# Efficacy of Prophylactic Antibiotics in Simple Knee Arthroscopy

Ronald W. B. Wyatt, M.D., Gregory B. Maletis, M.D., Liisa L. Lyon, M.S., Joan Schwalbe, M.S., and Andrew L. Avins, M.D., M.P.H.

**Purpose:** To determine the association between the use of preoperative antibiotics and the risk of postoperative infection after simple knee arthroscopy. **Methods:** The electronic medical records of a large integrated health care organization were used to identify patients who underwent simple knee arthroscopy between 2007 and 2012. Patient demographics, potential infection risk factors, and antibiotic administration data were extracted. Simple knee arthroscopy included debridement, meniscectomy, meniscus repair, synovectomy, microfracture, and lateral release. Complex knee arthroscopy, septic knees, and cases involving fractures were excluded. Deep infection was defined as a positive synovial fluid culture or signs and symptoms of infection and gross pus in the knee. Superficial infection was defined as clinical signs of infection localized to a portal site and treatment with an antibiotic. **Results:** Of 40,810 simple knee arthroscopies, 32,836 (80.5%) received preoperative antibiotics and 7,974 (19.5%) did not. There were 25 deep infections in the antibiotic group (0.08%) and 11 in the no-antibiotics group (0.14%) (risk ratio = 0.55, 95% confidence interval: 0.27 to 1.12, $P = .10$). There were 134 superficial infections in the antibiotic group (0.41%) and 32 in the no-antibiotics group (0.40%) (risk ratio = 1.01, 95% confidence interval: 0.29 to 1.49, $P = .93$). **Conclusions:** In our large sample of patients who underwent simple knee arthroscopy, there was no association between preoperative antibiotic use and postoperative deep or superficial infection rates at the 95% confidence level ($P = .05$). There was an association between preoperative antibiotic use and a decreased deep infection rate at the $P = .10$ level. **Level of Evidence:** Level IV, case series.

Knee arthroscopy is the most commonly performed orthopaedic procedure in the United States, with approximately 1 million procedures performed annually.[1] Studies have reported postoperative infection rates after knee arthroscopy that range from 0.1% to 3.4%.[2-6] Because of the low incidence of infection, studies to determine the effect of preoperative antibiotics on the postoperative infection rate require large sample sizes to achieve sufficient statistical power and most studies to date have been underpowered.[2-7]

*From the Department of Orthopedic Surgery, Kaiser-Permanente Walnut Creek (R.W.B.W.), Walnut Creek; Department of Orthopedic Surgery, Kaiser-Permanente Baldwin Park (G.B.M.), Baldwin Park; and Division of Research, Kaiser Permanente Northern California, (L.L.L., J.S., A.L.A.), Oakland, California, U.S.A.*

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*Address correspondence to Ronald W.B. Wyatt, M.D., Department of Orthopedic Surgery, Kaiser-Permanente, Walnut Creek, CA 94596, U.S.A. E-mail: ronald.wyatt@kp.org*



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Given the lack of medical evidence regarding the effectiveness of preoperative antibiotics before knee arthroscopy, surgeons have had to decide whether to administer preoperative antibiotics without the benefit of a sufficient evidence base. A survey of orthopaedic surgeons on practices associated with knee arthroscopy reported that the primary reason why surgeons gave preoperative antibiotics was medicolegal concerns.[4,8] This practice of "defensive" medicine, with tests and treatments of unproven value being administered to avoid potential future lawsuits, is a known and serious problem in the provision of low-value medical care.[9-11]

The purpose of this study was to determine the effect of administering a preoperative antibiotic to patients undergoing knee arthroscopy on the incidence of postoperative infection. We hypothesized that there would be an association between the administration of a preoperative antibiotic and the postoperative infection rate.

## Methods

Kaiser Permanente in California is a large, integrated health care delivery system caring for more than 7.4 million persons and is broadly representative of the statewide population.[12] This study was a retrospective

cohort study of California Kaiser Permanente patients. We identified patients who underwent 1 or more simple knee arthroscopy procedures (defined below) between January 1, 2007, and December 31, 2012, and had 3 months of membership after the procedure.

