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Patellar tendon rupture and marked joint instability after total knee arthroplasty

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Abstract *Background:* Patellar tendon rupture is a rare complication of total knee arthroplasty (TKA). Multiple repair methods have been described in the literature. *Methods:* A 66-year-old woman suffered a patellar tendon re-rupture and marked joint instability within 6 months after revision TKA. She underwent re-revision TKA and extensor mechanism reconstruction with femoral quadriceps tendon and augmentation by a Leeds-Keio ligament. *Result:* It was fairly difficult to acquire a satisfactory range of motion as well as gain in knee extension capacity by eliminating the extension lag. *Conclusion:* Patellar tendon ruptures after TKA should be repaired as soon as they are recognized.

Keywords Patellar tendon rupture · Total knee arthroplasty · Extensor mechanism · Prosthetic ligament · Extension lag

Introduction

Total knee arthroplasty (TKA) has been producing good results, but some patients are still plagued with complications that lead to revision procedures. Compared with primary TKA, second or third operations are associated with various problems, such as bone defects and poor ligamentous balance, presenting considerable difficulties in treatment. Among those who underwent revision procedures, our attention was called to a patient who suffered a patellar tendon rupture and marked joint instability while under the care of another physician. Her preoperative planning and surgical procedure presented considerable difficulty. The details of the case are presented below.

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Case report

A 66-year-old woman with osteoarthritis in her right knee underwent Nagoya City University-type TKA by another physician about 16 months ago. Eight months later, she fell and suffered a fracture of the tibial component, which was subsequently replaced. During this procedure, the patellar tendon attachment was ruptured, requiring suturing of the lesion. Since then, the patellar tendon gradually developed a rupture for the second time, resulting in a dislocation of the tibiofemoral joint. Within 6 months following the replacement of the tibial component, the patient was transferred to our department. Her medical history included schizophrenia, but this condition was relatively mild and under control.

A physical examination revealed swelling and slight local heat of the right knee. The right knee joint was incapable of extension without aid, and the patella was located 20 cm above the joint line. Anterior, varus, and valgus instabilities were evident. The ROM was 0° to 130°.

Radiographs showed that the tibiofemoral joint had been dislocated, with marked patella alta. The patella height was 2.05 (left knee, 1.25) according to the Insall-Salvati method. Two staytacks, perhaps used in the previous surgical procedure, were seen at the proximal portion of the tibia (Fig. 1). On the stress radiographs, varus, valgus, and anterior instabilities were evident (Fig. 2).

A median incision was made in surgery, which revealed that the patellar tendon had almost completely disappeared. In the intra-articular space, the synovial membrane was characterized by marked proliferation and a black coloration due to metallosis caused by a contact between the tibial and femoral components. These components were removed, and the lesion was cleared of the residual bone cement. The osteotomy surface was refreshed, and a Kinematic rotation hinge prosthesis was inserted and cemented. To reconstruct the patellar tendon, 1/3 of the femoral quadriceps tendon was dissected at the muscle-tendon transition area and reversed to the peripheral side; then the tendon was pulled out at the intercondylar tubercle (Fig. 3a). Later, according to a method proposed by Fujikawa et al. [5], the Leeds-Keio ligament was inserted in a figure-of-8 fashion, fluting it above the patella and through a drill hole in the tibial tubercle, and the ligament was secured to the bone by a staple (Fig. 3b). The immediate postoperative radiograph showed that patella alta remained, and the patella height was 1.95 (Fig. 4).

For 2 weeks after the operation, the knee was immobilized. Thereafter, ROM exercises were begun by using CPM. At the same time, full weight-bearing was allowed with a knee immobilizer. The knee was protected in a hinged rehabilitation brace for an additional 3 months.

