

high-intensity intervention was not too aggressive. Importantly, study patients out-performed previous published findings for patients after TKA for ROM and functional outcomes [6].

The ROM cutoff of 110° by 3 weeks that was proposed by Dr Wickline would label the majority of patients in our study as having poor ROM even though their eventual ROM outcome was outstanding [6]. Early, invasive MUAs based on these criteria may unintentionally harm these patients. When assessing the clinical benefits of MUA, the patient and surgeon must also weigh the potential complications. The consequences of MUA can be substantial, as patients who require MUA within 6 months of TKA have a 2-fold to 3-fold increased risk of subsequent early revision [7]. Clearly, more data are needed on defining expected ROM recovery and optimal candidate selection and timing for MUA.

Whether or not to offer PT might depend on how low the bar is set for defining “success.” Too often, success of TKA is defined by pain relief, ROM, and self-reported function. But these measures do not reflect the breadth of performance deficits after surgery [8]. When viewing patient outcomes from a long-term population health perspective, we believe outcomes should also include physical function. Many patients have persistent deficits in quadriceps strength (41% weaker), walking distance (28% less), and stair climbing speed (105% slower) compared to healthy adults [6]. Furthermore, 75% of patients with TKA report difficulty negotiating stairs years after TKA, and 52% of patients with TKA report some degree of limitation in performing functional activities [9], and PT is ideally suited to address these residual deficits. Therefore, there is clearly room for improvement to achieve more optimal outcomes.

Ultimately, the effectiveness of rehabilitation on outcomes after TKA has been heavily understudied [10], and it is likely that we need to better define populations that benefit from more or less rehabilitation. For example, it has been shown that individuals with the greatest restrictions in mobility may recover mobility more quickly with supervised therapy [11]. Additionally, recent findings using a large Medicare administrative and claims data set (n = 5967 TKA patients) further support the value of PT after TKA [12]. Our analysis found that reduced access to PT was associated with less recovery in activities of daily living function. For low PT utilizers, the likelihood of improving in function from baseline was only 75%; however, patients who received 9–13 PT visits had 70% greater functional performance outcomes than those who received fewer visits.

Finally, Chughtai et al [13] found that in patients following MUA, a multimodal PT protocol incorporating muscle strength enhancement and ROM strategies was able to significantly increase the proportion of patients who obtain optimal ROM as well as significantly reduce the rate of repeated MUAs over standard-of-care. These examples highlight the need for clinical medicine to work toward methods to better tailor PT to the individual rather than a one-size-fits-all approach. Such personalized medicine would allow us to target resources to patients at greatest risk for poor ROM or functional outcomes, tailoring the treatment approaches and frequency of care to meet individual patient needs and further optimize outcomes.

Victor A. Cheuy, PhD*

Jared R.H. Foran, MD

Roger J. Paxton, PhD

Michael J. Bade, PT, PhD

Joseph A. Zeni, PT, PhD

Jennifer E. Stevens-Lapsley, PT, PhD

University of Colorado Denver, Physical Therapy Program, Aurora, Colorado

*Reprint requests: Victor A. Cheuy, PhD, University of Colorado Denver, Physical Therapy Program, Aurora, CO 80045.

