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Short-term Outcome of Total Knee Replacement in a Patient with Hemophilia: A Case Report

TKR in PwH with malunion.

De-Long Yin, Jia-Min Lin, Yuan-Hui Li, Peng Chen, Mian-Dong Zeng

Abstract

BACKGROUND

Hemophilia A is a rare inherited bleeding disorder caused by mutations in the factor VIII gene. This clotting factor plays an intrinsic role in the blood coagulation pathway. Patients with hemophilia may develop orthopedic manifestations such as hemarthrosis, but multiple malunion of fractures over the knee is rare and difficult to treat.

CASE SUMMARY

We report a patient with hemophilia A who developed severe knee osteoarthritis along with fracture malunion and nonunion. Total knee replacement was performed using a custom-made modular hinged knee prosthesis (cemented) equipped with extended distal and proximal stems. At 3 years' follow-up, the patient exhibited excellent clinical function and remained satisfied with the surgical outcome. Surgical intervention was accompanied by rigorous coagulation factor replacement.

CONCLUSION

This case highlights various unique scenarios specific to individuals with hemophilia and fracture deformity.

Key Words:

Total knee replacement; Hemophilia; Multiple malunion of fractures; Hemophiliac arthropathy; Coagulation factor replacement.

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Core Tip: This patient had hemophilia for many years, with hematopathic arthritis of both knees. An old fracture of the left lower extremity had healed, a distal femur

fracture had recurred, and he had malunion of fractures of the proximal tibia and fibula. We resolved the left knee hematopathic arthritis, distal femur fracture nonunion, and proximal tibia fracture malunion with a single operation of total knee replacement with custom prosthesis.

INTRODUCTION

Hemophilia A is a rare inherited bleeding disorder caused by mutations in the factor VIII gene. This clotting factor plays an intrinsic role in the blood coagulation pathway[1]. This disorder is known to be X-linked recessive and, is thus, more commonly encountered in males[2].

Hemophilia can be mild, moderate or severe, depending on the plasma factor levels of 6%–40%, 1%–5%, or < 1%, respectively[3]. Patients with hemophilia may develop orthopedic manifestations---hemarthrosis. Hemarthrosis is repeated bleeding into the joints, such as: ankle, elbow and knee, leading to cartilage damage and degenerative articular changes, potentially resulting in severe osteoarthritis.

The third decade of life is the peak occurrence of the disease, and nearly 90% of patients with hemophilia have hemophiliac arthropathy[4]. The knee is the most involved joint in hemophilia, and some feasible treatment methods have been applied, and radiological and arthroscopic synovectomy is effective, in addition to arthrodesis, and most importantly, total knee replacement (TKR)[5-7]. The major surgical procedures can be safely performed in hemophilia patients with chronic arthropathy using available clotting factor concentrates, and TKR is considered the gold standard[8,9]. An increasing number of studies have reported TKR in patients with hemophilia[6, 10-12], although this procedure is challenging due to the high risk of bleeding and periprosthetic joint infection[1, 13, 14].

However, cases involving patients with hemophiliac arthropathy and multiple malunion of fractures over the knee are rarely reported. Here, we report a patient with hemophilia and nonunion of a femoral fracture and malunion fractures of the tibia and fibula. The outcome of this patient has, to date, been satisfactory > 2 years after surgery.

The patient exhibited excellent clinical function and has remained satisfied with the surgical outcome.

The patient was informed that anonymized data regarding the case would be submitted for publication, and he provided consent.

CASE PRESENTATION

Chief complaints

A 55-year-old man was diagnosed with moderate hemophilia A.

