The Cost of Superior Capsular Reconstruction is Understudied: A Scoping Review

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Objective: Analyze current published literature to establish the costs associated with performing superior capsular reconstruction for irreparable rotator cuff tears.

Design: Scoping Review

Main Outcome Measure: Cost of performing superior capsular reconstruction

Results and Conclusion. An initial search yielded 94 studies for screening of which two studies were eligible for inclusion. Estimated costs ranged from $5,642 to $20,837 U.S. dollars. The average cost for SCR was ultimately determined to be $16,330.56 with adjustments for inflation. There is extremely limited data regarding the current cost of SCR. Much of the cost associated with the procedure is driven by the costs of intraoperative factors including implants and operative time.

Level of Evidence: IV; Review

Keywords: Rotator cuff tear, Superior Capsular Reconstruction, shoulder surgery, cost, value, business

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INTRODUCTION

Surgical management of massive, irreparable rotator cuff tears (IRCT) includes debridement, partial repair, interposition grafts, superior capsule reconstruction (SCR), subacromial balloon spacers, tendon transfers, and reverse total shoulder arthroplasty (RTSA).[10] Outcomes following debridement, partial rotator cuff repair, and interposition grafts are associated with poor outcomes among young patients, and RTSA in young patients raises concerns regarding implant survival, activity limitations, joint destruction, and poor patient outcomes.[12] Subsequently, SCR, margin convergence, and lower trapezius tendon transfer (LTTT) have become increasingly popular in the treatment of young patients.[2] As first proposed by Mihata et al.[13] in 2012, SCR promotes improved biomechanics of the glenohumeral joint with the reconstruction of the superior capsule, commonly performed with fascia lata autograft or acellular dermal allograft.[7]

Unfortunately, cost analyses of IRCT treatments are scarce.[11] A 2016 study by Kang et al.[9] identified cost-effectiveness benefits for RTSA when compared with physical therapy, debridement with biceps tenotomy, and hemiarthroplasty, while a 2019 study by Castagna et al.[3] identified subacromial balloon spacer insertion as more cost-effective than arthroscopic partial repair and total shoulder arthroplasty. To our knowledge, there is no consensus on the cost of SCR, and no current literature reviews focused exclusively on gauging the overall cost of the procedure. Understanding the cost of orthopaedic procedures is critical to understanding relevant economic incentives, honing systems efficiency, and ultimately facilitating high-value care.[5,6,8,15-17] With many studies limited to data from single institutions, systematic and scoping reviews of disparate and heterogenous data may offer the most accurate estimation.[14]

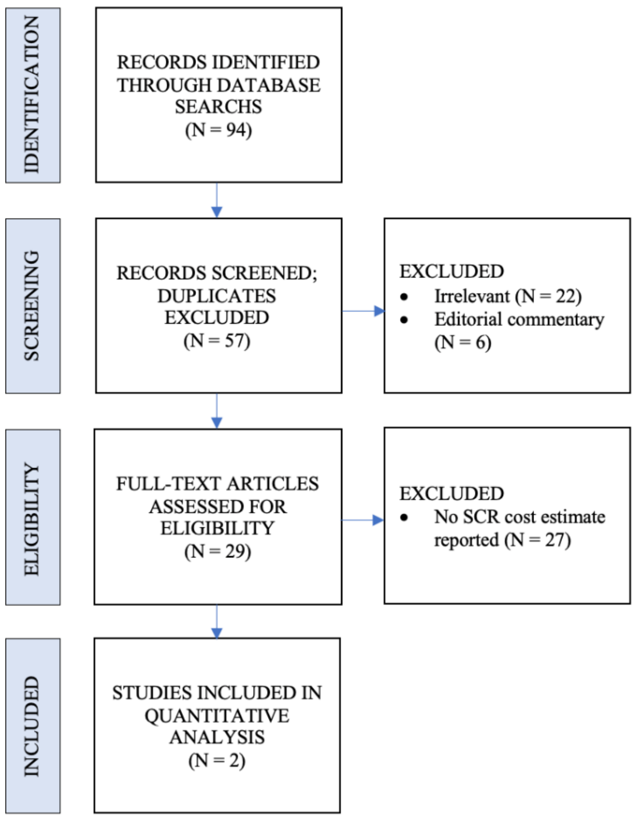
Given the recent adoption of SCR as a viable treatment for IRCT, understanding the cost implications of this procedure is important and offers value to stakeholders such as hospital systems, physicians, and patients. Subsequently, the purpose of this study is to investigate the cost estimates of SCR in existing literature in the setting of limited consensus on total SCR cost.

METHODS

This scoping review was performed per PRISMA guidelines for Scoping Reviews. Searches were performed in PubMed, Scopus, and Google Scholar via Harzing PoP software Version 8 for the following keywords: (superior capsu* reconstruction AND cost). Results were not limited by year. Eligibility criteria were determined by study design and reporting of relevant outcome data. Studies reporting both costs among adult patients and estimated costs for SCR were considered eligible for inclusion. Studies were excluded if no estimate was given. Data collected from articles included the SCR cost estimate and the year in which the cost estimate was made.

For articles that only reported a range, the median of the range reported was used in cost calculations. The fiscal year of data collection for cost estimate was used to adjust for inflation; however, in the absence of a fiscal year, the publication year of the final paper was used. All figures were adjusted for inflation to 2022 dollars.

