underwent elective lumbar spine surgery were included in the study, with 40 patients (66.7%) in the no-drain group and 20 patients in the drain-use group. The baseline demographic and clinical variables of both groups were comparable (Table1).

Table1: Baseline Characteristics of Patients According To Drain Use

Variable	No-Drain	Drain-use
Age (years), *mean* ± *SD*	44.8 ± 11.2	45.6 ± 10.9
Gender (Male/Female)	22 / 18	12 / 8
BMI (kg/m²), *mean* ± *SD*	26.5 ± 3.4	27.1 ± 3.6
Hypertension	8 (20.0%)	4 (20.0%)
Diabetes mellitus	6 (15.0%)	3 (15.0%)
Cardiovascular disease	4 (10.0%)	2 (10.0%)
Anemia	5 (12.5%)	3 (15.0%)
Depression	3 (7.5%)	2 (10.0%)
Anxiety	4 (10.0%)	2 (10.0%)

There were no statistically significant differences in mean age, gender distribution, or body mass index (BMI). Likewise, the prevalence of comorbidities such as hypertension, diabetes mellitus, cardiovascular disease, anemia, depression, and anxiety did not differ significantly between the two groups (all $p > 0.05$). These findings indicate that the two cohorts were clinically similar before surgery, thereby reducing confounding effects related to baseline risk factors. Postoperative outcomes are summarized in Table2.

Table2: Postoperative Complications According to Drain Use

Outcome	No-Drain	Drain-use	P-value
Surgical site infection	8 (20.0%)	6 (30.0%)	0.349
Hematoma	0 (0%)	0 (0%)	1.000
Urinary retention	3 (7.5%)	9 (45.0%)	0.001
Post-op weakness	5 (12.5%)	9 (45.0%)	0.008
Urinary tract infection	3 (7.5%)	4 (20.0%)	0.199
30-day readmission	1 (2.5%)	1 (5.0%)	0.545
Draining wound	1 (2.5%)	1 (5.0%)	0.545

Surgical site infection (SSI) occurred in eight patients (20.0%) in the no-drain group, and six patients (30.0%) in the drain-use group, and the difference was not statistically significant (p = 0.349). No postoperative hematomas were identified in either group. Urinary tract infection was observed in three patients (7.5%) without drains and four patients (20.0%) with drains (p = 0.199), while wound drainage and 30-day readmission rates were also similar between groups (p = 0.545 for both). Fever and sepsis were not recorded in any patient. However, two postoperative complications showed statistically significant associations with drain use. Urinary retention occurred in nine patients (45.0%) in the drain-use group and three patients (7.5%) in the no-drain group (p = 0.001). Similarly, postoperative weakness was reported in nine patients (45.0%) with drains compared to five patients (12.5%) without drains (p = 0.008). These associations are illustrated in Fig.1, which highlights the disproportionate frequency of urinary retention and weakness among patients who had drains placed. The mean postoperative length of stay (LOS) was significantly longer in the drain-use group (3.85 ± 0.67 days) than in the no-drain group (3.21 ± 0.72 days), confirmed by both the Mann–Whitney test (p = 0.004) and the independent-samples t-test (p = 0.001) (Table3).

