

# EPIDEMIOLOGICAL STUDY ON TENDON RUPTURES OF THE KNEE EXTENSOR MECHANISM AT A LEVEL 1 HOSPITAL

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## ABSTRACT

**Objectives:** The purpose of the present study was to review the epidemiological aspects of tendon ruptures of the knee extensor apparatus at a level 1 hospital. **Methods:** We retrospectively analyzed 76 lesions of the knee extensor apparatus that were treated surgically at the Miguel Couto Municipal Hospital between March 2004 and March 2011. We took into consideration age, sex, trauma mechanism, anatomical classification of the lesion, affected side, comorbidities and associated lesions. **Results:** Among the patients studied, 68 were male and the mean

age was 36 years. Regarding the trauma mechanism, 62 lesions occurred due to direct trauma; the right side was affected in 21 cases; eight presented comorbidities and four presented associated lesions. **Conclusion:** The majority of the patients were male, at an economically active age (young people), and were victims of direct trauma. Ruptures of the patellar ligament were the most frequent lesions. Associated lesions were rare and comorbidities were infrequent in our sample.

**Keywords**– Epidemiology; Knee; Rupture

## INTRODUCTION

Extensor mechanism injuries of the knee are rare. There are numerous comorbidities that predispose to the occurrence of this type of injury. Excessive sports activity and the chronic use of certain medications also facilitate tendon ruptures.

Epidemiological studies are fundamental tools for understanding the occurrence of the injury. In this study, we observe age, sex, and the most frequent type of injury, as well as the risk factors that should be observed in the prevention of extensor mechanism injuries of the knee. The aim of this work is to carry out a retrospective epidemiological study of tendon ruptures of the extensor mechanism of the knee at a level I trauma hospital.

## METHODS

Seventy-six knee extensor mechanism injuries, treated surgically at a level I trauma hospital in the

period March 2004 to March 2011, were retrospectively analyzed. The research was carried out through an active search on the database of the Hospital Municipal Miguel Couto (HMMC), using the search term International Classification of Diseases (ICD) M66, which corresponds to spontaneous rupture of synovium or tendon. After that, based on the patient's record number at the HMMC, a search was carried out on the medical records and image archives of the respective patients. The inclusion criteria were patients of both sexes and all ages, submitted to surgical treatment for tendon ruptures of the knee extensor mechanism, regardless of whether they had associated lesions or comorbidities. Those treated by a non-surgical method were excluded, as were those whose patient record and/or imaging exams were missing some item of data considered in our work. Tendon ruptures in other regions were also excluded from our analysis. Age, sex, affected side, comorbidities, trauma mechanism

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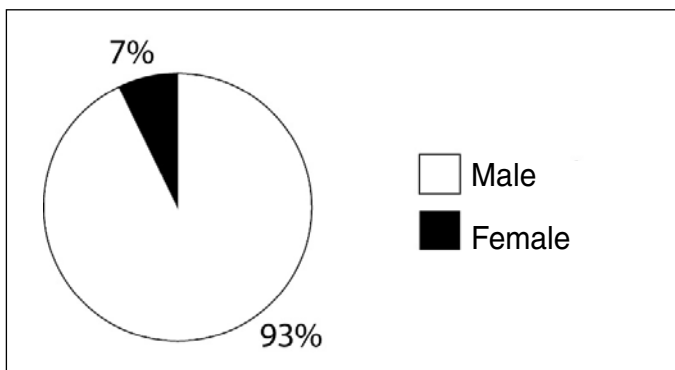
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and anatomical classification of the lesion were taken into consideration. Extensor mechanism injuries of the knee are classified as: rupture of the quadriceps tendon, fracture of the patella, rupture of the patellar ligament, and fracture of the tibial tuberosity<sup>(1)</sup>. All the patient records and radiographs in anteroposterior and profile projections of the knee were assessed by a doctor with a PhD, member of the Brazilian Society of Knee Surgery. The results were assessed by mean and frequency of occurrence.