At 6 months after the operation, the passive range of the knee was 0°–120° and extension lag, 45° (Fig. 5). The quadriceps strength was fair (3 of 5) in comparison to the left knee, which was good

Fig. 1a, b Preoperative radiographs, anteroposterior view (a) and lateral view (b). The tibiofemoral joint is dislocated, with marked raising of the patella

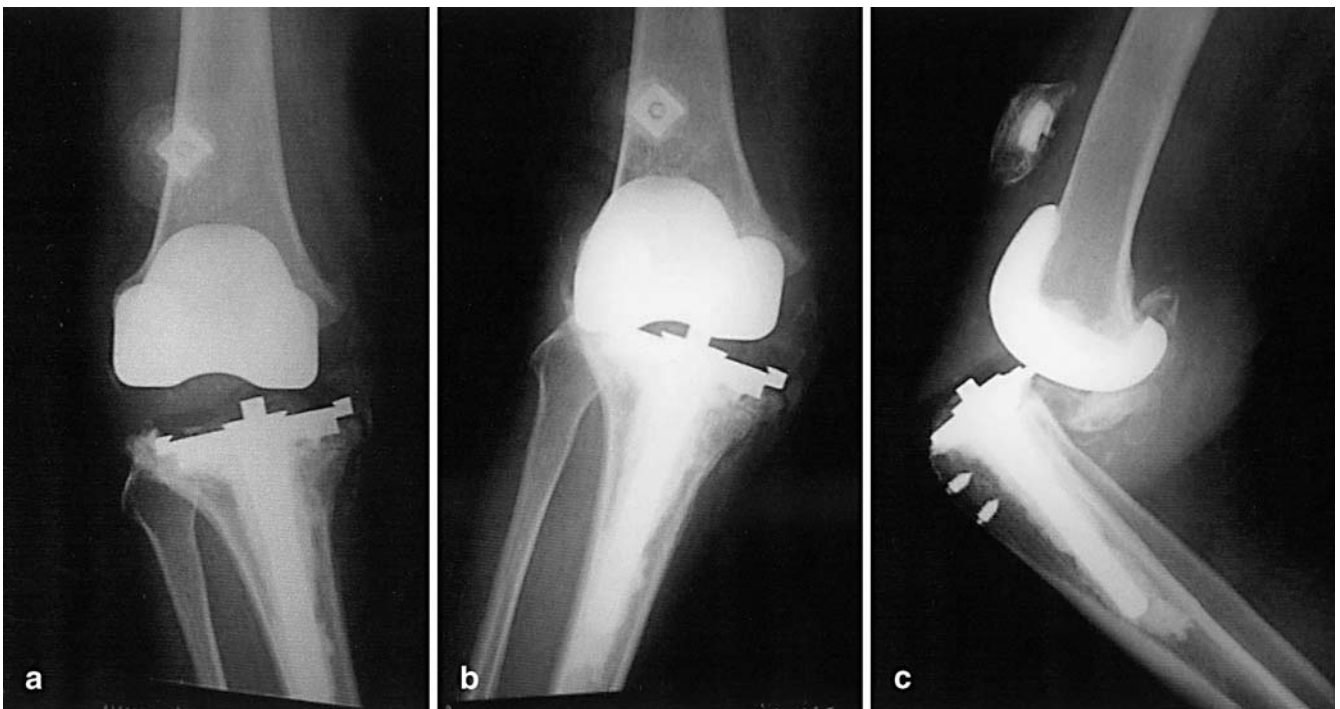
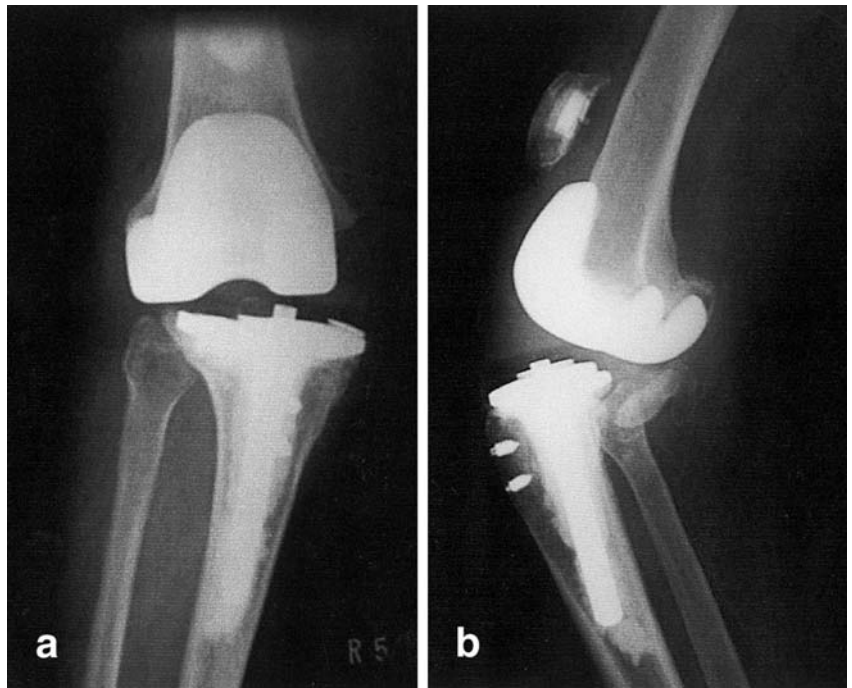


