PROGRESS ASSESSMENT OF INJURIES ASSOCIATED TO ANTERIOR CRUCIATE LIGAMENT INJURIES

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SUMMARY

Purpose: We reviewed 71 patients diagnosed with anterior cruciate ligament (ACL) injury on 72 knees. The incidence of associated injuries (meniscal and joint cartilage injuries) were evaluated according to the time elapsed until ACL reconstruction. Study design: Retrospective case series. Methods: Statistical analysis of the relationship between the time elapsed until surgery and the increase of associated lesions. Results: There was no statistically significant difference on the incidence of joint-cartilage and meniscal injuries assessed for the periods within 2-3 months, 4-6 months, 7-12 months, 13-24 months and above 24 months. Conclusion: Although a trend towards a higher number of meniscal injuries after 6 months, and of joint-cartilage injuries after 12 months since the primary anterior cruciate ligament injury, such fact showed no statistical significance.

Keywords: Anterior cruciate ligament; Knee; Joint cartilage

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INTRODUCTION

Anterior cruciate ligament rupture is a common injury in sports practice. It can be associated to many other injuries; the most frequent ones include meniscal and chondral injuries. Those injuries may be acute as a result of trauma, or chronic as a result of instability occasioned by anterior cruciate ligament injuries[1].

Menisci play an important functional role in the knee, because they enhance joint congruence, reduce cartilage stress, increase joint stability, and lend absorption to impacts. Together, the menisci transmit about 50% of joint load [2,3]. Meniscal loss reduces tibial contact area by about 50-70% resulting in an increased stress both on tibia and on femur[4].

Joint cartilage is a complex tissue largely constituted of type-2 collagen. It has the ability of dealing with strong forces during many cycles, but has a poor ability to regenerate after an injury[5].

Thus, the injuries associated to anterior cruciate ligament lead to a progressive degeneration of the joint cartilage, causing pain, edema, and limb function loss[6-9].

anterior cruciate ligament reconstruction is a well established surgery in orthopaedic practice; it is indicated for the great majority of patients, particularly in symptomatic patients wanting to resume sports practice.

This article intends to provide potentially assisting data for deciding on the best moment to operate, considering the likelihood of a higher number of secondary injuries (either chondral or meniscal) with time elapsed until the moment of surgery.

CASE SERIES AND METHODS

A retrospective study was conducted in order to analyze injuries associated to anterior cruciate ligament injuries. Seventy-two knees of 71 patients (8 women and 63 men) submitted to arthroscopic anterior cruciate ligament reconstruction surgery were assessed. all surgeries were performed by only one surgeon, in the period of 2001 to 2005. All patients presented as mechanism of trauma torsional injuries, most of them as a result of sports practice. The time interval between trauma and surgery ranged from 2 to 239 months, and patients' ages ranged from 16 to 56 years, with an average of 31.9 years. Patients with associated ligament injuries were excluded from the study. The anterior cruciate ligament was the only injured ligament, either by magnetic resonance and physical examination (under anesthesia) findings, or by intra-operative confirmation. Meniscal and cartilaginous injuries were assessed. Meniscal injuries were classified by the criteria described by O`Connor into longitudinal, horizontal, oblique, and radial, and according to its position at meniscal horn as anterior, posterior, or body. Cartilaginous injuries were classified by employing the OuterBridge criteria into four types: softening, fibrillation, fissure and erosion. For the statistical analysis, the incidence of both meniscal and chondral injuries was divided into periods according to the progression time of injury until surgery. Time intervals of 2-3 months, 4-6 months, 7-12 months, 13-24 months, and above 24 months were assessed. This variable was named "time until surgery". The existence of an association between months until surgery and the presence of medial meniscal injury (MMI), lateral meniscal

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injury (LMI), medial chondral injury (MCI), lateral chondral injury (LCI) or total chondral injuries (tCI) was evaluated by using the Fisher's exact test. Associated injuries classified as acute by literature[1] are those occurring within 3 weeks of ACL injury. In this study, as previously said, the minimum time between injury and surgery was 2 months; therefore, there are no acute injuries but chronic, due to the dynamics of the service, injuries occurred within the 3 previous months are regarded as premature.

