CASE REPORT

Patella dislocation following distal femoral replacement after bone tumour resection

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SUMMARY

We report the case of a 16-year-old girl with patella dislocation following distal femur replacement for a malignant tumour. We performed a medial plication and lateral release procedure to treat her persistent patellar dislocation after distal femur replacement following malignant tumour resection. This treatment improved the patient's gait ability dramatically. A distal femur reconstruction with a total knee arthroplasty (TKA) system for tumour resection is a frequently performed procedure. The reported incidence of patella dislocation following distal femur reconstruction with a TKA is 2.3%. However, treatment procedures for patella dislocation following a distal femur replacement after malignant tumour resection have not been studied extensively. To the best of our knowledge, this is the first English case report about patella dislocation following distal femoral replacement focusing on surgical treatment. Our experience suggests that treatment for patella dislocation following distal femur reconstruction with a TKA should be considered positively.

BACKGROUND

The distal femur has a predilection for developing skeletal sarcomas. A frequently performed distal femur tumour treatment is distal femur reconstruction with a total knee arthroplasty (TKA) system for tumour resection.^{1,2} The reported incidence of patella dislocation following distal femur reconstruction with a TKA is 2.3%.³ Treatment procedures for patella dislocation following a distal femur replacement with a TKA after malignant tumour resection have not been studied extensively.

We report that our treatment for patella dislocation after distal femur replacement for a malignant tumour dramatically improved the patient's gait ability. We performed a medial plication and lateral release procedure to treat our patient's persistent patellar dislocation after distal femur reconstruction with a TKA following malignant tumour resection. To the best of our knowledge, this is the first English case report about patella dislocation following distal femoral replacement focusing on surgical treatment.

CASE PRESENTATION

A 16-year-old girl was referred to our hospital for the treatment of a right distal femoral bone tumour. Her gait was normal although she suffered from knee pain. Patella tracking was normal without an apprehension sign by knee flexion. X-rays of the knee demonstrated the periosteal reaction. The preoperative tibiofemoral angle (TFA, 174.4°) and the Q-angle (4.1°) were within normal

range. The patella height ratio (a/b) was 0.93, showing slight patella alta (a=41.1, b=38.3; figure 1A,B). The skyline view demonstrated a dysplastic patellofemoral joint (PFJ) with a sulcus angle of 143.8°, Wiberg type III (figure 1C). CT showed a dysplastic PFJ with an ossified lesion in the lateral condyle as evidence of a tumour (figure 1D). MRI showed the tumour on the posterolateral aspect of the femur and dysplastic PFJ (not shown).

We performed preoperative chemotherapy after the diagnosis of osteosarcoma by open biopsy and a wide resection of the distal femoral tumour with a distal femoral reconstruction with a TKA via a lateral incision. A short head of the biceps femoris, the lower part of the vastus lateralis, and a part of the iliotibial tract were resected with the tumour to achieve wide resection with a negative margin. The reconstruction prosthesis was the Kyocera Physio Hinge Total Knee System Type III, a semiroating hinge knee joint which allows a maximal flexion of 142° and an internal/external rotation of 5°. The intraoperative passive range of motion (ROM) of the knee achieved extension to 0° and flexion to 120° with normal patella tracking. Postoperative X-rays showed no evidence of patella dislocation (figure 2A,B).

We had the patient use an elastic knee brace only for gait training for 3 weeks after the operation. We had her perform a daily passive ROM exercise 1 day after the operation, and then a daily active ROM exercise at 3 weeks after the operation. One month after the tumour resection, the knee's range was reduced because of patella dislocation; the active and passive ROM was extension to -20° and flexion to 45°. The X-rays and CT revealed the patella dislocation (figure 3A-C). The patient's gait was a circumduction gait. She could not walk up and down stairs.

TREATMENT

Seven months after the completion of her postoperative chemotherapy, we performed a modified Merkow's realignment procedure of the patella with medial plication and lateral release.⁴ The lateral release extended from the lateral side of the tibial tuberosity along the lateral side of the patella tendon, lateral margin of the patella proximally and split the operation scar between vastus lateralis and biceps at proximal end. The length of lateral release was 12 cm. Medial plication was accomplished by advancing the musculocutaneous flap containing the vastus medialis fascia laterally and distally over the anterior surface of the patella

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Figure 1 Preoperative anteroposterior (A) and lateral (B) radiographs of the right knee showing periosteal reaction on the lateral aspect of the distal femur. The Merchant view (C) showing a Wiberg type III patellofemoral joint (PFJ). CT (D) showing a dysplastic PFJ with an ossified tumour lesion in the lateral condyle.

completely. The operated knee was immobilised for 3 weeks after this surgery with an elastic knee brace, which maintained the knee extension and limited flexion to 20°.

