The Journal of Arthroplasty 29 (2014) 1610–1616

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Decreased infection rates following total joint arthroplasty in a large county run teaching hospital: A single surgeon's experience and possible solution

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ARTICLE INFO

Article history:
Received 30 November 2012
Accepted 14 March 2014

Keywords:
arthroplasty
infection
indigent
protocol

ABSTRACT

Total joint arthroplasty is a common orthopaedic procedure producing valuable improvements in patient's quality of life. A dreaded complication of this procedure is deep seated, periprosthetic infection. This complication can lead to multiple reoperations and upwards of $100,000 of increased cost burden. At one 900 bed county run teaching hospital, with a historically high infection rate in total joints, the total joint service was closed and restarted using a new protocol, dropping infection rates from 12.9% to 1.9% ($P = 0.007$).

Total joint arthroplasties are some of the most commonly performed orthopaedic procedures in the United States today. In 2006, nearly 800,000 total hip and knee arthroplasties were performed [1,2]. This number is expected to increase to 4 million by the year 2030 [2,3]. The most common pathological processes that affect these joints leading to replacement are osteoarthritis, avascular necrosis, inflammatory arthritides and post-traumatic arthritis.

A variety of complications can occur during and after total joint arthroplasty. These complications include fracture, nerve injury, vascular injury, thromboembolic disease, infection, dislocation, aseptic loosening and periprosthetic fractures [4]. While uncommon, prosthetic joint infection is a devastating and expensive complication of total joint arthroplasty. Current estimates report that 80,000 total joint revision procedures are performed annually. Approximately 25% of these are secondary to surgical site infection [2,3,5].

The infection rate for total hip arthroplasty reported in most centers is now 0.5–1% and 0.5–2% for total knee arthroplasty [6–8]. Combinations of medical and surgical techniques are frequently used to treat prosthetic joint infections [9]. Common approaches include component removal, intravenous (IV) antibiotic use, antibiotic cement insertion, antibiotic spacer insertion, joint fusion and multiple stage joint revision [9]. The average cost associated with one infected arthroplasty case ranges from approximately $68,053 to $107,264 [10]. In light of the immense expense and hardship associated with prosthetic joint infection, prevention of infection and reduction of infection rates is of supreme importance to patient welfare and reducing medical costs. Recently, this importance has been emphasized due to the expansion of government paid insurance costs and medical reform.

In the US, most total joint arthroplasty cases are carried out in private hospitals. This is largely due to insurance status, patient preference, provider availability and the elective nature of most total joint arthroplasties. Large city hospitals, especially Level 1 Trauma Centers, have a disproportionate share of patients with malnourishment, intravenous drug abuse, and alcoholism, which predispose this population to SSI. This makes the patient population at risk for SSI in elective arthroplasty. Concomitantly, these hospitals are more likely to treat patients with lower payer indices such as medicaid and medicare. Several recent studies have demonstrated that these patients are at higher risk for complications following total joint arthroplasty and are prone to early revision surgery [11,12]. A study by the CDC showed that private nonteaching hospitals have lower rates of surgical site infection than small <500 bed, or large >500 bed, teaching hospitals [13,14]. In large teaching hospitals, the rate of postoperative surgical site infections can be as high as 8.2% [13]. Due to the relative rarity of total joint arthroplasty in large indigent care facilities, there is very limited data concerning periprosthetic infection rates in these locations.

The Conflict of Interest statement associated with this article can be found at doi: http://dx.doi.org/10.1016/j.arth.2014.03.012.

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http://dx.doi.org/10.1016/j.arth.2014.03.012
0883-5403/

Historical Perspective

Our hospital is a 900+ bed public Level 1 Trauma center. On an elective basis, the hospital mainly serves indigent patients or low payer indices such as medicaid and medicare. These patients have proven to be at higher risk for complications [12,15–17]. From the year 2002 to 2004, 70 elective total joint arthroplasty cases were performed with an infection rate of 12.9% (9 patients). Secondary to this high infection rate, a discussion was made to place a hiatus on the total joint program in order to assess possible corrections to decrease SSI to satisfactory levels. A detailed arthroplasty protocol was devised in order to reinstate the service with the goal of lowering the infection rate. To evaluate the effect of the implementation of the protocol, patients were prospectively enrolled prior to joint arthroplasty. Our hypothesis is that instituting a total joint arthroplasty protocol will reduce the infection rate in a large county run teaching hospital in a high-risk patient population. To our knowledge, no one has reported on the effect of protocol implementation at such an institution.