History of present illness

The patient sustained many fractures to his left thigh, in addition to tibia, fibula, and a femoral fracture in 2013. Due to economic reasons and the unique treatment difficulties in patients with hemophilia, all fractures had been treated nonsurgically with plaster fixation. Before and after the fractures in 2013, factor VIII was infused intermittently. However, medical hemostasis management was not standardized. Fortunately, all of the above fractures successfully healed in 2016, although deformity resulted (Figure 1A–C). He was unable to ambulate by himself. He sustained a fracture to his left thigh again in 2018, and the left knee had bony ankylosis (Figure 1D). Along with severe knee osteoarthritis, this prompted him to undergo surgery for his left thigh (Figure 2A,B). He consulted the authors due to severe pain and a severely dysfunctional left leg, although his right leg was also affected by hemophiliac arthritis (Figure 2C). At that time, the total range of motion (ROM) in his left knee joint was 0° and he had no mobility, with a Hospital for Special Surgery Knee Scale score (HSSKS)[15] of 30 (Tables 1 and 2). Panoramic X-ray of the lower limbs revealed that the left thigh was nearly 8 cm shorter than the right femur (Figures 2C and 4A,B).

History of past illness

The patient had moderate hemophilia A.

Personal and family history

Not significant.

Physical examination

The left thigh was nearly 8 cm shorter than the right thigh. The patient had left lower extremity dysfunction with tenderness at the distal femur and bone abrasion.

Laboratory examinations

2

At the first examination, the patient's serum factor VIII level was 5% and inhibitor of factor VIII was absent, and he was negative for hepatitis C and HIV.

Imaging examinations

Preoperative left knee anteroposterior and lateral radiographs (A) in 2013, showed hemophiliac knee arthritis, old tibia and fibula fractures, and deformity of the distal femur fracture. (B) In 2016, radiographs showed aggravated hemophiliac knee arthritis with knee fusion, deformity of the distal femur fracture, and deformity of the tibia and fibula fractures. (C) On November 30, 2018, radiographs showed exacerbation of hemophiliac knee arthritis with knee fusion, deformity of the distal femur fracture, and deformity of the tibia and fibula fractures as before. (D) On December 14, 2018, radiographs showed hemophiliac knee arthritis with knee fusion, deformity of the tibia and fibula fractures, and recurrent fresh fracture of the distal femur on the top of the original deformity.

FINAL DIAGNOSIS

Hemophiliac arthropathy of both knees; hemophiliac knee arthritis with left knee fusion; fracture of distal femur; deformity of the tibia and fibula; and hemophilia A.

TREATMENT

To relieve joint dysfunction and pain in the left leg, TKR was scheduled. The other knee joint also appeared to require arthroplasty; however, this procedure was difficult for the patient to accept due to many factors, especially economic. The procedure was performed under the guidance of the expert consensus in China and a previous review[8,16]. Coagulation factors should be supplemented to 110% before the procedure, tranexamic acid should be used to prevent intraoperative bleeding[17], and should be supplemented according to operating duration, with a blood salvage system used during surgery. Blood loss during surgery in the present case was 900 mL, and the duration of the procedure was 4 h. The implants were cemented, and were a custom-made modular hinged knee prosthesis equipped with extended distal and proximal stems (Beijing Chunlizhengda Medical Instruments Co. Ltd., China) because it was necessary to treat both the femoral shaft fractures and the proximal tibial deformity fracture (Figure 3A–C).

OUTCOME AND FOLLOW-UP

The plan for supplementation of clotting factors before, during and after surgery is summarized in Table 3. Rehabilitation exercise started on postoperative day 2 with partial weight bearing (Figure 4C, D). From previous investigators combined with patient characteristics, the patient received physical therapy from Day 2 after the operative. Therapy sessions were carefully coordinated with factor replacement, also need to avoid exacerbation of pain or wound condition/hemostasis[18-20]. Furthermore, a continuous passive motion machine was used to restore total ROM of the knee joint, with flexion exercises starting at 45°. After 16 months' postoperative follow-up, the patient exhibited an ROM of 75° (5°–80°), with an HSSKS score of 73 (Table 2) (Figure

4E–G and Video 1). At 3 years' postoperative follow-up, the patient was satisfied with the left thigh outcome.

