Published in final edited form as:

Arthritis Rheumatol. 2020 January ; 72(1): 198–200. doi:10.1002/art.41124.

Response: Is a small meniscal radial tear equivalent to a radial posterior root tear in destabilizing the meniscus?

Jeffrey B. Driban, PhD¹, Grace H. Lo, MD, MSc^{2,3}, Matthew S. Harkey, PhD^{1,4}, James W. MacKay, MRCP, FRCR⁵, Robert J. Ward, MD⁶, Timothy E. McAlindon, MD, MPH¹

¹Division of Rheumatology, Allergy & Immunology; Tufts Medical Center, Boston, MA, USA

²Medical Care Line and Research Care Line, Houston Health Services Research and Development (HSR&D) Center of Excellence Michael E. DeBakey VAMC, Houston, TX, USA.

³Section of Immunology, Allergy, and Rheumatology, Baylor College of Medicine, Houston, TX, USA.

⁴Department of Population and Quantitative Health Sciences; University of Massachusetts Medical School, Worcester, MA 01605, USA

⁵Department of Radiology, University of Cambridge School of Clinical Medicine, Cambridge, United Kingdom.

⁶Department of Radiology, Tufts Medical Center, Boston, MA 02111, USA.

We thank Drs. Hayashi and Guermazi for their valuable insight and appreciate the opportunity to further elaborate on our decisions on how we defined destabilizing meniscal tears and miscellaneous pathologic changes.

Destabilizing meniscal tears:

We defined destabilizing meniscal tear as a “root tear, radial tear, or complex tear, which almost always featured a radial component”. As Drs. Hayashi and Guermazi noted, root tears compromise joint biomechanics and associate with incident and progressive tibiofemoral cartilage loss. Furthermore, a large radial tear compromises the circumferential collagen bundles of a meniscus that enable the meniscus to resist hoop stresses experienced with normal weightbearing (1, 2). This results in radial tears of the medial or lateral meniscus leading to decreased contact area and increased contact pressures, similar to a root tear (1, 3, 4). For this reason, radial tears are a risk factor for osteoarthritis (5). Given this rationale, we grouped root tears with radial tears and complex tears, which typically included a radial component, as destabilizing meniscal tears.

While 80% of the destabilizing tears in our study were in the posterior horns, there is less known about how size and location of a radial tear may influence outcomes. A partial radial

Address correspondence and reprint requests to Jeffrey Driban, PhD, ATC, CSCS; Division of Rheumatology, Tufts Medical Center; 800 Washington Street, Box 406, Boston, MA 02111; Phone: 617-636-7449; Fax: 617-636-1542; jeffrey.driban@tufts.edu.

Conflict of Interest: JBD reported payment for lectures from Pfizer, Inc and consultancy from Pfizer/Lilly. All other authors have no other conflicts of interest regarding this work.

tear – defined as compromising 50% of the meniscal width in the anterior half of a medial meniscus – impedes the function of a meniscus with reduced strain in the anterior horn but increased strain in the posterior horn when loaded to three times the body weight of the donor knee(6). Furthermore, a radial tear that affects at least 33% of the width of a meniscus was associated with incident KOA over the subsequent 2 years (5). However, if smaller radial tears are insignificant then this would have led us to underestimate the true association between destabilizing tears and accelerated KOA.

We respectfully disagree that just because something is common in the general population that it must be benign. Based on similar logic, we would also assume that obesity is benign given its high prevalence of 40%, affecting 93 million US adults. On the contrary, instead obesity is viewed by the CDC and NIH as a serious concern given its association with death and lower quality of life. Additionally, although Englund et al. [6] found that meniscal tears are common, they also found that among those without radiographic evidence of osteoarthritis, that meniscal tears were more common among those with knee pain (32% versus 23%) for an adjusted prevalence ratio of 1.43 (1.08 to 1.90). Additionally, in a follow up study using a different cohort, Englund et al found that meniscal tears among those without surgery were at 5.7x increased risk of developing incident KOA over a 30 month follow up period, supporting the critical nature of meniscal tears in osteoarthritis pathology (7).

Miscellaneous pathologic changes:

We defined miscellaneous pathologic changes as “attrition, acute ligamentous or tendinous injuries, subchondral insufficiency fractures, and any other incidental findings” (see Table 1 for more details) to ensure there was sufficient statistical power for analyses. We also offered the frequency of attrition and the other findings separately by group and time in Table to help clarify the frequency of these findings and to highlight that statistical analyses were impossible because only one or two adults with typical or no KOA had these findings. These findings highlight that while other pathologies are occurring among people with accelerated KOA they don’t represent a large portion of the group and hence support our focus on destabilizing meniscal tears in the presence of a joint with greater pre-radiographic disease burden than their peers with typical KOA.

