Radiology Case Reports 20 (2025) 1900–1903

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

A case of aseptic loosening after total knee replacement with porous-coated mega prosthesis despite progression of extra bone growth ☆

Ryota Miyamoto, MD[a], *Yasushi Goto, MD*[b], *Toshitaka Fujito, MD, PhD*[c], *Hirohito Abe, MD, PhD*[b], *Yasuo Kunugiza, MD, PhD*[b,*]

[a] *Department of Orthopaedics, Osaka International Cancer Institute, Osaka, Japan*
[b] *Department of Orthopaedic Surgery, Japan Community Health Care Organization Hoshigaoka Medical Center, Osaka, Japan*
[c] *Department of Orthopaedic Surgery, National Hospital Organization Osaka National Hospital, Osaka, Japan*

ARTICLE INFO

Article history:
Received 29 December 2024
Accepted 4 January 2025

Keywords:
Megaprosthesis
Extracortical bone growth
Radio lucent line
Aseptic loosening

ABSTRACT

Total knee replacement with mega prosthesis for periprosthetic fractures after total knee arthroplasty is related to early functional recovery, but aseptic loosening of the implant has been a major reoperation factor in the long-term outcome of total knee replacement with mega prosthesis. Extracortical bone formation caused by bone-collar interface osteointegration may decrease the probability of aseptic loosening by promoting bone formation and improving bone-implant fixation. Here, we report a case of total knee replacement using mega prosthesis with porous-coated collar showing extra bone growth without osteointegration of prosthesis and leading to aseptic loosening.

Introduction

Megaprosthesis is the most predominant reconstruction method after long bone segmental resection against bone tumors, but can also be used in limb salvage surgery for nononcologic cases [1]. The use of megaprosthesis for comminuted periprosthetic fracture after total knee arthroplasty (TKA) causes early functional recovery [2]. However, aseptic loosening of the implant has been a major complication in the long-term outcome of total knee replacement with megaprosthesis in nononcologic settings [1,3]. Aseptic loosening originates from cortical bone loss at the bone-implant junction, causing progressive osteolysis along the implant stem by mechanical force [4]. Bone-collar interface osteointegration may prevent aseptic loosening by blocking bone loss and progression of osteolysis [5].

We report a case of total knee replacement using megaprosthesis with porous-coated collar showing extra bone growth without osteointegration of prosthesis and leading to aseptic loosening.

☆ Competing Interests: The authors have declared that no competing interests exist.

* Corresponding author.
E-mail address: kunugi@est.hi-ho.ne.jp (Y. Kunugiza).

https://doi.org/10.1016/j.radcr.2025.01.019

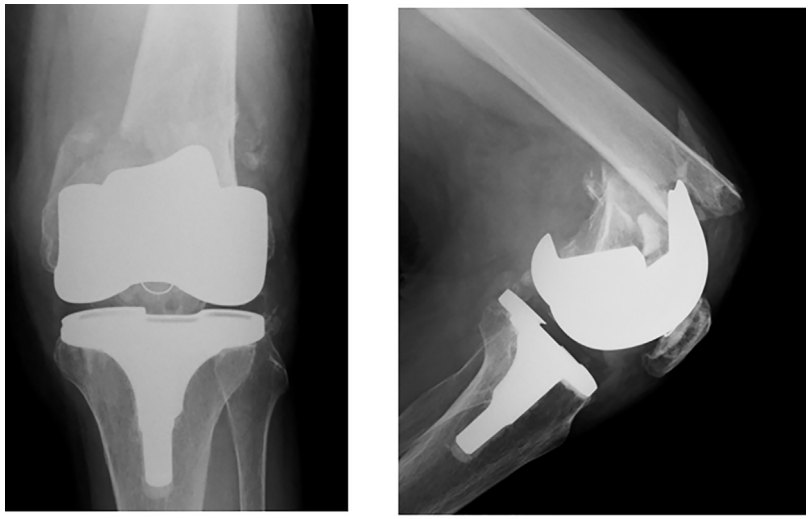

Fig. 1 – (A) Frontal and (B) lateral radiographs of the knee at the time of the clinic visit.