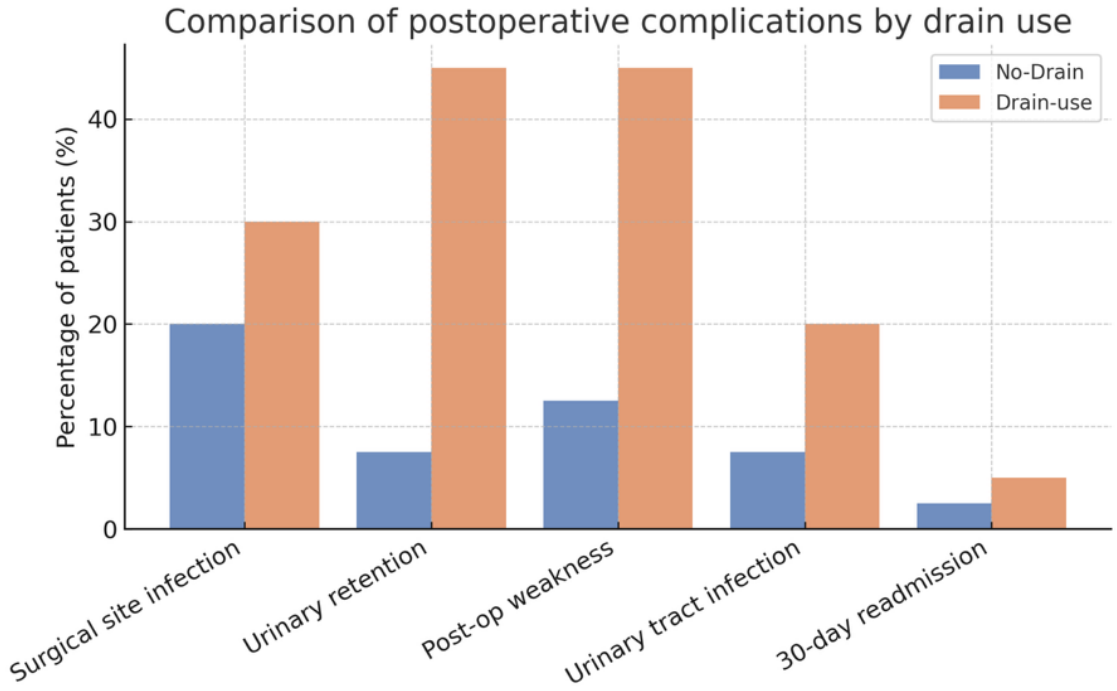

Figure1: Comparison of Postoperative Complications by Drain Use. Bar Chart Illustrating the Frequency of Major Postoperative Complications in Patients Who Underwent Lumbar Spine Surgery with And Without Drain Placement. Urinary retention and postoperative weakness occurred significantly more often in the drain-use group (p = 0.001 and p = 0.008, respectively), while rates of surgical site infection, urinary tract infection, wound drainage, and 30-day readmission were comparable between groups.

Table3: Length of Stay by Drain Use

Groups (n)	Mean Los (days)	Median LOS (days)	Mann-Whitney P value	T-test P value
No-Drain	3.21 ± 0.72	3.0	0.004	0.001
Drain-use	3.85 ± 0.67	4.0		

The distribution of LOS is presented in Fig.2, which demonstrates a rightward shift toward longer hospitalization among patients with drains. Notably, all patients in the no-drain group were discharged within four days postoperatively, whereas several patients with drains remained hospitalized beyond that period. Exploratory correlation analyses showed no significant relationships between LOS and preoperative comorbidities, including hypertension, diabetes mellitus, cardiovascular disease, anemia, depression, or anxiety (all $p > 0.17$). This suggests that drain placement, rather than underlying health status, was the major determinant of postoperative stay duration. Similarly, no associations were found between LOS and age or BMI ($p > 0.05$). A binary logistic regression model incorporating drain use, hypertension, diabetes mellitus, and LOS as predictors for surgical site infection (SSI) revealed no significant independent risk factors ($p > 0.05$). Drain placement was associated with an odds ratio (OR) of 2.44 (95% CI 0.52–11.45, $p = 0.26$) for infection, suggesting a non-significant trend toward higher infection rates with drains. Given the limited number of events, this model was underpowered for firm conclusions. Subgroup analysis according to the type of surgery (fixation versus decompression) also showed no significant difference in infection rates between patients with and without drains within either subgroup ($p > 0.05$). Across all analyses, the absence of postoperative hematoma indicates that hemostasis was well controlled regardless of drain use. Overall, drain placement was not associated with a reduction in surgical site infection, hematoma, or urinary tract infection. In contrast, patients with drains exhibited significantly higher rates of urinary retention and postoperative weakness and had a longer hospital stay. Collectively, these findings demonstrate that routine drain use after lumbar spine surgery does not improve postoperative safety and may instead contribute to increased morbidity and delayed discharge.