Fig. 2a–c Stress radiography, varus stress (a), valgus stress (b), anterior drawer stress (c). Varus, valgus, and anterior instabilities are evident

(4 of 5). The Hospital for Special Surgery Clinical Score was 61. Weight-bearing was possible without any orthosis. But there was a limitation of function due to the concurrent pain in the left knee, and the patient was barely able to ambulate with the aid of a walker. The circumferences of the thighs were 1 cm smaller than the left knee. Radiographs revealed patella alta, 1.95, which remained unchanged at follow up.

Discussion

The following are cited as problems plaguing this patient. In spite of the patellar tendon rupture at the attachment to the intercondylar tubercle, reconstruction was attempted by using only staytacks without sufficient immobilization thereafter; and the joint instability was left untreated, with the reconstruction limited to the tibia due to a tibial tray fracture.

For the revision of the replacement joint with instability such as that described above, a posterior stabilizer or

Fig. 3a, b Reconstruction of the patellar tendon. **a** Diagram of reconstruction with femoral quadriceps tendon. **b** Augmentation by a Leeds-Keio ligament

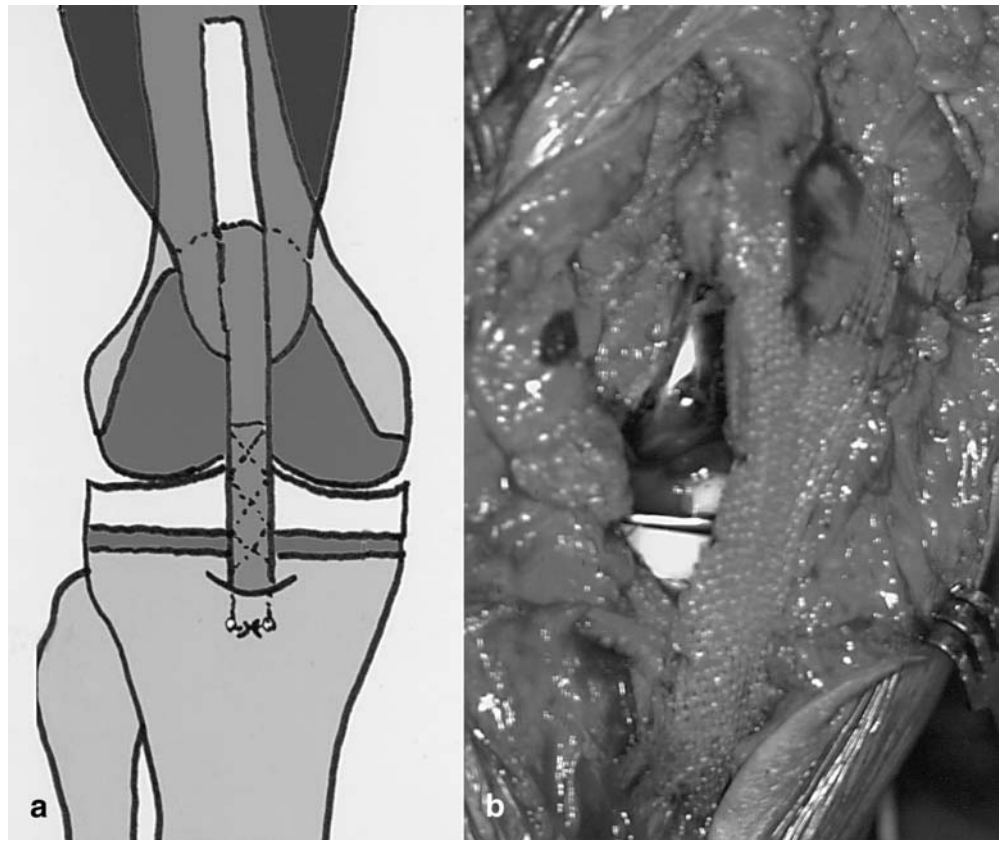


Fig. 4a, b Postoperative radiograph after repair of the patellar tendon rupture and revision TKA, anteroposterior view (**a**) and lateral view (**b**). Kinematic rotation hinge prosthesis is inserted and cemented. Patella alta remains

