



Original Article

Radiographic analysis of factors predisposing toward tendon tears in the knee extensor mechanism ☆,☆☆

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ABSTRACT

Objectives: to review radiographs of patients who suffered tendon tears of the knee extensor apparatus and observe alterations that might be factors predisposing toward this type of injury.

Methods: we retrospectively analyzed 60 cases of injury to the knee extensor mechanism that were treated surgically at the Miguel Couto Municipal Hospital between March 2004 and March 2011. Four patients were excluded due to poor quality of the examination.

Results: of the 56 patients evaluated, 23 were considered to be normal and 33 presented radiographic alterations. Among these, eight (24.3%) presented suprapatellar osteophytes alone; seven (21.2%), infrapatellar calcification; seven (21.2%), suprapatellar calcification; six (18.2%), supra- and infrapatellar osteophytes; and five (15.1%), infrapatellar osteophytes alone.

Conclusion: radiographic alterations were frequently observed in patients with extensor mechanism tears.

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Análise radiográfica de fatores predisponentes às rupturas tendinosas do mecanismo extensor do joelho

RESUMO

Objetivos: revisar radiografias de pacientes vítimas de rupturas tendinosas do aparelho extensor do joelho e observar alterações que possam ser um fator predisponente a esse tipo de lesão.

Métodos: analisamos, retrospectivamente, 60 lesões do mecanismo extensor do joelho, tratadas cirurgicamente no Hospital Municipal Miguel Couto, de março de 2004 a março de 2011, e quatro pacientes foram excluídos por má qualidade do exame.

Palavras-chave:

Traumatismos do joelho

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Resultados: dos 56 pacientes avaliados, 23 foram considerados normais e 33 apresentaram alterações radiográficas, oito (24,3%) com presença de osteófito suprapatelar isolado, sete (21,2%) com calcificação infrapatelar, sete (21,2%) com calcificação suprapatelar, seis (18,2%) com osteófitos supra e infrapatelares e cinco (15,1%) com osteófito infrapatelar isolado.

Conclusão: as alterações radiográficas foram frequentes em pacientes com ruptura do mecanismo extensor.

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Introduction

Muscle-tendon tears of the knee extensor mechanism are rare but highly incapacitating injuries. Many comorbidities, such as excessive sports activity (overuse injuries) and chronic use of corticosteroids, among others, predispose toward occurrences of this type of injury.¹

The diagnosis of tearing of the knee extensor mechanism is basically clinical. Imaging examinations provide complementary information that helps in surgical planning and in detecting any predisposing factors for the etiology of such injuries. The injury mechanism generally comes from knee trauma, and radiography is the first examination to be requested in order to rule out occurrences of fractures. In addition, radiographs are useful for measuring the height of the patella, in comparison with the contralateral side.

The aims of this study were to make an analysis of knee radiographs from patients who had suffered tendon tears of the extensor mechanism and to observe whether there were any abnormalities that might predispose toward occurrences of this type of injury, such as osteophytes or calcifications.

Methods

Sixty cases of injury to the knee extensor mechanism that had been treated surgically at a trauma hospital between March 2004 and March 2011 were analyzed retrospectively. An active search was conducted in the database of the Miguel Couto Municipal Hospital, using the International Classification of Diseases (ICD) code M66, which corresponds to spontaneous tears of the synovial membrane or tendon. Then, from the patient's registration number at the hospital, the respective imaging files were consulted.

The inclusion criteria were that the patients could be of either gender and of all ages, who underwent surgical treatment for tendon tears of the knee extensor mechanism, independent of whether they had any associated injuries or comorbidities. Patients treated using nonsurgical methods were excluded, but none of the patients were treated conservatively during this period, and the surgical indication was determined from the deficit of active extension. Four patients whose radiographs were of poor quality that made proper assessment difficult were excluded from the study. Age, gender, side, comorbidities and injury location were taken into consideration. All the radiographs in anteroposterior and lateral view of the knee were evaluated by a doctor with a PhD who is a member of the Brazilian Society of Knee Surgery.

