Journal of Clinical Neuroscience 23 (2016) 76–80

Contents lists available at ScienceDirect

Journal of Clinical Neuroscience

journal homepage: www.elsevier.com/locate/jocn

Clinical Study

Incidence and risk of delayed surgical site infection following instrumented lumbar spine fusion

Peter Lewkonia [a,*], Christian DiPaola [b], John Street [a]

[a] Combined Neurosurgical and Orthopaedic Spine Program, Vancouver General Hospital, University of British Columbia, 818 West Tenth Avenue, Vancouver, BC V5Z 1M9, Canada
[b] Department of Orthopedics, Spine Division, University of Massachusetts Medical Centre, Worcester, MA, USA

ARTICLE INFO

Article history:
Received 22 April 2015
Accepted 2 May 2015

Keywords:
Antibiotic prophylaxis
Lumbar vertebrae
Postoperative complication
Surgical wound infection

ABSTRACT

We reviewed a retrospective case series of patients with delayed infections after spinal fusion, and surveyed medical experts in Canada and the USA regarding their use of prophylactic antibiotics for patients undergoing invasive procedures following spine surgery. Infections after spinal fusion are a relatively common complication, which typically occur early in the postoperative period. Infections which occur more than 3 months from the index procedure are rare and are often caused by atypical pathogens. The proportion of infections that required debridement and occurred 6 months after the index procedure was 4.3% (7/162). Over 85% of these infections were polymicrobial, with one third of those containing methicillin-resistant *Staphylococcus aureus*. The most common operative indications were either trauma or tumour, and most patients with a delayed infection had a distant chronic infection. The majority of spine experts do not routinely recommend prophylactic antibiotics for invasive procedures after spine fusion. In the multivariate analysis, experts were more likely to recommend antibiotics for patients undergoing a non-dental procedure, those who were diabetic, and those who were greater than 1 year out from their procedure. In summary, the delayed presentation of infection after instrumented spinal fusion is a rare but serious complication. However, due to its infrequency, routine prophylaxis to prevent haematogenous seeding is likely unnecessary.

1. Introduction

Although multiple minimally invasive techniques now exist [1], a traditional posterior fusion of the lumbar or cervical spine requires invasive exposure to safely place instrumentation and complete other parts of the surgical procedure [2–4]. One of the unintended consequences of such a broad dissection is a relatively high rate of postoperative surgical site infection [5]. Infection rates have been cited extensively in the literature, with recent reviews indicating that approximately 2% of instrumented lumbar spine fusions are complicated by postoperative surgical site infections [5–8]. Postoperative infections following instrumented lumbar spine fusion generally require complex medical and surgical treatments involving long term antibiotic coverage, prolonged hospital stays, local wound drainage systems and, in some patients, multiple operations with advanced soft tissue reconstruction techniques [7–11]. These additional treatments may have a significant impact on the long term outcomes [12]. It is also known that certain patient and surgical characteristics increase the risk of postoperative infection, including smoking, obesity, hyperglycaemia, postoperative incontinence, advanced age, large blood loss, longer operative times and the involvement of trainees during surgery [13–16]. More complex pathologies such as trauma and tumour surgery, as well as complex spinal deformity corrections, also result in a higher rate of infection, among other complications [5,7,14,15,17].

Most infections occur early in the postoperative period, typically within the first 3 months [8,17,18]. On the other hand, delayed infections, which occur more than 3 months from the index procedure are quite uncommon. The clinical presentation may include a localised abscess, pain, and implant failure with or without wound drainage [19,20]. The limited evidence on delayed infections suggests that they are often caused by atypical pathogens and can have an insidious onset which makes diagnosis difficult [18–21]. It has been hypothesised that these late infections may be related to transient bacterial contamination from a distant anatomical source, perhaps during invasive medical procedures such as dental surgery, urinary tract instrumentation or colonoscopies [19]. This phenomenon, known as haematogenous seeding, has been described in patients who are at risk of bacterial endocarditis [22], and also in patients with a total joint arthroplasty

* Corresponding author. Tel.: +1 403 984 1910; fax: +1 403 452 0995.
E-mail address: pdlewkon@ucalgary.ca (P. Lewkonia).

http://dx.doi.org/10.1016/j.jocn.2015.05.039
0967-5868/

of the hip or knee [23]. In recent years, the American Academy of Orthopaedic Surgeons has produced a policy statement which states that antibiotic prophylaxis should be considered during invasive medical procedures for all patients with total joint arthoplasty implants [24]. It is felt that this prophylaxis reduces the risk of developing a delayed infection. No such guidelines are available for patients following spinal instrumentation. Based on the studies of large total joint replacement, treatment of delayed or chronic postoperative infections may also be more complex, requiring implant removal and more aggressive tissue debridement [25,26].