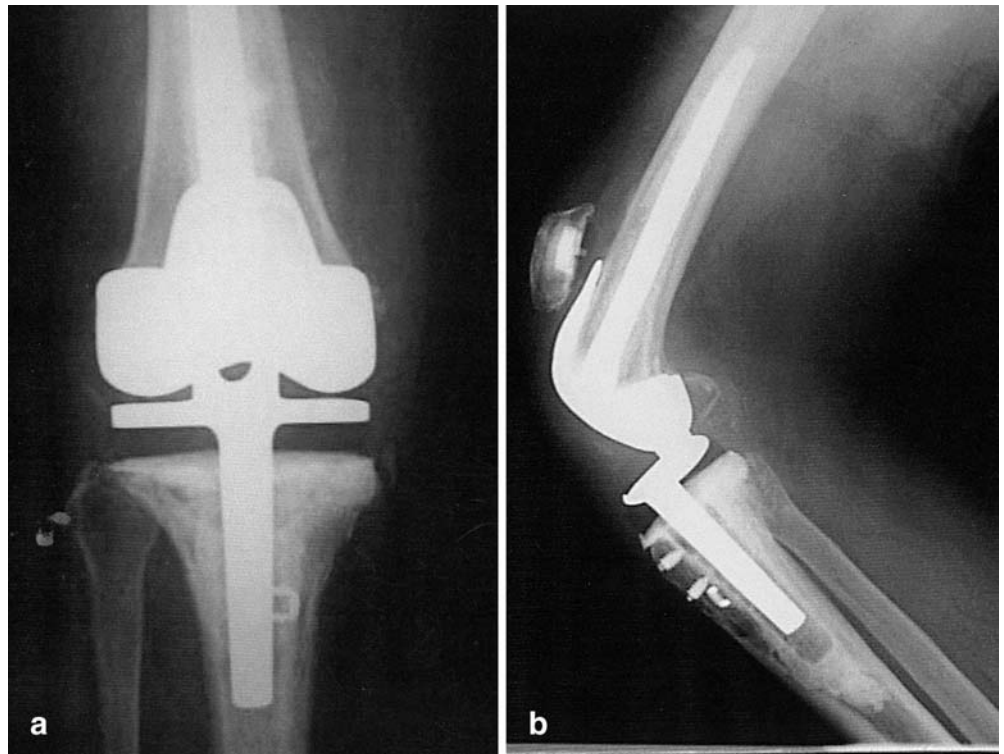
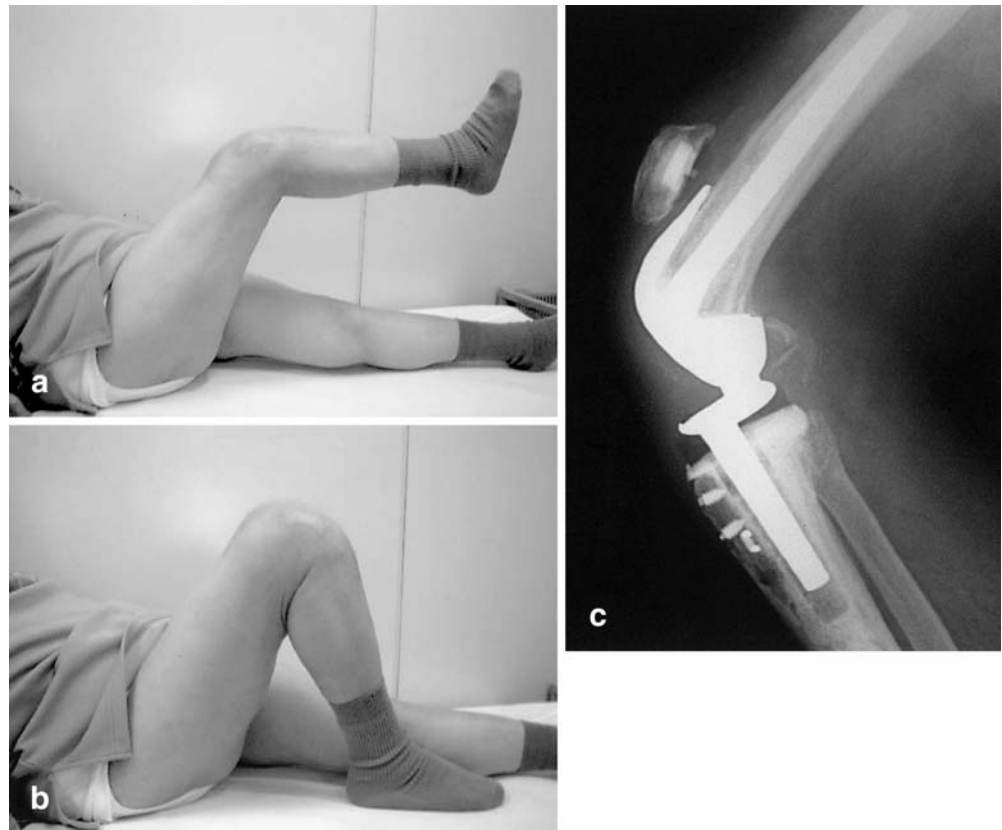


