



Mini-Open Thoracolumbar Corpectomy: Perioperative Outcomes and Hospital Cost Analysis Compared with Open Corpectomy

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■ **BACKGROUND:** Standard open surgical management of thoracolumbar infection, trauma, and tumor is associated with significant morbidity. We compared perioperative and immediate postoperative morbidity of open and mini-open thoracolumbar corpectomy techniques including direct hospital costs.

■ **METHODS:** We retrospectively reviewed medical records of all patients who underwent open or mini-open corpectomy. Demographics (age, sex, body mass index, primary diagnosis), operative data (length of surgery, estimated blood loss, blood transfusion), surgical level, preoperative and postoperative neurologic status (using American Spinal Injury Association Impairment Scale), immediate perioperative complications (within 30 days postoperatively), overall length of stay from admission, length of stay from surgery, and total direct hospital costs were tabulated and analyzed.

■ **RESULTS:** The study included 43 patients, 20 (46.51%) undergoing open corpectomy and 23 (53.48%) undergoing mini-open corpectomy. Clinical and statistically significant findings in favor of mini-open corpectomy included lower estimated blood loss (1305 mL vs. 560 mL, $P = 0.0072$), less blood transfusion (241 mL vs. 667 mL, $P = 0.029$), shorter overall length of stay (7.2 days vs. 12.2 days, $P = 0.047$), and shorter surgery time (376 minutes vs. 295 minutes, $P = 0.035$) as well as lower total direct hospital cost (\$34,373 vs. \$45,376, $P = 0.044$). There was no statistically

significant difference in postoperative complications between the 2 groups (medical complications 5% vs. 4.3%, $P = 0.891$; surgical complications 5% vs. 8.69%, $P = 0.534$).

■ **CONCLUSIONS:** Mini-open TL corpectomy is a safe, cost-effective, clinically effective, and less morbid alternative to standard open thoracotomy surgical techniques.

INTRODUCTION

The standard open anterior approach to the thoracolumbar (TL) spine with removal of the vertebral body is commonly used in the treatment of unstable burst fractures,^{1,2} vertebral body tumors,^{3,4} and vertebral osteomyelitis.⁵ The technique is advantageous because it provides simultaneous anterior decompression of the dural sac, restoration of the anterior weight-bearing column,⁶ and superior visualization of the operative field. Together, these aspects facilitate the safe mobilization of relevant nerves and vasculature.⁷ Despite the obvious benefits, these approaches are also associated with a significant complication rate.⁸⁻¹⁰ To mitigate these effects, minimally invasive anterior approaches have been established.¹¹⁻¹⁵ Minimally invasive procedures provide an adequate and direct visualization of the anterior part of the spine with reportedly reduced morbidity and mitigate the need for an approach surgeon.

Although advantageous, mini-open corpectomy techniques have a steep learning curve, and published data comparing them with standard open techniques are limited, although reductions in both

Key words

- Cost-effectiveness
- Mini-open corpectomy
- Open corpectomy
- Perioperative outcome
- Spine infection
- Spine trauma
- Spine tumor

Abbreviations and Acronyms

- ASIA:** American Spinal Injury Association
BT: Blood transfusion
EBL: Estimated blood loss
LOS-A: Length of stay from admission until discharge

LOS-S: Length of stay from surgery until discharge
TL: Thoracolumbar

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blood loss and direct costs have been reported in other minimally invasive spinal surgeries.¹⁶ In this study, we investigated the differences between open corpectomy and mini-open corpectomy with regard to perioperative morbidity considering admitting diagnosis, preoperative and postoperative neurologic status, estimated blood loss (EBL), length of surgery, immediate postoperative complications, and the total length of hospital stay. A secondary analysis involved the comparison of direct hospital cost between the 2 approaches.

MATERIALS AND METHODS

This study was approved by the Institutional Review Board of Ochsner Medical Center. Retrospective data were collected from patients treated by the senior author (O.A.R.S.) operating at Ochsner Medical Center between September 2009 and September 2015. All patients who underwent open or mini-open corpectomy of the TL spine were included in this study. Patients were grouped into either the open or the mini-open group, and medical records were reviewed for demographics (age, sex, body mass index, primary diagnosis), operative data (length of surgery, EBL, blood transfusion [BT]), surgical level, preoperative and postoperative neurologic status (using American Spinal Injury Association [ASIA] Impairment Scale), immediate perioperative complications (within 30 days postoperatively), length of stay from admission until discharge (LOS-A), length of stay from surgery until discharge (LOS-S), and total direct hospital costs.