Very little is known about the risk of haematogenous seeding of spinal implants by the same mechanism as that proposed for artificial heart valves and hip and knee arthroplasty implants. The risk of a delayed presentation of postoperative surgical site infections in the lumbar spine is thought to be low. Furthermore, recent invasive medical procedures may not be identified or documented when patients suffer from a postoperative infection. For these reasons, even retrospective case-control studies are difficult. Despite the low incidence of delayed infection, the consequences can be devastating for the patient and costly for the medical system [11,12]. As a result, administering antibiotic prophylaxis for patients with spinal implants before invasive procedures is a relatively simple intervention which could limit patient morbidity, if evidence or expert opinions are found to support the practice.

This study examines the risk of delayed spine surgical site infection, particularly after invasive medical procedures. Firstly, we present a review of a large consecutive cohort of patients who developed either acute or delayed surgical site infections following spine instrumentation. Secondly, we examine expert opinions using a number of systematically prepared scenarios involving patients with lumbar instrumented fusions in clinical situations who may be at risk of a delayed surgical site infection.

2. Materials and methods

We first performed a retrospective review of a single academic surgical centre to identify all patients who developed delayed surgical site infections following lumbar spine surgery with instrumentation. This data was then used to inform the systematic development of a survey of expert opinion, which was distributed to the members of two academic spine societies (the Canadian Spine Society and the New England Spine Study Group). The study protocol was approved by our University Clinical Research Ethics Board.

2.1. Retrospective patient review

A retrospective review of a prospectively collected database was performed. The review included 5770 consecutive patient admissions during the period from April 2000 to March 2008. This cohort included all patients who were admitted to a quaternary academic referral centre for elective or emergency spine procedures. All patients who developed surgical site infections (treatment included a debridement and irrigation of their wound during the admission) were identified from unique procedure codes. Further data, including age, medical comorbidities, procedure type (including the use of bone graft material, instrumentation and approach), information about infection bacteriology, and time from index procedure to readmission, were also identified. From this cohort of patients with surgical site infections, all patients who presented 3 or more months (>90 days) from the index spine surgery procedure were identified. The database variables for this cohort were supplemented by individual paper and electronic chart reviews. All patients whose primary diagnosis included an infection such as discitis, osteomyelitis or spinal abscess were excluded.

2.2. Survey of expert opinion

The second component of the study was a multicentre survey of spine experts. Each participant was presented with a set of standardised patient histories for those who had previously undergone instrumented spinal fusion. The histories are presented in Supplementary Material 1 in their entirety. The survey asked the participants about their routine practice in either recommending or not recommending the use of prophylactic antibiotics for patients undergoing invasive medical procedures, such as colonoscopies or dental work following spine surgery. The questions varied with a series of patient and surgical factors: date from index procedure to invasive intervention (such as dental work); type of invasive procedure (dental work, colonoscopy, cystoscopy); length of instrumentation (single level *versus* multiple level); smoking status; diabetes status; body mass index status (overweight *versus* healthy body weight); previous spinal surgery predating the instrumentation.

In addition to patient characteristics from the histories, the responder characteristics were also anonymously collected. This information included: the level of training (trainee, general orthopaedic or spine surgeon, fellowship trained spine surgeon); type of training (orthopaedic *versus* neurosurgical); location of practice (USA *versus* Canada); practice type (proportion of spine surgery *versus* general orthopaedic or neurosurgery).

The survey was distributed to two independent academic spine societies (the Canadian Spine Society and the New England Spine Study Group) in 2011. The paper version was distributed at the Canadian Spine Society annual meeting. Once the paper surveys had been returned, a follow-up email directed any members who had not yet completed the survey to participate in an online version over the subsequent weeks. The electronic version was the sole form of distribution (by email) to the New England Spine Study Group. All data were compiled using Excel (Microsoft, Redmond, WA, USA) for subsequent analyses. For the correlation part of the analyses, responses were converted to a binary response of "antibiotics or no antibiotics". Any antibiotic choice was considered a positive response. To assess the effect of participant characteristics on the use of antibiotics, both bivariate analyses (using Fisher's exact test) and multiple logistic regression were performed. For the analyses of patient characteristics, McNemar's test was used by grouping the question responses to assess for single explanatory variables, such as invasive procedure type or medical comorbidities. An alpha value of $p = 0.05$ was used as a measure of statistical significance for all comparisons. A Bonferroni correction for multiple comparisons was used where appropriate.

3. Results

3.1. Retrospective study

From the total number of patients in the cohort (5770 procedures), 162 patients were identified who re-presented to the same institution and were treated with a debridement procedure for surgical site infection. This represents a total surgical site infection rate of 2.8%, which is not dissimilar from that reported in the literature [5,6]. Of those, only seven patients presented 3 months or more after their index procedure (4.3% of all infections, and 0.12% of all patients in the consecutive cohort). A detailed summary of all patients with delayed infections is presented in Table 1. Not all patients had inflammatory markers (C-reactive protein, erthryocyte sedimentation rate) drawn, but all of those who did had elevations in all blood tests.

Of the seven patients with a delayed infection, presenting 3 months or more from the index procedure, only a single patient lacked an obvious risk factor for infection such as prolonged wound drainage, a chronic remote infection, or an initial infection in a remote site during the early postoperative period.