Spine Deformity

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Spine Deformity 4 (2016) 277–282

Management of Spinal Implants in Acute Pediatric Surgical Site Infections: A Multicenter Study

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Received 9 April 2015; revised 3 February 2016; accepted 6 February 2016

Abstract

Study Design: A retrospective review of patients who underwent posterior spinal fusion (PSF) and returned within 90 days with an acute infection.

Objectives: The study motive is to identify and understand the risk factors associated with failure of retaining spinal implants and failure to treat acute infection.

Background: The natural history of early surgical site infection (SSI) (less than 3 months) after PSF is not known and removing the implants early after PSF risks pseudarthrosis and deformity progression.

Methods: Patients ranging from 1999 to 2011 with surgical site infections (SSIs) who required irrigation and debridement within 3 months of PSF were identified from 4 institutions. Univariable and multivariable regression analysis were used to identify risk factors associated with failure of acute infection treatment.

Results: Eighty-two patients (59 female, 23 male) with a mean age of 13.6 years were identified. Median follow-up after initial surgery was 33 months (range: 12–112 months). Sixty-two (76%) were treated successfully with acute treatment and did not return with recurrent infection (cleared infection, group C); 20 (24%) returned later with chronic infection (recurrent infection, group R). Multivariable analysis indicated that patients with stainless steel implants (OR = 6.4, 95% CI = 1.7–32.1; p = .009) and older subjects (OR = 1.3, 95% CI = 1.0–1.6; p = .03) were more likely to present with recurrent infection. There was no difference between the groups with regard to the initial time of presentation post fusion, proportion of non-idiopathic diagnosis, rate of positive cultures, culture species, presence of fusion to pelvis, and time on antibiotic treatment.

Conclusions: Seventy-six percent of patients presenting with an SSI less than 3 months after PSF did not require implant removal to clear their infection. Early postoperative SSIs can be treated with retention or implant exchange. Older patients and patients with stainless steel instrumentation are more likely to present with a late recurrent infection compared to other metals.

Level of Evidence: Level III.

Keywords: Posterior spine fusion; Acute infection; Spine instrumentation; Surgical site infection

Author disclosures: MPG (other from Medtronic, from null, outside the submitted work), JAG (none), PEM (none), MJT (none), DLS (grants from POSNA & SRS, personal fees from Biomet; Medtronic, non-financial support from Growing Spine Study Group, Growing Spine Foundation, Medtronic Strategic Advisory Board, nonfinancial support from Scoliosis Research Society, personal fees from Expert testimony, personal fees from Biomet; Medtronic; Stryker, other from Wolters Kluwer Health–Lippincott Williams & Wilkins; Biomet Spine, personal fees from Stryker; Biomet, Medtronic, other from Medtronic, outside the submitted work; in addition, DLS has a patent Medtronic issued), MGV (personal fees and other from Stryker, Biomet, grants, personal fees and nonfinancial support from SRS, POSNA, CWSDSG, OREF OMeGA, CSSG FoxPSDSG, personal fees from CSSG, POSSNA, during the conduct of the study; personal fees and other from Stryker, Biomet, grants, personal fees and non-financial support from SRS, POSNA, CWSDSG, OREF OMeGA, CSSG FoxPSDSG, personal fees from CSSG, POSSNA, outside the submitted work), JMF (personal fees from Biomet, personal fees from LWW, outside the submitted work), KKB (none), GIP (none), BNA (none), DJH (none).

This study received institutional review board approval from the Office of Clinical Investigation, Boston Children's Hospital (No. IRB-P00007600).

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2212-134X/$ - see front matter © 2016 Scoliosis Research Society.
http://dx.doi.org/10.1016/j.jspd.2016.02.001

Introduction

Given the direct and indirect costs associated with a surgical site infection (SSI) after spinal deformity surgery, there has been a recent emphasis on optimizing prevention and treatment strategies [1-4]. In cases of delayed deep spinal infection, retention of implants is usually not possible [3]. In the setting of an early (less than 3 months after the index fusion) infection, implant retention is frequently attempted because removing the implants early after posterior spinal fusion (PSF) risks pseudarthrosis and deformity progression in the setting of an unfused spine. It is not clear whether ultimately these patients can be treated with irrigation and debridement (I&D) alone, or if they will progress to recurrent infection and need for implant removal [3,5-7]. The purpose of this study is to examine the outcomes after treatment of early spinal infections after pediatric spinal deformity surgery (less than 3 months after the index procedure) and to understand factors that may indicate whether instrumentation should be retained or removed when treating these events.

