Incidence of Prosthetic Joint Infections After Primary Knee Arthroplasty

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Abstract: We report the 1-year incidence of postoperative infections in an unselected series of 2647 consecutive primary knee arthroplasties (3137 knees) performed in a modern specialized hospital dedicated solely to joint arthroplasty surgery in 2002 to 2006. The rates of superficial and prosthetic joint infections were 2.9% and 0.80%, respectively. Prospective surveillance by hospital infection register failed to detect 6 of the 24 prosthetic joint infections. Increased rate of prosthetic joint infections was associated with complex surgery and with several patient-related factors, for example, comorbidity, obesity, and poor preoperative clinical state. The rate of prosthetic joint infections in contemporary knee arthroplasty is low and mainly related to patient-related factors, of which patient comorbidity has the most profound effect on the infection rate. **Keywords:** postoperative infection, knee arthroplasty, surveillance, risk factors.

Despite improvements in operative environment and surgical techniques, postoperative infections remain one of the most devastating complications of knee arthroplasty affecting slightly less than 1% of patients undergoing primary knee surgery [1-3]. The experience of a health care provider, as measured by the annual volume of operations per hospital and per surgeon, has been reported to associate with the rate of postoperative complications [4-7] and even clinical outcome [7]. These results have prompted attempts to improve outcomes by centralization.

In recent years, the growing demand for reconstructive joint surgery has compelled hospitals to improve their volume and efficacy. As an effort to meet these demands, a hospital specialized only in joint arthroplasty surgery was founded in 2002 in a Finnish hospital district serving an area of approximately 470 000 inhabitants. Besides the goal to improve the efficacy, effort was taken to minimize the rates of postoperative complications by optimizing the operative environment and treatment protocols.

The purpose of the present study was to analyze the incidence of postoperative infections in this setting using meticulous case-finding methodology. In addition, factors associated with increased rate of infections were studied. On the basis of the present results, it is hypothesized that, under optimal operative circumstances, the rates of postoperative infections are determined mainly by patient-related risk factors.

Materials and Methods

The hospital is a publicly funded tertiary care center, situated on the university hospital campus, and is responsible for providing all publicly funded joint arthroplasty surgery within the hospital district area. The hospital started operations in September 2002. The annual operative volume was 1494 joint arthroplasty operations in 2003 and 2943 in 2006. The hospital is the only one performing joint arthroplasty surgery within its hospital district and also the only referral center for patients presenting with a suspected complication of joint prosthesis. Therefore, the probability that patients with an infectious complication would end up in any other hospital for treatment is negligible.

From the beginning of hospital operative activity in September 2002 until March 2006, a total of 2647 elective primary knee arthroplasties (3137 knees) were performed on 2443 consecutive patients. These patients represent an unselected cohort of patients with an end-stage knee destruction requiring knee arthroplasty

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operation. Patient demographics and preoperative data are described in Table 1. The general health and condition of the patients were carefully evaluated during a preoperative visit 1 to 3 weeks before the operation. All possible sites of ongoing infections (eg, urinary tract, teeth, skin ulcers) were strictly treated before the operation was scheduled.

The operations were performed in modern operation theaters with vertical laminar air flow. Most of the operations were performed under regional anesthesia. One dose of intravenous cefuroxime was routinely administered upon induction of anesthesia. Simultaneous bilateral knee arthroplasty was performed in 490 cases (19%). There were 296 (9%) unicompartmental and 2841 total knee prostheses. Of the total knee arthroplasty implants, 977 (34%) were cruciate retaining, 1691 (60%) were cruciate substituting, 141 (5%) constrained condylar type, and 29 (1%) were hinged implants. Patella was resurfaced in 31% of cases. Except for 214 (7%) cementless tantalum tibial components, all components were fixed with gentamicin-impregnated bone cement. The mean total operative time was 111 minutes (49-350 minutes) in unilateral and 207 (91-402) minutes in bilateral procedures. A suction drain was routinely left in the joint and removed during the first postoperative day. The length of the postoperative hospital stay was 3 days on average (range, 1-22 days), after which, most patients were transferred to outside hospital or health care center ward for rehabilitation.

Table 1. Patient Demographics and Preoperative Data

Patient Demographics (n = 2647; for Joint-Level Data, n = 3137)	Percentage of Cases or Median (Range)
Age (y)	70 (35-97)
<60 y	16.4
60-70 y	27.0
70-80 y	42.4
>80 y	14.3
Sex, female	70.4
BMI (kg/m^2)	29.9 (16.7-49.5)
ASA risk score	
ASA 1	4.6
ASA 2	50.5
ASA 3	43.4
ASA 4	1.4
Diagnosis	
Primary or secondary osteoarthritis	91.7
Rheumatoid arthritis	4.5
Other arthritis	0.6
Sequels after fracture	2.0
Other	1.2
Previous open surgeries	
None (including arthroscopies)	84.4
Open meniscectomy	8.9
Osteotomy	2.9
Osteosynthesis for fracture	1.6
Other	2.1
Preoperative clinical status	
Range of motion	106 (0-155)
KSS score	45 (0-100)
KSS pain score	
Mild or no pain	7.1
Moderate pain	83.8
Severe pain	8.5

BMI indicates body mass index; KSS, Knee Society Score.

The operations were performed by 40 surgeons, 22 of whom were residents in training. Residents were always under direct supervision of a senior surgeon. Senior joint surgeons operated 82.2% of the knees, and half of the operations were performed by surgeons whose annual number of primary knee arthroplasty operations exceeds 90. The operating surgeons and sterile theater staff wore indicator double gloving and ventilated surgical helmets (Personal Protection System; Stryker, Kalamazoo, Mich).

Data Sources

Postoperative infections were traced initially from the files of local hospital infection register. The register collects data in a prospective manner according to national guidelines, based on Centers for Disease Control and Prevention (CDC) [8] definitions and National Nosocomial Infection Surveillance System methodology [9,10].

Revision knee arthroplasties performed because of infection were detected from the local hospital database Tekoset, in which preoperative, perioperative, and follow-up data on all operations was prospectively registered [11]. Information concerning subsequent readmissions to the operating hospital or to the adjacent university hospital and minor reoperations was searched from the administrative patient database of the hospitals.

Data from these 3 partly overlapping sources were combined to maximize the sensitivity in the detection of infected cases. Records of all patients with a suspected postoperative infection were manually reviewed by one of the authors who verified the computerized data and additionally recorded data concerning diagnostics, treatment, and outcome.

Statistical Methods

The primary outcome was occurrence of prosthetic joint infection within the first postoperative year. Prosthetic joint infections were defined according to CDC criteria [8]. Infections restricted to skin and subcutaneous tissue (superficial wound infections in CDC classification) and those affecting muscle or fascia but not extending into the joint cavity (deep wound infections) are referred to as superficial infections. A similar classification has previously been used by Phillips et al [2].

Death (n = 25) or any operative procedures involving the operated joint (revision or, eg, isolated exchange of tibial insert or secondary patellar resurfacing, n = 19) for aseptic reasons were considered end points of follow-up. Patients with such events were excluded from further analyses. For the remaining patients, the minimum follow-up was 6 months.