

# Location of Meniscus Tears Affect Return to Sport in National Collegiate Athletic Association Athletes: A Review of the PAC-12 Injury Database

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**INTRODUCTION:** There is a high occurrence of meniscus injuries in collegiate athletes, and more up-to-date epidemiological data are necessary to guide efforts toward effective injury prevention and management. There is limited literature on the period and rate of return to sports (RTS) after meniscus tears in National Collegiate Athletic Association (NCAA) athletes, with most studies focusing on football players. Additionally, these studies demonstrate significant variability in data reporting, and few have provided details on injury location (medial vs. lateral) and the effect on return to play. The purpose of this study was to evaluate epidemiological data related to meniscus injuries in the Pacific-12 (PAC-12) Conference across all men's and women's sports and the specific factors that impact RTS.

**METHODS:** Athletes who were noted to have meniscus injuries within the prospectively collected PAC-12 injury database from the 2017-18 through the 2021-22 academic years were analyzed. Meniscus tear rates and proportions were used to describe injury incidence by sport, sex, season period, injury mechanism (cutting, contact), the timing of injury (beginning vs. end of the match), percentage, and time to return to sports (RTS). Injury rates (IR) per 100,000 athlete-expose hours (AEH) were used to compare differential distributions. Furthermore, the study compared surgical or nonsurgical treatment outcomes, including time and percentage of RTS, using the rate ratio in sports with higher meniscus injuries.

## RESULTS:

A total of 276 meniscus tears were reported from 10.67 million AEH (10,669,932). The highest IR (per 100,000 AEH) was observed among gymnasts (3.4), soccer players (3.3), football players (2.5), and basketball players (2.2). There were significant gender differences observed among sports, with male gymnasts (4.3) and soccer players (3.6) having higher scores than their female counterparts (2.8 and 3.1, respectively). However, male basketball players (1.4) had lower rates compared to their female counterparts (3.1) (Table 1). Overall, there was a slight difference between the overall percentage of medial (39%) and lateral (58%) meniscus tears. However, in football and tennis, injuries to the lateral meniscus were more frequent, measuring 76% and 67%, respectively.

Overall, 87.3% returned to their previous level of competition at 127±185 days, regardless of treatment type. Approximately 84.3% of athletes RTS following surgical management and 90% RTS following nonsurgical care. Regarding laterality, athletes with medial meniscus injuries had a higher RTS, measuring 89% compared to 84% for those that were diagnosed with lateral meniscus tears. Athletes with medial and lateral side injuries had the lowest RTS, measuring 71%. Of note, those treated (operative and nonsurgical) for medial meniscus injuries reported a faster RTS with an average of 107±146 days compared to the lateral meniscus (137±208) (Table 2).

There was a slight difference in injury rates that occurred during various points of quarterly competition during games (1<sup>st</sup>-22%; 2<sup>nd</sup>-21%; 3<sup>rd</sup>-28%; 4<sup>th</sup>-30%). Injury rates were more significant during the third quarter of basketball, football, and wrestling (50%, 32%, and 36%) and the last quarter of soccer and gymnastics (45% and 40%). The most commonly observed injury mechanism was cutting or changing of direction (overall: 32%, soccer: 41%, basketball: 50%), contact with another player (overall: 22%, wrestling: 76%), and landing from a jump (overall: 9%, gymnastics: 58%).

## DISCUSSION AND CONCLUSION:

Previous studies have reported that lateral meniscus injuries have a greater impact on compartment contact pressures and lead to chondrolysis. Additionally, tears on the medial side, those requiring smaller resection, age under 30 years, and higher preinjury levels have been associated with shorter times for RTS. Consistent with our findings, medial injuries demonstrated a higher %RTS (89% vs. 84%) and earlier RTS (107 days vs. 137) compared with the lateral side. Our study's %RTS also aligns with findings from other studies on college athletes.

