

Direct Cost Analysis of Outpatient Arthroscopic Rotator Cuff Repair in Medicare and Non-Medicare Populations

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Background: Providing high-quality care while also containing cost is a paramount goal in orthopaedic surgery. Increasingly, insurance providers in the United States, including government payers, are requiring financial and performance accountability for episodes of care, including a push toward bundled payments.

Hypothesis: The direct cost of outpatient arthroscopic rotator cuff repair was assessed to determine whether, due to an older population, rotator cuff surgery was more costly in Medicare-insured patients than in patients covered by other insurers. We hypothesized that operative time, implant cost, and overall higher cost would be observed in Medicare patients.

Study Design: Cohort study; Level of evidence, 3.

Methods: Billing and operative reports from 184 outpatient arthroscopic rotator cuff repairs performed by 5 fellowship-trained arthroscopic surgeons were reviewed. Operative time, number and cost of implants, hospital reimbursement, surgeon reimbursement, and insurance type were determined from billing records and operative reports. Patients were stratified by payer (Medicare vs non-Medicare), and these variables were compared.

Results: There were no statistically significant differences in the number of suture anchors used, implant cost, surgical duration, or overall cost of arthroscopic rotator cuff repair between Medicare and other insurers. Reimbursement was significantly higher for other payers when compared with Medicare, resulting in a mean per case deficit of \$263.54 between billing and reimbursement for Medicare patients.

Conclusion: Operating room time, implant cost, and total procedural cost was the same for Medicare patients as for patients with private payers. Further research needs to be conducted to understand the patient-specific factors that affect the cost of an episode of care for rotator cuff surgery.

Keywords: arthroscopy; rotator cuff; cost analysis; economics

Shoulder disease is a major cause of musculoskeletal disability in the United States. Chronic shoulder pain has been estimated to affect approximately 8% of all American adults, second only to chronic knee pain in our society's

burden of musculoskeletal disease.^{1,16} Rotator cuff pathology is the leading cause of shoulder-related disability seen by orthopaedic surgeons,¹⁴ and surgical volume is on the rise. One study, for example, notes a 141% increase in rotator cuff repairs from 1996 to 2006 in the United States.³ As our society continues to age and remain active, volume will undoubtedly increase as well. Previous research by our group has shown that most repairs in the United States are conducted arthroscopically.¹⁷ A large body of work has investigated arthroscopic rotator cuff repair with respect to surgical technique, healing rates, and clinical outcomes; however, the financial implications of this surgical procedure are understudied.

In the current era of declining reimbursements, surgeons and hospitals must be cognizant of the cost of delivering care to maintain their financial viability. Preliminary work at our institution evaluated the direct cost of arthroscopic

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outpatient rotator cuff repair surgery at our surgical center and identified consumable costs (specifically suture anchors) and duration of surgery as the major cost drivers of this procedure.¹¹ The purpose of this study was to further characterize actual implant costs from anchor utilization, surgical duration, and overall cost of outpatient arthroscopic rotator cuff repair with a larger patient cohort. These actual costs were compared with hospital reimbursements from various third-party payers. We hypothesized that operative time, implant cost, and overall cost would be higher in Medicare patients.

METHODS

Under institutional review board protocol, patients who underwent primary rotator cuff repair for magnetic resonance imaging (MRI)-confirmed rotator cuff tears between March 2013 and December 2014 were identified from the billing records of 5 fellowship-trained arthroscopic surgeons at a single academic center. The attending surgeon performed all surgeries with the assistance of a senior orthopaedic resident or fellow. Specific operative technique for performing the repair, including the number and configuration of suture anchors, was done at the discretion of the attending surgeon. All surgeries were performed in the outpatient surgery center at our institution.

