Transverse Stress Fracture of the Proximal Patella
A Case Report

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Abstract: Among stress fractures associated with sports activities, patellar stress fracture is rare. Regarding patella stress fractures, so far only distal transverse or lateral longitudinal fractures have been reported, but there are no reports of transverse fractures occurring in the proximal patella. We describe an extremely rare case of transverse stress fracture of proximal patella in a 9-year-old athlete.

A 9-year-old boy, who participated in sports (sprints and Kendo) presented with left knee pain without any external injury. In plain radiographs, a fracture line was observed in the proximal 1/3 of the left patella, and a patella stress fracture was diagnosed. For treatment, because 7 months of conservative therapy showed no improvement, internal fixation was carried out using Acutrak screws, and bone union was thus achieved. Three months after the operation, he was able to return to his previous level of athletic sports activity.

Regarding the mechanism of onset, it is believed that the causes are longitudinal traction force and patellofemoral contact pressure. On the other hand, the contact region of the patella with the femur changes with longitudinal traction force and patellofemoral contact pressure at a flexion angle of >90°, so it is believed that it occurred as a clinical condition from being subjected to repeated longitudinal traction force and patellofemoral contact pressure at a flexion angle of >90°, during the sports activities of sprints and Kendo. The nonunion of the transverse stress fracture of his proximal patella was successfully treated with internal fixation using Acutrak screws.

INTRODUCTION

Stress fractures are common injuries most often associated with the participation in sports involving running, jumping, or repetitive stress.1–3 In comparison with other locations of stress fractures, patellar stress fractures are rare. A patellar stress fracture was first described in a German journal by Muller in 19434 and in an English journal by Devas in 1960.5 Stress fractures of the patella have been described to be represented by 2 different types; those with a longitudinal fracture of the lateral part and those with a transverse fracture of the distal or middle part.6 To our knowledge, no report about a stress fracture of the patella has described a transverse fracture of the proximal part. In this report, we describe a case of an extremely rare type of patellar stress fracture, a “proximal transverse fracture”, in a 9-year-old athlete.

METHOD

This was a case report. Informed consent was obtained from the patient and his parents.

Case Report

A 9-year-old boy participated in various sports, including running sprints twice per week for 1.5 years, and engaging in Kendo twice per week for 3 years. He presented at a nearby orthopedic clinic 1 month after experiencing left knee pain while playing these sports, without any injury event. He had no subcutaneous hemorrhage and no external injury at the first visit to the clinic. His left knee radiograph showed a transverse fracture of the left proximal patella and a right knee radiograph showed no evidence of fracture (Figure 1), and he was therefore diagnosed to have a transverse stress fracture of the left proximal patella. The femorotibial angle of the left knee was 174° and that of the right knee was 176°. The Insall and Salvati ratio of the left knee was 0.91 and that of the right knee was 0.97. The ratios of both knees revealed that his patellae were of normal height. The roentgenographic patellofemoral congruence was almost normal, because the sulcus angle of the left knee was 138° and the congruence angle was 5°. He was treated conservatively for 7 months, with inhibition from playing sports, but without immobilization, such as cast fixation or bracing. However, his left knee pain did not disappear, so he presented to our hospital for treatment.

A physical examination revealed no ligamentous laxity, no effusion, no range of motion deficit in his left knee and mildly localized tenderness at the left proximal patella. His left knee radiograph showed a transverse fracture of the proximal patella with nonunion (Figure 2). We made a diagnosis of nonunion of a proximal transverse patellar stress fracture and performed surgery. A 2-cm anterior longitudinal incision was made over the superior portion of the patella. The left proximal patellar stress fracture was drilled with a 0.88-mm K-wire for freshening of the nonunion portion and was internally fixed using Acutrak mini screws (Acumed, Hillsboro, OR). Three months after the operation, he had returned to his previous level of sports activity without any complaints. Six months after the operation, the left
patella fracture was completely united (Figure 3). At 2 years
postoperatively he has had no recurrence.

