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REVIEW ARTICLE

Acute and old ruptures of the extensor apparatus of the knee in adults (excluding knee replacement)

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Summary Rupture of the extensor apparatus of the knee in adults is infrequent and dominated by patellar fracture, which in our experience is six times as frequent as quadriceps or patellar tendon tear. Patellar fracture poses few diagnostic problems and treatment is now well codified. Tension-band osteosynthesis is generally used, involving two longitudinal K-wires and wire in a figure-of-eight pattern looped over the anterior patella; sometimes, for more complex fractures, cerclage wiring is added to the tension band. Non-union is rare and generally well tolerated. Quadriceps tendon tear mainly affects patients over 40 years of age, in a context of systemic disease. Diagnosis is easily suggested by inability to actively extend the knee, but is unfortunately still often overlooked in emergency. In most cases, early surgical management is needed to reinsert the tendon at the proximal pole of the patella by bone suture. For chronic lesions, it is often necessary to lengthen the quadriceps tendon by V-Y plasty or the Codivilla technique. Patellar tendon tear, on the other hand, typically occurs in patients under 40 years of age, often involved in sports. Diagnosis is again clinically straightforward, but again may be missed in emergency, especially in case of incomplete tear. Surgery is mandatory in all cases. The procedure depends on the type of lesion: either end-to-end suture or transosseous reinsertion. In most cases repair is protected by tendon augmentation. Old lesions often require tendon graft or a tendon-bone-tendon-bone graft taken from the opposite side.

Introduction

The knee-extensor apparatus comprises the quadriceps, patella and patellar ligament. Rupture may involve any of these, and usually results in failure of active extension of the knee, with highly disabling functional consequences. Frequency varies according to reports, but is generally considered low, especially for quadriceps tendon and patellar ligament tear. The 21-year experience of our department totals 102 quadriceps tendon avulsions, 98 patellar ligament tears and 600 patellar fractures. Quadriceps lesions classically involve rectus femoris lesions at the proximal insertion onto the antero-inferior iliac spine and distal

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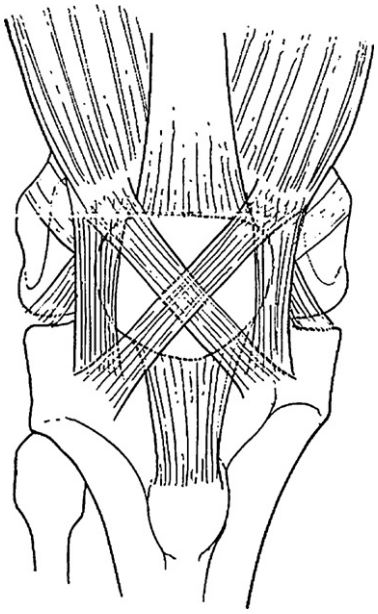

Figure 1 Diagram of knee-extensor apparatus with anterior vastus expansion.

Figure 2 Patella bipartita.

insertion onto the vastus intermedius aponeurosis; as they have little impact on knee extension, they will not be dealt with in this update.

Knee-extensor apparatus anatomy and biomechanics

The quadriceps or femoral muscle is the extensor of the knee. When the knee is in hyperextension, the quadriceps is not required to maintain upright posture, but acts strongly to prevent falling as of the first degrees of flexion.

The quadriceps comprises four muscles, ending in a common tendon on the anterior tibial tuberosity [1]: three single-joint muscles —vastus intermedius, lateralis and medialis, which are purely extensors— and one double-joint muscle, the rectus femoris, which contributes only one-fifth of the total quadriceps force, so that tearing has little impact on knee extension force.

The patella is a sesamoid bone, part of the knee-extensor apparatus (Fig. 1). The quadriceps tendon, terminating the three vasti and the rectus femoris, is inserted onto its proximal side, and the patellar ligament, stretched between the anterior side of the patella and the anterior tibial tuberosity, is inserted at its distal pole. It enhances quadriceps action, shifting traction force forward. Expansion of the vasti and fascia lata passes forward of the patella, forming the classic fibrous pre-patellar fascia, which is involved in knee extension (Fig. 1). The patellar wings contribute to its mediolateral stability. The superior three-quarters of the posterior side is covered by very thick cartilage and has two facets, medial and lateral, separated by a blunt vertical crest; 2 to 3% of the population have an accessory ossification node at the craniolateral angle, not integrated at end of growth, known as patella bipartita (Fig. 2).

Patellar fractures

Mechanism

Fracture may be caused by direct or indirect trauma. Direct trauma is a shock to the anterior side of the knee in falling; it involves patellar compression, resulting in comminutive or stellate fracture. Although frequently without displacement, there may be major associated cartilage damage [2].

Indirect trauma involves knee-extensor apparatus tension, which may fracture the patella if it exceeds bone resistance [3].

Classification

Classification should consider on the one hand fracture displacement and on the other the location of the fracture line or lines. A fracture may be said to be displaced if there is a step and/or inter-fragment space exceeding 2 or 3 mm. In terms of fracture-line (Fig. 3), fractures interrupting extensor apparatus continuity (transverse [Fig. 4], comminutive [Fig. 5], superior and inferior pole fracture-avulsion [4]) and those which do not hinder extension (sagittal and fragmented fracture) are to be distinguished.

Duparc's classification, referred to by Neyret [5], distinguishes three types of fracture: type 1, with a simple transverse line usually at the junction between the proximal two-thirds and distal third, without posterior joint-surface compaction and with variable displacement; type 2, with a type-1 transverse line associated with compaction or comminution of the distal fragment with the proximal fragment intact or at worst with a non-displaced fracture line; type 3, with compaction of the entire joint surface, stellate (comminutive) fracture and osteochondral fragments molded onto the femoral trochlea.