Received: 4 November 2021 | Accepted: 18 January 2022

DOI: 10.1002/ccr3.5366

CASE REPORT

Clinical Case Reports Open Access WILEY

Usefulness of robot-assisted total knee arthroplasty in patients with retained hardware: A report of two cases

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Funding information
None

Abstract

Total knee arthroplasty (TKA) is technically demanding in patients with pre-existing hardware around the knee. We report two cases of knee osteoarthritis in patients with retained hardware who would have difficulty undergoing conventional TKA. Robot-assisted TKA can be a useful treatment for knee osteoarthritis in patients with retained hardware.

KEYWORDS

osteoarthritis, retained hardware, robot-assisted surgery, total knee arthroplasty

1 | INTRODUCTION

Total knee arthroplasty (TKA) is an effective surgical intervention for treatment of end-stage osteoarthritis of the knee, and it can decrease pain and improve function. Appropriate component positioning is important for maximal implant longevity and increased patient function in TKA.[1,2] However, in patients who undergo TKA with retained hardware around their knees, hardware either in the femur or the tibia can cause technical difficulty.[3] The removal of older hardware or that attached to bone can present a challenge for the surgeon and require a longer surgical procedure.

Patients with retained hardware who may have difficulty undergoing conventional TKA are encountered in clinical practice. Robot-assisted TKA is a new technology that has been developed to overcome some limitations of conventional TKA surgery.[4,5] This procedure allows accurate bone resection and component positioning without removal of retained hardware.

Here, we report two cases of robot-assisted TKA in two patients with osteoarthritis of the knee and retained hardware who would have difficulty undergoing conventional TKA. TKA using a robot-assisted system resulted in significant clinical and radiographic improvement.

2 | CASE REPORTS

2.1 | Case 1

An 81-year-old woman who complained of serious pain in both knees for the past 3 years presented to our clinic in January 2021. She measured 147.0 cm in height and 54.0 kg in weight, with a body mass index of 25.0 kg/m^2. She reported that walking was difficult because of her bilateral knee pain, and she had experienced no improvement of symptoms after medication and injection at another clinic. Her medical history was significant for cardiac arrhythmia, hypertension, and diabetes mellitus. In addition, after a fall 3 years prior, the patient underwent open reduction and internal fixation with an internal medullary nail (IM nail) for a shaft fracture of the left femur. The physical examination revealed a large effusion

and pain with limited range of motion in both knees. Kellgren-Lawrence (K-L) grade IV osteoarthritic change in both knees was documented (Figure 1). The Hospital for Special Surgery (HSS) scores of the right and left knees were 60 and 55, respectively. A weight-bearing X-ray revealed a varus deformity, and the hip-knee-ankle (HKA) angles of the right and left knees were 6.2° and 11.5°, respectively (Figure 1C).

The patient required bilateral TKA surgery. In addition, the left knee required TKA surgery after removal of the IM nail and screw in the femur. However, because of the patient's comorbid medical problems and advanced age, the physician cautioned that the patient's life could be in danger if she chose to undergo TKA after IM nail removal. After considering all the circumstances, the patient underwent staged bilateral TKA using the Mako robotic system (Stryker Orthopaedics) without IM nail removal surgery (Figure 2). The patient was advised to perform immediate weight bearing as tolerated, and active exercise was initiated under the supervision of a physiotherapist during rehabilitation. The patient recovered without any complications.

The patient was satisfied with the outcome of her surgery; she reported a marked reduction in pain and improved stability of the bilateral knee joints at postoperative 6 weeks. Three months later, the patient reported no pain in her knees, and she was able to walk unaided. Her active range of motion was right 0–140° and left 0–140°. Additionally, the HSS scores of the knees were right 85 and left 80. A postoperative weight-bearing X-ray showed favorable limb alignment on coronal view. The standing HKA angle improved from a preoperative value of 6.2° to a postoperative value of 2.7° in the right knee and from a preoperative value of 11.5° to a postoperative value of 2.9° in the left knee during the follow-up period (Figure 2C). At her 6-month follow-up visit, the patient was asymptomatic with a range of movement from 0 to 135° in both knees.

2.2 | Case 2

A 61-year-old woman who complained of severe pain in both knees for the previous 6 months presented to our clinic in January 2021. She measured 150.0 cm in height and 58.0 kg in weight, and she had a body mass index of 25.8 kg/m^2. She had no systemic musculoskeletal disease or other medical history. Five years prior, she had undergone bilateral high tibial osteotomy to treat medial osteoarthritis of both knees. K-L grade IV osteoarthritic changes in both knees were documented (Figure 3). The HSS scores of the right and left knees were 60 and 65, respectively. A weight-bearing X-ray revealed a varus deformity, while the HKA angles of the right and left knees were 12.6° and 16.5°, respectively (Figure 3C).