DISCUSSION
The location of stress fractures in adult athletes was
reported to be the following: 49.1% in the tibia, 25.3% in
the tarsal bones, 8.8% in the metatarsal bones, 7.2% in the
femur, 6.6% in the fibula, 1.6% in the pelvis, 0.9% in the
sesamoids, and 0.6% in the spine; in children, these were 47%
in the tibia, 21% in the fibula, 12% in the femur, 9% in the
radius, 9% in the metatarsals, and 3% in the humerus. Stress
fractures of the patella are rare. There have been 22 case
reports of patellar stress fractures in athletes published in the English
literature since 1960. The previously reported cases in the
English literature have described 2 different types: a
longitudinal fracture type and a transverse fracture type. The longitudinal fractures were described in 6 case reports, all of which were located in the lateral part. Transverse fractures were described in the other 16 case reports, 14 of these cases were located in the distal 1/3 and 2 cases were located in the middle 1/3.8 In our case, the fracture was located in the proximal 1/3. This appears to be an extremely rare type of patellar stress fracture.

Patellar stress fractures have been reported in athletes including soccer players, basketball players, and runners.8,9 These sports activities involve the high frequency use of the knee extensor mechanism, repetitively increasing the patellofemoral joint reaction force and patellofemoral contact pressure.6,8 This mechanism is related to the occurrence of the stress fracture of the patella. The present case ran sprints and performed Kendo. Kendo is Japanese fencing, and athletes step forward and backward repetitively.10 As it was demonstrated that an increased patellofemoral joint reaction force was dependent on the increase of the knee flexion angle,11 we think that the repetitive increase in the patellofemoral joint reaction force due to the Kendo, in addition to the sprints, is 1 factor associated with the development of the transverse stress fracture of his left patella.

It was previously reported that the contact area of the patella articular surface against the femoral surface was different from the flexion angle of the knee.12,13 For example, if the knee was flexed at 30°, 60°, and >90 to 120°, the patella surface contact, respectively, was in the distal 1/3 area, middle 1/3 area, and proximal 1/3 area. In the present case, the transverse stress fracture occurred in the proximal patella, whereas most reported locations of the transverse stress fractures of the patella were in the distal 1/3. The radiograph of left lateral patellar view taken 6 months after the operation (Figure 3) revealed a subtle, shallow radiolucent area at proximal patella, which may have been the contact point for the creation of the stress fracture. We suggest that the repetitive motion with >90° of left knee flexion during sprinting and while performing Kendo caused the transverse stress fracture of his left proximal patella, because these motions increased the patellofemoral contact pressure for the proximal patellar articular surface, in addition to repetitively increasing the patellofemoral joint reaction force, including the longitudinal traction force for the patella.

Some methods of surgical treatment for patellar stress fractures have been reported. Internal fixation with the tension band technique,14 the cannulated screw technique,15 curettage, bone grafting, or drilling have all been reported. In our case, 7 months of conservative treatment, including no sports activities, did not improve the left knee pain. We therefore performed surgical treatment by means of drilling and internal fixation using the cannulated screw technique with Acutrak screws for the left knee, because the patient had a nonunion of the proximal patellar transverse stress fracture. Postoperatively, the patient was able to return to his previous level of athletic sports activity. Therefore, we think that we could successfully treat the nonunion of a transverse stress fracture of the proximal patella with internal fixation using Acutrak screws.

CONCLUSION

We herein reported an extremely rare case of transverse stress fracture of the proximal patella. We believe that the repetitive motion with 90° left knee flexion induced by running sprints and participating in Kendo caused the transverse stress fracture of the patient’s left proximal patella, because these motions increased the patellofemoral contact pressure for the proximal patellar articular surface, in addition to repetitively increasing the patellofemoral joint reaction force, including the longitudinal traction force on the patella. The nonunion of the transverse stress fracture of his proximal patella was successfully treated with internal fixation using Acutrak screws, and he was able to return to his previous level of athletic sports activity postoperatively.
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