Acknowledgments

These analyses were financially supported by a grant from the National Institute of Arthritis and Musculoskeletal and Skin Diseases of the National Institutes of Health under Award Number R01-AR065977. Dr. Lo is supported by K23 AR062127, an NIH/NIAMS funded mentored award, providing support for design and conduct of the study, analysis, and interpretation of the data. This work is supported in part with resources at the VA HSR&D Center for Innovations in Quality, Effectiveness and Safety (#CIN 13-413), at the Michael E. DeBakey VA Medical Center, Houston, TX. The views expressed in this article are those of the authors and do not necessarily represent the views of the Department of Veterans Affairs. The funding sources had no role in study design; in the collection, analysis and interpretation of data; in the writing of the report; nor in the decision to submit the article for publication.

REFERENCES:

1. Bedi A, Kelly N, Baad M, Fox AJ, Ma Y, Warren RF, et al. Dynamic contact mechanics of radial tears of the lateral meniscus: implications for treatment. *Arthroscopy* 2012;28:372–81. [PubMed: 22074620]

2. Bedi A, Kelly NH, Baad M, Fox AJ, Brophy RH, Warren RF, et al. Dynamic contact mechanics of the medial meniscus as a function of radial tear, repair, and partial meniscectomy. *J Bone Joint Surg Am* 2010;92:1398–408. [PubMed: 20516315]
3. LaPrade CM, Jansson KS, Dornan G, Smith SD, Wijdicks CA, LaPrade RF. Altered tibiofemoral contact mechanics due to lateral meniscus posterior horn root avulsions and radial tears can be restored with in situ pull-out suture repairs. *J Bone Joint Surg Am* 2014;96:471–9. [PubMed: 24647503]
4. Padalecki JR, Jansson KS, Smith SD, Dornan GJ, Pierce CM, Wijdicks CA, et al. Biomechanical consequences of a complete radial tear adjacent to the medial meniscus posterior root attachment site: in situ pull-out repair restores derangement of joint mechanics. *Am J Sports Med* 2014;42:699–707. [PubMed: 24585675]
5. Badlani JT, Borrero C, Golla S, Harner CD, Irrgang JJ. The effects of meniscus injury on the development of knee osteoarthritis: data from the osteoarthritis initiative. *Am J Sports Med* 2013;41:1238–44. [PubMed: 23733830]
6. Jones RS, Keene GC, Learmonth DJ, Bickerstaff D, Nawana NS, Costi JJ, et al. Direct measurement of hoop strains in the intact and torn human medial meniscus. *Clin Biomech (Bristol, Avon)* 1996;11:295–300.
7. Englund M, Guermazi A, Roemer FW, Aliabadi P, Yang M, Lewis CE, et al. Meniscal tear in knees without surgery and the development of radiographic osteoarthritis among middle-aged and elderly persons: The Multicenter Osteoarthritis Study. *Arthritis Rheum* 2009;60:831–9. [PubMed: 19248082]

Table 1.

Detailed breakdown of miscellaneous pathologic changes observed among adults with accelerated KOA (AKOA), typical KOA (KOA), or no KOA.

Variable	Visit	AKOA n (%)	Typical KOA n (%)	No KOA n (%)
Subchondral Insufficiency Fractures	–2	2 (2%)	0 (0%)	0 (0%)
	–1	0 (0%)	0 (0%)	0 (0%)
	Index	3 (3%)	0 (0%)	0 (0%)
	1	0 (0%)	0 (0%)	0 (0%)
	2	0 (0%)	0 (0%)	0 (0%)
Acute Ligamentous Injuries	–2	2 (2%)	1 (2%)	1 (1%)
	–1	2 (2%)	1 (1%)	1 (1%)
	Index	2 (3%)	1 (1%)	1 (1%)
	1	0 (0%)	2 (2%)	1 (1%)
	2	0 (0%)	1 (1%)	0 (0%)
Acute Tendinous Injuries	–2	0 (0%)	0 (0%)	0 (0%)
	–1	1 (1%)	0 (0%)	0 (0%)
	Index	1 (1%)	0 (0%)	0 (0%)
	1	1 (1%)	0 (0%)	0 (0%)
	2	1 (3%)	0 (0%)	0 (0%)
Other Incidental Findings	–2	1 (1%, Popliteus Strain)	0 (0%)	0 (0%)
	–1	1 (1%, OCD)	0 (0%)	0 (0%)
	Index	1 (1%, OCD)	0 (0%)	1 (1%, Tibial Contusion)
	1	1 (1%, OCD)	0 (0%)	0 (0%)
	2	0 (0%)	0 (0%)	0 (0%)

OCD = osteochondral lesion. Index visit = visit where the criteria for AKOA or typical KOA was met or a matched timepoint for those with no KOA.