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Brucella infection following total joint arthroplasty: A systematic review of the literature

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ABSTRACT

Introduction: The aim of this systematic review was to analyze the results of published treatment options in Brucella infection following total joint arthroplasty (TJA).

Methods: We performed a systematic review of the literature regarding outcomes of Brucella infection after TJA (hip and knee). We searched multiple databases for articles in the area published from 1950 to 2016.

Results: A total of 18 patients (12 male and 6 female; mean age 59 years) from 14 published studies were identified. The minimum follow-up time was 6 months (range, 6–120 months). Seven patients were treated with debridement or antibrucella treatment only. Eleven patients (61%) underwent removal of the prosthesis and were treated with one or two-stage exchange arthroplasty. The mean duration of antibiotic therapy was 5.8 months. There was no relapse of infection.

Conclusions: In the absence of loosening of the components of the prosthesis, an attempt to treat Brucella infection medically might be a reasonable choice. One or two-stage exchange arthroplasty could provide successful results without relapse of infection when combined with appropriate antibiotherapy.

Level of evidence: Level III, therapeutic study.

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Introduction

Brucellosis is a common zoonosis worldwide but predominantly affects the Persian Gulf, South America, India, Central Asia, and Mediterranean countries.¹ Transmission can occur via breaks in the skin in direct contact, through the ingestion of unpasteurized dairy products or raw meat, or through ingestion of aerosolized bacteria.² Brucella infection following total joint arthroplasty (TJA) is extremely rare and not quickly diagnosed.³ This bacteria tend to be slow growing, so the culture period should be made longer than usual.⁴ In the majority of cases diagnosis is serological and the low positiveness (15–20%) of the culture increases the period of no diagnosis.⁵

The generic name of Brucella includes a group of small gram-negative cocci and cocci rods that are aerobic, not mobile, with no spores. Six different species are known: *B melitensis*, *B abortus*, *B suis*, *B canis*, *B ovis*, and *B neotomae*.⁶ These species are capable of surviving within phagocytic cells, making antibiotic treatment difficult.² Correct management for Brucellar infection diagnosed through aspiration or over a well fixed TJA is still unclear.⁷ Traditionally, routine treatment usually includes the surgical removal of all bioprosthetic components.³ Debridement without removal of prosthesis is a controversial issue due to the potential risk of relapse of infection. However, a few cases of Brucella prosthetic infection successfully treated with antibrucella agent alone without surgical treatment had been reported.^{4,8} Due to the insufficiency of standardized clinical and evidence-based guidelines, there is no appropriate therapeutic schedule. In addition, the risk of relapse following treatment for Brucella prosthetic joint infection is unknown. Although a few reviews of single institution experience exist on this subject, an absence of systematic literature reviews about the outcomes of Brucella infection following TJA provides the impetus for this systematic review.

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The current study was designed to evaluate the epidemiology and treatment outcomes of Brucella infection after TJA with a review of the literature and pooled analysis. We therefore asked: (1) What are the treatment options for Brucella infection following total joint arthroplasty? (2) What are the outcomes of Brucella infection according to treatment modality?

Methods

Literature review

We performed a systematic review of the available literature using multiple separate search strategies. Four computer databases (PubMed, Web of Science, Embase, and Cochrane Library) were searched with the search words “arthroplasty”, “Brucella”, and “infection” in different combinations. Two independent reviewers separately completed the search, and the results were duplicated two times by each reviewer. The initial search was performed on June 10, 2016 with an update in August 10, 2016, to ensure accuracy. No additional study was identified by repeating the search.

Study inclusion

The inclusion criteria included (1) articles published from January 1, 1950 to January 10, 2016, (2) English-written articles in human species, (3) electronic publications that reported cases of Brucella infection, (4) both retrospective and prospective series, (5) only cases of Brucella infection after TJA, and (6) Only those articles that evaluated the final outcomes including reinfection.