Surgical billing records and operative reports for patients meeting inclusion criteria were reviewed to determine the following information: time spent in the operating room, duration of actual surgical procedure, number of suture anchors used in the rotator cuff repair, total implant cost, hospital reimbursement for the procedure, surgeon reimbursement, and insurance type. Patients were stratified by payer (Medicare vs non-Medicare), and the aforementioned variables were compared between groups. Hospital margin was calculated as the difference between reimbursement and charges. Statistical differences between groups were calculated using the Student *t* test, with significance set at $P < .05$.

RESULTS

A total of 69 Medicare patients (mean age, 68.8 years) and 115 patients with private insurance coverage (mean age, 57.9 years) meeting inclusion criteria were included in the cost analysis. Patients with private coverage were younger than those with Medicare coverage ($P < .001$). Tear location in both payer groups is noted in Table 1. Isolated tears of the supraspinatus were most common in both groups, but there were no statistically significant differences for tear location between the 2 groups. Tears of the long head of the biceps were noted in 22 of 69 (31.9%) Medicare patients and 45 of 115 (39.1%) patients who had other payers.

There were no statistically significant differences in the number of suture anchors used, implant cost, surgical duration, or overall cost of the procedure between patients insured by Medicare compared with other payers (Table 2). Reimbursement for the surgeon and the

TABLE 1
Tear Location Stratified by Payer Source^a

Tear Location	Medicare	Other Payers
SSP alone	32 (46.3)	54 (47)
IS alone	0 (0)	1 (0.87)
SSC alone	6 (8.7)	6 (5.2)
SSP + IS	12 (17.4)	24 (20.9)
SSP + SSC	7 (10.1)	14 (12.1)
SSP + SSC + IS	12 (17.4)	13 (11.3)
SSC + IS	0 (0)	2 (1.7)
SSP + IS + TM	0 (0)	1 (0.9)
Total	69 (100)	115 (100)

^aData are presented as n (%). IS, infraspinatus; SSC, subscapularis; SSP, supraspinatus; TM, teres minor.

hospital was significantly lower for patients with Medicare compared with other payers. A mean per case deficit of \$263.54 between billing and reimbursement was observed for the hospital regarding patients with Medicare compared with a mean net hospital gain of \$4560.33 with all other payers.

DISCUSSION

The cost of delivering effective health care has become a major focus of American economic policy both on a national level and for individual health care institutions. The present study evaluates both the cost of arthroscopic rotator cuff repair and the surgeon/hospital reimbursement for the procedure. Understanding the financial details of these procedures is important in both cost containment and in avoiding further decline in reimbursement. In this study, we demonstrated that rotator cuff tears in the Medicare population were not more costly to fix than in patients insured by other providers. However, in our health system, actual reimbursement from Medicare did not quite cover these costs, resulting in a small overall per case deficit.

Cost containment strategies in this country have largely focused on budgetary fixes, fee structure reform, and an emphasis on value-based health care delivery.^{9,12} Declining reimbursement to surgeons, including bundled payments, is a well-known fact. Medicare reimbursement for arthroscopic rotator cuff repair has continued to decline. In 2015, for example, mean reimbursement was reported as \$1084.44, down from \$1101.19 in 2014.^{4,5} Similar declines have been noted with private payers, though surgeon reimbursement overall remains higher for private payers as compared with Medicare, as the present study illustrates.

While there remains much debate regarding the cost-effectiveness of single- versus double-row repairs, rotator cuff repair surgery overall remains financially justified. Mather et al¹⁰ performed an elegant economic analysis of rotator cuff repair surgery in the United States, noting an increase in quality-adjusted life-years (QALYs) for all patients undergoing rotator cuff repair, irrespective of age. An estimated \$3.44 billion lifetime societal savings was also noted for the approximately 250,000 rotator cuff repairs