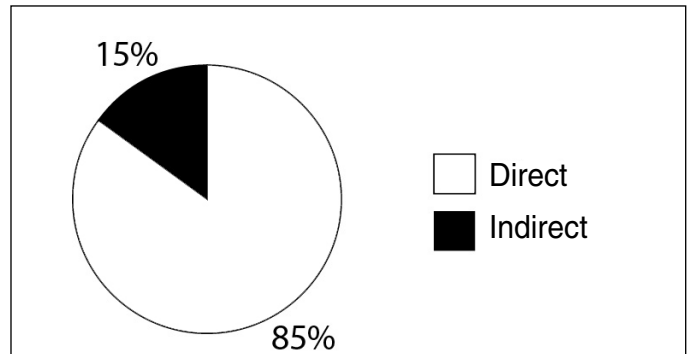
Of the 76 patients assessed, three were excluded from the analysis because their medical records and/or imaging exams had incomplete data in relation to the topics considered in the present study. This exclusion was due to failure to obtain information relating to the trauma mechanism of the injury. During the period of the study, there were no individuals treated by non-surgical means. In all, 73 patients were effectively included in our analysis. This study is in accordance with the Helsinki Declaration of the World Medical Association.

**RESULTS**

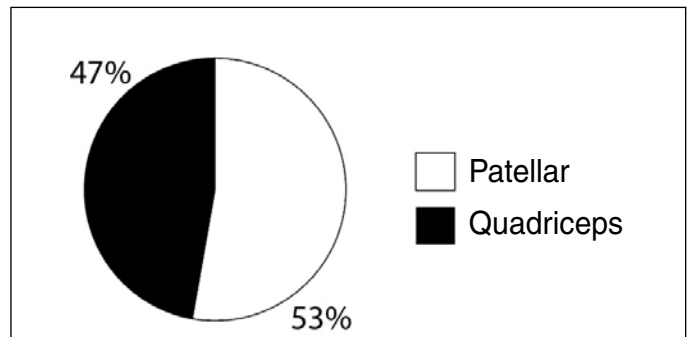
Of the 73 patients, 68 were male and five were female (Figure 1), and the mean age was 36 years (minimum of 10 and maximum of 80 years). In relation to the mechanism of the injury, 62 were by direct trauma and 11 were by indirect mechanism (Figure 2); 39 patients presented rupture of the patellar ligament, versus 34 with rupture of the quadriceps tendon (Figure 3); 52 cases were on the left side, and 21 were on the right side (Figure 4); 29% of the injuries occurred in the muscle belly, 26% in the lower patellar pole, 22% in the osteotendinous junction, 12% in the tibial tuberosity, 7% in the tendon substance, and 4% were sleeve fractures (Figure 5); eight patients presented



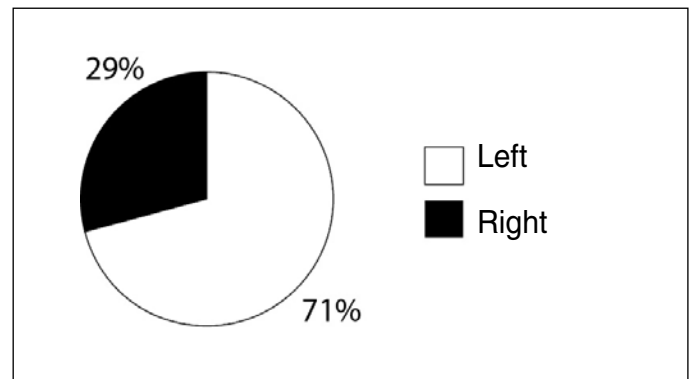
**Figure 1** – Distribution by sex.  
Source: Hospital Municipal Miguel Couto, 2011.



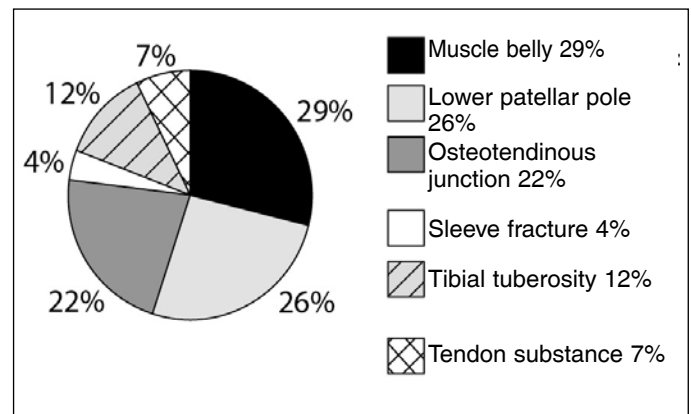
**Figure 2** – Trauma mechanism.  
Source: Hospital Municipal Miguel Couto, 2011.