The exclusion criteria included (1) conference presentations, (2) abstracts only, (3) articles without postoperative follow-up period and outcomes, (4) evaluation of any other lesion than the hip and knee joint, (5) native joint infection before arthroplasty, and (6) non-English articles. Due to the limited evidence available on the topic, case reports and case series were included in our study. Limits for the number of patients in each study or the minimum duration of follow-up were not used. Brucella infection following osteotomy and internal fixation was excluded.⁹

Study selection

Searching the aforementioned databases yielded a total of 64 articles. A simplified flow-chart depicting this process is seen in Fig. 1. A first search of the PubMed database yielded 19 articles and a second search of the Web of Science database with use of the same search strategy yielded 11 articles. There were 36 articles that appeared in more than one of the four searches yielding a total of 28 unique articles. Abstracts and full texts of the retrieved articles were read by 2 authors independently, and all relevant articles were read in full. In addition, we screened the references of the obtained articles for any additional studies. Disagreements regarding inclusion were resolved by discussion. Stringent exclusion criteria were applied, leaving 14 articles appropriate finally. Owing to a lack of prospective studies, most of the larger cohorts giving an answer or at least an insight to clinical problems were selected for this review. The Preferred reporting items for systematic reviews and meta-analyses (PRISMA) guideline¹⁰ was followed. Studies of Brucella infection after TJA predominantly started after the cases of Jones et al in 1983³, although there had been several prior reports of osteoarticular infection due to brucella.¹¹

Data extraction

Data were extracted from the included studies by two reviewers and checked by another. Where possible, corresponding authors

were contacted to obtain missing data. The following data were extracted: demographics including age, gender, underlying disease, history of previous infection, risk factor, time to symptom after TJA, preoperative erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), diagnosis of Brucella infection, management of infection, postoperative antibrucella therapy, outcomes following treatment including clinical resolution, reactivation of infection, and other complications.

Results

Our systematic literature review of PubMed, Web of Science, Embase, and Cochrane literature searches revealed a total of 18 patients from 14 selected articles which have been reported from 1983 to 2015. Although complete data were not available, data such as age, gender, underlying medical/surgical conditions, reactivation of infection and postoperative complications were collected. Age, gender, pathogen organism, and antibiotic treatment were clearly identified in all the reports.

Epidemiology

There were 12 male patients and 6 female patients. The mean age of the patients was 59 years. The minimum follow-up was 6 months (range, 6–120 months). Demographic information is detailed in Table 1. The median duration from prosthesis implantation to the onset of symptoms was 3.9 years. It was difficult to analyze blood levels of CRP and ESR at presentation due to reporting inconsistencies (Table 2). Preoperative arthrocentesis and joint fluid cultures were performed in 13 patients and yielded negative culture results for 5 patients (38%). Eight patients (62%) were diagnosed with Brucella infection by Preoperative joint aspirates. *B. melitensis* was found to be the most common pathogen organism, with a pooled percentage of 78% (14/18). *B. abortus* was the second most common pathogen organism (22%). Additional history taken from the patients after the culture results revealed that almost all patients (94%) had a history of contact with live-stock, or ingestion of unpasteurized dairy products (Table 3). Patient's history was not clearly reported in one study.⁵

Treatment

Eleven patients (61%) underwent removal of the prosthesis for initial treatment and were treated with one or two-stage exchange arthroplasty (Table 4). Two-stage exchange arthroplasty was performed in 8 patients (44%) with variable time frame between removal of the prosthesis and reimplantation (median 3.1 months, range 1.5–6 months). No patient underwent resection arthroplasty. Surgical debridement, retention of implant, and antibrucella therapy were performed in one patient.⁷ Six patients were treated with antibrucella treatment only. The mean duration of antibiotic therapy for all patients was 5.8 months. Antibiotic therapy duration ranged from 6 weeks to 26 months, and the antibiotic treatment involved combination therapy with multiple agents (most commonly doxycycline, rifampin, and streptomycin). It was difficult to analyze the dose of antibrucella drugs due to a wide variation.

Outcomes

Mean duration of follow up after the surgical procedure was 3 years (range, 0.5–10 years). There was no relapse of infection. In one patient, at the time of the latest follow-up at three years, radiographs showed a radiolucent line at the femoral interface. There was no death related to the brucella infection following TJA and

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