Figure 1: PRISMA Flow Diagram



RESULTS

The initial search yielded 94 studies (Figure 1). Of these, 37 were eliminated due to duplication. Of the remaining 57 studies available for title and abstract screening, six editorial commentaries and 22 irrelevant studies were excluded and 29 underwent full-text review. Of these, 27 did not estimate the cost of SCR and were subsequently excluded, resulting in two articles considered eligible for inclusion.

Estimated costs given within the cited articles ranged from $5,642 to $20,837 (Table 1). Given the recency of the adoption of SCR, all costs were estimated in the last five years, specifically between 2018 and 2022. After adjustment for inflation, the higher SCR cost estimate ranged from $24,629.29 – $23,896.16 and the lower estimate from $6550.15 – $10,246.65. Averaging each separate range yielded two cost estimates of $24,262.73 and $8,398.40. Between these, the average cost estimate for SCR was ultimately $16,330.56.

DISCUSSION

Ultimately, the average cost of SCR was found to be $16,330.56 when adjusted for inflation to 2022, with a range from $6550.15 to $24,629.29. In this scoping review, only two studies were eligible for inclusion, both including data from 2018 to 2022. The recency of these studies subsequently illustrates the recent adoption of this procedure as well as the paucity of data available in investigating the cost of SCR. However, with only two studies, it is difficult to elucidate concrete and quantifiable estimates of the cost of the procedure. Similarly, while both studies' methodologies offer valuable insight into estimating the cost of this procedure, the heterogeneity between the two further complicates the calculation of an accurate cost.

The two existing studies that currently assess the cost of SCR offer different methodologies for estimating the cost of the procedure. In their cost analysis comparing SCR, LTTT, and RTSA for IRCT, Marigi et al.[11] assessed costs associated with preoperative evaluation, index surgical hospitalization, and postoperative care, ultimately concluding that total costs were $16,915, $17,210, and $20,837 for LTTT, RTSA, and SCR, respectively, in cohorts of 47, 88, and 20 patients, despite SCR being performed as an outpatient procedure and LTT and RTSA accruing a one-night hospital stay. In their critical review of SCR, Galvin et al.[7] compare double-row rotator cuff repair and SCR based on the number and cost of suture anchors, operative time for anchor insertion, and cost of human dermal allograft, without including preoperative workup or postoperative admission or evaluation. While Marigi et al.[11] focus more on the upstream and downstream associated costs of the procedure in their assessment, Galvin et al.[7] offer a detailed and specific look into the different factors that directly impact the cost of the procedure. Despite the differences in their methodologies that may limit comparability, both studies offer valuable comparisons that ultimately contribute to an estimation of the SCR cost and the differences between them and reiterate the limited availability of cost-related data to physicians and patients at large.

Table 1: Included Studies

Author (Year)	SCR Cost	Year	SCR Cost Adjusted for Inflation	Adjusted Average
Marigi et al (2022)[11]	$20,837.00	2018-2022	$23,896.16 – $24,629.29	$24,262.73
Galvin et al (2019)[7]	$5,642 – $8,826	2019	$6550.15 – $10,246.65	$8,398.40
Average				$16,330.56

Both intraoperative and perioperative decision-making contributes to variability in surgical cost. In Marigi et al.'s[11] discussion of perioperative decision-making, factors associated with greater percentages of the total cost of SCR as compared to LTTT and RTSA include implants, operating room, and supplies, while hospital room and pharmacy costs were lower, likely due to SCR being performed as an outpatient procedure versus LTTT and RTSA protocols including postoperative admission. The authors further specify that human dermal allograft and operative time are major contributors to the operative cost. However, preoperative costs were $507 for SCR and LTTT versus $730 for RTSA with no significantly different complications, reoperation, and readmission in the 90-day postoperative period, none of which occurred among patients undergoing SCR, implying that much of the cost discrepancy between the procedures is likely attributable to intraoperative factors. In Galvin et al.'s[7] review focusing on intraoperative factors, the SCR technique requires six to seven anchors, with two to three anchors used to attach the human dermal allograft to the glenoid rim. They further identify the human dermal allograft as a substantial proportion of the cost, accounting for nearly half of the overall cost of the procedure, ranging from $3,200 to $3,947 out of $5,642 to $8,826 overall. Furthermore, implantation of both human dermal allograft and the additional required anchors prolongs operative time, with each anchor prolonging the procedure by eight to 15 minutes[1], ultimately increasing the cost of the procedure between $320 to $1,350 as compared to double-row rotator cuff repair.

With the majority of the cost associated with SCR stemming from intraoperative factors, several ways can be used to promote cost-effectiveness. Some authors have advocated for replacing the human dermal allograft with a long head of the biceps (LHB) autograft by maintaining the LHBB's attachment at the superior labrum and performing tenodesis at the greater tuberosity[4], thereby eliminating the need for allograft as well as decreasing the overall number of suture anchors required as well as the operating room time requisite for their insertion.

Limitations to this study are numerous, with the majority propagated by the extremely limited data available for comparison. However, as previously mentioned, the absence of available studies discussing the cost of SCR creates challenges in quantifying the outcome. Despite these limitations, we strongly believe that there is substantial value in harnessing this scoping review to emphasize the importance of encouraging cost transparency to influence decision-making as well as the underlying intraoperative trends that drive costs associated with SCR.

CONCLUSION

There is extremely limited data regarding the current cost of SCR. Regardless, much of the cost associated with the procedure appears to be driven by the costs of intraoperative factors including implants, specifically human dermal allografts and anchors, and operative time. Future research identifying pertinent costs to SCR will be invaluable in determining the role of this procedure in treating IRCTs as well as how to maximize cost-effectiveness in general.

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