**Figure 3** – Affected region.  
Source: Hospital Municipal Miguel Couto, 2011.



**Figure 4** – Affected side.  
Source: Hospital Municipal Miguel Couto, 2011.



**Figure 5** – Site of the injury.  
Source: Hospital Municipal Miguel Couto, 2011.

comorbidities, two with bilateral lesions, and four with associated lesions. Chart 1 shows the general sample of the case series.

## DISCUSSION

The knee extensor mechanism injuries include patellar fractures and tendon lesions of the extensor apparatus. Patellar fractures are more frequent than tendon ruptures, with rates of 17/1 and 43/1, respectively<sup>(2)</sup>. For this reason, patellar fractures were excluded, in order to better understand the epidemiology of tendon ruptures of the extensor mechanism of the knee. There is no literature to date on the epidemiology of knee extensor mechanism injuries.

Clayton and Court-Brown<sup>(3)</sup> carried out an epidemiological study on ligament and tendon lesions of the musculoskeletal system. This research observed a percentage of 0.6 of rupture of the patellar ligament and 1.3 of rupture of the quadriceps tendon. These results confirm our findings that these are very rare injuries, even in a level I trauma clinic.

Rupture of the patellar ligament is the third most common cause of injury of the knee extensor mechanism, surpassed in number only by patellar fractures and rupture of the quadriceps tendon. It is estimated that a force of 17.5 times the body weight is needed to cause a rupture of the patellar ligament in healthy individuals<sup>(4)</sup>. In our study, we found a higher occurrence of rupture of the patellar ligament compared with that of the quadriceps.

In our case series, males were more commonly affected, corroborating with the literature in regard to the prevalence of males over females<sup>(3)</sup>. Our view is that males, because they are physically stronger, are more susceptible to rupture of the knee extensor mechanism. Meanwhile, females have greater ligament laxity and hormonal changes due to the menstrual cycle.

Obesity is considered a predisposing factor in knee extensor mechanism injuries. Kellersmann et al<sup>(2)</sup> believe that excess weight generates a chronic overload on the patellar ligament, making it more vulnerable to rupture. In an epidemiological study, the ideal practice would be to measure the body mass index; however, injury of the extensor apparatus of the knee incapacitates the patient from remaining in the ortostatic position, balancing the lower limb equally, which makes the discharge of weight greater on the contralateral side to the injury. For this reason, these

measurements were not included in the analysis. Our view was that these measurements would be inadequately collected, generating a research bias.

The ruptures of the patellar ligament were classified according to the site of the lesion: lower patellar pole, ligament substance, and tibial tuberosity<sup>(5)</sup>. Our findings demonstrated that the lower patellar pole was the most frequent site, which corroborates with the findings in the literature<sup>(6)</sup>. In the quadriceps lesions, the most frequent site was the muscle belly. Ilan et al<sup>(7)</sup> mention the osteotendinous junction and the muscle belly as the most common sites, corroborating with our findings.

Injuries in younger patients are generally related to physical activities, generating repetitive microtraumas. In elderly patients, meanwhile, the main causal factor is degeneration of the tendon, causing it to become weak<sup>(5)</sup>. The findings in group also agreed with this assertion. In our opinion, tendinopathies caused by excessive use, in young patients, should be better assessed and treated.

Ruptures of the patellar ligament occur in patients aged under 40 years, while ruptures of the quadriceps tendon are more common in patients over 40 years<sup>(5)</sup>. Our research confirms these data.

Bilateral lesions of the knee extensor apparatus are largely related to the presence of comorbidities<sup>(7)</sup>. We did not observe this fact in this study.

There have been studies on structural changes in the tendon arising from microtraumas or degeneration of the tendon, leading to traumatic ruptures<sup>(8,9)</sup>. On the other hand, other researchers defend the view that direct traumatism of the knee is the cause of patellar lesions in healthy patients<sup>(10)</sup>. In this research, we observed a higher occurrence of patellar ligament rupture in young adults with no previous complaints or systemic diseases. For this reason, we defend direct trauma as the mechanism of injury, as demonstrated by Cree et al<sup>(11)</sup>. However, we agree that structural changes increase the risk of these injuries.