Case report

An 85-year-old woman fell and hit her left knee and was referred to the emergency department of our hospital by ambulance because she had difficulty walking. She underwent left TKA for knee osteoarthritis (OA) 4 years before; however, her activities of daily living (ADL) had declined to the level of walking with a cane indoors 3 years postoperatively due to dementia and right knee OA progression. She complained of pain in her left thigh and knee but with no neurological symptoms during emergency medical examination. Radiographs during emergency consultation examination demonstrated a TKA periprosthetic fracture in the left femur. The fracture was comminuted and displaced with no signs of implant loosening, which was categorized as Lewis and Roraback classification type II (Fig. 1A and B).

Revision total knee replacement with megaprosthesis (OSS Orthopedic Salvage System; Zimmer Biomet) was conducted for surgical treatment because of the old age and low ADL of the patient. The femur was cut at the diaphyseal level and replaced with a segmental type femoral component with a titanium plasma spray coated collar located at the shoulder of the implant (Fig. 2A and B). We used a nonmodular type tibial component. Postoperative radiograph showed the full cement implantation of the femoral and tibial component (Fig. 3A and B). The patient had no pain in the left knee for 6 months postoperatively. Postoperative radiographs at 2 weeks (Fig. 4A) and 6 months (Fig. 4B) showed the progression of extra bone growth at the bone-implant junction in the left femur. 1 year post-

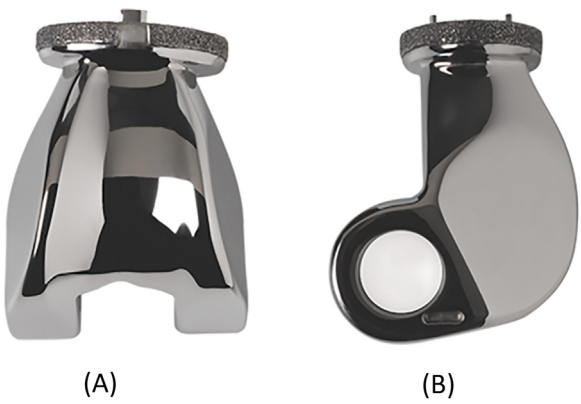

Fig. 2 – (A) Frontal and (B) lateral views of the segmental type femoral component.

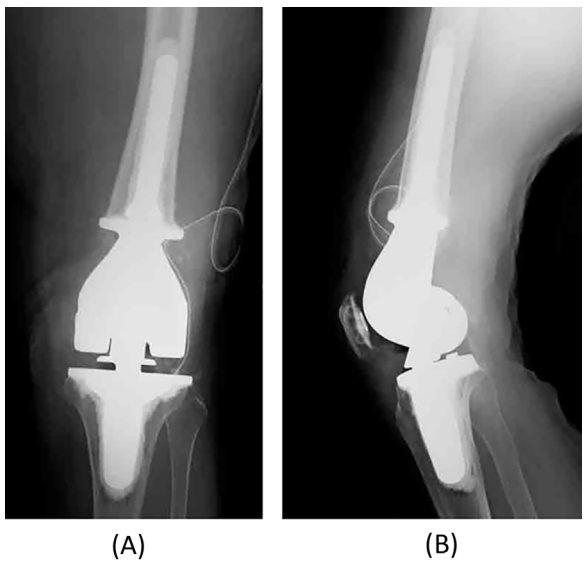

Fig. 3 – (A) Postoperative frontal and (B) lateral radiographs of the knee.