Both knees required staged bilateral TKA surgery, but we anticipated difficultly in removing the existing hardware around both knees because the metal plates were covered with bone (Figure 3D,E, yellow arrow). Also, there was risk of intraoperative fracture of the left knee if all

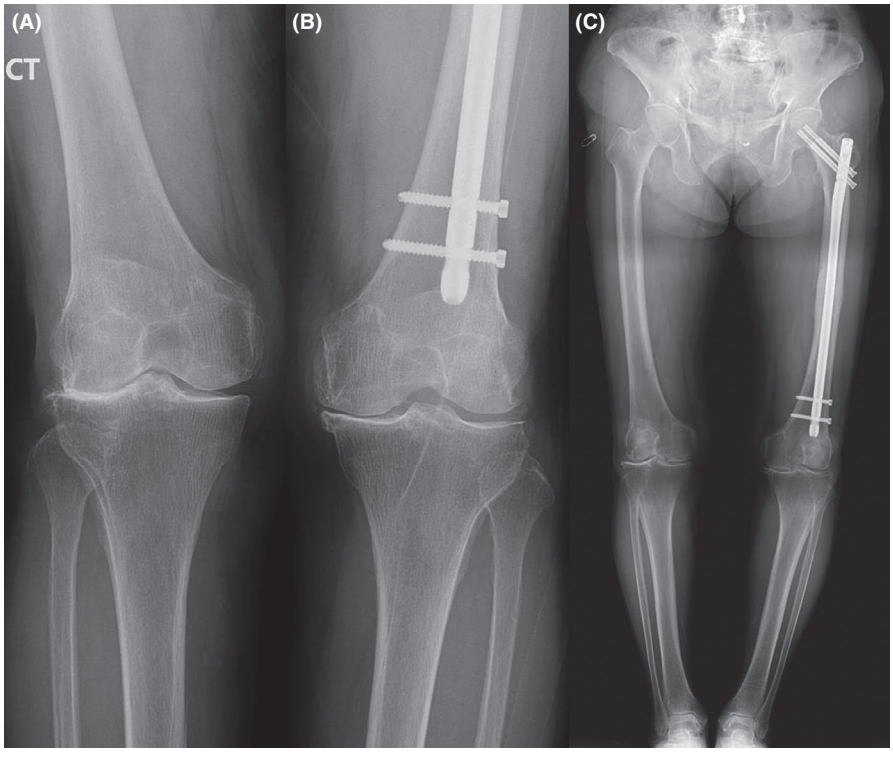

FIGURE 1 (A and B). Bilateral Kellgren-Lawrence (K-L) grade IV osteoarthritic changes in an 81-year-old woman who failed to respond to conservative management. Three years prior, she had undergone open reduction and internal fixation with an internal medullary nail for a shaft fracture of the left femur. (C) A preoperative standing anteroposterior (AP) radiograph of the bilateral lower extremities shows a right hip-knee-ankle (HKA) angle of 6.2° and a left HKA angle of 11.5°