In the immature skeleton, the muscles, ligaments and tendons are generally stronger than the growth plates. For this reason, it is rare to find rupture of the tendon substance in children or adolescents. In the proximal region of the patellar ligament, the most common lesion is sleeve fracture, while in the distal region, we saw tibial tuberosity avulsion<sup>(12)</sup>. At our hospital, because it is a level I emergency hospital, we

Chart 1 – General sample of the case series.

Patient number	Age	Sex	Affected side	Injury	Injury mechanism	Location	Comorbidities	Associated injuries
1	35	M	R	Patellar	Direct trauma	Lower patellar pole	No	No
2	40	M	L	Quadriceps	Direct trauma	Osteotendinous junction	No	No
3	65	M	R	Patellar	Direct trauma	Lower patellar pole	No	No
4	34	M	R	Patellar	Direct trauma	Lower patellar pole	No	No
5	34	M	L	Patellar	Direct trauma	Lower patellar pole	No	No
6	48	M	L	Quadriceps	Direct trauma	Muscle belly	No	No
7	45	M	R	Quadriceps	Direct trauma	Osteotendinous junction	Renal failure	No
8	45	M	L	Quadriceps	Direct trauma	Osteotendinous junction	Renal failure	No
9	19	M	R	Patellar	Direct trauma	Tibial tuberosity	No	No
10	42	F	L	Quadriceps	Direct trauma	Osteotendinous junction	No	No
11	56	M	R	Quadriceps	Direct trauma	Osteotendinous junction	No	No
12	28	M	L	Quadriceps	Direct trauma	Osteotendinous junction	No	No
13	33	M	L	Patellar	Direct trauma	Lower patellar pole	No	No
14	48	F	R	Patellar	Direct trauma	Lower patellar pole	No	No
15	42	M	R	Quadriceps	Direct trauma	Osteotendinous junction	No	No
16	52	M	L	Patellar	Direct trauma	Tendon substance	No	No
17	57	M	L	Quadriceps	Direct trauma	Osteotendinous junction	No	No
18	54	M	L	Patellar	Direct trauma	Lower patellar pole	No	No
19	80	M	L	Quadriceps	Direct trauma	Muscle belly	No	No
20	49	M	L	Patellar	Indirect trauma	Tibial tuberosity	No	No
21	10	M	R	Patellar	Direct trauma	Sleeve fracture	No	No
22	15	M	L	Patellar	Direct trauma	Tibial tuberosity	No	No
23	25	M	R	Quadriceps	Direct trauma	Muscle belly	No	No
24	35	M	L	Quadriceps	Indirect trauma	Osteotendinous junction	No	No
25	34	M	L	Quadriceps	Direct trauma	Muscle belly	No	No
26	74	M	L	Quadriceps	Indirect trauma	Osteotendinous junction	Diabetic	No
27	37	M	L	Quadriceps	Direct trauma	Muscle belly	No	No
28	46	M	L	Quadriceps	Direct trauma	Osteotendinous junction	No	No
29	22	M	L	Patellar	Direct trauma	Tendon substance	Exposed	Ulnar fracture
30	42	M	R	Quadriceps	Direct trauma	Muscle belly	No	No
31	36	M	L	Quadriceps	Indirect trauma	Muscle belly	No	No
32	38	M	R	Patellar	Indirect trauma	Lower patellar pole	No	No
33	30	M	R	Quadriceps	Indirect trauma	Osteotendinous junction	No	No
34	35	M	L	Patellar	Direct trauma	Lower patellar pole	No	No
35	52	M	L	Quadriceps	Indirect trauma	Osteotendinous junction	Diabetic	No
36	45	M	L	Quadriceps	Direct trauma	Muscle belly	No	No
37	26	M	R	Patellar	Direct trauma	Muscle belly	No	Tibial fracture
38	24	M	R	Quadriceps	Direct trauma	Muscle belly	No	Exposed
39	34	F	R	Patellar	Direct trauma	Lower patellar pole	No	No
40	20	M	L	Patellar	Direct trauma	Lower patellar pole	No	No
41	66	M	L	Quadriceps	Indirect trauma	Osteotendinous junction	Diabetic	No
42	48	M	R	Quadriceps	Indirect trauma	Muscle belly	No	No
43	40	M	L	Patellar	Direct trauma	Lower patellar pole	No	No
44	49	M	L	Patellar	Direct trauma	Lower patellar pole	Renal failure	No
45	49	M	R	Quadriceps	Direct trauma	Muscle belly	Renal failure	No
46	62	M	L	Quadriceps	Indirect trauma	Muscle belly	Diabetic	No
47	47	M	L	Patellar	Direct trauma	Lower patellar pole	No	No
48	38	M	L	Quadriceps	Direct trauma	Osteotendinous junction	No	No
49	29	M	L	Patellar	Direct trauma	Muscle belly	Exposed	Femoral + R tibial fracture
50	23	M	L	Quadriceps	Direct trauma	Muscle belly	No	Femoral + L tibial fracture
51	24	M	L	Patellar	Direct trauma	Tendon substance	No	No
52	47	M	L	Patellar	Direct trauma	Lower patellar pole	No	No
53	69	M	L	Patellar	Direct trauma	Tibial tuberosity	Diabetic	No
54	27	M	L	Patellar	Direct trauma	Tendon substance	No	No
55	27	M	R	Patellar	Direct trauma	Tendon substance	No	No
56	11	M	L	Patellar	Direct trauma	Sleeve fracture	No	No
57	11	M	L	Patellar	Direct trauma	Lower patellar pole	No	No
58	15	M	L	Patellar	Direct trauma	Tibial tuberosity	No	No
59	25	M	R	Patellar	Direct trauma	Lower patellar pole	No	No
60	42	M	L	Quadriceps	Direct trauma	Muscle belly	No	No
61	36	M	L	Patellar	Direct trauma	Lower patellar pole	No	No
62	36	M	L	Quadriceps	Direct trauma	Muscle belly	No	No
63	62	M	L	Quadriceps	Direct trauma	Muscle belly	Diabetic	No
64	23	M	L	Patellar	Direct trauma	Lower patellar pole	No	No
65	12	M	L	Patellar	Direct trauma	Sleeve fracture	No	No
66	53	M	L	Quadriceps	Indirect trauma	Muscle belly	Lupus	No
67	13	M	L	Patellar	Direct trauma	Tibial tuberosity	No	No
68	14	M	L	Patellar	Direct trauma	Tibial tuberosity	No	No
69	13	F	L	Patellar	Direct trauma	Tibial tuberosity	No	No
70	13	F	R	Patellar	Direct trauma	Tibial tuberosity	No	No
71	13	M	L	Quadriceps	Direct trauma	Muscle belly	No	No
72	52	M	L	Patellar	Direct trauma	Osteotendinous junction	Diabetic	No
73	43	M	L	Quadriceps	Direct trauma	Muscle belly	No	No

