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Bilateral synchronous total hip arthroplasty for end-stage arthropathy in hemophilia A patients

A retrospective study

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Abstract

Total hip arthroplasty (THA) has been an effective tool of advanced hemophiliac hip arthritis. There are only limited data of bilateral synchronous THA for end-stage arthropathy in hemophilia A patients.

The aim of this retrospective study was to analyze clinical outcome and complication rate of bilateral THA for hemophilia A patients with end-stage arthropathy of hip and review the operative strategy.

From August 2012 to July 2016, 48 hips of 24 patients with hemophilia A patients underwent THA by a single experienced chief orthopedic surgeon. Clinical and radiological evaluations were included of operation time, blood loss, the quantity of blood transfusion, clotting factor consumption, duration of hospitalization, modified Harris hip score, complication rate, and radiographic assessment.

All the 24 patients successfully completed the operation, followed up for 5 to 8 years, and the mean time was 6.5 years. The average operation time was 140 minutes (range, 120–180 minutes). The average total blood loss was 225 mL (range, 150–400 mL). The mean red blood cell transfusion amount was 2.4 U (range, 0–6 U). the mean hospitalization time was 24 days (range, 16–46 days). The mean amount of clotting factor VIII used in the perioperative period for management of hemophilia A was 30,600 U (range, 18,000–52,000 U). Average modified Harris hip score increased from 46.6 (range 28–70) points preoperatively to 90.2 (range 75–98) points at final follow-up, complications were few.

With excellent operative techniques and hematological management, bilateral synchronous THA for end-stage arthropathy in hemophilia A patients can provide satisfactory outcomes.

Abbreviations: THA = total hip arthroplasty, BMI = body mass index, TXA = tranexamic acid.

Keywords: bilateral synchronous, hemophilia A, hemophilic arthropathy, total hip arthroplasty

1. Introduction

Hemophilia A is a congenital bleeding disorder caused by an X-linked hereditary defect and a deficiency in clotting factor VIII. The most prominent clinical characteristic of hemophilia A is a bleeding tendency, mostly in the joints and muscles. The incidence of joint bleeding is 70% to 80%.[1] Intra-articular bleeding can lead to destruction of the joint cartilage and thus, to hemophilic arthritis. Hemophilic arthropathy is more common in the ankle, knee, and elbow, but the hip, shoulder, and wrist may also be involved.[1–4] Hip involvement adversely affects a patient's quality of life, due to pain, impairment, and the loss of mobility. Among hemophilia patients in the second and third decades of life, 90% will develop hemophilic arthritis.[5–7] At present, there is no cure for hemophilia A and the main treatment is substitution therapy, in which exogenous factor VIII is administered. If treatment fails to prevent the progression of joint damage, the gold standard treatment of end-stage hemophilic arthropathy of the hip is total hip arthroplasty (THA), which provides both pain relief and functional restoration.[8–10] In a group of hemophilia patients who underwent cementless THA,[9] good results were obtained even at the 10-year follow-up. However, as many hemophilia patients suffer from multiple joint disease, some will be candidates for unilateral or bilateral joint arthroplasty. In patients with bilateral hemophilic knee arthropathy, some clinicians[11] prefer simultaneous bilateral total knee arthroplasty, as it is both safe and cost-effective and does not have a high rate of complications. However, there are few data on bilateral THA in hemophiliacs. Thus, in this study, we examined the outcomes of hemophilia A patients with end-stage hip arthropathy treated with simultaneous bilateral THA. A review of the operative strategy is also presented.

BJH and QM contributed equally to this work.

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All data generated or analyzed during this study are included in this published article.

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2. Materials and Methods

2.1. Ethical approval

This retrospective study was approved by the Ethical Committee of the First Affiliated Hospital of Zhejiang Chinese Medical University. Informed consent was obtained from all participants in the study.

2.2. Inclusion criteria

Hemophilia A patients with bilateral end-stage arthropathy who underwent primary THA were included in the study.

2.3. Exclusion criteria

The exclusion criteria were as follows: bleeding disorders other than hemophilia, revision hip replacement, incomplete patient information and records, and simultaneous knee or ankle arthropathy, as either would affect the outcome of total hip replacement.

2.4. Patient information

This retrospective study was based on a review of a case series spanning August 2012 to July 2016, during which time THA was performed on 48 hips of 24 hemophilia A patients by a single experienced chief orthopedic surgeon at our institute. All patients were male, with an average age of 40.6 ± 7.8 (range, 26–56) years at the time of THA and an average body mass index of 23.5 ± 2.7 (range, 21–28) kg/m^2. The severity of hemophilia was determined based on the factor VIII level[1]: 18 patients had severe disease, defined as factor VIII activity <1%, and 6 patients had moderate disease, defined as factor VIII activity of 1% to 5%. Eight patients presented with hepatitis C virus infection, and 1 with a hepatitis B virus infection. No patients tested positive for human immunodeficiency virus. Two patients had hypertension and 1 had diabetes. General information about the patients is summarized in Table 1.

