Original Article

Joint replacement in human immunodeficiency virus-infected patients

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Abstract

Background: Human immunodeficiency virus (HIV)-infected patients are at risk for bacterial and opportunistic infections with worsening immunosuppression.

Methods: From June 2000 to January 2009, six patients who were diagnosed with HIV infection underwent 10 joint replacement procedures, including six total hip arthroplasties, two total knee arthroplasties, and one shoulder hemiarthroplasty. An ordinary dose of postsurgical-empirical antibiotics was prescribed, with an average follow-up period of 38.6 months. All prostheses of total knee arthroplasty and shoulder hemiarthroplasty were fixed with vancomycin-impregnated bone cement.

Results: The rate of postoperative infection for HIV infected patients is supposed to be higher than for HIV negative patients. However, in our institution, there have been no HIV-positive patients who have suffered postoperative infection.

Conclusion: HIV-positive patients can have excellent outcomes after undergoing various arthroplastic surgeries. This revelation, coupled with the advances in antiviral therapy that have helped to lengthen HIV patient lifespans, strongly suggests that these patients should receive arthroplastic surgery.

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Keywords: arthroplasty; HIV; infection; joint replacement; osteonecrosis

1. Introduction

Human immunodeficiency virus (HIV) has been recognized as an invasive medical entity for more than 20 years, and a large number of articles have been published on the topic. Common orthopedic problems among HIV-positive patients include myopathy and arthropathy.1 The cause of these orthopedic problems is either related to HIV-induced immunodeficiency, or due to side effects of antiviral drugs.2 Osteonecrosis of the femoral head is the most common orthopedic problem requiring surgical intervention. The incidence of osteonecrosis in HIV-positive patients has increased in recent years.3–6 Several reports revealed that osteonecrosis of the femoral head was associated with highly active antiretroviral therapy (HAART), specifically protease inhibitors.7–9 The risks of performing arthroplasty on HIV-positive patients include postoperative infection, contamination of medical instruments, and HIV exposure to the medical team.

We performed a retrospective survey of the clinical outcomes of all HIV-positive patients who had undergone arthroplasty in our institution, and assessed the rate of postoperative infection and functional recovery.

2. Methods

Five HIV-positive patients who underwent a total of 9 joint replacement surgeries (6 total hip replacements (THR), 2 total knee arthroplasties (TKA), and 1 hemishoulder arthroplasty) from September 2003 to May 2010 were studied. The
diagnosis of the three patients who underwent THR was osteonecrosis of the femoral head (Ficat Stages III to IV) (Fig. 1A). The diagnosis of the patient who underwent bilateral TKA was advanced secondary inflammatory arthritis (Fig. 2A,B). The patient who underwent hemishoulder arthroplasty was diagnosed with a 3-part fracture-dislocation of the humeral head (Fig. 3A,B). The mean age of these 5 patients was 44.5 years (range 36–54 years). All 5 patients were male and had undergone antiviral therapy, with a mean follow-up period of 38.6 months (range 4–84 months). The patients’ general data are shown in Table 1.

These five patients were admitted to isolation wards. Routine laboratory tests, including hematology, chemistry and coagulability were performed, and active infection was ruled out prior to surgery. All members of the medical team wore protective suits with three layers of surgical gloves, without self-contained breathing units. Skin preparation prior to surgery was performed with hibiscrub and betadine alcohol, and all surgical drapes were waterproof.

First-generation cephalosporins (Cefa Inj. 1 g IV; Taiwan Biotech Co. Ltd, Taoyau, Taiwan) were administered for prophylaxis 30 minutes prior to the beginning of each surgery. All nine joint replacement surgeries were performed by one surgeon, and all surgical assistants were either senior residents or nurses. No minimally-invasive surgery was performed on any of the patients, and all surgeries were performed at the end of the day to minimize the risk of spreading HIV.

The procedures performed were cementless THR (Fig. 1B), vancomycin-impregnated cemented TKA (Fig. 2C,D), and hemishoulder arthroplasty (Fig. 3C). The vancomycin concentration was 1 g in 40 g of polymethylmethacrylate. First-generation cephalosporins (Cefa Inj. 1 g IV) were administered post-surgically every 6 hours for 3 days. Furthermore, all medical waste was managed separately during hospitalization. Early rehabilitation began the day after surgery, with a mean period of hospitalization of 6 days (range 5–9 days). All five patients underwent regular outpatient follow-up, with subsequent review of Harris hip scores, Knee Society scores, and Constant scores used to evaluate function recovery.

Consent of the citation of all medical records within the study had been obtained from the patients.

3. Results

Postoperative complications, such as infection, prosthesis loosening, limping, and neurovascular compromise were not mentioned in any of the patient records. For THR, all patients demonstrated obvious improvement in function. The mean pre- and postoperative Harris hip scores were 46 (range 45–47), and 92.83 (range 92–94), respectively (Fig. 1C–E). For TKA, both knees had excellent functional recovery after surgery (Fig. 2E,F). The mean pre- and postoperative Knee Society scores were 39.5 (41 and 38), and 92, respectively. For hemishoulder arthroplasty, the patient was satisfied with the function of his right shoulder (Fig. 3D,E), with a postoperative Constant score of 85. The complete results are shown in Table 2.

