ELSEVIER

CrossMark

The Spine Journal 14 (2014) 2911–2917

THE SPINE JOURNAL

Clinical Study

Negative pressure wound therapy reduces incidence of postoperative wound infection and dehiscence after long-segment thoracolumbar spinal fusion: a single institutional experience

Owoicho Adogwa, MD, MPH[a,*], Parastou Fatemi, BS[a], Edgar Perez, BS[a], Jessica Moreno, RN, BSN[a], Gustavo Chagoya Gazcon, BS[a], Ziya L. Gokaslan, MD[b], Joseph Cheng, MD, MS[c], Oren Gottfried, MD[a], Carlos A. Bagley, MD[a]

[a]*Division of Neurosurgery, Duke University Medical Center, 3807, Durham, NC 27710, USA*
[b]*Department of Neurosurgery, Johns Hopkins University School of Medicine, 733 N. Broadway, Baltimore, MD, 21205, USA*
[c]*Department of Neurosurgery, Vanderbilt University Medical Center, 1211 Medical Center Dr, Nashville, TN 37232, USA*

Received 8 October 2013; revised 24 March 2014; accepted 16 April 2014

Abstract

BACKGROUND CONTEXT: Wound dehiscence and surgical site infections (SSIs) can have a profound impact on patients as they often require hospital readmission, additional surgical interventions, lengthy intravenous antibiotic administration, and delayed rehabilitation. Negative pressure wound therapy (NPWT) exposes the wound site to negative pressure, resulting in the improvement of blood supply, removal of excess fluid, and stimulation of cellular proliferation of granulation tissue.
PURPOSE: To assess the incidence of wound infection and dehiscence in patients undergoing long-segment thoracolumbar fusion before and after the routine use of NPWT.
STUDY DESIGN: Retrospective study.
PATIENT SAMPLE: One hundred sixty patients undergoing long-segment thoracolumbar spine fusions were included in this study.
OUTCOME MEASURES: Postoperative incidence of wound infection and dehiscence.
METHODS: All adult patients undergoing thoracolumbar fusion for spinal deformity over a 6-year period at Duke University Medical Center by the senior author (CB) were included in this study. In 2012, a categorical change was made by the senior author (CB) that included the postoperative routine use of incisional NPWT devices after primary wound closure in all long-segment spine fusions. Before 2012, NPWT was not used. After primary wound closure, a negative pressure device is contoured to the size of the incision and placed over the incision site for 3 postoperative days. We retrospectively review the first 46 cases in which NPWT was used and compared them with the immediately preceding 114 cases to assess the incidence of wound infection and dehiscence.
RESULTS: One hundred sixty (NPWT: 46 cases, non-NPWT: 114 cases) long-segment thoracolumbar spine fusions were performed for deformity correction. Baseline characteristics were similar between both cohorts. Compared with the non-NPWT cohort, a 50% decrease in the incidence of wound dehiscence was observed in the NPWT patient cohort (6.38% vs. 12.28%, p=.02). Similarly, compared with the non-NPWT cohort, the incidence of postoperative SSIs was significantly decreased in the NPWT cohort (10.63% vs. 14.91%, p=.04).
CONCLUSIONS: Routine use of incisional NPWT was associated with a significant reduction in the incidence of postoperative wound infection and dehiscence.

FDA device/drug status: Not applicable.

Author disclosures: ***OA:*** Nothing to disclose. ***PF:*** Nothing to disclose. ***EP:*** Nothing to disclose. ***JM:*** Nothing to disclose. ***GCG:*** Nothing to disclose. ***ZLG:*** Speaking/Teaching Arrangements: AO North America (E), AO Spine (E), NREF (E), DePuy (E); Stock Ownership: US Spine (A) and Spinal Kinetics (C); Honorarium: AO Foundation (A per diem); Board of Directors: JNS, Spine Journal, Journal of Spine Disorders, European Spine Journal, Nature Review World Neurosurgery, Journal of Surgical Oncology; Trips/Travel: Visiting Professor (A); Travel/accommodations/meeting expenses unrelated to activities listed: AOSpine. ***JC:*** Nothing to disclose. ***OG:*** Nothing to disclose. ***CAB:*** Nothing to disclose.