<https://doi.org/10.1016/j.arth.2017.11.009>

References

- [1] Wickline A. Letter to the editor. JOA 2017. <https://doi.org/10.1016/j.arth.2017.11.007>. [Epub ahead of print].
- [2] Gillespie MJ, Friedland J, Dehaven KE. Arthrofibrosis: etiology, classification, histopathology, and treatment. *Oper Tech Sports Med* 1998;6:102–10.
- [3] Shelbourne KD, Wilckens JH, Mollabashy A, DeCarlo M. Arthrofibrosis in acute anterior cruciate ligament reconstruction. The effect of timing of reconstruction and rehabilitation. *Am J Sports Med* 1991;19:332–6.
- [4] Ranawat CS, Ranawat AS, Mehta A. Total knee arthroplasty rehabilitation protocol: what makes the difference? *J Arthroplasty* 2003;18:27–30.
- [5] Westby MD, Brittain A, Backman CL. Expert consensus on best practices for post-acute rehabilitation after total hip and knee arthroplasty: a Canada and United States Delphi study. *Arthritis Care Res* 2014;66:411–23.
- [6] Bade MJ, Struessel T, Dayton MR, Foran JRH, Kim RH, Miner T, et al. Early high-intensity versus low-intensity rehabilitation after total knee arthroplasty: a randomized controlled trial. *Arthritis Care Res* 2017;69:1360–8.
- [7] Werner BC, Carr JB, Wiggins JC, Gwathmey FW, Browne JA. Manipulation under anesthesia after total knee arthroplasty is associated with an increased incidence of subsequent revision surgery. *J Arthroplasty* 2015;30:72–5.
- [8] Stevens-Lapsley JE, Schenkman ML, Dayton MR. Comparison of self-reported knee injury and osteoarthritis outcome score to performance measures in patients after total knee arthroplasty. *PM R* 2011;3:541–9.
- [9] Noble PC, Gordon MJ, Weiss JM, Reddi RN, Conditt MA, Mathis KB. Does total knee replacement restore normal knee function? *Clin Orthop Relat Res* 2005;157–65.
- [10] Artz N, Elvers KT, Lowe CM, Sackley C, Jepson P, Beswick AD. Effectiveness of physiotherapy exercise following total knee replacement: systematic review and meta-analysis. *BMC Musculoskelet Disord* 2015;16:15.
- [11] Naylor JM, Crosbie J, Ko V. Is there a role for rehabilitation streaming following total knee arthroplasty? Preliminary insights from a randomized controlled trial. *J Rehabil Med* 2015;47:235–41.
- [12] Falvey JR, Nuccio E, Bade MJ, Burke RE, Stevens-Lapsley JE. Utilization of rehabilitation services is associated with better functional outcomes and reduced readmissions for Medicare home health users following total knee arthroplasty. *Academy Health Annual Research Meeting. Top abstracts section, Surgical and Perioperative Care Special Interest Group meeting, New Orleans, LA. 2017.*
- [13] Chughtai M, McGinn T, Bhav A, Khan S, Vashist M, Khlopas A, et al. Innovative multimodal physical therapy reduces incidence of repeat manipulation under anesthesia in post-total knee arthroplasty patients who had an initial manipulation under anesthesia. *J Knee Surg* 2016;29:639–44.

Letter to the Editor on “Risk Factors, Outcomes, and Timing of Manipulation Under Anesthesia After Total Knee Arthroplasty”



To the Editor:

We read with great interest the study by Newman et al regarding risk factors and different timing of manipulation under anesthesia (MUA) in patients with stiffness after total knee arthroplasty (TKA) [1]. We would like to congratulate authors for such an interesting publication considering the appropriate design to answer the questions; however, there are some comments we would like to add in order to contribute to a better understanding of its clinical application.

First, we would like to highlight the methodology of this study which is consistent with the objective of determining the risk factors for early MUA after TKA. Although we consider it would have been useful to mention a measure of association such as odds ratio and its confidence interval, that could provide the magnitude of association of the variables of interest.

Secondly, authors conclude that an early intervention (before 6 weeks) significantly improves outcomes when compared to late MUA [1–3]. Despite the weaknesses acknowledged by authors,

DOI of original article: <https://doi.org/10.1016/j.arth.2017.08.002>.

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to <https://doi.org/10.1016/j.arth.2017.09.044>.

this conclusion is consistent with previous reports and the natural history of arthrofibrosis [4]. However, the most important limitation not only of this study but also in the whole scientific knowledge is the lack of criteria that defines the indication for an early intervention [5]. This limitation arises from the fact that the normal progression of range of motion after TKA has not been properly described.

In summary, the main purpose of this letter is to highlight that it is crucial to identify which of these patients require this early intervention, because range of motion thresholds for stiffness remain unclear [6]. Future research efforts in this field should be done.

Cristina Suárez, MD
Sergio Londoño, MD
Alejandra Forero, MD

Department of Orthopedics and Traumatology, Hospital Universitario Fundación Santa Fe de Bogotá, Bogotá, Colombia

Guillermo A. Bonilla, MD*

Department of Orthopedics and Traumatology, Hospital Universitario Fundación Santa Fe de Bogotá, School of Medicine, Universidad de Los Andes, Universidad del Rosario, Bogotá, Colombia

*Reprint requests: Guillermo A. Bonilla, MD, Department of Orthopedics and Traumatology, Hospital Universitario Fundación Santa Fe de Bogotá, Carrera 7 No. 117 – 15, Bogotá D.C., Colombia.