4. Discussion

Individuals infected with HIV eventually develop acquired immunodeficiency syndrome (AIDS), which is characterized by frequent infections, neoplasms, and neurologic disorders. According to the literature, bacterial infection rates are increased in HIV-infected patients who receive surgical treatment.

Teeuwsen et al described the presence of in vivo immune system abnormalities 3 months following seroconversion. Some researchers also reported that asymptomatic HIV-positive patients with normal CD4 counts also have selective depletion of CD29+ memory T cells, lower amounts of viral DNA integration into host CD4+ cells, and decreased cytotoxicity exhibited by monocytes and macrophages. In addition to the immunodeficiency, the increased bacterial infection rate might be attributable to poor wound healing. Seltzer et al stated, “Patients with HIV disease are more susceptible to postoperative complications, specifically delayed healing, increased infection rates, and perhaps even progression of their disease state.” HIV-positive patients may have decreased wound healing ability because of a blunted inflammatory response.

In our study, only one patient had symptoms of immunodeficiency of recurrent bacterial enteritis. He underwent bilateral TKA for the treatment of secondary inflammatory arthritis. Prior to the operation, he was admitted for treatment of infectious enteritis due to coagulase-negative Staphylococcus, and completed a 7-day course of antibiotics. The other
four HIV-positive patients were asymptomatic. None of the patients were noted to have experienced postoperative infections in our study, which might reflect the advanced state of antibiotics and antiviral agents, as well as the technical skills of the surgeon.

Many studies have reported that arthropathies are associated with HIV infection and/or the antiviral agents. HIV-associated arthritis most commonly affects the knees and ankle, and one proposed etiology suggests a direct effect of HIV on the joint. Another theory was that HIV-associated arthritis might be related to the presence of immune complexes within the synovium. In radiographic and advanced imaging studies, diffuse osteopenia and/or joint effusions with or without erosive changes may be identified.

Another common orthopedic disorder among HIV-positive patients is osteonecrosis of the femoral head, which may be related to the use of protease inhibitors. Reports suggest that altered lipid metabolism may result in emboli and bone infarction, and that engorgement of marrow adipocytes may lead to compression of the bone vasculature. In addition to the drug effect, increased serum levels of anticardiolipin and antiphospholipid antibodies might lead to an increased risk of thromboembolic events, possibly resulting in osteonecrosis of

Fig. 2. (A,B) The patient was diagnosed with bilateral advanced secondary inflammatory arthritis of the knee. (C,D) Vancomycin-impregnated cemented TKA was chosen. (E,F) 84 months of right knee and 7 month of left knee postoperative follow-up. Both knees had good clinical outcomes.
Delayed diagnosis of osteonecrosis of the femoral head is common and may lead to an irreversible condition. Inexperience on the part of HIV clinicians and lack of awareness by patients often contribute to a delay in diagnosis. Pain syndromes are common among HIV-infected patients, and the providers and patients might overlook the severity of this condition. In our study, all five patients were undergoing antiviral therapy. Three patients were diagnosed with osteonecrosis of the femoral head, and one patient was diagnosed with secondary inflammatory arthritis of both knees. Musculoskeletal complaints were noted at least 6 months before their surgeries.

Many studies have described the increasing occupational risks of HIV exposure for surgical healthcare workers, and further reported the benefits of eye protection and double gloving to help minimize these risks. Before the operations in our study, eye protection, protection suits, and triple gloving were in place to minimize the risk of exposure to HIV.

In conclusion, since a greater number of orthopedic problems has been reported among HIV-positive patients, additional scrutiny is needed with regard to the surgical care provided to these patients. Many clinicians might hesitate to surgically treat HIV-positive patients due to concerns about the risk of postoperative infection and the exposure to HIV for the surgical healthcare team. However, advances in surgical techniques, improved surgical instrumentation, and increasingly effective antibiotics have reduced those concerns. The excellent clinical outcomes of these HIV-positive patients who received arthroplasty should indicate that, with the proper precautions, necessary medical procedures can be safely performed on HIV-positive patients, which can both prolong the life of HIV patients, while not compromising the health of the surgical teams involved. Advances in the use of antibiotics for prevention of postoperative infection, improved surgical techniques which promote better functional recovery, and the longer lifespans of HIV patients due in large part to advances in antiviral therapy all support the notion that surgical treatment is appropriate, and functionally workable for these patients.

Table 1
The mean age of these patients was 44.5 years (range 36–54 years). All patients were male and had undergone antiviral therapy. The mean follow-up interval was 38.6 months (range 4–84 months).

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THR = total hip replacement; TKA = total knee arthroplasty.

Fig. 3. (A,B) The patient was diagnosed with a right humeral head three-part fracture dislocation, but he was misdiagnosed at first and had delayed treatment. (C) Vancomycin-impregnated cemented hemishoulder arthroplasty was chosen. (D,E) 73 month postoperative follow-up. The patient was satisfied with the right shoulder functional recovery.
No Procedure Follow-up interval (mo) Preoperative score Postoperative score

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