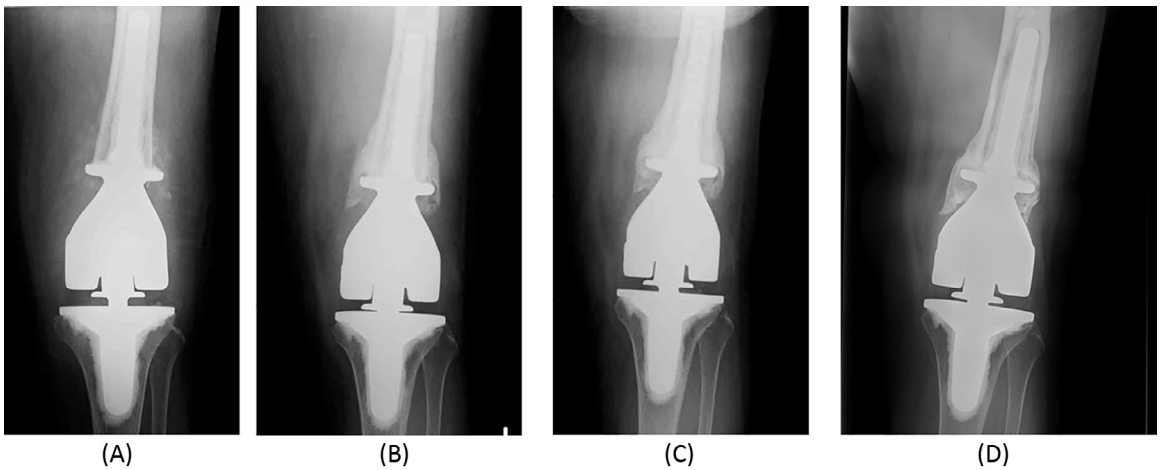

Fig. 4 – Frontal radiographs of the knee at (A) 2 weeks, (B) 6 months, (C) 1 year, and (D) 7 years postoperatively.

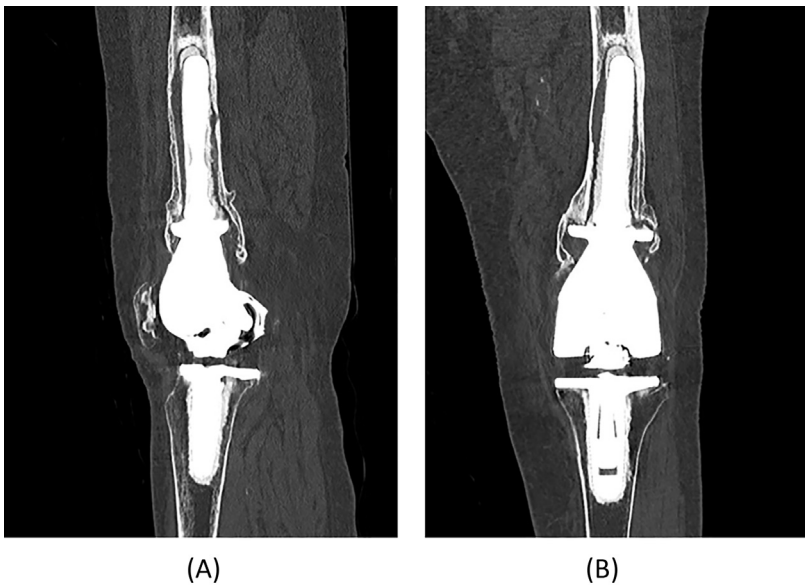

Fig. 5 – (A) Coronal and (B) sagittal computed tomography images of the knee at 7 years postoperatively.

operatively the patient complained of slight pain in the distal thigh when ascending and descending stairs. Postoperative radiographs at 1 year (Fig. 4C) reveal radio lucent line between the formed bone and collar of the femoral component. Seven years postoperatively, the patient is in 92 years old and lives in a nursing home. She uses a walker with wheels to walk and complains of mild pain in the femur. Radiographs (Fig. 4D) and CT (Fig. 5A and B) at 7 years postoperatively also showed loosening and sinking of the femoral component with radiolucent line between the femoral cortex and surface of the stem and collar. She has been offered a revision surgery, but does not want to undergo it because of her advanced age.

Discussion

Revision TKA was performed for TKA periprosthetic left femur fracture using megaprosthesis with a circumferential porous-coated collar at the shoulder of the femoral component. Postoperatively, aseptic loosening of femoral component was detected. A previous report revealed that aseptic loosening was seen in about 10% of distal femur megaprosthesis in the treatment of non-neoplastic diseases [6]. Aseptic loosening begins with the loss of cortical bone at the bone-implant junction in direct contact with the collar of the implant. Osteolysis increases with time, followed by

cortical bone loss at the bone-implant junction, eventually causing aseptic loosening of the component [4].

Extracortical bone formation by hydroxyapatite (HA) coating [7] and extracortical bone bridging induction by bone grafting to the bone-implant junction have been applied to improve megaprothesis fixation [8,9]. In these bone reactions, extracortical bone growth osteointegration to the bone-implant junction may contribute to a more advantageous biomechanical environment and improve implant stability. Additionally, this may be associated with osteolysis prevention by sealing the bone-implant junction against wear particle infiltration [4].