Since surveying the cases was based on the diagnosis of tendon injury and not on the extensor mechanism injury, it was not necessary to exclude cases of patellar fracture, given that these were not included in the study at any stage.

Among the 56 patients who were actually included in the study, 51 (91%) were men and five (9%) were women, and their mean age was 42 years (range: 10–80 years). From subdividing the mean age according to the region affected, the mean age of the patients with quadriceps tendon injuries was 47 years and the mean age of those with patellar ligament injuries was 34 years. Regarding the knee in which the injury occurred, 34 cases were on the left side and 22 on the right side. Six patients presented clinical comorbidities: four with diabetes mellitus and two with renal insufficiency. Two patients presented sequelae of Osgood–Schlatter disease and three had bilateral lesions.

The descriptive analysis presented the observed data in the form of tables. The data were expressed as mean \pm standard deviation (SD) for numerical data and as frequency (*n*) and percentage (%) for categorical data. Graphs were constructed to illustrate the relative distribution of the radiological alterations. The statistical analysis was processed using the SAS® System statistical software, version 6.11 (SAS Institute, Inc., Cary, North Carolina, USA).

Results

Regarding the location of the injury, 31 patients presented quadriceps tendon tears and 25 had patellar ligament tears. In relation to the radiographic alterations, it was observed that 23 knees were normal and 33 presented abnormalities on the images. Among the latter, the most prevalent abnormality was suprapatellar osteophytes alone, which were present in eight patients (24.3%), followed by alterations of infrapatellar calcification and suprapatellar calcification, with 21.2% each (seven patients) (Table 1). Six patients (18.2%) presented supra- and infrapatellar osteophytes and five (15.1%) had infrapatellar osteophytes alone.

Table 2 shows the general data from the sample.

Discussion

Most studies that have reported on extensor system tears with radiographic evaluations have focused on the alterations caused by the injury, such as changes to the position of the patella, fractures and avulsions. So far, there are no studies in the Brazilian literature correlating radiographic alterations suggestive of risk factors to knee extensor system injuries.

Table 1 – Characteristics of the sample.

Variable	n	%
Age (years)	42 ± 16 (10–80)	
Sex		
Male	51	91.1
Female	5	8.9
Side		
Right	22	39.3
Left	34	60.7
Location		
Quadriceps	31	55.4
Patella	19	33.9
Patella/TAT	5	8.9
Patella/sleeve fracture	1	1.8
Radiography		
Altered	33	58.9
Normal	23	41.1
Type of radiological alteration		
Infrapatellar calcification	7	21.2
Suprapatellar calcification	7	21.2
Infrapatellar osteophytes	5	15.1
Suprapatellar osteophytes	8	24.3
Supra/infrapatellar osteophytes	6	18.2
Comorbidity		
Present	8	14.3
Absent	48	85.7
<i>Age was expressed as mean ± standard deviation (minimum–maximum)</i>		
Source: Miguel Couto Municipal Hospital, 2012.		

Albuquerque et al. conducted an epidemiological study on tendon injuries of the knee extensor system.² These injuries were observed to be infrequent, even though their study was conducted at an open emergency service. Our results confirmed these findings. However, in our study, we attempted to find evidence of radiographic alterations that might indicate factors predisposing toward these injuries.

We observed that quadriceps tendon tears occurred more often than patellar ligament tears, which is concordant with the literature. In our sample, men were more commonly affected, which corroborates the literature data.² Although women present greater ligament laxity and have hormonal alterations relating to the menstrual cycle, we believe that because men have greater physical strength, they are more susceptible to tearing of the knee extensor mechanism. Our series showed that quadriceps tendon tears occurred in patients who were older than those with patellar ligament tears, which again confirms the epidemiological data in the literature.³

Several authors have suggested that structural alterations to the tendon, resulting from microtrauma or degeneration within the substance, are involved in the genesis of these traumatic tears.^{4–6} However, many other researchers have hypothesized that direct trauma to the knee is the cause of patellar injuries in healthy patients.^{7,8} In our sample, there were only six patients with associated diseases, which potentially favors occurrences of degenerative alterations in tendons, in general. Based on this low statistic, we take the side of the theory that direct trauma is the main injury

mechanism, although we agree that structural alterations may contribute toward increasing the risk of injuries to the knee extensor mechanism.

