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Comparison of implant cost and surgical time in arthroscopic transosseous and transosseous equivalent rotator cuff repair

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Background: We investigated the cost savings associated with arthroscopic transosseous (anchorless) double-row rotator cuff repair compared with double-row anchored (transosseous-equivalent [TOE]) repair.
Methods: All patients undergoing double-row arthroscopic rotator cuff repair from 2009 to 2012 by a single surgeon were eligible for inclusion. The study included 2 consecutive series of patients undergoing anchorless or TOE repair. Excluded from the study were revision repairs, subscapularis repairs, patients with poor tendon quality or excursion requiring medialized repair, and partial repairs. Rotator cuff implant costs (paid by the institution) and surgical times were compared between the 2 groups, controlling for rotator cuff tear size and additional procedures performed.
Results: The study included 344 patients, 178 with TOE repairs and 166 with anchorless repairs. Average implant cost for TOE repairs was $1014.10 ($813.00 for small, $946.67 for medium, $1104.56 for large, and $1507.29 for massive tears). This was significantly more expensive compared with anchorless repairs, which averaged $678.05 ($659.75 for small, $671.39 for medium, $695.55 for large, and $716.00 for massive tears). Average total operative time in TOE and anchorless groups was not significantly different (99 vs. 98 minutes). There was larger (although not statistically significant) case time variation in the TOE group.
Conclusions: Compared with TOE repair, anchorless rotator cuff repair provides substantial implant-related cost savings, with no significant differences in surgical time for medium and large rotator cuff tears. Case time for TOE repair varied more with extremes in tear size.
Level of evidence: Level IV; Economic Analysis

Keywords: Arthroscopic transosseous; rotator cuff; cost; operative time; value; transosseous equivalent

With the goal of improving outcomes and reducing costs, providers and policymakers alike have increasingly prioritized the promotion of value-based care in the current health care climate.[6,8,10] The importance of applying these tenets to rotator cuff surgery are self-evident, given the high prevalence of disease and steady rise of rotator cuff repairs in the United States.[12] During the past few years, studies have begun to

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analyze the cost effectiveness and economic value of rotator cuff repairs. Rotator cuff repair is cost effective to the patient (as determined by standard cost-effectiveness ratios)[37] and produces net societal cost savings when considering direct and indirect costs of treatment.[24]

However, the most effective and least costly way to repair a torn rotator cuff is a topic of considerable debate. Many authors advocate the biomechanical superiority of double-row repair for fixation strength,[1-4,20-22,25,29,33,38,39] although data remain mixed on the utility of double-row fixation on patient outcome and retear rate. Recent meta-analyses and systematic reviews conclude that double-row repairs may have higher healing rates and less retears,[23,26,40] although clinical outcomes data do not overwhelmingly favor one repair modality over another. Moreover, although rotator cuff repair as a whole produces net societal cost savings,[24] studies indicate that double-row repair is not cost effective, mainly because of the incremental cost of suture anchors with an additional row of fixation.

A novel method of all-arthroscopic transosseous rotator cuff repair exists that combines anchorless transosseous double-row fixation with the benefits of arthroscopic technique.[7,14,15,34] This technique negates the use of anchors as fixation points, which may confer substantial cost savings despite similar biomechanical fixation strength and suture configurations.[5,19] Multiple fixation points can be used in this technique by passing sutures through bone tunnels, and the addition of further tunnels (fixation points) can be performed without a large incremental cost.

This study analyzed differences in implant costs and surgical time between 2 cohorts of patients—those undergoing arthroscopic transosseous equivalent (TOE) rotator cuff repair and those undergoing arthroscopic transosseous rotator cuff repair. We hypothesized that transosseous repair would have significantly decreased implant costs but similar operative times compared with the TOE technique and that this effect would be magnified for larger rotator cuff tears.

Materials and methods

We retrospectively reviewed all patients who underwent arthroscopic rotator cuff repair by the senior author (M.D.L.) during a 4-year period (January 2009-December 2012). Approximately midway through this period, in December of 2010, rotator cuff repair fixation was switched from the standard TOE double-row technique to an all arthroscopic transosseous double-row repair using the ArthroTunneler device (Tornier, Bloomington, MN, USA). This allowed 2 separate consecutive treatment arms to be analyzed and compared.

All patients in our practice with full-thickness tears of the rotator cuff receive a double-row repair unless the tendon is of poor quality or excursion will not allow a double-row repair without excess tension on the rotator cuff. In these cases, a single-row "medialized" repair or partial repair is performed.

The study included patients who underwent a double-row rotator cuff repair for full-thickness posterosuperior tears or high-grade partial thickness tears with >50% tearing of the tendon substance; in our practice, these are converted to full-thickness tears and repaired as such. Exclusion criteria included concomitant subscapularis repair, a medialized repair due to poor rotator cuff excursion or poor tendon quality, or both, partial repairs, and revision rotator cuff repair.

The primary treatment variables analyzed were TOE and arthroscopic transosseous repair. Rotator cuff tear sizes were recorded and categorized according to the Cofield classification,[11] and any associated surgical procedures performed during the index surgery were recorded and analyzed as subcategories.

The primary outcome variables were total implant cost per case and surgical time. Total implant cost was measured as the overall cost the hospital paid for implants directly related to rotator cuff repair—anchors for TOE cases and the disposable transosseous shuttle device with additional suture material for transosseous cases. An additional lateral implant that can be used for cortical augmentation in cases of poor bone stock is the TunnelPro (Tornier). The use of this implant did not affect case/implant cost because these implants were bundled with pricing of the ArthroTunneler system at our institution.

The price calculation did not include prices of motorized shavers, suture passers, or surgical instruments owned and supplied by the hospital. Additional implants used for associated procedures (ie, biceps tenodesis) were not included in the cost calculation. Operations were performed at 1 of 2 institutions; therefore, prices were adjusted to account for differences in institutional implant pricing contracts and for price changes over time. Cost of implants was reflected as actual cost paid by each institution at the time of surgery, a number subject to change over time depending on contract/pricing negotiation. Largely, these data only varied by less than 5% overall implant cost between institutions and over time. Pricing data are reflected as a total implant charge per case to preserve the confidentiality of vendor contracts on individual implants and devices. Surgical time was determined by anesthesia records as the time from incision to the time dressings were applied to the shoulder.

Surgical technique and additional procedures

All patients underwent arthroscopic rotator cuff repair in the beach chair position under general anesthesia with supplemental regional anesthesia, unless contraindicated. Residents or fellows, or both, participated as assistants in all cases. Associated procedures were performed, when indicated, and included subacromial decompression, labral débridement or repair, biceps tenotomy or tenodesis, chondroplasty, and suprascapular nerve decompression. Rates of associated procedures within each repair category are reported in Table I.

Table I Associated procedures

Procedure	TOE (n = 178) (%)	Transosseous (n = 166) (%)
Subacromial decompression	95.5	93.4
Labral débridement	70.2	79.5
Biceps tenotomy	15.7	17.5
Biceps tenodesis	5.6	9.0
Chondroplasty	2.2	1.2
Labral repair	3.4	2.4
SSN decompression	1.1	1.2

SSN, suprascapular nerve; *TOE*, transosseous equivalent.