OUTCOME AND FOLLOW-UP

At the 24-month postoperative follow-up, the patient was able to walk up and down the stairs without any support. The active ROM was extension to -10° and flexion to 120° with an extension lag of 10°. X-rays and CT demonstrated good congruence at 24 months after the patella realignment operation (figure 4A–C). Plain anteroposterior X-rays showed a TFA of 177.8° and a Q-angle of 5.4°; the patella height ratio was 0.83 (a=37.5, b=45.2; figure 4A,B). Patellar maltracking and dislocation have never occurred.

DISCUSSION

With the advances of musculoskeletal malignant tumour treatment, we can expect long-term survival and limb salvage for patients with these malignancies.^{1 5} The well-accepted method for limb salvage surgery for primary bone tumours of the distal femur is endoprosthetic reconstruction following wide resection.^{2 5} The reported 5-year survival rates of these implants vary from 67% to 90%.² The potential complications for this reconstruction option are aseptic or septic loosening, periprosthetic

fracture, patella-associated complications, infection and prosthetic or component fracture.^{2 3 6} Patella-associated complications include patellar impingement on the tibial polyethylene, patella baja and alta, osteonecrosis, fracture, dislocation, loosening of the patellar component, patellar pain requiring revision, and avulsion of the patellar tendon.³ In their analysis of their 43 cases, Schwab *et al*³ reported one case of patella dislocation following distal femur replacement for a malignant tumour. This is the only reported case of patella dislocation following distal femur replacement in the English literature, to the best of our knowledge. The treatment procedure and rehabilitation schedule for patella dislocation have not been reported.

The procedures to treat patella dislocation after a conventional TKA are categorised into two groups: soft tissue correction with or without osteotomy. These are candidate procedures.

Complete replacement of the whole implant is a third candidate procedure.

Regarding our patient's non-operated site and referring to her preoperative circumstances and preoperative CT, she may have avoided lateral dislocation of her patella by unconscious femoral rotation. Her preoperative CT showed that her femur was rotated to the lateral aspect of the patella. If her implant was a rotating-hinge endoprosthesis, her dislocation could possibly have been avoided.

Figure 2 Postoperative anteroposterior (A) and lateral (B) radiographs after primary distal femur replacement with no evidence of patella dislocation.

We chose the modified Merkow's procedure of proximal realignment of the quadriceps without osteotomy⁴ for three reasons. First, the Q-angle was within normal limitations. Second, a large part of the bone-marrow cavity was occupied by

Figure 4 Eighteen months after the secondary patella realignment operation. Anteroposterior (A) and lateral (B) radiographs and the postoperative CT (C) demonstrated good congruence.

the stem of the tibial component. The firm fixation of the osteotomised tibial tubercle was thus difficult. We rejected the soft tissue correction procedure with osteotomy. Third, it was essentially impossible for us to predict the muscle balance after the tumour resection and distal femur reconstruction with a rotating-hinge endoprosthesis. In addition, a complete replacement of the implant could have been very invasive. From 6 weeks after the operation and as of the time of this writing, 18 months later, the patient has shown that she can walk up and down stairs without any support.

Unconscious femoral rotation, insufficient balancing of soft tissues at the time of closure, and a semirotating hinge implant are thought to be the reasons for the postoperative patella dislocation of this patient. Intraoperative patella tracking was normal in this case. The patient's lateral soft tissues tightened up to cover the implant with muscles with good blood flow. Thus, the limitation of unconscious femoral rotation and the scarring of the tightened-up lateral soft tissues facilitated the patella dislocation.

It is very difficult to predict the postoperative patella tracking of a patient who has been engaged in unconscious femoral rotation. If we note the unconscious femoral rotation at the time of preoperative planning for tumour resection and distal femur replacement, a rotating hinge system must be used, not a semirotating hinge system. If a rotating hinge system is not available, the proximal realignment of quadriceps procedure at the time of tumour resection and distal femur replacement should be considered. A free musculocutaneous flap to cover the implant is also worth considering in such cases.

We conclude that it is very important for the proper clinical outcome of a distal femur replacement to focus on not only the tumour resection but also the anatomical features of the knee of each patient.

Figure 3 One month after the primary operation. Anteroposterior (A) and lateral (B) radiographs showing patella dislocation. The postoperative CT (C) revealed that the patella groove of the femoral component was too shallow and narrow to stabilise the patella in the normal track.

Learning points

- ▶ Encountering patella dislocation following distal femur replacement, a salvage operation should be considered positively.
- ▶ A medial plication and lateral release procedure was effective to treat our patient's persistent patellar subluxation after distal femur replacement following malignant tumour resection.
- ▶ A treatment for patella dislocation following distal femur replacement significantly improved the patient's gait function.

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Competing interests None.

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