* Corresponding author. DUMC, Box 3807, Durham, NC 27710, USA. Tel.: (919) 668-6760; fax: (919) 668-1221.
E-mail address: owoicho.adogwa@gmail.com (O. Adogwa)

1529-9430/$ - see front matter
http://dx.doi.org/10.1016/j.spinee.2014.04.011

Keywords: Negative pressure wound therapy; Deformity; Wound dehiscence; Wound infection; Spine outcomes; Surgical site infections

Introduction

Despite the use of prophylactic antibiotics, advances in surgical technique, and postoperative care, wound infections, and dehiscence after spine surgery remain a serious problem [1–6]. Numerous published studies have reported rates of wound complications ranging from 2% for simple discectomies to 15% after larger deformity correction procedures; with increased risk associated with spinal instrumentation [6–13]. The medical and financial sequelae of such complications can be devastating. The cost of medical care for postoperative spinal infection is greater than four times that of an uncomplicated case. In fact, the average ''added cost'' per patient with wound infectious complications has been reported to exceed $100,000 [4].

Wound infections lead to tissue breakdown and ultimately wound dehiscence through interference with the normal cellular mechanisms of wound healing and devitalization of underlying tissue [4,14,15]. Aggressive tissue mobilization for wound closure without proper attention to preservation of skin blood supply can lead to dehiscence and infection as devitalized tissue is a nidus for bacterial infection. This is particularly true for larger wounds, where presumably, there may be potential spaces surrounded by devascularized tissue, often containing metallic hardware [5,16,17]. Additionally, longer operative times potentially allow more infectious agents to be introduced. Furthermore, prior operations, irradiated surgical beds, and concomitant steroid therapy dramatically increase the chance for wound dehiscence and infection.

Negative pressure closure dressings after elective surgery have been used in other surgical disciplines with good clinical outcomes [5,11,16,17]. Negative pressure closure dressings decrease fluid excess and edema around the wound site and facilitate arteriolar dilation. As a result, use of these devices improve microcirculation and reduce bacterial colonization [5,11,16,17]. Whether routine use of negative pressure closure devices reduce the incidence of wound infections and dehiscence and the duration of in-hospital stay remain unknown.

Although a growing number of studies have been performed on nonspinal applications of negative pressure wound therapy (NPWT), there remains a paucity of data on this type of closure for the spine. The aim of the present study is to assess the incidence of wound infection and dehiscence in deformity patients undergoing multilevel thoracolumbar fusion before and after the routine use of NPWT.

Methods

Patient selection

The primary aim of this study was to determine whether the routine use of NPWT in elective long-segment spine fusions would result in fewer postoperative wound infections and dehiscence. Long-segment fusions were defined as fusion constructs of four levels or greater. All adult patients undergoing thoracolumbar fusion for deformity correction at Duke University Medical Center over a 6-year period by senior author (CB) were enrolled in this study. The institutional review board approved this retrospective review.

A retrospective review of hospital records from January 2007 to January 2013 was performed of adult patients at our institution undergoing posterior thoracolumbar spinal fusion for deformity correction by senior author (CB). The inclusion criteria consisted of patients older than 18 years who had undergone multilevel (more than four vertebral levels) posterior spinal fusion using pedicle screws and rod instrumentation at any level in the thoracolumbar spine for deformity correction. The exclusion criteria included the history of infections at the surgical site, severe coexistent pathology that could confound the assessment of operative outcome (eg, rheumatoid arthritis, osteoarthritis, metabolic bone disease), history of immunosuppression or chronic systemic infection, and pregnancy.

Patient demographics, clinical presentation, comorbidities, radiologic studies, and all treatment variables were reviewed for each case.

Standard pre- and postoperative systemic prophylactic antibiotic regimen

All patients received standard systemic antibiotic prophylaxis consisting of weight-based intravenous (IV) cefazolin within 1 hour of surgical incision, followed by IV cefazolin every 8 hours for 1 day. If the patient was allergic to penicillin, weight-based IV clindamycin was used instead. All patients were prepared with chlorhexidine. A standard midline incision and open approach was used in all cases. Fusion levels were determined based on the quality of bone and stability of the fracture. Before skin closure, irrigation with 3 L of normal saline by pulse lavage was performed.

Treatment and control cohorts

In 2012, a categorical switch was made by the senior author (CB) that included the routine use of negative pressure