Total Knee Arthroplasty for Severe Valgus Knee Deformity with a Thin Bowl Shaped Patella

Takatomo Mine*, Koichiro Ihara, Hiroyuki Kawamura, Ryutaro Kuriyama and Ryo Date

Department of Orthopaedic Surgery, National Hospital Organization Kanmon Medical Center, Yamaguchi, Japan

*Corresponding Author: Takatomo Mine, Department of Orthopaedic Surgery, National Hospital Organization Kanmon Medical Center, ChofuUshiroda Simonoseki, Yamaguchi, Japan.

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Abstract

Valgus knee is associated with exaggerated dysfunction of the patello-femoral joint and the lateral compartment of the femorotibial joint, and may be associated with contracture of the lateral soft tissues and laxity of the medial soft tissues. The authors encountered a case of severe valgus knee deformity with a thin bowl-shaped patella. The case was treated with total knee arthroplasty (TKA), using a lateral approach. It was not possible to resurface the patella. Osteotomy of the patella was performed to enhance patellar tracking. After surgery, the complication of postoperative skin necrosis developed. A pedicled muscle flap from the lateral head of the gastrocnemius muscle and all layers of the skin were grafted. The patient has been symptom-free for following surgery.

Keywords: Valgus Knee; Total Knee Arthroplasty; Lateral Approach

Introduction

In cases of severe varus or valgus deformity or flexion contracture of the knees, problems, such as the optimum extent of the osteotomy, balancing of the knee ligament, and delicate adjustment of the position of the implant to be inserted, may complicate the replacement procedure [1-5]. In severe valgus deformed knee, the problems are particularly formidable. The authors encountered a case of severe valgus knee deformity with a thin bowl-shaped patella. The case presented the problem of intra-operative management of the patella, and the complication of postoperative skin necrosis developed.

Case Report

The patient, a 77-year-old woman, had been suffering from rheumatoid arthritis. Since approximately 4 years earlier, exacerbated pain of the right knee, flexion contracture and valgus deformity progressed gradually, resulting in difficulty with locomotion. The patient received conservative treatment but the difficulty with ambulation forced her to rely on a wheelchair. She was subsequently admitted to our department.

Physical examination revealed swelling and slight local heat of the right knee, and lateral dislocation of the patella. The right knee joint exhibited marked valgus deformity (27°) and flexion contracture (30°). The range of motion (ROM) was 30 ~ 120°. It was found that external correction of the valgus deformity and flexor contracture was not possible. The Hospital for Special Surgery Clinical Score (HSS) was 22 points; the RA classification was stage 4; the RA functional disability, class 3; and Lansbury’s Index, 38%.

Radiographs showed a sunken lateral tibial condyle, severe valgus and external rotation deformity of the tibia with an femorotibial angle (FTA) of 155°. The patellar surface was markedly depressed and thin, and the patella was laterally dislocated (Figure 1A, B, C).

Figure 1: Preoperative radiograph. A: anteroposterior view B: Lateral view C: Skyline view.

Varus stress, which was hardly correctable, immobilized the valgus deformity in general, and flexion contracture complicated it. A lateral approach was used for surgery. The lateral soft tissues were extensively dissected to expose the intra-articular space. An extensive
bone defect of the lateral femoral condyle was recognized: the patellar groove was almost obliterated, and bone defects were evident at both the medial and lateral sides of the tibia. The articular surface of the patella was markedly concave and had thinned to a thickness of 8 - 10 mm. The articular cartilage was obliterated. Synovitis presented a general burned-out appearance throughout. The anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) were completely absent.

The lateral collateral ligament (LCL) and the posterior lateral capsule were released under the periosteum, and the iliotibial (IT) band was extended by the multiple puncture technique. The popliteus was not released. The femoral biceps was also extended by 2.5 cm. The common peroneal nerve was separated to avoid the risk of peroneal nerve palsy.

A NexGen posterior stabilizing prosthesis (Zimmer, USA) was inserted and cemented. However, it was not possible to resurface the patella, because the patella was cup-shaped and measured only approximately 8 mm in thickness. Osteotomy of the patella was performed to enhance patellar tracking (Figure 2A, B, C).

Figure 2: Postoperative radiograph. A: anteroposterior view B: Lateral view C: Skyline view.

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The implant was fixed satisfactorily; but because a tendency for patellar subluxation was noted, the distal patellar tendon–fascial border was left unsutured, instead of lateral release. The lateral tissue gap was filled with an expanded fat pad. FTA was 172°, indicating sufficient improvement in its alignment; but because the medial support structure was lax, slight valgus instability persisted.

