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A Bio-Mechanical Relationship between ACL Tear and Meniscal Injuries

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ABSTRACT

***Objective**: To examine how often meniscal tears occur alongside ACL injuries and to understand their characteristics and patterns.*

***Methodology**: This retrospective study explored the experiences of patients treated for anterior cruciate ligament (ACL) tears at Sree Balaji Medical College and Hospital over two years, from August 2023 to August 2024. We included 52 patients in our research. By reviewing their case records, we aimed to understand how often meniscal lesions occurred alongside ACL tears and used appropriate statistical methods to analyze the data.*

Our findings highlight the connection between ACL injuries and meniscal damage, which can help shape better treatment plans and improve outcomes for patients. Sharing more about our statistical analysis and specific results can deepen our understanding of these important insights.

***Results**: In this study, we reviewed 52 patients with ACL tears. Most of these injuries were found in the younger age group of 20 to 29 years, representing 46.15% of the cases. Out of these patients, 19 (36.54%) had meniscal tears. Specifically, 9 patients (47.37%) had tears in the lateral meniscus, 6 (31.58%) had tears in the medial meniscus, and 4 (21.05%) had tears in both menisci. Notably, bucket handle tears (n=12) were the most frequently observed type of meniscal injury. Additionally, radial tears were especially common in patients with bilateral meniscus injuries (n=4).*

***Conclusion**:Meniscal tears are the most common intra-articular injuries associated with ACL tears, especially among those aged 20 to 29. Our findings showed that lateral meniscal tears are significantly more prevalent than medial meniscal tears. Additionally, bucket handle tears were the most frequently encountered type of meniscal injury. As a result, it's important for surgeons to have the right tools for meniscal repair in their surgical toolkit.*

***Keywords**: ACL tear; Lateral meniscus injury; Bucket handle tear.*

INTRODUCTION

The meniscus is vital for distributing forces and maintaining stability in the knee. Meniscal tears typically happen from twisting or sudden movements and are common among young, active adults, especially during sports or heavy lifting. In contrast, degenerative tears are more frequent in people with osteoarthritis. Once thought to be just a leftover part of the knee, recent research has shown how important the meniscus is for overall knee function.

Meniscal tears often occur alongside other ligament injuries, particularly with anterior cruciate ligament (ACL) tears, due to their close relationship in structure and function. Isolated ACL tears are relatively rare. For those who lead an active lifestyle, keeping the meniscal tissue intact is crucial for long-term joint health. However, additional meniscal surgeries haven't made a significant difference in strength or jumping ability after the procedure. Repairing the posterior horn of the lateral meniscus early on can improve load distribution in the lateral compartment, potentially preventing cartilage damage and reducing the risk of osteoarthritis after

partial meniscectomy.This study seeks to explore how often meniscal injuries occur with ACL tears, as well as the types and characteristics of these injuries.

METHODOLOGY

We conducted a retrospective study involving patients treated from August 2023 to August 2024, gathering data from the Orthopaedics Department's database at SBMCH

Inclusion Criteria:

- Age 18 - 70 years
- Isolated ACL injuries

Exclusion Criteria:

- Previous surgery involving partial meniscectomy
- Multi-ligament injuries
- Prior ACL surgery

Throughout the study period, a total of 52 patients qualified for inclusion, consisting of 45 males and 7 females.

RESULTS

In our study of 52 patients, we found that 19 of them (about 37%) had a meniscal injury along with their ACL tear, while 33 patients (63%) had an isolated ACL tear. You can check out the demographic details in Table 1.

Looking at the age distribution, we noticed that 2 patients (around 4%) were between 10-19 years old, 23 patients (44%) were in the 20-29 range, 17 patients (33%) were aged 30-39, 7 patients (13%) were in their 40s, and 3 patients (6%) were aged 50-59. Notably, the highest number of ACL tears—24 cases (46%)—occurred in the 20-29 age group, indicating that these injuries are especially common among younger adults.

When we examined where the ACL tears occurred, we found that 38 patients (73%) had tears in their right knee, 13 patients (25%) had tears in their left knee, and 1 patient (2%) had tears in both knees.