2.5. Surgical treatment

The bilateral operations were performed by an experienced chief orthopedic surgeon. The patients were placed under general anesthesia with controlled hypotension achieved using dexmedetomidine combined with 2% to 3% sevoflurane and 1.0 g of intravenous tranexamic acid (TXA; Brilliant Pharmaceutical, Chengdu, China) administered 10 minutes before the skin incision. Cementless THA was performed via a posterolateral approach. On the completion of one side, the other side was operated on after the patient's position was changed accordingly. During the operation, hemostasis was carefully maintained and proliferative synovial tissues were thoroughly cleared, including of hemosiderin. Proliferative osteophytes were removed, fibrosis or contracture of the muscle tissue around the joint capsule was properly released, and the range of motion of the joint was restored. Drains were generally used and were removed at 12 to 24 hours postoperatively. Active and passive rehabilitation training began at 24 hours after the operation, under the guidance of rehabilitation doctors. All patients were treated with cementless implants (Zimmer, Trilogy IT cup and FMT proximally porous-coated tapered titanium femoral stem) with ceramic-on-ceramic surface bearings (Zimmer, Blolox Delta ceramic femoral head).

Table 1

General information of the patients.

No. of patients	24
Age (y)	40.6 (26–56)
BMI (kg/m^2)	23.5 (21–28)
Severity of hemophilia	
Severe	18
Moderate	6
Concomitant disease	
Hepatitis C	8
Hepatitis B	1
Hypertension	2
Diabetes	1

BMI = body mass index.

2.6. Hematological management

A standardized protocol following the World Federation of Hemophilia's Guidelines[1] was adopted for the management of hemophilia during the perioperative period. The pharmacokinetics were assessed before surgery, revealing that each unit of intravenously infused factor VIII per kg body weight elevated the plasma factor VIII level by approximately 2 IU/dL. The half-life of factor VIII is 8 to 12 hours. The dose was calculated according to the following equation: patient's weight (kg) × desired rise in the factor VIII level (IU/dL) × 0.5. Factor VIII activity was tested before and at 0.5, 3, 12, and 24 hours after infusion, together with the activated partial thromboplastin time. Substitution therapy was administered so as to guarantee that surgery was performed with a factor VIII activity of ~100%, a level that was usually maintained for 2 days postoperatively. Thereafter, the target was 80% until day 5, 60% until day 7, and 40% until day 14 after surgery (suture removal).

During the operation, if massive bleeding occurred, patients were immediately given additional fresh frozen plasma and factor VIII. The presence of factor VIII inhibitors was not determined, as during the study period it was the practice at our institution that patients with active inhibitors did not undergo major elective joint surgery.

2.7. Clinical evaluation

Clinical and radiological evaluations were undertaken at 6 weeks, 3 months, 6 months, and 1 year after surgery and yearly thereafter. Clinical outcomes were analyzed with respect to the operation time, blood loss amount, quantity of blood transfusion, clotting factor consumption, and duration of hospitalization. The modified Harris hip score[9] was determined and the range of motion measured both prior to surgery and at the last follow-up, with the results used in the clinical evaluation. Radiographic assessment for prosthesis stability, bone formation, and signs of implant loosening or bone response around the prosthesis, such as heterotopic ossification, osteolysis, and other complications, was performed after surgery and during the final evaluation.

2.8. Statistical analysis

Statistical analyses were performed using SPSS v.23.0 statistical software (SPSS v.23.0, IBM Corp, Armonk, NY). Quantitative data are represented by the mean ± standard deviation. Data that conformed to a normal distribution and exhibited homogeneity of variance were compared between groups using an independent-sample *t*- test; otherwise, a Mann–Whitney *U*- test was performed. Significant independent predictor variables were identified as those with a P value <.05.

3. Results

Surgery was successfully completed in all 24 patients. The operation time was 120 to 180 minutes, with an average of 140

minutes. The average total blood loss amount was 225 mL (range, 150–400 mL), and the mean volume of red blood cells transfused was 2.4 U (range, 0–6 U). All patients were followed up for 5 to 8 years (mean, 6.5 years). The mean hospitalization time was 24 days (range, 16–46 days).