Using health plan databases, data on age, sex, self-reported race, or ethnic group, preoperative diagnosis, operative procedure, and the use of preoperative antibiotics were collected. Clinical characteristics studied included American Society of Anesthesiology (ASA) scores, diagnosis of diabetes, and body mass index (BMI). Procedure variables included whether a preoperative antibiotic was administered and the type of antibiotic, anesthesia type, postoperative diagnosis (based on operative report text string search), procedure performed (based on the International Classification of Diseases [9th revision] codes), and operative time. Whether or not a preoperative antibiotic was administered was at the discretion of the individual surgeon.

Patients with the following diagnoses or conditions were excluded: knee sepsis, previous ipsilateral knee replacement, patients who had taken therapeutic (not prophylactic) antibiotics within 24 hours of the knee arthroscopy, patients undergoing another surgical procedure at the time of the knee arthroscopy, and patients who received their preoperative antibiotic more than 2 hours before the surgical incision. For patients who had more than 1 knee arthroscopy during the study period only the first procedure was included.

Simple knee arthroscopy included the following procedures: diagnostic arthroscopy, joint debridement, synovectomy, partial or complete meniscectomy, meniscus repair, microfracture, and lateral retinacular release. Meniscus repairs included implants and often a nonportal incision. Complex knee arthroscopy procedures were excluded, including ligament reconstruction, meniscus transplant, cartilage restoration procedures (except microfracture), procedures associated with fractures (such as tibial plateau fracture), and arthroscopic procedures that proceeded to arthrotomy. We also excluded cases lasting longer than 120 minutes.

A data mining algorithm, which has previously been described,[13] was used to determine which patients developed a deep or superficial infection within 90 days of the simple knee arthroscopy. All of the infections that were identified by data mining were confirmed by manual review of the electronic medical record. Deep infection was defined as (1) a positive culture of the knee synovial fluid or (2) clinical diagnosis based on the patient's signs or symptoms (severe knee pain with range of motion, fever, effusion, erythema, increased warmth), positive laboratory findings (increased serum white blood count, increased erythrocyte sedimentation rate, knee fluid white cell count greater than 50,000 per cubic millimeter, positive gram stain), and a finding of gross pus in the knee at therapeutic arthroscopy. A superficial infection was defined as clinical signs of localized infection at a portal site (erythema, tenderness, swelling, drainage) that was treated with an oral antibiotic, with or without a single dose of an intravenous antibiotic.

### Statistical Analysis

Demographic and clinical characteristics were examined in bivariate analysis comparing the groups that were administered antibiotics and those that were not. Categorical variables were evaluated using frequencies and proportions and associations were tested with $\chi^2$ tests. Continuous variables were evaluated using means and *t*-tests. Medians and Mann-Whitney *U*-tests were used to compare continuous but non-normally distributed data. Multiple logistic regression was used to identify independent risk factors associated with infection.

The primary predictor was administration of a preoperative antibiotic. Potential confounders included were BMI, gender, race, incision duration, age, diagnosis of diabetes, and ASA rating. SAS 9.3 was used for all analysis. A 2-sided alpha level of 0.05 was considered significant.

An a priori power calculation was performed before conducting this study. The assumptions used in and the results of these calculations are as follows. Hypothesis: There is no association between receipt of preoperative prophylactic antibiotics and risk of postoperative infection among patients undergoing simple knee arthroscopy. Alpha: 0.05 (2-tailed). Beta: 0.2 (Power = 80%). Clinically relevant change in relative risk = 0.5. Baseline (control) risk of postoperative infection = 0.003. Ratio of antibiotic-treated to untreated patients: 2.33 (estimate based on an initial chart review). The statistical test on which calculations are based: *z*-test (pooled variance).

The results of our initial power calculations indicated that the number of subjects required to answer our research question was 39,105. However, after data collection, we found that the ratio of antibiotic-treated patients to non−antibiotic-treated patients was 4.1 (not 2.33), which reduced our power, but the baseline risk of infection was found to be 0.54% (not 0.3%), which had the effect of increasing our power. Repeating the power calculation for the actual observed values resulted in a requirement for 29,529 patients, a value well below the actual 40,810 we analyzed. This indicates that our study was well powered to address the research question.

## Results

During the study period, there were 40,810 patients who underwent a simple knee arthroscopy. Of these patients, 32,836 (80.5%) received a preoperative