Editorial review: *American Journal of Sports Medicine* "*Evaluation of the Risk Factors for a Rotator Cuff Retear After Repair Surgery*"

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With reported retear rates of 17–19% in recent large cohorts following arthroscopic rotator cuff repair surgery, identification of risk factors leading to retears is of significant prognostic value (1,2). Additionally, historic rotator cuff repair failure rates have ranged from 11% to 94%. In this study by Lee *et al*., three independent risk factors for retear following rotator cuff repair were identified: patient age, initial tear size, and fatty degeneration of the supraspinatus. The authors performed a level of evidence 3 retrospective case-control study to exam risk factors for rotator cuff repair failure. This cohort was all treated by a single surgeon and the comparisons between single row repair and transosseous equivalent double row repair represent a change in practice by the surgeon. As one of the largest retrospective cohort studies on the topic with 693 patients, the authors reported a retear rate of 7.22%. The failure rate of the single row group was 7.5% (16/214) and the transosseous equivalent group 7.1% (34/479). Furthermore, the authors performed a power analysis on retear rates and although they did not comment on whether this calculation was done a priori, they showed they found a sample size of 207 would provide 80% power. While this is comparable to recent studies in the literature, its slightly better retear rate may be a reflection of the large proportion of partial-thickness tears (23.1% of the cohort), which have been shown to have improved healing rates (3) as well as small and medium size tears 61% (422/693). In addition, while a prior study by Iannotti *et al*. reports that retears primarily occur between 6 and 26 weeks following arthroscopic repair. The average time to postoperative magnetic resonance imaging (MRI) in this study was between 4 to 7 months (4). It is therefore reasonable to conclude that the authors captured that majority of repair failures and/or retears in this cohort, but it is unknown how longer follow up would affect these results based on the current literature.

The size of its cohort is undoubtedly one of the strengths of this study. Both the single row repair group and transosseous equivalent group both were adequately powered based on the sample size calculations provided. The ability to obtain routine MRI both pre- and postoperatively over the course of 9 years despite the financial and logistical burden was crucial to the success of the study. As the authors did acknowledge, however, the economic limitations for some patients did create an inherent selection bias as they were excluded from the study.

The finding of preoperative tear size as an independent risk factor for rotator cuff repair has been well studied and illustrated throughout the literature. Recent large cohort studies by Le *et al*., Wu *et al*., and Kim *et al*. all cite cuff tear size as a predictor of retear following cuff repair (1,2,5). Similarly, a recent meta-analysis by Saltzman *et al*. correlated larger preoperative cuff tear size to significantly higher retear rates, particularly in the setting of early motion rehabilitation programs (6). While some studies have challenged the idea of age correlating to retear rate, others report findings consistent with that of this study, as an independent risk factor for retear (1,7,8). What is difficult to assess with the data provided is what specific age range or cut off increases the risk of repair failure. While the findings of this study demonstrate that failure correlates with age they are nonspecific as to what age. Fatty

degeneration of the supraspinatus was also found to be an independent risk factor for retear, a finding also supported by a recent meta-analysis by Khair *et al*. (9).

Perhaps the most original aspect of this study by Lee *et al*. concerns the intraoperative evaluation of the rotator cuff repair as determined by the amount of greater tuberosity footprint coverage and presence of any remaining humeral head exposure. Initially described by Sugaya *et al*., this was categorized numerically from type I to type IV repairs, with type I representing a complete repair to the lateral-most portion of the footprint on the greater tuberosity (10). While conceptually, greater footprint coverage by a repair would perhaps infer an improved repair and lower risk of retear, this was not corroborated in the study. It is an interesting factor to analyze, given that the completeness of repair is variable intraoperatively and dependent on surgeon experience, characterization of the rotator cuff, integrity of the repair, and many other components. As proposed by the authors of the paper, the completeness of repair is quite dependent on aforementioned variables like initial tear size and fatty degeneration of the supraspinatus, so the ability to maximize footprint coverage during a repair obligates an effect on these variables as well. The challenge in analyzing an intraoperative variable like repair completeness based on footprint coverage calls to question its reliability and reproducibility, particularly given that the operations in this study were performed by a single surgeon, with uncertain precision in the measurements and grading of footprint coverage. Additionally, footprint coverage of the repair may be related to proper tear pattern recognition. It would be interesting to learn from future studies how well inter-observer and intra-observer measurements fare in this unique variable to assess completeness of the cuff repair and its relationship with retear rates as well as how tear pattern correlates with the ability to cover the footprint. Although no known studies to this point have proven any significance in the extent of footprint coverage during a repair, a study by Liu *et al*. also found no difference in postoperative retear rates when comparing tape versus number 2 suture use for repair, despite finding that tape yielded a greater footprint contact pressure (11). A retrospective study by Nakamura *et al*. showed that at 3.6 years of follow up, patient-reported outcome scores were significantly improved despite rotator cuff retear after repair as long as tendon healing at the middle facet was preserved (12). This finding, in addition to the questions raised by Lee's study probes at the significance of precise anatomic considerations during repair and their relationship to retear rates in the postoperative setting following rotator cuff repair.

Limitations of this study include its retrospective design, it is only a single surgeon experience, and the comparative groups represent a historic change in practice. Given only 42% (693/1,633) of the arthroscopic rotator cuff repairs performed met inclusion criteria this introduces some selection bias to the results as we do not know how the other 58% did or how these subjects could have effected results.

Ultimately, this large retrospective comparative cohort study further substantiates variables associated with cuff retear after arthroscopic rotator cuff repair, identifying patient age, initial tear size, and fatty degeneration of the supraspinatus each as independent risk factors. And while it fails to correlate completeness of rotator cuff repair based on the extent of footprint coverage, it further begs the question of what role footprint coverage has on postoperative outcomes, and how this role interrelates with other known variables.

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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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