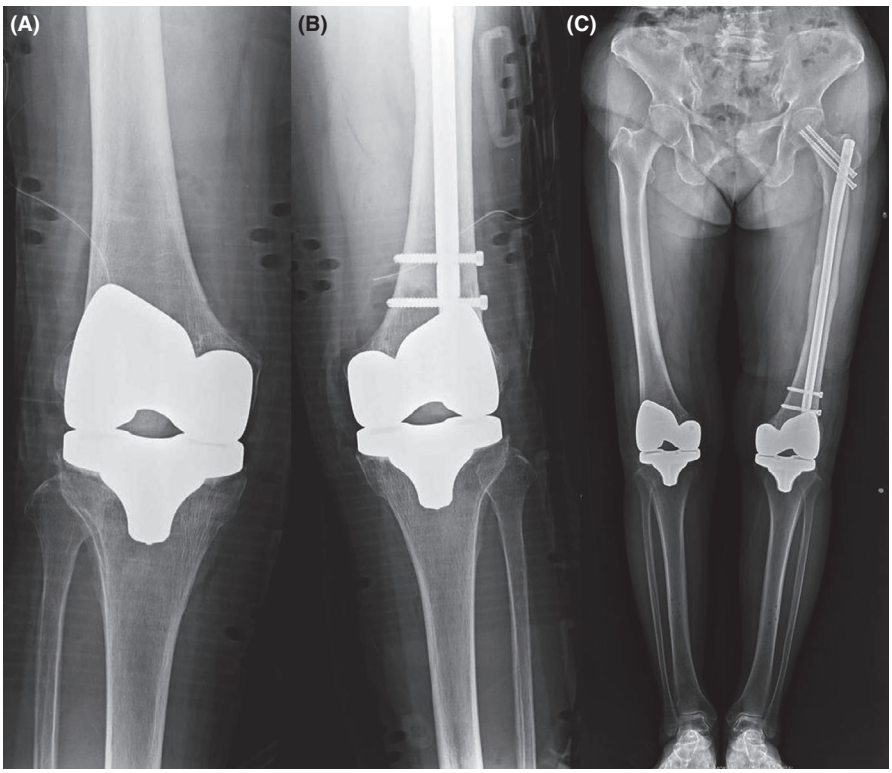

FIGURE 2 (A and B) An 81-year-old woman underwent bilateral robot-assisted total knee arthroplasty (TKA) without removal of retained hardware. (C) A 4-week postoperative standing AP radiograph shows a right HKA angle of 2.7° and a left HKA angle of 2.9°

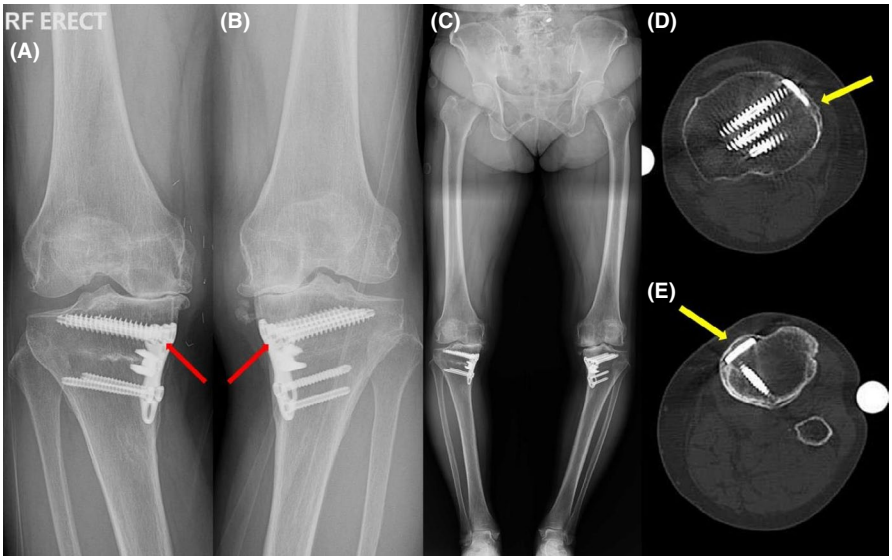

FIGURE 3 (A and B) Bilateral K-L grade IV osteoarthritic changes in a 69-year-old woman. Five years prior, she had undergone bilateral high tibial osteotomy to treat medial osteoarthritis. (C) A preoperative standing AP radiograph shows a right HKA angle of 12.6° and a left HKA angle of 16.5°. (D and E) A preoperative CT scan of the right (D) and left knees (E) shows metal plates covered with bone (yellow arrow)

metal plates and screws were removed from the proximal tibia to perform the TKA surgery. Therefore, the patient underwent staged bilateral TKA using a robot-assisted system after removal of the proximal screws (Figure 3A,B, red arrow) that interfered with the tibial component fixation procedure in both knees (Figure 4). The patient recovered without any complications. Three months later, she reported no pain in either knee, and she could walk unaided. Her active range of motion in both knees was 0–140°. The HSS score in both knees was 85 at 3 months after surgery. A postoperative weight-bearing X-ray showed favorable limb alignment on the coronal view. The standing HKA angle improved from a preoperative value of 12.6° to a postoperative value of 0.2° in the right knee and from a preoperative value of 16.5° to a postoperative value of −1.9° in the left knee during the follow-up period (Figure 4C). At the 6-month follow-up visit, she was asymptomatic with a range of movement in both knees from 0 to 135°.