DISCUSSION

Hemophilia is among the most common bleeding disorders come across in orthopedic surgery. It is an X-linked recessive condition affecting 1 in 5000 males[3, 7]. Factor deficiency leads to recurrent spontaneous hemarthroses, which then lead to contractures and early degenerative joint disease. The knee joint is the most common affected by hemophiliac arthropathy[7]. In a recent meta-analysis, the prevalence of hemophilia among males was estimated to be 5.5/100 000 in Mainland China[21]. There were 16 083 patients with hemophilia A and 2447 with hemophilia B registered in Mainland China in 2019[22]. The hemophilia care level in China lags behind that in developed countries[23]. Sun *et al* found that hemophilia patients in China received less prophylaxis, these patients faced greater difficulty in obtaining replacement factor products, and were vulnerable to more annual bleeds[24]. Currently, TKR is considered to be the gold standard for patients with hemophilia who develop severe arthropathy[6, 25]. Several previous studies have reported satisfactory outcomes[25-28].

TKR in patients with hemophilia is a viable alternative to conventional methods of treatment for chronic arthropathy, and expectations for pain relief and functional gain can be high[10]. With continuous advances and developments in surgical treatment in recent years, and the emergence of recombinant clotting factors, the success ratio of surgical treatment for hemophilia has gradually increased[26]. In our case, we maintained a high level of clotting factor replacement throughout the first 2 wk postoperatively. Moreover, the level was higher than currently recommended by international guidelines. According to previous research, this can reduce the rate of infection[13]. Due to the complexity of orthopedic procedures, such as TKR and osteotomy, the duration of surgery is longer than normal, which increases the risk for intraoperative bleeding and infection. Postoperatively, the patient described in this report was treated with elastic bandages to prevent deep venous thrombosis. On

postoperative days 2 and 7, intra-articular hemorrhage occurred twice, for which 150 and 300 mL of accumulated blood, respectively, was drawn from the knee joint under sterile conditions. Rehabilitation was effective. Safe rehabilitation exercises were prescribed after surgery and the patient used a walking cane the day after surgery[29] (Figure 4D). Physical therapy typically included isometric exercise for the quadriceps, hamstrings and gluteal muscles, knee ROM exercises include active and passive, and progressive resistive lower extremity exercises when the patient progressed[19]. We also prescribed rehabilitation to restore ROM of the knee joint by starting with continuous passive motion for functional exercises from postoperative day 2. All rehabilitation exercises followed daily supplementation of coagulation factors.

TKR is an effective procedure for improving ROM and decreasing functional deficits resulting from hemophiliac arthropathy. Knee score information show that TKR improves overall function[5]. TKR provides significant improvement in pain and better function in patients with end-stage hemophiliac arthropathy of the knee jiont. Peri- and postoperative care tends to be more complicated than in patients without hemophilia undergoing TKR and requires a multidisciplinary team approach[30]. With our patient, preoperative preparation included supplementation of clotting factors, an adjustment plan for supplementation, preparation of the prosthesis, and rehearsal of the surgical process. Postoperatively, we prevented possible complications such as hemorrhage, infection and venous thromboembolism. Our patient experienced intra-articular hemorrhage twice, with 150 and 300 mL of blood drained. However, under strict postoperative management and supplementation of coagulation factors, there was no postoperative infection and further bleeding. After careful postoperative rehabilitation, the patient achieved satisfactory recovery. Ideally, any patient with severe hemophilia should be followed-up by a specialist, with once or twice per year[20]. Our patient recover well during annual follow-up after discharge, with ambulatory function similar to healthy individuals.

CONCLUSION

Several important factors should be considered before considering surgery in patients with hemophilia. In particular, osteotomy orthopedic surgery should be performed at the same time. Osteotomy angle of the tibia, supplementation of clotting factors, customization of prostheses, and patient tolerance should all be considered. Postoperative rehabilitation exercise is also important to achieve good outcomes. Collectively, TKR using customized prostheses has been demonstrated to be a viable option for patients with HA and fracture deformities.

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