RESULTS

In our analysis, we found a prevalence of 67% of meniscal injuries within the period, being 35% medial meniscal injuries, 14% lateral meniscal injuries, and 18% injuries in both menisci.

We correlated the incidence of meniscal injuries with the time until surgery, as previously described. We found a higher incidence of lateral meniscal injuries - 33% compared to medial (22%) within the 2-3 months interval. In the subsequent period (4-6 months) these values are inverted, being 33% medial meniscal injuries and 22% lateral meniscal injuries. From 7 months on, there is an increased incidence of both injuries, with 50% for both injuries in the period of 7-12 months, corresponding to an incidence increase by 78%. The incidence of medial meniscal injuries remained stable for the 13-24 month period (50%), increasing to 53% in the period above 24 months. On the other hand, the incidence of lateral meniscal injuries was reduced to 35% in the 13-24 months period, following the same drop trend, up to 25% for the period above 24 months. (Table 1)

Nevertheless, the statistical analysis showed no significant correlation between months until surgery and presence of medial meniscal injury (ρ=0,359) or between months until surgery and lateral meniscal injury (ρ=0.707).

		Months until surgery						
		2 - 3	4 - 6	7 - 12	13 - 24	>24	Total	p[1] Value
Medial meniscal injury	n	2	3	5	7	17	34	0,359
	%	22,2%	33,3%	50,0%	50,0%	58,6%	47,9%	
Lateral meniscal injury	n	3	2	5	5	8	23	0,707
	%	33,3%	22,2%	50,0%	35,7%	27,6%	32,4%	
Total patients		9	9	10	14	29	71	

1 p vaule corresponding to Fisher's exact test.

Table 1 - *Number of medial and lateral meniscal injuries according to time until surgery and correspondent percentages.*

		Months until surgery						
		2 - 3	4 - 6	7 - 12	13 - 24	>24	Total	p[1] Value
Medial chondral injury	n	4	0	1	4	10	19	0,125
	%	44,4%	0,0%	10,0%	28,6%	34,5%	26,8%	
Lateral chondral injury	n	1	0	1	4	3	9	0,370
	%	11,1%	0,0%	10,0%	28,6%	10,3%	12,7%	
Total chondral injuries	n	4	3	2	8	12	29	0,480
	%	44,4%	33,3%	20,0%	57,1%	41,4%	40,8%	
Total patients		9	9	10	14	29	71	

1 p value corresponding to Fisher's exact test.

Note: *Total chondral injuries represent the number of patients with any kind of chondral injury, whether they are on medial, femoral or patellofemoral compartment.*

Table 2 - *Number of medial, lateral and total chondral injuries according to time until surgery and correspondent percentages*

Regarding chondral injuries, a similar study was performed. The incidence of chondral injuries was studied for the same periods in which meniscal injuries were assessed. However, for chondral injuries, a division by compartments was made, with the medial compartment corresponding to injuries on medial tibial plateau and on medial femoral condyle, and the lateral compartment corresponding to related tibial and femoral injuries.

Regarding injuries occurring in 2-3 months, 9 patients (2 with 2 months and 7 with 3 months), we found a higher incidence of medial compartment injuries (44%0, compared to lateral compartment (11%). It is worthy to remember that these are not acute injuries, because we have no data available of patients with less than 3 weeks. The incidence of injuries both at lateral and medial compartments drops until the period of 7-12 months, reaching to an incidence of 10%. For the following period, 13-24 months, there is a significant increase in the incidence of both injuries, reaching to 28.6% for both injuries. After that period, medial compartment injuries continue to grow, reaching to an incidence of 34.5% after 24 months, while lateral compartment injuries tend to drop, reaching 10.3% after 24 months. (Table 2)

However, the statistical analysis indicated no significant correlation between time until surgery and presence of medial chondral injury (ρ=0.125) or between time until surgery and lateral chondral injury (p=0.370).