Fig. 5a–c Six months after surgery, knee extension (a), knee flexion (b), radiograph (c). Patella height remained unchanged at follow-up



semi-constrained type is a possible joint replacement. Because of previous patellar tendon rupture and the high position of the patella as in this case, the use of a semi-constrained type is considered a necessity.

There are several reports in which the methods to reconstruct a ruptured patellar tendon are described. These procedures differ in the reconstructive materials and fixation methods used [1, 2, 3, 4, 6, 7]. They include primary suturing, repair using staples, semitendinous augmentation, plantaris augmentation, distal extensor mechanism allograft, and carbon-fibre graft; and all have yielded mixed results. But no-one has obtained consistent clinical success.

Rand et al. reviewed the orthopaedic literature and identified 24 previously reported cases. The results were discouraging when compared with the results after operations in patients who had not undergone a total arthroplasty of the knee. Only 4 (25%) of the reconstructions by primary suture and 1 reconstruction using the semitendinous tendon were successful [7]. Emerson et al. employed allograft distal extensor mechanism reconstruction. Knee extension power and improved function were achieved in 11 cases, although a moderate extension lag of 10–20° was present in 3 cases [4]. Cadambi and Engh reported that use of a semitendinous tendon autogenous graft restored quadriceps strength and motion of the knee [3].

Semitendinosus grafts are associated with a strength amounting to 40–50% of that of the patellar ligament grafts. In this case the semitendinosus tendon was not long enough and of small calibre. Therefore, the central 1/3 of the femoral quadriceps tendon was separated, reversed, and used to

replace the patellar tendon that had been lost. Although the femoral quadriceps muscle was well separated from the surrounding tissue, it was not sufficient to correct the height of the patella because of its shortening. The patellar height remained unchanged immediately after the reconstruction of the patellar tendon and at follow-up. This would mean that there was not secondary insufficiency of the patellar tendon possibly due to a complete or partial re-rupture. Therefore, it appeared that the patella would not have been raised to this level if the patellar tendon had been repaired as soon as it was recognized. An early and sound reconstructive procedure is mandatory.

The maximal tensile strength of the Leeds-Keio ligament is 2200 N [5]. In addition, the figure-of-8 technique allows early ROM exercises [1]. In this case, however, only one staple could be used, and the width of the femoral quadriceps tendon was only about 12 mm, which necessitated a slight delay before training could begin. It is fairly difficult to acquire a satisfactory ROM as well as retain extensor power without the extension lag. A question arises as to the degree of tension that should be imposed on a Leeds-Keio ligament in intraosseous tibial fixation with staples. In the present case, a sufficient ROM was achieved by fixation with the knee positioned in flexion to 20°, but the extension lag remained fairly large (45°). To avoid this, it is necessary to increase the tension during reconstruction of the extensor mechanism; but this may restrict the capacity for flexion. Finding a balance between these two parameters is a very delicate undertaking: it poses a problem for future studies to solve.

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