Table 2 shows the locations of meniscal tears. The lateral meniscus was the most frequently injured, affecting 9 patients (47%). Six patients (32%) had bilateral meniscal tears, and there were also one each with tears in the lateral and medial menisci. We even encountered one case of a flap tear in a patient with a lateral meniscal tear. For the 6 patients with medial meniscal tears, we performed a partial medial meniscectomy. The 4 patients with bilateral meniscal tears underwent both partial meniscectomy and ACL reconstruction. Additionally, 4 patients (21%) had tears in both the lateral and medial menisci.In Table 3, we outline the different types of meniscal tears linked to ACL injuries. The most common type was the bucket handle tear, found in 12 patients, mostly among those with bilateral meniscal tears (4 patients) and one each with lateral and medial meniscal tears. We also noted one flap tear in a patient with a lateral meniscal tear. Those with medial meniscal tears received a partial medial meniscectomy, while those with bilateral tears had that procedure along with ACL reconstruction.

Table 1. Socio-demographic details of patient

Parameters	Variables	Frequency N=52	Percentage
Age	10-19	2	3.85
	20-29	24	46.15
	30-39	17	32.69
	40-49	7	13.46
	50-59	2	3.85
Side of ACL tear	Right Left Bilateral	38	73.07
		13	25
		1	1.93
Meniscal Tear	Yes	19	36.54
	No	33	63.46

Table 2. Site of meniscal tear

Site	Frequency N=19	Percentage
Lateral meniscus	9	47.37
Medial meniscus	6	31.58
Bilateral meniscus	4	21.05

Table 3. Morphology of meniscal tears

Morphology	Lateral	Medial	Bilateral	Total	Chi square value	P value
Bucket handle tear	7	5	-	12	11.87	0.018
Radial tear	1	1	4	6		
Flap tear	1	-	-	1		
Complex tear	-	-	-	-		
Root tear	-	-	-	-		
Total	9	6	4	19		

Fig. 2. Morphology of Meniscal Tears

Table 4.

Age	Twisting injury	RTA	Sports injury	Chi square value	P value
10-19	0	0	7	29.25	<0.0001
20-29	0	2	9		
30-39	4	6	8		
40-49	3	7	0		
50-59	1	5	0		

Table 5.

Age Group	Bucket Handle Tear	Radial Tear	Flap Tear	Chi Square Value	P-Value
10-19	0	0	0	2.9	0.821
20-29	6	3	0		
30-39	3	2	1		
40-49	2	1	0		
50-59	1	0	0		

Table 6.

Morphology	Lateral	Medial	Bilateral	Chi-squar	P value
Bucket handle tear	7	5	0	11.87	0.018
Radial tear	1	1	4		
Flap tear	1	0	0		

DISCUSSION

The anterior cruciate ligament (ACL) is a crucial band of connective tissue connecting the femur and tibia, playing a vital role in keeping the knee stable. ACL tears are quite common, affecting about 68.6 to 100,000 people annually. These injuries often happen during weight-bearing activities that involve twisting the knee, leading to quick swelling and significant pain.

In our study, we found that lateral meniscal injuries frequently accompany ACL tears, occurring in 47.37% of cases. This aligns with research by Jewell Brent Duncan and colleagues, who discovered that 83% of their patients had lateral meniscal injuries, while only 17% had injuries to the medial meniscus. Their findings also noted that the combination of ACL, medial collateral ligament (MCL), and lateral meniscus injuries was nine times more common than the combination involving the medial meniscus. Further supporting these results, Tetsuo Hagino and his team reported that in their group of patients with acute ACL injuries, 69.4% experienced lateral meniscal injuries, 10.8% had medial injuries, and 24.7% had tears in both menisci. In cases of chronic ACL injuries, bilateral meniscal tears were the most common (41.4%), with lateral and medial tears occurring in 33.9% and 24.7% of cases, respectively. Overall, these studies highlight a strong link between ACL tears and lateral meniscal injuries. This underscores the importance of a thorough assessment and effective management of both types of injuries in clinical practice. Our findings indicate that bucket handle tears are most commonly seen in patients with meniscal tears, particularly in the medial meniscus rather than the lateral one. Tetsuo Hagino and his team reported bucket handle tears in 25 knees, while we observed them in 12. When it comes to radial tears, previous studies have suggested a connection with medial meniscal tears and even bilateral meniscal tears. In our research, we found radial tears present in both the medial and lateral menisci. To confirm ACL tears and any related meniscal injuries, we performed diagnostic arthroscopy. This method is often considered the gold standard for diagnosing meniscal tears and tends to be more accurate than MRI.

CONCLUSION

Meniscal tears often go unnoticed during the preoperative phase. Recognizing the link between ACL injuries and meniscal tears is crucial for preparing surgeons to tackle these problems effectively. When both injuries occur, the feeling of instability can sometimes overshadow the pain, making it easy to miss the meniscal injury. That's why it's important for doctors to be aware of the typical meniscal issues that might arise alongside ACL tears, so they can provide the best possible treatment.

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