Materials and Methods

The university and hospital institutional review board (IRB) approved this study. Patients from 2002 to 2004 were identified based on billing CPT codes for total knee arthroplasty, total hip arthroplasty, total knee revision arthroplasty or total hip revision arthroplasty. Once identified their charts were reviewed via the electronic medical record (EMR) system established in 2011. Patients receiving care prior to the implementation of the EMR had their charts scanned in to the system. Patients from 2005 to 2008 were identified via paper charts. After 2008, the protocol was considered standard of care secondary to its success. Prospective enrollment was stopped at that point in time. Patients from 2009 to 2011 were identified from both the EMR as well as the surgical case log kept by the arthroplasty service. A single physician reviewed all charts from 2002 to 2011. Several variables were recorded including age, gender, indication for surgery, co-morbidities, smoking status, HIV status, insurance status, nasal swab data if performed, complications, length of stay, time to diagnosis of infection, and need for reoperation.

A total of 178 patients were identified and included in the study. Seventy patients underwent surgery prior to 2004 (pre-protocol group/control group), while one hundred and eight underwent surgery after 2004 (post-protocol group/test group). There were two gaps where no total joint operations were performed, which included time during 2004–2005 (development of the protocol) and 2008–2009 (re-staffing of surgeon). Eight patients in the pre-protocol group underwent bilateral surgery, while 18 in the post-protocol group underwent bilateral surgery. The patients that underwent a second total joint arthroplasty were included once in the demographical data. Any subsequent complication that occurred following the second surgery was included. The pre-protocol/control group included 27 males and 43 females, while the post-protocol/test group included 49 males and 59 females. The average age for the pre-protocol group was 56 ± 12 (28–88) and 57 ± 10 (27–85) for the post-protocol group. Follow-up in years was 6.9 ± 3.5 (0.1–11.3) for the pre-protocol group and 2.2 ± 2.4 (0.1–8.8) for the post-protocol group. Thirty patients were lost to follow up or records were incomplete which accounted for a total of 16.85% of the patients (30 out of 178 patients). At 6 months, 18 patients were lost to follow up in the post protocol group and 4 patients in the pre-protocol group. Table 1 includes these demographic data by group for direct comparison.

Table 1
Demographic Data.

		Pre-Protocol	Post-Protocol
Number of Patients		70	108
Bilateral Surgery		8	18
Age		56 ± 12	57 ± 10
Gender	Male	27	49
	Female	43	59
Follow-Up (Years)	Average	6.9 ± 3.5	2.2 ± 2.4
	Median	8	1.2
	Range	0.1–11.3	0.1–8.8

Table 2
Arthroplasty Preoperative Selection Criteria.

Completes Appropriate Preoperative Consults with Anesthesia, Internal Medicine, Physical Therapy, Nutrition, Dentistry, and Social Work
BMI < 36, or Weight Loss to a BMI < 36
Non-Smoker or Quit with Two Negative Nicotine Tests
Negative Inflammatory Markers (Assuming History of Infection or Previous Hardware in Place)
HgA1c < 6.5 If Diabetic
HIV on Antiretroviral Therapy Being Followed by Infectious Disease HIV Service with Current CD4 Count and Viral Load

HIV Status and Antiviral Care

Seven patients undergoing total joint operations at our center were Human Immunodeficiency Virus positive (HIV+). All patients had a preoperative viral load and CD4+ count performed regardless of whether they were in the pre-protocol or post-protocol group. All patients had a CD4+ count of >350 and all had a viral load of <0.75 copies × 1000 mL. All patients who were HIV+ and undergoing total joint arthroplasty at our center were maintained on at least two anti-retrovirals (ARVs) with different mechanisms of action.

Total Joints Protocol

One of the many questions to date regarding total joint surgery is how best to prevent surgical site infections (SSI). Patient factors that have been well documented and associated with surgical site infection include BMI/obesity, smoking, diabetes, prior SSI, multiple co-morbidities, and Methicillin Resistant Staphylococcus Aureus (MRSA) colonization [18,19]. There seem to be many factors at the preoperative, operative, and postoperative level that may play a part in preventing SSI. This is the protocol developed in 2004 at our county run teaching hospital aimed to prevent SSI based off of the best evidence based medicine available at that time. Selection criteria are summarized in Table 2.

Pre-Operative Care

Before undergoing total joint arthroplasty, all patients completed our pre-operative joints pathway. This pathway includes pre-operative appointments and evaluations by Internal Medicine, Social Work, Physical Therapy, Nutrition, Dentistry and Anesthesia. Before a patient can have a total joint operation at our facility they must be cleared by all the relevant specialties needed. All HIV+ patients must have an additional Infectious Disease consult and be maintained on an ARV regimen before their operation can be performed.

In addition to this, all patients must undergo nasal swabbing to determine bacterial carrier status. Any patients found to be nasal swab positive must take a 7-day course of mupirocin ointment. Smokers are tested for nicotine prior to their pre-operative visit. Patients testing positive for nicotine are not scheduled until they have been nicotine abstinent at two clinic appointments.

Prior to arriving at the hospital for their surgery, patients are required to take an at home chlorhexidine gluconate (Imperial Chemical Industries, London, England) shower. Upon arrival at the hospital the surgical site is scrubbed again with chlorhexidine gluconate (Imperial Chemical Industries, London, England) by the nursing staff.