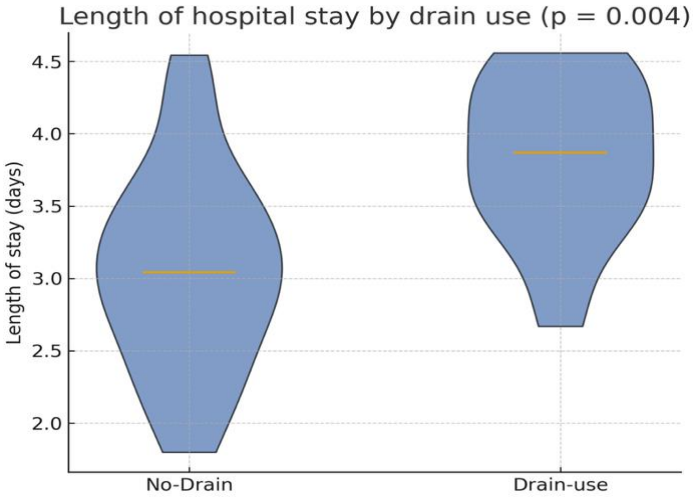

Figure2: Length of Hospital Stay by Drain Use. Violin Plot Showing the Distribution of Postoperative Length of Stay (LOS) Among Patients with And Without Drains. The median LOS was longer in the drain-use group (3.85 ± 0.67 days) than in the no-drain group (3.21 ± 0.72 days), and the difference was statistically significant (Mann–Whitney $p = 0.004$; t-test $p = 0.001$).

4. Discussion

The present study evaluated the impact of postoperative drain use on clinical outcomes following lumbar spine surgery. The results showed no significant reduction in surgical site infection or hematoma formation with drain placement. Instead, patients with drains experienced longer hospital stays and significantly higher rates of urinary retention and postoperative weakness. These findings are consistent with recent international studies questioning the necessity of routine drainage in spinal procedures. Several investigations have reported that the use of closed-suction drains does not significantly reduce postoperative infection rates, likely due to advances in surgical hemostasis and perioperative antibiotic prophylaxis (Buser et al., 2022; Molina et al., 2023; Muthu et al., 2020). Others have suggested that drains may even facilitate retrograde bacterial migration, particularly when left in place for extended periods (Abu El-Ela et al., 2024). The present results, therefore, support the growing evidence that meticulous surgical technique and aseptic wound closure are more critical in infection prevention than the presence of a drain (Hung et al., 2016; Glennie et al., 2015). No cases of postoperative hematoma were identified in this cohort, which agrees with multiple reports showing that adequate intraoperative hemostasis and the natural tamponade effect of surrounding soft tissue are sufficient to prevent clinically relevant collections (Kanayama et al., 2010; Patel et al., 2017). Furthermore, some studies have noted that drains may paradoxically increase postoperative bleeding by inhibiting early clot formation and promoting persistent suction-related oozing (Walid et al., 2012; Muthu et al., 2020). This mechanism may explain why, in the current study, similar to others, we found no protective advantage associated with their use. The higher incidence of urinary retention among patients with drains observed in this study is in line with findings from several recent analyses (Jayakrishnan et al., 2024; Chanbour et al., 2024).