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

Source: Hospital Municipal Miguel Couto, 2011.

saw extremely rare injuries in the immature skeleton (bilateral avulsion fracture of the tibial tuberosity in a 13-year-old girl, rupture of the patellar ligament and contralateral sleeve fracture in an 11-year-old boy, and rupture of the quadriceps tendon in a 13-year-old youth).

In relation to the imaging exams, the knee radiography (trauma series) provides good accuracy in the diagnostic confirmation, as well as being low in cost. We did not use ultrasound, as it is an examiner-dependent exam. On the other hand, Heyde et al<sup>(13)</sup> recommend ultrasound in injuries of the knee extensor mechanism. In our view, magnetic resonance imaging is a high-cost imaging exam that is not available in all Brazilian hospitals. As this exam becomes more widespread, it will contribute greatly to the analysis of the condition of the tendon and the structures around the knee. We emphasize that the diagnosis of ruptures of the extensor apparatus of the knee is basically cli-

nical. Imaging exams are complementary exams that assist in the surgical planning.

We believe our case series is representative, and this research is aimed at improving our understanding of the occurrence of this type of lesion, and based on these data, enabling effective prevention. Ramseier et al<sup>(14)</sup> carried out a study on postoperative functional assessment of extensor apparatus injuries. They report on a small case study, and affirm that future research on this subject is necessary, a view with which we agree and corroborate.

## CONCLUSION

The majority of the patients were male, of an economically active age (young), and victims of direct trauma, with ruptures of the patellar ligament as the most frequent injuries. Associated injuries are rare, and comorbidities were infrequent in our case series.

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