By analyzing the trend of meniscal injuries compared to chondral injuries, we built Graph 1.

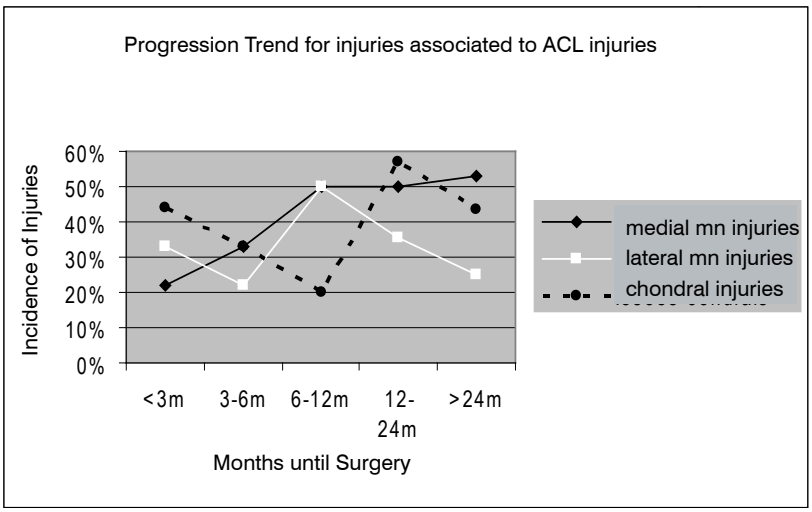
One can notice that the greatest increase of meniscal injuries occurred in the period of 6-12 months, and that the greatest increase of chondral injuries occurred 6 months after, that is, in the period of 12-24 months.

DISCUSSION

The incidence of meniscal injuries associated to ACL injuries ranges from16 to 82% in acute cases, and up to 92% in chronic cases (10-14). In a study, Barret(14) noticed that the incidence of lateral meniscal injuries associated to ACL injuries was higher than the incidence of acute medial meniscal injuries, but, when the ACL injury becomes chronic, the medial meniscus is the most commonly involved structure.

The medial meniscus is more tightly bonded to posteromedial capsule, to the posterior oblique ligament and to semimembranous muscle. These links preclude the meniscus to perform wide movements and make it function as a stabilizer in case of an ACL injury[16-17]. Cerebona and Indelicato[10] and Bittar[18] argument that the medial meniscal injury, particularly at the posterior horn, is a result of this restraint mechanism, in which, after ACL injury, the medial meniscus would act as a barrier against tibial anteriorization, being submitted to repeated loads, until it finally surrender. Authors such as Murrell[19] and others[12,20] correlate the time elapsed since ACL injury with the prevalence of meniscal injuries, as observed in the results.

Chondral and sub-chondral injuries can often be



Graph 1 - *Progression trend for medial and lateral meniscal injuries and for total chondral injuries related to time until surgery.*

accompanied by ACL injuries. In patients receiving a conservative treatment, an increasing finding of degenerative changes was seen[6,7,21,22]. Chondral injuries may happen at the moment of trauma [13,18,23,24], presenting as chondral softening, chondral fractures, flaps or cracks, particularly occurring at lateral compartment, but involving the medial side in 30% [25,26].

In our study, as opposite to literature reports, there was a higher early incidence (less than 3 months) of chondral injuries on medial compartment (44%) against 11% on lateral compartment. This fact may be due to the fact that the injuries reported by literature were assessed within less than 3 weeks, that is, acute injuries, while in this study these were observed with 2-3 months.

Another important fact is that the more significant increase regarding chondral injuries, either on medial or lateral compartment, occurred in the period of 13-24 months, while for meniscal injuries, this increase occurred in the period of 7-12 months (Graph 1). We can see, based on the studies discussed above about the progression of meniscal and chondral injuries, that there is an increased incidence of meniscal injuries, which is potentially due to the unstable environment created by ACL injury in a period above 6 months. We can also notice a subsequent increase of the incidence of chondral injuries in the subsequent period (after 12 months). This fact had already been reported by O´Connor in a similar study, but with a significantly superior number (1375 patients)[27].

