The Role of Drains in Lumbar Spine Fusion

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Key words
- Blood transfusion
- Drain
- Lumbar fusion
- Posthemorrhagic anemia
- Postoperative fever
- Wound infection

Abbreviations and Acronyms
IVPB: Intravenous piggyback
LDF: Lumbar decompression and fusion

OBJECTIVE: To study the role of drains in lumbar spine fusions.

METHODS: The charts of 402 patients who underwent lumbar decompression and fusion (LDF) were retrospectively reviewed. Patients were classified per International Classification of Diseases, 9th Edition (ICD-9) procedure code as 81.07 (lateral fusion, 74.9%) and 81.08 (posterior fusion, 25.1%). The investigators studied the prevalence of drain use in lumbar fusion procedures and the impact of drain use on postoperative fever, wound infection, posthemorrhagic anemia, blood transfusion, and hospital cost.

RESULTS: No significant differences in wound infection rates were noted between patients with and without drains (3.5% vs 2.6%, P = 0.627). The difference in postoperative fever rates between patients with and without drains (63.2% vs 52.6%, P = 0.05) was of borderline significance. Posthemorrhagic anemia was statistically more common in patients with drains (23.5% vs 7.7%, P = 0.000). Allogeneic blood transfusion was also statistically more common in the drained group (23.9% vs 6.8%, P = 0.000). Postoperative hemoglobin levels were lower in patients with drains who underwent one-level (9.5 g/dL vs 11.3 g/dL) or two-level (9.3 g/dL vs 10.2 g/dL) spine fusions. In this series in which drains were liberally used, no patient had to return to the operating room because of postoperative hematoma. An increased rate of allogeneic blood transfusion was noticed with posthemorrhagic anemia and drain use. The rate of allogeneic blood transfusion increased from 5.6% in patients without drains or posthemorrhagic anemia to 38.8% in patients with drains and posthemorrhagic anemia as a secondary diagnosis. The use of drains was associated with statistically insignificant increases in length of stay and cost in posterior procedures. Drain use was associated with shorter length of stay and hospital charges in lateral fusions of three or more levels.

CONCLUSIONS: Drain use did not increase the risk of wound infection in patients undergoing LDF, but it had some impact on the prevalence of postoperative fever. Drain use was significantly associated with posthemorrhagic anemia and allogeneic blood transfusion. Drain use did not have a significant economic impact on hospital length of stay and charges except in lateral procedures involving three or more levels.

INTRODUCTION
Postoperative surgical site infections (wound infections) can be quite complicated and a challenge to the treating physician. The literature reports the incidence of such infections ranging from 0.7%–16% of spinal surgery patients, with more occurring in instrumented fusions (3, 6). Reducing the number of such infections would help prevent extended hospital stay and reoperation and ultimately reduce the overall surgical stress. The U.S. Centers for Disease Control and Prevention estimated that 22% of all health care–associated infections are surgical site infections and result in $1–10 billion annually in direct and indirect medical costs (1). Fever is also common in postoperative patients and does not always indicate infection (3).

Although drains serve a valuable role to the patient, they are essentially foreign bodies that can promote infections at the wound site after a surgical procedure. The insertion of the drain incites a local inflammatory response, which leads to activation of neutrophils and other cells of the host defense system, and can act to spread infections inadvertently to neighboring sites of sterile tissue (5). The debate on whether to use drains in surgical patients continues (1). Many surgeons and infectious disease specialists believe that the use of a drain increases the risk of infection, which outweighs the purpose of using it (ie, decreasing hematoma risk and postoperative neurologic difficulties). In this study, a cohort of postoperative spinal surgery patients was analyzed to investigate the relationship between the use of a drain and the risk of fever, wound infection, or hematoma formation in patients undergoing lumbar fusion.

METHODS
In our institution, lumbar decompression and fusion (LDF) procedures are usually...
performed by a neurosurgeon and an orthopedic surgeon, and a Jackson-Pratt closed-suction drain is habitually installed at the end of the procedure to decrease the risk of hematoma formation and neurologic compromise. In this study, the charts of 402 patients undergoing LDF operated between October 2007 and September 2009 were retrospectively reviewed. Patients were classified per International Classification of Diseases, 9th Edition (ICD-9) procedure code as 81.07 (lateral fusion, 74.9%) and 81.08 (posterior fusion, 25.1%):

- **81.07**
  1. Lateral transverse process technique
  2. Arthrodesis of lumbar or lumbosacral region
    a. Posterior (interbody) technique
    b. Posterolateral technique
  3. Transforaminal lumbar interbody fusion

Postoperative temperature threshold was 100°F (37.7°C). Wound infection was determined by hospital course and follow-up. Posthemorrhagic anemia was extracted from the ICD-9 secondary diagnosis codes. Hospital charges were used as reflective of hospital cost.

