BS Structured Summary

Article: Seeing the Anterior Oblique Ligament on Routine MRI — From Cadaver to Clinic

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Structured Summary: Seeing the Anterior Oblique Ligament on Routine MRI — From Cadaver to Clinic

Original Article: Magnetic resonance imaging of the knee anteromedial quadrant

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Journal: BMC Musculoskeletal Disorders

Year: Vol. 24, article 596 — 2023

DOI: 10.1186/s12891-023-06732-z

INTRODUCTION / BACKGROUND

The lateral side of the knee has been studied in depth — culminating in the anterolateral ligament and its now-routine MRI characterisation. The medial side is more lopsided: the posteromedial corner (POL, meniscotibial ligaments, oblique popliteal ligament, posterior horn of the medial meniscus and a semimembranosus arm) is well understood as an essential restraint to anteromedial rotatory instability (AMRI), but the anteromedial quadrant has classically been described as an almost empty space.

Building on their own dissection series, the authors had described in that quadrant — bounded by the medial border of the patellar ligament, the anterior border of the superficial MCL (sMCL) and the distal border of the medial patellar retinaculum — a previously unreported, histologically ligamentous structure superficial to the sMCL, named the anterior oblique ligament (AOL). The AOL completes their Theory of the Tibial Quadrants, in which rotational control is shared by diagonally opposite quadrants; the AOL and the anterior sMCL fibres occupy the anteromedial quadrant and restrain valgus and external tibial rotation.

An anatomic description only becomes clinically useful if the structure can be seen non-invasively. The question driving this study was therefore practical: can the AOL be identified on routine knee MRI, and how reproducibly? Establishing that would let any radiologist or surgeon look for the ligament in everyday practice — the bridge from cadaver to clinic.

OBJECTIVE

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To evaluate whether the anterior oblique ligament (AOL) — an extra-articular thickening of the knee anteromedial quadrant — can be characterised on routine MRI scans, and to quantify how reliably two independent musculoskeletal radiologists identify it.

METHODS

Pilot phase: two whole-knee cadaveric specimens from transfemoral amputations underwent 1.5-T MRI (6-channel dedicated knee coil; T1 and T2 in axial, sagittal and coronal planes). The pieces were then dissected as previously described and a polytetrafluoroethylene (PTFE) tube — low signal on T1 and T2 — was sutured along the AOL; a same-day repeat MRI made the ligament's path explicit. Two board-certified musculoskeletal radiologists (10 and 7 years' experience) then studied the AOL trajectory together on the tube-marked specimens.

Clinical phase: 100 knee MRI studies were randomly drawn from the institutional database (Feb–May 2020; ≈21% of all knee MRIs in that period), acquired on a 1.5-T scanner with the routine protocol. Exclusion criteria were MCL tear, expansile bony lesions, soft-tissue masses and post-operative knees — conditions that could distort morphology or accompany an AOL tear. Normal exams and those with degenerative, inflammatory/infectious or non-MCL traumatic findings were kept, to avoid selection bias.

The two radiologists read the 100 exams independently, free to view orthogonal planes simultaneously and recording only the presence or absence of the AOL, without correlating it to other structures or pathologies. Intra- and interobserver agreement was quantified with Cohen's kappa. Ethics approval was obtained (CAAE 34459220.0.0000.5479; No. 4.251.622), with informed consent from all participants.

MAIN RESULTS

Three of the 100 exams were excluded (two MCL tears, one ACL reconstruction), leaving 97 studies (53 women, 44 men; ages 13–68, mean 35).

Radiologist 1 identified the AOL in 41 of 97 scans (42.2%) and radiologist 2 in 38 of 97 (39.2%). In both readers, every identified ligament was seen on the axial plane (100%), and far fewer on coronal (41.4% and 31.6% respectively) — likely reflecting the ligament's oblique orientation and the coronal slice gap. The structure was best seen in its middle third; femoral origin and tibial insertion were not always precisely resolved.

Interobserver agreement for AOL identification was substantial: kappa 0.68 (95% CI 0.532–0.828), with 84.5% raw agreement.

The readers converged on a practical axial recipe: find a structure arising from the anterior aspect of the medial femoral epicondyle, close to the medial superior geniculate artery, running anteroinferiorly with fibres just anterior to the sMCL; in a three-layer scheme it sits in the second layer, anterior to the sMCL. It can be followed distally to a tibial insertion in the posterior third between the MCL and the patellar ligament, roughly 1 cm distal to the medial tibial plateau. On coronal images it appears thin and mostly vertical, with a femoral origin often inseparable from the sMCL.

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AUTHORS' CONCLUSION

MRI is a promising, non-invasive method for evaluating the anteromedial thickening now termed the anterior oblique ligament: it is a consistent knee structure that can be visualised frequently on routine scans, with substantial interobserver agreement, once radiologists know what to look for. The AOL can therefore be used reliably in future imaging and clinical studies of the anteromedial quadrant; higher-field (3-T) imaging may refine its description further.

💬 BS DISCUSSION

This is the imaging chapter of our AOL programme — and the most clinically actionable of the three. The anatomy papers (2021, 2022) and the OJSM 2024 consolidation answered 'is there a ligament there?'; this BMC study answers the question a surgeon actually asks in clinic: 'can I see it on the MRI in front of me?' The answer — in roughly 40% of unselected routine exams, with substantial interobserver agreement (kappa 0.68) — is the step that turns a cadaveric curiosity into something usable on a Tuesday afternoon.

The single most useful take-home for BS — and the thing to teach at the Summit — is the axial recipe. Look on the axial plane (where 100% of positives were found, not coronal), for a fibre originating at the anterior medial epicondyle, next to the medial superior geniculate artery, running anteroinferiorly just in front of the sMCL, inserting on the tibia about 1 cm below the plateau between the MCL and the patellar tendon. That is a reproducible checklist any of our fellows can apply.

The honest reading of the 40% is the ALL precedent, which the paper rightly invokes. When Helito first imaged the anterolateral ligament it was fully characterised in only about a third of cases; with familiarity and better protocols that rose above 90%. The AOL is at its own 'early ALL' moment: 40% almost certainly reflects detection skill and 1.5-T coronal slice gaps, not true absence in 60% of knees — the cadaveric series found it in 100%. The expected trajectory is upward as we standardise sequences and train the eye.

Where this matters clinically is the AMRI phenotype we keep coming back to: the ACL tears in valgus and external rotation, the medial side is injured far more often than the 'isolated ACL' label suggests, and the anteromedial quadrant is precisely where the AOL lives. Being able to flag the AOL on a pre-op MRI is the first step toward asking whether its injury tracks with residual anteromedial rotatory laxity — and whether addressing it changes outcomes. That is hypothesis, not established practice, and the paper is careful to say the biomechanics are still in progress.

For our Labs and protocol standardisation: this paper is effectively a scanning and reading SOP. Two concrete asks follow from it — prefer axial fat-sat sequences and tighten the coronal slice gap when the AOL is a question, and consider 3-T where available. The limitations are explicit and define the next studies: 1.5-T only, no 3-T comparison, origin/insertion not always resolved, and — most importantly — no link yet between MRI-visible AOL injury and clinical instability. Imaging reproducibility is now in hand; the functional and outcome work is the agenda we own.

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