Injuries associated to anterior cruciate ligament injuries lead to an increased incidence of osteoarthritis[20,27]. Those injuries, regardless of being chondral or meniscal, may present as acute injuries resulting from initial trauma, or they may be chronic due to an unstable environment created by anterior cruciate ligament injury[1,18]. Regarding chronic injuries, an increased incidence of meniscal injuries within a period above 6 months and an increased incidence of chondral injuries in a period above 1 year were reported, but we found no statistical significance for both in our study. This trend was also reported by O´Connor[27] as previously mentioned, but, with a larger sample, it showed statistical significance. In our study, therefore, it seems that the number of patients may have caused a bias.

It seems obvious to think that a ligament reconstruction should be performed within a time period shorter than 6 months, before this associate injuries cycle starts occurring. However, in literature, a controversy exists regarding the role of anterior cruciate ligament reconstruction. While some authors advocate the surgery would protect knee by creating a stable environment[15-17,27], others attribute injuries to a multifactorial environment, both chemical - by means of inflammatory mediators - and mechanical, as discussed in this article. Thus, even when improving instability symptoms, surgery would not determine the end of associate injuries' progression that would ultimately lead to osteoarthrosis[1,28-30]. It is also worthy to comment that these studies assessed the progression of patients operated along time, but they do not discriminate how long after injury these patients have been operated, or which the early findings were regarding associate injuries at the moment of surgery, which could interfere on the results of the study.

As the ACL reconstruction surgery has the primary role of stabilizing the knee for the patient to be able to resume sports practice, it seems a common sense to perform it before a higher risk of associate injuries is imposed to those patients.

CONCLUSION

There is a trend to an increased number of intrinsic injuries of the knee with time until surgery for anterior cruciate ligament reconstruction. Meniscal injuries present a trend to increase after 6 months, while chondral injuries tend to increase after 1 year. However, this was not shown to be statistically significant in the present study.