Many imaging examinations can be used as diagnostic tools in investigating injuries to the knee extensor mechanism. Nonetheless, we believe that radiography of the knee (trauma series), associated with detailed clinical examination, presents good accuracy in diagnosing tendon tears of the knee extensor mechanism, as well as having a low cost. Heyde et al.⁹ recommended ultrasonography for injuries to the knee extensor mechanism. However, we did not use this because it is an examiner-dependent examination and we do not routinely do this in our institution. Likewise, magnetic resonance is not used, because we do not have this examination available at our hospital. It should be emphasized that, despite the diversity of imaging examinations and the medical-legal calls for such examinations to be requested, which are increasingly common nowadays among the public, the diagnosis of knee extensor mechanism tears is basically clinical.

In a study on the radiographic diagnosis of quadriceps tears, Newberg and Wales¹⁰ observed that radiologists did not make the correct diagnosis in any of their cases. According to these authors, lateral-view radiographs provide evidence suggesting occurrences of tearing of the quadriceps, such as calcification of the quadriceps, suprapatellar osteophytes, suprapatellar effusion and lack of definition of the quadriceps density. Calcification of the quadriceps and avulsion of patellar fragments have been noted in several reports as factors that predispose toward tearing of the knee extensor mechanism. In metabolic diseases, the likely factor is dystrophic calcification. On the other hand, neglected injuries of the quadriceps show suprapatellar calcification resulting from bone formation from the hematoma. However, most tears of the knee extensor mechanism come from degenerative alterations of the tendon or suprapatellar osteophytes.¹⁰

Kaneko et al.¹¹ suggested that these radiographic alterations, observed after tearing of the quadriceps tendon, should be considered as factors predisposing toward occurrences of tears of the knee extensor mechanism, and we agree with this thinking. These authors observed that obliteration of the quadriceps tendon occurred in 100% of the patients with quadriceps tendon tears. Moreover, a suprapatellar mass and suprapatellar calcification were seen in 67%, suprapatellar osteophytes in 44%, low patella in 56% and joint effusion in 28% of the cases in their study. All the patients presented some type of alteration that could predispose toward such injuries.

Ramsey and Muller¹² observed that, in elderly or obese patients, there were preexisting degenerative alterations in the tendon that would facilitate tendon tearing of the knee extensor mechanism. There are many comorbidities that predispose toward the risk of tearing of the knee extensor mechanism. In our hospital, because it deals with open emergencies and is a referral center for trauma, it was observed that only a small number of the patients had comorbidities. We believe that if this was a quaternary-level hospital, this sample could increase in size. The patients would be treated through other specialties and, in the case of extensor mechanism injuries, the base hospital would be the reference point.

The differential diagnosis of the radiographic findings comprises synovial osteochondromatosis, synovial sarcoma and

Table 2 – General data from the sample.