On the 4th day after surgery, the skin infero-lateral to the patella became necrotic (Figure 3). After the wound was well demarcated, a pedicled muscle flap from the lateral head of the gastrocnemius muscle and all layers of the skin were grafted. Postoperative care involved immobilization of the knee for 2 weeks, then ROM exercises were started using continuous passive motion (CPM). At the same time, full weight bearing was allowed.

![Figure 3: Skin necrosis on lateral border of knee.](image)

It could be due to concurrent pain in the left knee, but the patient was barely able to ambulate with the aid of a walker, even after 6 months. The patient's postoperative HSS score was 55. The movable range of the joint was 15 to 95°. The postoperative course has been satisfactory and the patient has been symptom-free for following surgery.

Discussion

Valgus deformity, which often develops following trauma or RA, is complicated by excessive external tibial rotation or elongation of the medial collateral ligament. Cases with a fixed valgus deformity, which is accompanied by marked contracture of the lateral soft tissues and cannot be corrected manually, are difficult to manage surgically [3,5-9]. Our patient suffered from a fixed valgus deformity with a thin bowl-shaped patella. Performing a total knee arthroplasty(TKA) has several problems: approach, ligament balance, choice of prosthesis, and patella resurfacing.

Two approaches for TKA are available: medial and lateral. Many surgeons prefer the former. In cases with a relatively mild valgus deformity of the knee, a medial approach is adequate. With severe deformity (as in the present case), it has been reported that the efficacy

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of the medial approach is limited [10], because extensive release of soft tissue is required, and this may exacerbate instability or invite the development of a hematoma. Keblish and Buechel recommend TKA through a lateral approach for fixed valgus knee [6,7]. This surgical method was advantageous because it permitted direct approach of the affected sites and soft tissue release was easy. At the same time, however, the method caused a problem: it was technically difficult to raise the tibial tubercle that was still lightly attached to the bone to evert the patella.

To balance the ligament, it is necessary to release the lateral structures during surgery on a knee with severe valgus deformity. To achieve satisfactory alignment in the present case, very aggressive lateral release, iliotibial band, posterior lateral capsule and lateral collateral ligament were required. However, the popliteus was not released. Since the condition was associated with elongation of the medial collateral ligament, the valgus instability persisted. If one wants to achieve stability, choosing the right prostheses is important to achieve stability. For better stability, the semi-constrained type may be preferable, as Stern recommends [4,11]. Our patient's knee joint was very small; and because there was not an appropriately sized implant to select among the semi-constrained type, a PS type had to be used. In this patient, the soft tissue was extensively released. But the popliteus was not released to protect the knee from lateral instability during flexion. The knee could not be corrected to less than approximately 4 degrees of valgus. The patient’s bone quality was extremely poor; and devising a stem extension by using a cementless pressfit type would seemed not sufficient for fixation. Thus, a short stem extension with cement fixation was chosen. Since osseous defect of the femoral condyle was extensive, the posterior condyle was not available as a reference and the epicondylar line could not be used as a guide to determine the position for rotation of the femoral component. Osteotomy was conducted vertically to the AP line, as Whiteside, et al. recommended, to set the rotational position [1].

Patellar replacement was difficult in the present case because of the marked concave deformation of the patella and its limited width (8 ~ 10 mm). Marked concave deformity resulted in poor tracking of the patella. Therefore, osteotomy of the joint surface was limited to 5 mm without replacing the patella. The patella articulated with the femoral component.

Various types of complications of TKA conducted to treat valgus knee have been reported [9,10]. In the present case, skin necrosis developed on the lateral side below the patella. Fixed valgus deformity and soft tissue contraction had also occurred. When alignment was corrected from 155° to 172°, excessive tension was applied to the lateral side. Subcutaneous tissue was very thin and the release was extensive on the lateral side with a lateral approach. The soft tissue gap occurred on the lateral side. There is poor circulation on the lateral side below the patella. However, the soft tissue gap that occurred during flexion was covered with an expanded fat pad by a filet technique. When a muscle flap from the medial head of the gastrocnemius muscle was applied immediately after the necrotic area became clearly demarcated, the implant was adequately covered and no further infection developed.

Conclusion

The authors encountered a case of severe valgus knee deformity with a thin bowl-shaped patella. The problem was intra-operative management of the patella, and the complication of postoperative skin necrosis developed.

Conflict of Interest Statement

There are no prior publications, conflicts of interest, copyright constraints, or industry funding to report for any of the authors.

Bibliography


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