REFERENCES

1. Jones H, Appleyard R. Meniscal and condral loss in the anterior cruciate ligament injured knee. Sports Med. 2003; 33:1075-89.
2. Seedhom BB. Loadbearing function of the menisci. Physiotherapy. 1976; 62: 223.
3. Walker PS, Erkman MJ. The role of the menisci in force transmission across the knee. Clin Orthop Relat Res. 1975; (109):184-92.
4. Ahmed AM, Burke DL. In-vitro measurement of static pressure distribution in synovial joints. Part 1. Tibial surface of the knee. J Biomech Eng. 1983; 105: 216-25.
5. Miller RH 3rd. Knee injuries. In: Canale ST, editor. Campbell´s operative orthopaedics. 10th. Philadelphia: Mosby; 2003. p. 2165-337.
6. Funk FJ. Osteoarthritis of the knee following ligamentous injury. Clin Orthop Relat Res. 1983; (172): 154-7.
7. Kannus P, Jarvinen M. Conservatively treated tears of the anterior cruciate ligament: long-term results. J Bone Joint Surg Am. 1987; 69: 1007-12.
8. Fetto JF, Marshall JL. The natural history and diagnosis anterior cruciate ligament insufficiency. Clin Orthop Relat Res. 1980; (147):29-38.
9. Drongowski RA, Coran AG, Wojtys EM. Predictive value of meniscal and chondral injuries in conservatively treated ACL injuries. Arthroscopy. 1994; 10:97-102.
10. Cerabona F, Sherman MF, Bonamo JR, Sklar J. Patterns of meniscal injury with acute anterior cruciate ligament rupture. Am J Sports Med. 1988; 16: 603-9.
11. Hawkins RJ, Misamore GW, Merritt TR. Follow-up of the acute nonoperated isolated anterior cruciate ligament tear. . Am J Sports Med. 1986; 14:205-10.
12. Keene GC, Bickerstaff D, Rae PJ, Paterson RS. The natural history of meniscal tears in anterior cruciate ligament insufficiency. Am J Sports Med. 1993; 21: 672-9.
13. Noyes FR, Bassett RW, Grood ES, Butler DL. Arthroscopy in acute traumatic heamarthrosis of the knee: incidence of anterior cruciate ligament tears and other injuries. J Bone Joint Surg Am. 1980; 62: 687-95.
14. Smith JP, Barrett GR. Medial and lateral meniscal tear patterns in anterior cruciate ligament-deficient knees. Am J Sports Med. 2001; 29:415-9.
15. Colby S, Francisco A, Yu B, Kirkendall D, Finch M, Garrett W Jr. Electromyographic and kinematic analysis of cutting maneuvers. Am J Sports Med. 2000; 28: 234-40.
16. Allen CR, Wong EK, Livesay GA, Sakane M, Fu FH, Woo SL. Importance of the medial meniscus in the anterior cruciate ligament deficient knee. J Orthop Res. 1998; 18:109-15.
17. Marcus Hollis J, Pearsall AW, Niciforos PG. Change in meniscal strain with anterior cruciate ligament injury and after reconstruction. Am J Sports Med. 2000; 28:700-4.
18. Indelicato PA, Bittar ES. A perspective of lesions associated with ACL insufficiency of the knee: a review of 100 cases. Clin Orthop Relat Res. 1985; (198):77-80.
19. Murrell GA, Maddali S, Horovitz L, Oakley SP, Warren RF. The effects of time course after anterior cruciate ligament injury in correlation with meniscal and cartilage loss. Am J Sports Med. 2001; 29:9-14.
20. Irvine GB, Glasgow MM. The natural history of the meniscus in anterior cruciate insufficiency: arthroscopic analysis. J Bone Joint Surg Br. 1992; 74:403-5.
21. Fetto JF, Marshall JL. The natural history and diagnosis of anterior cruciate ligament insufficiency. Clin Orthop Relat Res. 1980; (147):29-38.
22. Drongowski RA, Coran AG, Wojtys EM. Predictive value of meniscal and chondral injuries in conservatively treated ACL injuries. Arthroscopy. 1994; 10:97-102.
23. Spindler KP, Schils JP, Bergfeld JA, Andrish JT, Weiker GG, Anderson TE, et al. Prospective study of osseous, articular and meniscal lesions in recent anterior cruciate ligament tears by magnetic resonance imaging and arthroscopy. Am J Sports Med. 1993; 21:551-7.
24. Speer KP, Spritzer CE, Bassett FH 3rd, Feagin JA Jr, Garrett WE Jr. Osseous injury associated with acute tears of the anterior cruciate ligament. Am J Sports Med. 1992; 20:382-9.
25. Johnson DL, Urban WD Jr, Caborn DN, Vanarthos WJ, Carlson CS. . Articular cartilage changes seen with magnetic resonance imaging-detected bone bruise associated with anterior cruciate ligament tears. Am J Sports Med. 1998; 26:409-15.
26. Faber KJ, Dill JR, Armendola A, Thain L, Spouge A, Fowler PJ. Occult osteochondral lesions after ACL rupture: six-year MRI follow-up study. Am J Sports Med. 1999; 27:489-94.
27. O´Connor DP, Laughlin MS, Woods GW. Factors related to additional knee injuries after anterior cruciate ligament injury. Arthroscopy; 2005; 21:431-8.
28. Gillquist J, Messner K. Anterior cruciate ligament reconstruction and the long-term incidence of gonarthrosis. Sports Med. 1999; 27:143-56.
29. Shelbourne KD, Tinker Gray MA. Results of anterior cruciate biomechaniligament reconstruction based on meniscus and articular cartilage status at the time of surgery. Am J Sports Med. 2000; 28:446-52.
30. Noyes FR, Barber-Westin SD. A comparison of results in acute and chronic anterior cruciate ligament ruptures of arthroscopically assisted autogenous patella tendon reconstruction. Am J Sports Med. 1997; 25:626-34.