**Limitations**

This study is based on hospital administrative data, which are coded using the ICD-9 system. These codes may not differentiate minimally invasive from open lumbar fusion cases. Estimated blood loss, recorded in anesthesia or surgery records, was not collected in this study; instead, postoperative hemoglobin and secondary ICD-9 diagnosis of posthemorrhagic anemia were used. This choice may have caused a selection bias.

### RESULTS

#### Demographic Characteristics and Comorbidities

The patient cohort comprised 57.6% women and 43% men. The mean age was 57.3 years.
and the mean body mass index was 31.3 kg/m² (standard deviation 6.8 kg/m²). Diabetes mellitus was present in 29.1% of patients.

Diagnosis Codes, Procedure Codes, and Number of Levels

One-level (n = 37) and two-level (n = 48) lumbar/lumbosacral lateral fusions performed for lumbar disk displacement were the most common cases (Table 2).

Prevalence of Outcome Variables

The prevalence of outcome variables was as follows:

- 70.9% of patient had drains
- 60.1% had postoperative fever
- 3.2% had wound infection
- 18.9% had posthemorrhagic anemia
- 18.9% had allogeneic blood transfusion

No significant differences in wound infection rates were noted between patients with and without drains (3.5% vs 2.6%, P = 0.627, Figure 1). The difference in postoperative fever rates between patients with and without drains (63.2% vs 52.6%, P = 0.05) was of borderline significance. In diabetic patients, drains were associated with a statistically insignificant increase in infection rate (7.1% vs 3.0%, P > 0.05).

Posthemorrhagic anemia was statistically more common in the group with drains (23.5% vs 7.7%, P = 0.000). Allogeneic blood transfusion was also statistically more common in the drained group (23.9% vs 6.8%, P = 0.000), especially with fewer operated levels (Figure 2). Postoperative hemoglobin levels were lower in patients with drains who underwent one-level (9.5 g/dL vs 11.3 g/dL) or two-level (9.3 g/dL vs 10.2 g/dL) spine fusions.

In a model including obesity, type of procedure, age, gender, number of levels, drain use, and blood transfusion, drain use and number of levels were significant predictors (P < 0.01) of posthemorrhagic anemia and allogeneic blood transfusion. Drain use was not a significant predictor of postoperative fever or wound infection. An increased rate of allogeneic blood transfusion was noticed with posthemorrhagic anemia and drain
use. The rate of allogeneic blood transfusion increased from 5.6% in patients without drains or posthemorrhagic anemia to 38.8% in patients with drains and posthemorrhagic anemia as a secondary diagnosis (Figure 3).

Economic Impact of Drain Use
The use of drains was associated with a statistically insignificant increase in length of stay and cost in posterior procedures. In contrast, drain use was associated with shorter length of stay and hospital charges in lateral fusions involving three or more levels (Figure 4).

DISCUSSION
Our study has several limitations inherent to any retrospective study. Not all variables could be normalized in regard to intraoperative factors and comorbidities other than obesity and diabetes (3, 6). Nevertheless, this investigation generated several useful findings.

On the positive side of drain use, there was no return to the operating room because of neurologic compromise related to postoperative bleeding, a finding that supports the use of drains in lumbar fusions. Also, the liberal use of drains was not associated with an increased risk of wound infection. This finding seems to be consistent with the findings of other researchers such as Payne et al. (4), who conducted a study on closed suction drainage after single-level lumbar laminectomy and found “no significant difference in the rate of infection or wound healing” between patients with and without drainage, and no patient developed postoperative neurologic deficit. Scuderi et al. (7) studied drain use after lumbar fusions at a single level for degenerative disease and concluded that drains do “not appear to increase the risks of wound related complications.” More recently, Kanayama et al. (2) showed that “the risk of wound infection and hematomas” in single-level lumbar decompression surgery “was not influenced by use of a drain.” From an economic point of view, drain use did not significantly increase hospital charges or length of stay.

On the negative side of drain use, we found an increased prevalence of postoperative fever associated with drain use, which could be a reaction to the invasiveness of surgery and the nature of drains as a foreign body. Drain use was associated with a significant increase in blood transfusion requirements. There was no way to know if drains have a role in impairing the coagulation cascade and preventing wound tamponade or whether drains are more willingly used in cases with excessive intraoperative bleeding. Because our study was retrospective, the rationale behind the decision to use a drain in each case was unknown.

CONCLUSIONS
To resolve these contradictory results, we recommend larger prospective controlled
studies in which drains are employed in a random fashion with the caveat that a surgeon may opt to remove a patient from the study and insert a drain if the surgeon believes the hemostatic status of the patient warrants this maneuver. Until such data become available, the use of drains will be based on individual surgical judgment.

REFERENCES


Conflict of interest statement: The authors declare that the article content was composed in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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