Another study revealed that the greater the proportion of extracortical bone formation around the collar and the more osteointegration is promoted, the lesser amounts of aseptic loosening is likely to be observed [5]. Once osteointegration is complete, the continuity of the newly formed bone and components can be seen radiographically [5].

In this case, titanium plasma spray coating was used, and at the 6 months postoperative radiograph, extracortical bone growth was observed at the femoral bone-to-implant junction. However, radiolucent line (RLL) was observed between extracortical bone and the coated area of the femoral component at 1 year postoperatively, suggesting that this extracortical bone growth without osteointegration would have limited effect on improving component fixation. RLL in TKA has been defined radiologically as a translucent area between the cement/implant interface and bone affected by osteolysis or osteosclerosis [10,11]. Although sometimes considered a precursor of aseptic loosening, not all RLLs represent loosening. RLL that is <2mm and do not progress is often not clinically problematic, whereas RLL that progress and is associated with pain and implant mobility is suggestive of aseptic loosening and may require revision surgery [10].

In the present case, titanium plasma spray coating was used, and radiographs showed that the RLL between extracortical bone and coated collar of the femoral component led to aseptic loosening.

Conclusion

We report a case of total knee replacement using megaprosthesis that osteotomized the femur at the diaphysis with porous-coated collar showed extra bone growth. RLL between formed bone and collar was observed at 1 year postoperatively, and RLL between cortex of the femur and surface of the stem and collar was observed at 7 years postoperatively. The RLL may indicate aseptic loosening; however, this should be interpreted with caution using the findings from radiographic and clinical picture.

Patient consent

Informed consent for the procedure and publication of data was obtained from the patient and documented.

REFERENCES

[1] Sambri A, Parisi SC, Zunarelli R, Prinzio LD, Morante L, Lonardo G, et al. Megaprosthesis in non-oncologic settings—A systematic review of the literature. J Clin Med 2023;12(12):4151.

[2] Cannon SR. The use of megaprosthesis in the treatment of periprosthetic knee fractures. Int Orthop 2015;39(10):1945–50.

[3] Ogura K, Yakoub MA, Boland PJ, Healey JH. Finn/Orthopedic Salvage System distal femoral rotating-hinge megaprostheses in oncologic patients:llong-term complications, reoperations, and amputations. J Bone Joint Surg Am 2021;103(8):705–14.

[4] Coathup MJ, Sanghrajka A, Aston WJ, Gikas PD, Pollock RC, Cannon SR, et al. Hydroxyapatite-coated collars reduce radiolucent line progression in cemented distal femoral bone tumor implants. Clin Orthop Relat Res 2015;473:1505–14.

[5] Davies B, Kaila R, Andritsos L, Gray Stephens C, Blunn GW, Gerrand C, et al. Osteointegration of hydroxyapatite- coated collars in cemented massive endoprostheses following revision surgery. Bone Jt Open 2021;2(6):371–9.

[6] Vaishya R, Thapa SS, Vaish A. Non-neoplastic indications and outcomes of the proximal and distal femur megaprosthesis: a critical review. Knee Surg Relat Res 2020;32(1):18.

[7] Coathup MJ, Sanghrajka A, Aston WJ, Gikas PD, Pollock RC, Cannon SR, et al. Hydroxyapatite-coated collars reduce radiolucent line progression in cemented distal femoral bone tumor implants. Clin Orthop Relat Res 2015;473(4):1505–14.

[8] Chao EYS, Fuchs B, Rowland CM, Ilstrup DM, Pritchard DJ, Sim FH. Long-term results of segmental prosthesis fixation by extracortical bone-bridging and ingrowth. J Bone Joint Surg Am 2004;86(5):948–55.

[9] Luk MH, Yee AH, Yau R, Ho KW, Lam YL. Vascularised bone graft is an effective technique for extracortical bone bridging to combat cemented megaprosthesis loosening at the bone–implant junction. J Orthop Surg (Hong Kong) 2020;28(3):2309499020972483.

[10] Wautier D, Ftaïta S, Thienpont E. Radiolucent lines around knee arthroplasty components: a narrative review. Acta Orthop Belg 2020;86(1):82–94.

[11] Hampton CB, Berliner ZP, Nguyen JT, Mendez L, Smith SS, Joseph AD, et al. Aseptic loosening at the tibia in total knee arthroplasty: a function of cement mantle quality? J Arthroplasty 2020;35(6S):S190–6.