3.1. Clotting factor consumption

The mean volume of clotting factor VIII used in the perioperative management of hemophilia A was 30,600 U (range, 18,000–52,000 U). No clotting factor inhibitors were identified before or after surgery.

3.2. Clinical outcome

Hip joint function improved significantly after surgery. The average modified Harris hip score increased from 46.6 (range, 28–70) points preoperatively to 90.2 (range, 75–98) points at the final follow-up (t = –15.420; P = .00). The outcome was excellent in 17 patients (score range, 90–100), good in 5 patients (80–89), and fair in 4 patients (70–79), corresponding to an excellence rate of 91.67%. All patients were subjectively satisfied with the bilateral THA.

3.3. Radiological evaluation

The average acetabular abduction angle determined across all patients was 36.2° ± 7.3° (range, 32°–55°). At the last follow-up, imaging examinations showed that osseous fixation was achieved in all patients (Figs. 1–3). There were no major radiologically visible complications, such as osteolysis or prosthesis loosening.

3.4. Complications

There were a few complications. One patient developed subcutaneous bleeding at the periphery of the surgical incision at 10 days postoperatively, which was managed by stopping the rehabilitation exercise and immediately injecting 1000 U of factor VIII. The wound healed well and on schedule. Another patient complained of swelling and pain in the left lower limb on day 7 after surgery. An ultrasound examination showed inter-muscle thrombosis, which was treated with an anticoagulant. After the administration of therapeutic doses of low-molecular-weight heparin for 7 days, the swelling resolved at 14 days postoperatively. Periprosthetic fracture and periprosthetic joint infection did not develop in any of the patients over the entire follow-up period.

4. Discussion

Early diagnosis and treatment are key to delaying the occurrence and progression of hemophilic arthritis. If the disease progresses to the end stage, it will seriously affect hip function and thus, patients' quality of life. Currently, the most satisfactory treatment is arthroplasty, which not only alleviates pain but also significantly improves joint function. Primary multiple joint replacement for hemophilic arthritis has been analyzed in a few reports,[11–13] whereas this study assessed the efficacy of bilateral THA in hemophilia A patients with end-stage hip arthropathy, including the operative strategy.

Bilateral simultaneous THA has been proposed to reduce costs, improve rehabilitation, and accelerate the return to normal life. In hemophilia patients with hemophilic arthritis, the risk of bleeding should be addressed first, especially in multiple joint replacement. Mortazavi et al[11] performed simultaneous bilateral TKA in 8 patients (16 knees) with bilateral hemophilic knee arthropathy and showed that it was safe, cost-effective, and did not increase the rate of complications. In our series, the Harris hip score increased from 46.6 (range, 28–70) points preoperatively to 90.2 (range, 75–98) points at the final follow-up. Complications were few. One patient who developed subcutaneous bleeding 10 days after the surgery stopped rehabilitation exercise and was immediately administered 1000 U of factor VIII; the wound healed well and on schedule. Our study

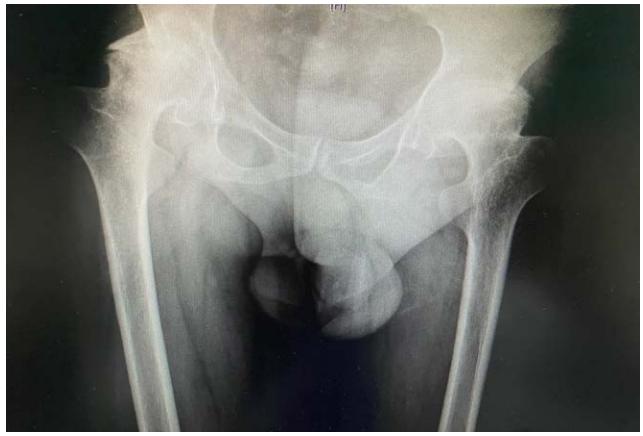

Figure 1. A 34-y-old man with end-stage arthropathy in hemophilia A before surgery.

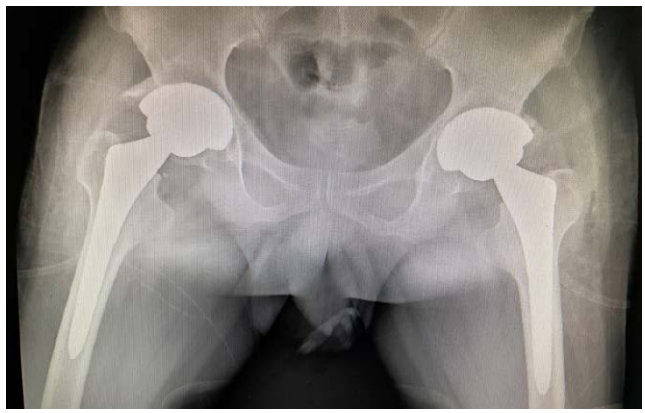

Figure 2. Postoperative radiograph after cementless total hip replacement with ceramic to ceramic bearing surface.