Patient	Age	Sex	Side	Location	Radiograph	Comorbidities
1	24	M	R	Quadriceps	Suprapatellar calcification	No
2	34	F	R	Patella	Normal	No
3	35	M	R	Patella	Infrapatellar osteophytes	No
4	40	M	L	Quadriceps	Supra/infrapatellar osteophytes	No
5	65	M	R	Patella	Normal	No
6	34	M	R	Patella	Infrapatellar calcification	No
7	48	M	L	Quadriceps	Suprapatellar calcification	No
8	45	M	L	Quadriceps	Normal	Diabetes
9	45	M	R	Quadriceps	Normal	Diabetes
10	19	M	R	Patella/TAT	Normal	No
11	42	F	R	Quadriceps	Suprapatellar osteophytes	No
12	56	M	R	Quadriceps	Suprapatellar osteophytes	No
13	33	M	L	Patella	Infrapatellar osteophytes	No
14	28	M	L	Quadriceps	Normal	No
15	48	F	R	Patella	Normal	No
16	42	M	L	Quadriceps	Suprapatellar osteophytes	No
17	52	M	L	Patella	Supra/infrapatellar osteophytes	No
18	57	M	L	Quadriceps	Suprapatellar osteophytes	No
19	54	M	L	Patella	Infrapatellar calcification	No
20	10	M	R	Patella/sleeve fracture	Normal	No
21	80	M	L	Quadriceps	Supra/infrapatellar osteophytes	No
22	49	M	L	Patella/TAT	Infrapatellar calcification	No
23	43	M	L	Quadriceps	Normal	No
24	52	M	L	Patella	Infrapatellar calcification	No
25	60	M	L	Quadriceps	Suprapatellar calcification	No
26	66	M	L	Quadriceps	Suprapatellar calcification	No
27	48	M	R	Quadriceps	Suprapatellar osteophytes	No
28	40	M	L	Patella	Normal	No
29	42	M	R	Quadriceps	Normal	No
30	35	M	L	Quadriceps	Normal	No
31	50	M	R	Quadriceps	Supra/infrapatellar osteophytes	No
32	60	M	R	Quadriceps	Suprapatellar osteophytes	No
33	35	M	L	Patella	Normal	No
34	52	M	L	Quadriceps	Supra/infrapatellar osteophytes	Osgood-Schlatter
35	35	M	R	Patella	Infrapatellar osteophytes	No
36	45	M	L	Quadriceps	Suprapatellar osteophytes	No
37	26	M	R	Patella	Infrapatellar osteophytes	No
38	47	M	L	Quadriceps	Suprapatellar calcification	No
39	20	M	L	Patella	Normal	No
40	34	M	L	Quadriceps	Suprapatellar calcification	No
41	36	M	L	Quadriceps	Normal	No
42	22	M	L	Patella	Normal	No
43	62	M	L	Quadriceps	Suprapatellar osteophytes	No
44	47	M	L	Patella	Infrapatellar calcification	No
45	38	M	R	Patella	Infrapatellar osteophytes	No
46	15	M	L	Patella/TAT	Infrapatellar calcification	Osgood-Schlatter
47	29	M	L	Patella	Normal	No
48	25	M	R	Quadriceps	Normal	No
49	74	M	L	Quadriceps	Normal	Diabetes
50	74	M	R	Quadriceps	Supra/infrapatellar osteophytes	Diabetes
51	37	M	L	Quadriceps	Normal	No
52	13	F	L	Patella/TAT	Normal	No
53	13	F	R	Patella/TAT	Normal	No
54	49	M	L	Patella	Infrapatellar calcification	Renal insufficiency
55	49	M	R	Quadriceps	Suprapatellar calcification	Renal insufficiency
56	38	M	L	Quadriceps	Normal	No

M, male; F, female; R, right; L, left.

Source: Miguel Couto Municipal Hospital, 2012.

myositis ossificans. For this reason, we believe that because orthopedists have the possibility of making detailed clinical examinations, together with radiographic analysis, they should be the main specialists responsible for diagnosing

these injuries. In cases of partial injury of the knee extensor mechanism, the height of the patella may not be modified. Therefore, we believe that sometimes it is better for radiologists not to diagnose these injuries.¹⁰ In the study

by Kaneko et al.,¹¹ from the radiologists' analysis, only six knees were correctly diagnosed with quadriceps tears, while 12 knees had wrong diagnoses. Kaneko et al.¹¹ concluded that if the radiographic alterations had been analyzed more attentively, there would have been greater accuracy in making the primary diagnosis of quadriceps tears.

We believe that our sample was representative and that, through this study, an attempt to achieve better understanding of occurrences of these injuries has been made. This study has also shown radiographic alterations that predispose toward these injuries and might indicate some prevention measures of greater effectiveness. Our thinking is that if the radiographic alterations signaled in this series are observed, even in a healthy patient, actions for preventing tearing of the knee extensor mechanism should be implemented. These conservative actions could encompass stretching, physiotherapy and body weight control, among others.

Conclusion

Radiographic alterations occurred frequently in cases of tearing of the knee extensor mechanism.

Conflicts of interest

The authors declare no conflicts of interest.

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