Materials and Methods

Between 1999 and 2011, patients diagnosed with deep SSIs who required I&D within 3 months of PSF were identified from four institutions. For the purposes of this study, an ''early'' or ''acute'' infection is defined as an SSI occurring within 3 months of the index spinal fusion procedure. Chronic infections are defined as infections that occur more than 3 months after the index fusion procedure. A total of 82 patients, including 59 females and 23 males with a mean age of 13.8 (range: 8.4–22.0) years were identified. Demographic (gender, age) and clinical (diagnosis, type of metal implanted, intraoperative culture data, number of surgical I&Ds, total time on antibiotics, number of levels fused, and instrumentation to the pelvis) data were collected. Details of how the early infection was treated were collected from available operative reports. Patients were then assessed for failure defined as recurrent infection (clinical signs or symptoms, wound problems, elevated laboratory tests) requiring a repeat surgical intervention with or without retention of implants at any time point after the acute treatment was completed.

Statistical methods

Patient, infection, and treatment characteristics were summarized and compared between subjects who were successfully treated with serial I&D or acute implant exchange and subjects that experienced chronic recurrence of infection requiring implant removal and/or deferred reinstrumentation. Approximately normal and symmetric data were summarized by mean and standard deviation, whereas data that significantly deviated from normality were summarized by median and interquartile range (25th–75th percentile). Binary and categorical characteristics were compared using either a χ^2 test or Fisher exact test, as appropriate. For continuous characteristics, independent *t* tests or the Wilcoxon rank-sum test were used.

Univariable and multivariable logistic regressions were used to identify risk factors of recurrent infection. Factors analyzed included age, diagnosis (idiopathic/congenital vs. syndromic/neuromuscular), number of levels fused and instrumentation to the pelvis, implant metal type (stainless steel vs. other metals), bacteria culture (positive vs. negative), number of washouts, duration of parenteral antibiotics (weeks), and the time to initial infection (days). A backwards model section procedure was used based on the Akaike information criterion and likelihood ratio tests. All tests were two sided and p values less than .05 were considered significant.

Source of Funding

There was no external source of funding, nor did funding source play a role in conducting the investigation.

Results

Patient, surgical, and outcome characteristics for all subjects are summarized in Table 1. Median follow-up after

Table 1
Patient, surgical, and outcome characteristics for all subjects. (N = 82).

	Freq.	%
Patient and surgical characteristics		
Gender (*% male*)	23	(28%)
Age at index procedure (*years; mean ± SD*)	13.7	± 2.85
Diagnosis		
Neuromuscular	39	(48%)
Syndromic	19	(23%)
Congenital	5	(6%)
Idiopathic	19	(23%)
Number of levels fused (*median (IQR)*)	14	(11–16)
Instrumentation to the pelvis	26	(32%)
Number of implants (*mean ± SD*)	23.8	± 6.94
Metal type		
Stainless steel	38	(46%)
Titanium	25	(30%)
Cobalt chrome	4	(5%)
Titanium & cobalt chrome	3	(4%)
Vitallium	3	(4%)
Unknown	9	(11%)
Infection and treatment characteristics		
Time to acute infection (*days; median (IQR)*)	15	(10–25)
Positive bacteria culture	67	(82%)
Number of washouts (*median (IQR)*)	2	(1–3)
Duration of IV antibiotics (*weeks; median (IQR)*)	6	(4–6)
Outcome characteristics		
Recurrent Infection	20	(24%)
Time to recurrent infection (*months; median (IQR)*)	18	(14–30)
Follow-up time (*months; median (IQR)*)	33	(22–57)

IQR, interquartile range (25th percentile – 75th percentile); SD, standard deviation.