<https://doi.org/10.1016/j.arth.2017.09.044>

References

- [1] Newman ET, Herschmiller T, Attarian DE, Vail TP, Bolognesi MP, Wellman SS. Risk factors, outcomes, and timing of manipulation under anesthesia after total knee arthroplasty. *J Arthroplasty* 2017. <https://doi.org/10.1016/j.arth.2017.08.002> [Epub ahead of print].
- [2] Fitzsimmons SE, Vazquez EA, Bronson MJ. How to treat the stiff total knee arthroplasty? A systematic review. *Clin Orthop Relat Res* 2010;468:1096–106. <https://doi.org/10.1007/s11999-010-1230-y>.
- [3] Schiavone Panni A, Cerciello S, Vasso M, Tartarone M. Stiffness in total knee arthroplasty. *J Orthop Traumatol* 2009;10:111–8. <https://doi.org/10.1007/s10195-009-0054-6>.
- [4] Cheuy VA, Foran JRH, Paxton RJ, Bade MJ, Zeni JA, Stevens-Lapsley JE. Arthrofibrosis associated with total knee arthroplasty. *J Arthroplasty* 2017;32:2604–11. <https://doi.org/10.1016/j.arth.2017.02.005>.
- [5] Mamarelis G, Sunil-Kumar KH, Khanduja V. Timing of manipulation under anaesthesia for stiffness after total knee arthroplasty. *Ann Transl Med* 2015;3:316. <https://doi.org/10.3978/j.issn.2305-5839.2015.10.09>.
- [6] Issa K, Banerjee S, Kester MA, Khanuja HS, Delanois RE, Mont MA. The effect of timing of manipulation under anesthesia to improve range of motion and functional outcomes following total knee arthroplasty. *J Bone Joint Surg Am* 2014;96:1349–57. <https://doi.org/10.2106/JBJS.M.00899>.

Response to Letter to the Editor on “Risk Factors, Outcomes, and Timing of Manipulation Under Anesthesia After Total Knee Arthroplasty”



In Reply:

We appreciate the thoughtful commentary of Dr Suárez et al. Their letter highlights the most vexing problem in assessing func-

tional outcome after TKA: patients with poor motion are easily identified at 3 or 6 months postoperatively, but detecting the at-risk patient in the immediate postoperative period can be a challenge. As noted by the commentators, our study is neither prospective nor a characterization of the “natural history” of the progression of postoperative knee motion.

However, the immediate premanipulation motion among patients undergoing early manipulation under anesthesia (MUA within 6 weeks of index procedure) in our study was 59°. Manipulations among these patients were performed at an average of 34 days postoperatively (range, 21–42). While it is likely that these patients would have seen some subsequent improvement in motion over time even without manipulation, we believe that, anecdotally, most surgeons would agree that flexion under 60° at 5 weeks postoperatively would portend a poor outcome without intervention. That these early MUA patients achieved a satisfactory outcome—final flexion values statistically equivalent to those of appropriately matched controls—suggests that very poor motion in the early postoperative period is not necessarily a functional death knell for “at-risk” patients (defined, in our cohort, as young smokers with prior knee surgeries), if MUA is performed early. We agree with the commentators that it is impossible, from our data alone, to identify the extent to which early manipulation altered the postoperative course for these patients; a prospective and randomized protocol, with frequent postoperative motion checks, will be required to characterize this.

Erik T. Newman, MD^{a,*}
Thomas A. Herschmiller, MD^b
David E. Attarian, MD, FACS^c
Thomas P. Vail, MD^d
Michael P. Bolognesi, MD^c
Samuel S. Wellman, MD^c

^aHarvard Combined Orthopaedic Residency Program
Boston, MA

^bOlympic Medical Center
Port Angeles, WA

^cDepartment of Orthopaedic Surgery
Duke University Medical Center
Durham, NC

^dDepartment of Orthopaedic Surgery
University of California
San Francisco Medical Center
San Francisco, CA

*Reprint requests: Erik T. Newman, MD, Department of Orthopaedics, Massachusetts General Hospital, 55 Fruit Street, Boston, MA 02114.

<https://doi.org/10.1016/j.arth.2017.09.045>

DOI of original article: <https://doi.org/10.1016/j.arth.2017.09.044>.

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to <https://doi.org/10.1016/j.arth.2017.09.045>.