This association may be related to patient discomfort, limited mobility, and reflex detrusor inhibition caused by local pain or traction at the drain site. Early mobilization, a key factor in restoring normal bladder function, is often delayed in patients with drains, further contributing to postoperative retention (Cui et al., 2024). Postoperative weakness was also more frequent in the drain-use group. This finding may reflect local muscular irritation or traction resulting from drain placement, leading to transient neuropraxia of paraspinal nerve branches. Delayed ambulation, which often accompanies the presence of drains, could further exacerbate early postoperative weakness and prolong rehabilitation (Buser et al., 2022; Molina et al., 2023; Choi et al., 2016). Length of hospital stay was significantly longer in patients with drains, consistent with previous studies showing that drainage prolongs postoperative recovery (Abu El-Ela et al., 2024; Liu et al., 2016; Cui et al., 2024). Institutional policies requiring drain removal after 48 hours, coupled with delayed ambulation and additional urinary or wound management, likely contribute to this extended stay. Furthermore, evidence suggests that the duration of drainage rather than its use per se is the main determinant of prolonged hospitalization and infection risk (Rao et al., 2011; Liu et al., 2023). Regression analysis in this study revealed no independent predictors of surgical site infection, which aligns with earlier reports indicating that infection risk is multifactorial and influenced more by operative duration, tissue handling, and contamination level than by drain placement (Patel et al., 2017; Liu et al., 2023). Taken together, these results reinforce the international consensus that routine drain placement provides no clear benefit in lumbar spine surgery and may increase postoperative morbidity. Selective drain use, restricted to patients with extensive dissection, abnormal bleeding, or coagulopathy, appears to be a more rational approach (Buser et al., 2022; Chanbour et al., 2024).

The findings also emphasize the importance of early drain removal when its use is unavoidable, as prolonged placement has been consistently linked to higher complication rates (Liu et al., 2016; Cui et al., 2024). From a regional perspective, this study contributes valuable data from a Middle Eastern cohort, where published evidence on postoperative spinal management remains limited. The similarity of the current findings to those reported across Europe, Asia, and North America highlights the global applicability of current evidence-based recommendations regarding selective drain use.

This study has several limitations that should be considered when interpreting the results. First, its retrospective design introduces the potential for information bias, particularly in the documentation of minor complications and postoperative symptoms. Although data extraction was standardized, some clinical parameters, such as intraoperative blood loss, drain duration, and precise timing of mobilization, were not consistently available across all cases. Second, the sample size, while adequate for detecting differences in common postoperative outcomes, may not have been sufficient to identify rare complications such as deep infection or symptomatic hematoma. Third, the study was conducted in a single institution, and although the surgical team and perioperative protocols were uniform, institutional practices and discharge criteria may have influenced the duration of hospitalization. Fourth, postoperative management, including decisions regarding early drain removal and mobilization, was not randomized, which may have introduced selection bias toward more complex cases being assigned to the drain group. Despite these limitations, the findings are consistent with international literature and therefore demonstrate a degree of external validity.

The patient population in this study was demographically and clinically comparable to those reported in multicenter studies from Europe, North America, and Asia, suggesting that the outcomes observed here are likely generalizable to other tertiary spine centers with similar surgical expertise and perioperative standards. The inclusion of both decompression and fixation procedures enhances the applicability of the results across a wide range of lumbar spine surgeries. However, further prospective multicenter studies with standardized protocols and larger sample sizes are warranted to confirm these findings and to refine the criteria for selective drain use.

Conclusion

Routine postoperative drain placement after lumbar spine surgery did not reduce the incidence of surgical site infection or hematoma and was associated with increased rates of urinary retention, postoperative weakness, and longer hospital stay. These findings suggest that drain use does not confer additional safety benefits and may contribute to unnecessary morbidity. Selective use should therefore be reserved for patients with intraoperative bleeding, extensive tissue dissection, or other specific risk factors. Early drain removal and emphasis on meticulous hemostasis, aseptic technique, and early mobilization remain key strategies for optimizing postoperative recovery and minimizing complications.

Declarations

Ethics approval and consent to participate

Ethical approval for this study was obtained from the Institutional Ethics Committee of Shar Teaching Hospital, Sulaymaniyah, Iraq, and the Institutional Ethics Committee of the University of Sulaimani College of Medicine, Sulaymaniyah, Iraq. As this was a retrospective study based on routinely collected clinical data, the ethics committee waived the requirement for informed consent to participate.

Consent for publication

As mentioned before, informed consent was waived by the Institutional Ethics Committee of both institutes since the study does not contain any identifiable individual data, images, or personal information requiring specific consent for publication.

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