3 | DISCUSSION

In these two cases, robot-assisted TKA was an effective procedure to treat knee osteoarthritis in patients with retained hardware. The technical difficulty of TKA in

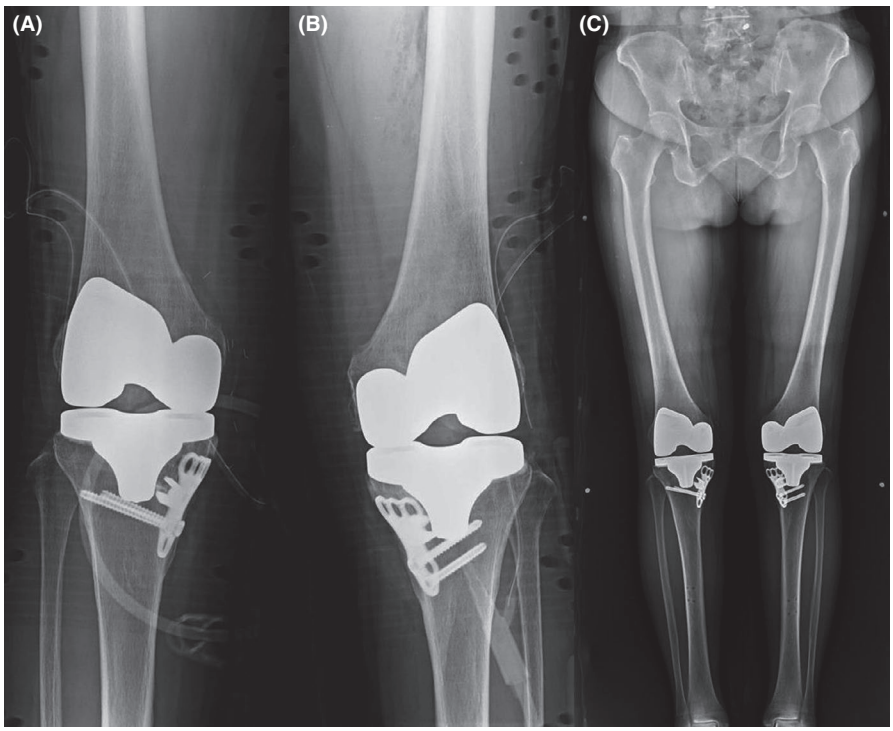

FIGURE 4 (A and B) A 69-year-old woman underwent bilateral robot-assisted total TKA after removal of proximal screws that interfered with tibial component fixation. (C) A 4-week postoperative standing AP radiograph shows a right HKA angle of 0.2° and a left HKA angle of −1.9°

patients with retained hardware around the knee has been reported.[3] A hardware removal procedure during TKA can lead to increased surgical times, excessive exposure, increased bleeding, and transfusions, which can increase the risk of infection.[6,7] In addition, some elderly patients cannot undergo TKA surgery because of its high risk associated with hardware removal. In our patient from case 1, TKA with an IM nail removal procedure would have endangered the patient's life due to her comorbid medical problems and advanced age. The robot-assisted system does not require intramedullary instrumentation and can be performed without femoral IM nail removal. In our patient from case 2, complete metal removal was difficult because the metal plate was covered with bone, and the procedures would have put her at risk of proximal tibial fracture. Robot-assisted TKA reduces potential medical complications and does not require removal of retained hardware and represents an interesting treatment when removal of the existing hardware is limited due to various causes.

Robot-assisted TKA has several distinct advantages over conventional TKA. First, if old metal components are difficult to remove or if the removal procedure could put the patient's life at risk, robot-assisted TKA offers a less invasive and alternative therapeutic strategy without the need for metal removal. Second, in the robot-assisted system, a preoperative CT scan is performed and incorporated with the robotic software to identify accurate implant size and positioning. This process enables the surgeon to make accurate bony cuts and correctly orient the components before surgery. If existing hardware is difficult to remove because it is covered in bone, the robot-assisted system enables TKA surgery without complete metal removal.

Therefore, in well-planned and selected cases, robot-assisted TKA can be a useful treatment for knee osteoarthritis in patients with retained hardware. This technique provides an alternative approach to conventional TKA for treating these difficult patients with retained hardware.

ACKNOWLEDGEMENT

None.

CONFLICT OF INTEREST

Each author certifies that he or she has no commercial association (e.g., consultancies, stock ownership, equity interest, patent, and licensing arrangements) that might pose a conflict of interest in connection with the submitted article.

AUTHOR CONTRIBUTIONS

Ji-Hoon Baek and Chang Hyun Nam contributed to writing and revision of article. Su Chan Lee and Hye Sun Ahn contributed to data collection.

ETHICAL APPROVAL

This study was approved by the Institutional Review Board of Himchan Hospital.

CONSENT

All patients provided written, informed consent to participate in the study.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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How to cite this article: Baek J-H, Lee SC, Ahn HS, Nam CH. Usefulness of robot-assisted total knee arthroplasty in patients with retained hardware: A report of two cases. *Clin Case Rep*. 2022;10:e05366. doi:10.1002/ccr3.5366