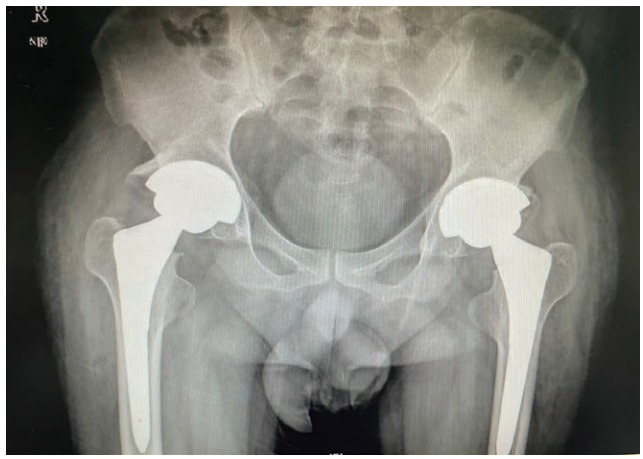

Figure 3. After 8 y, radiographs showed both components were well fixed in both hips. There was no radiolucency around the prosthesis and the patient had good function.

demonstrates that bilateral synchronous THA can provide satisfactory outcomes in hemophilia patients. The results were similar to those of a previous study[9,10] in which patients underwent unilateral hip arthroplasty. Lee et al[9] reported on 21 hips in 17 hemophilia patients who were followed for an average of 11 years after THA (range, 10–18 years), during which time the Harris hip score improved from 57 to 94 points. Wu et al[10] followed 21 hemophilia patients for an average of 113 months (range, 5–15 years) after THA and reported an improvement in the Harris hip score from 37 (range, 15–81 points) before surgery to 90 (range, 70–96) points at the last follow-up. These results together with our own suggest that simultaneous bilateral and unilateral THA in hemophilia A patients yields equally good joint function.

The association of extensive arthrofibrosis, flexion contractures, and joint deformity with poor bone condition in hemophilic arthropathy makes THA a challenging procedure. Previous studies[8,14–16] reported significantly higher rates of postoperative complications, such as repeat hemarthrosis, impaired wound healing, deep infection, deep venous thrombosis, and implant loosening, in hemophilia compared to non-hemophilia patients. Therefore, when treating hemophilia patents, the surgical technique should be optimized to reduce surgery-related complications.

Postoperative bleeding complications in patients with hemophilia are likely to be the most common type of complication after major orthopedic surgery such as THA,[18] especially after simultaneous bilateral THA. The possible reasons for this type of complication include a low postoperative level of factor VIII, the development of coagulation factor inhibitors, delayed bleeding in residual synovial tissue, and improper functional exercise after surgery. In our hospital, several measures are taken to prevent postoperative bleeding. The first and perhaps most important measure is the prevention of articular cavity bleeding by completely ligating the bleeding blood vessels during the operation and cutting the proliferative synovial tissue as thoroughly as possible. Second, intravenous TXA is used to reduce intraoperative and postoperative bleeding. TXA has been shown to reduce perioperative blood loss, hidden blood loss, and the transfusion rate. Hemophilia patients in the study of Huang et al[12] who underwent hip and knee replacement were administered TXA perioperatively. Third, the coagulation factor concentration is regularly monitored after surgery, using a standardized protocol following the World Federation of Hemophilia's Guidelines,[1] which contributes to better clotting factor efficiency without additional blood loss or the risk of transfusion. Finally, the timing and method of rehabilitation are important considerations. In our patients, active and passive rehabilitation training began at 24 hours postoperatively, under the guidance of rehabilitation doctors. The optimal time for rehabilitation training is within 2 to 3 hours after the infusion of coagulation factors. By this time, coagulation factor levels have peaked, such that the activity level can be increased and rehabilitation training intensified. Functional exercise should be slow, continuous, and gradual.

Our study had some limitations, including its retrospective design and lack of a control group, the limited number of participants, and the fact that it was a single-center study, which might have introduced bias. Confirmation of our results awaits a prospective, controlled, multi-center study with a large sample.

5. Conclusion

With excellent operative techniques and hematological management, bilateral simultaneous THA can provide satisfactory outcomes in hemophilia A patients with end-stage arthropathy.

Author contributions

HBJ, MQ wrote the paper; HBJ, LJ, LSJ performed the research; JHT, TPJ designed the research study; MQ, JHT analyzed the data.

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