Inclusion and Exclusion Criteria

Patients who were operated on by the primary surgeon (O.A.R.S.) between September 2009 and September 2015 were included. All patients with a diagnosis of metastatic spine tumor, spine trauma, or spinal infection who underwent TL corpectomy were included with the exception of patients who were pregnant or <18 years old.

Surgical Techniques

Mini-Open Corpectomy. The procedure for a mini-open anterior TL corpectomy using extreme lateral interbody fusion has been

described previously.¹⁵⁻¹⁷ Briefly, the patient is positioned in a true lateral decubitus position, and a left-sided extreme lateral approach is taken for the desired level (T6-L4). The outline of the diseased vertebral body and, in the case of the thoracic spine, overlying rib is drawn on the patient's body. A 5- to 10-cm incision is made in the midaxillary line or parallel to the rib overlying the vertebral body to be removed. The area is prepared and draped using standard sterile technique. A retroperitoneal, retropleural, or combined approach to the spinal column is used (Figure 1A and B). The lateral transthoracic or retroperitoneal retractor system is used as per standard technique for access. Standard technique is used for a thoracic or a lumbar corpectomy. Expandable cages are filled with FormaGraft (NuVasive, Inc., San Diego, California, USA) and INFUSE (Medtronic Sofamor Danek, Memphis, Tennessee, USA) bone graft. Lateral plates alone are used for all 1-level corpectomies and all corpectomies ≥ 2 levels are supplemented with lateral plates and percutaneous pedicle screw instrumentation.

Open Corpectomy. Patients treated with open TL corpectomy underwent standard TL exposure using combined retroperitoneal and retropleural approaches with or without thoracotomy by exposure surgeons (Figure 1A and B). Some patients underwent extracavitary approaches for corpectomy in the thoracic spine. The corpectomy was done in a fashion similar to the mini-open technique by the neurosurgeon, and the posterior instrumentations were done using standard open technique. All open corpectomies were supplemented with posterior instrumented fusion.

Statistics

Statistical analysis was performed using SAS software (SAS Institute Inc., Cary, North Carolina, USA). Two-sample t tests were used to compare perioperative data between the 2 groups; χ^2 test was used to compare the incidence of diagnoses between the groups. Pearson correlation and linear and multiple logistic regression tests were used to assess the relationship between the

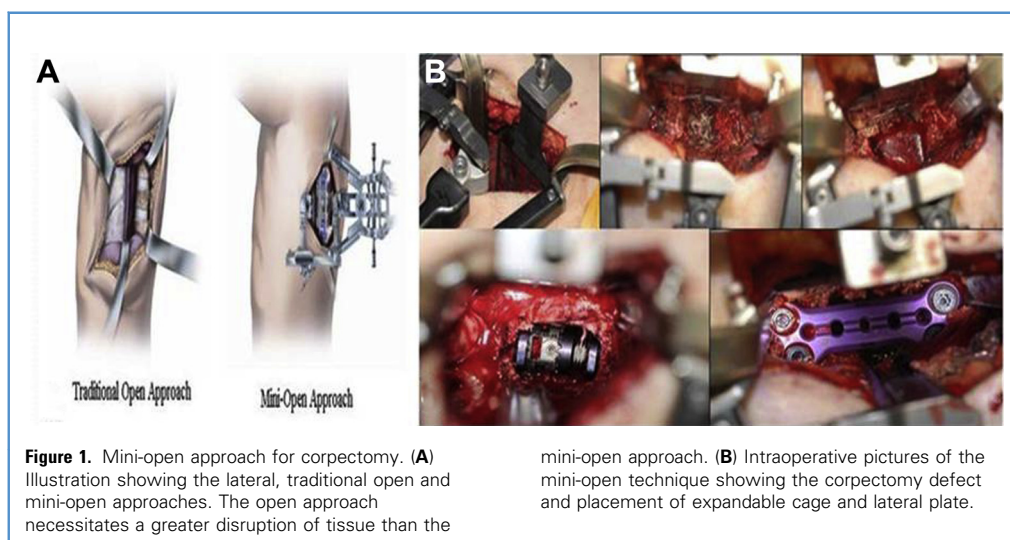


Figure 1. Mini-open approach for corpectomy. (A) Illustration showing the lateral, traditional open and mini-open approaches. The open approach necessitates a greater disruption of tissue than the

mini-open approach. (B) Intraoperative pictures of the mini-open technique showing the corpectomy defect and placement of expandable cage and lateral plate.

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