There is a paucity of data reporting the association between the incidence of meniscus lesions and the time at which injuries occurred during game competition. In general, we found differences among injury rates between quarters (22-30%). Specifically, there were higher rates of meniscus tears that occurred during the latter periods of games, including 50% in the third quarter and 45% during the 4th quarter of competition (45%). These observations may be attributed to impaired performance and biomechanical malfunction due to fatigue.

To the best of our knowledge, this is the largest epidemiologic study investigating meniscus tears among a large and diverse cohort of collegiate athletes.

The data provided from epidemiological studies with larger populations enhance the identification of athletes who are more prone to meniscus injuries; and contributes to determining potentially modifiable risk factors that can be targeted in prevention programs.

Table 1: Rate of Meniscal Injuries by Sport and Injury Location †

Sport	All injuries		Team		Injury Location		
	(n)	Rate	Men's	Women's	MM	LM	BM
Total	276	-	-	-	39%	58%	3%
Gymnastics	38	3.4 (1.9-5.0)	4.3	2.8	94%	00%	0%
Soccer	43	3.3 (2.3-4.2)	3.6	3.1	49%	31%	0%
Football	100	2.5 (2.0-3.0)	2.5	No team	23%	76%	1%*
Basketball	22	2.2 (1.3-3.1)	1.4	3.1	41%	55%	5%*
Tennis	9	2.2 (0.8-3.6)	2.0	2.3	33%	67%	0%
Baseball	12	1.4 (0.6-2.3)	1.4	No team	50%	50%	0%
Volleyball	8	1.3 (0.5-2.9)	No team	1.7	75%	15%	13%*
Softball	4	1.1 (0.0-2.1)	No team	1.1	100%	0%	0%
Track and Field	10	0.5 (0.2-0.7)	0.3	0.6	50%	40%	10%*
Swimming + Diving	4	0.2 (0.0-0.4)	0.3	0.2	50%	50%	0%
Other	46	-	-	-	48%	46%	7%^

Abbreviations: MM, Medial Meniscus; LM, Lateral Meniscus; BM, Both Menisci.  
 †Data are shown as number of injuries per 100,000 athlete hours and associated 95% Confidence Intervals (CIs).\*(n)=1, ^ (n)=3.

Table 2: Return to Sports (%) and Average Missed Days by Surgery or Conservative Management per Injured Side and Season

	Injury Location			Season	
	MM	LM	BM	In-Season	Off-Season
	Conservative Management per Injured Side and Season				
<b>Total meniscal tears</b>	109	160	7	134	142
<b>All</b>					
%RTS	89%	84%	71%	84%	90%
Time to RTS (days)	107	137	44	109	141
SD	146	208	40	128	218
<b>Surgery</b>					
% Surgery	80%	62%	57%	69%	70%
%RTS	87%	84%	73%	87%	85%
Time to RTS (days)	114	159	58	113	162
SD	157	238	50	128	249
<b>Conservative</b>					
% Conservative	20%	38%	43%	30%	31%
%RTS	95%	84%	67%	83%	98%
Time to RTS (days)	74	98	23	96	100
SD	52	134	3	131	132

Abbreviations: RTS: Return to Sports; SD: Standard deviation; MM, Medial Meniscus; LM, Lateral Meniscus; BM, Both Menisci.

Table 3: Return to Sports (%) and Average Missed Days by Surgery or Conservative Management per Sport

Sport	Injury Location	Average time to RTS (days)		%RTS				
		MM	LM	All	Surgery	Conservative		
		MM	LM	MM	LM	MM	LM	
Total	276	107	137	89%	84%	87%	84%	90%
Gymnastics	38	114	68	65%	90%	57%	86%	100%
Soccer	43	87	123	93%	91%	93%	86%	100%
Football	100	179	154	91%	88%	96%	87%	100%
Basketball	22	63	92	67%	92%	71%	100%	50%
Baseball	12	75	132	100%	100%	100%	100%	100%
Wrestling	21	58	165	92%	100%	100%	100%	85%
Track and Field	10	146	113	80%	73%	75%	100%	100%
Other	50	113	172	88%	71%	81%	71%	100%

Abbreviations: MM, Medial Meniscus; LM, Lateral Meniscus; BM, Both Menisci.