TABLE 2
Surgical Variables Stratified by Payer Source^a

Variable	Medicare	Other Payers	P Value
Time in operating room (wheels in to wheels out), min	145.8 ± 30.9	151 ± 36.8	.39
Duration of surgery (incision to dressings on), min	100.8 ± 26.7	107 ± 33.4	.14
Number of suture anchors used	2.96 ± 1.4	3.16 ± 1.5	.42
Total implant cost, \$	1063.8 ± 583.3	1151.81 ± 748.17	.43
Total variable cost, \$	6367.64 ± 1499.64	6904.3 ± 2718.23	.16
Hospital reimbursement, \$	6104.1 ± 1560.55	11464.62 ± 4908.58	<.001
Hospital margin, \$	-263.54 ± 2314.86	4560.33 ± 4527.09	<.001
Surgeon reimbursement, \$	1062 ± 188.33	1680 ± 413	<.001

^aData are presented as mean ± SD. Cost given in 2014 US dollars.

performed annually in the United States. Similar improvement in QALYs was noted in prior work by Vitale et al.¹⁵

Numerous authors have published outcomes of rotator cuff repair surgery. However, outcomes are only part of the value equation. Health care economists define “value” as patient health outcomes achieved per dollar of cost expended in a care cycle (diagnosis, treatment, and ongoing management) for a particular disease or disorder.^{7,13} However, there remains a paucity of literature regarding the cost of shoulder pathology in general, and an even smaller number of studies pertaining specifically to the rotator cuff. A recent systematic review by Kuye et al⁸ identified only 32 published economic evaluations of the shoulder from 1980 to 2010, only 8 of which (25%) addressed the rotator cuff. Similarly, Nwachukwu et al¹² performed a systematic review of cost effectiveness analyses within the sports medicine literature, identifying 12 studies meeting inclusion criteria, only 3 of which pertained to the rotator cuff.

Several authors have evaluated the cost of arthroscopic rotator cuff repair, estimating the cost from \$5449 to \$10,605, depending on the specific cost methodology used.^{2,6,11,15} The present study demonstrates costs within this range, noting a cost of \$6367 for Medicare patients and \$6904 for patients with other insurers. Unlike prior work, however, we present data regarding the effect of these surgeries on the institutional reimbursement, and importantly, identify that arthroscopic rotator cuff repair in Medicare patients results in a net per case deficit to our health system with current techniques.

There are several limitations of our study. First, this is a retrospective review involving multiple surgeons at a single institution. It is therefore subject to the standard biases inherent in retrospective studies. Moreover, patients from all involved surgeons were pooled together and stratified only by insurer and not by differences in tear chronicity, size, or location, which all affect operative time and cost and may have differed between the groups. Similarly, surgeon-specific differences in the number, type, or configuration of suture anchors (which may vary in cost between the multiple vendors utilized by the surgeons in our institution) or preference for performing biceps tenotomy or tenodesis concurrently with rotator cuff repair could affect the cost estimates for each insurance group. Tear size, which is a major driver of implant cost and surgical time, was not specifically evaluated between groups, as operating surgeons did

not consistently report tear size in their operative reports nor were preoperative MRIs consistently available for review in our electronic medical record. However, these surgeon- and tear-related variables are likely evenly distributed between the 2 groups in the study, and differences related to these variables are likely small given similar operative times and consumable usage between the groups.

In addition, the results of the present study may not be generalizable to other surgical centers. Age distribution between payer groups may vary by region, with more potential for private insurance instead of Medicare coverage above age 65 years in more affluent areas, for example. Furthermore, all surgeons in the present study are fellowship-trained arthroscopic surgeons who perform a high volume of rotator cuff repairs, which directly affects surgical time and cost. Furthermore, institution-specific contracts with device and implant manufacturers may affect the overall profitability of rotator cuff repair surgery at other centers, even assuming similar surgical time and consumable utilization.

CONCLUSION

Rotator cuff tears in Medicare patients were of similar size and required similar operative times and anchor use during the repair compared with patients insured privately. Although rotator cuff tears in the Medicare patient were not more costly to repair, reimbursement was significantly lower. Patient-, hospital-, and surgeon-specific factors should be further studied with respect to cost efficiency to ensure financial viability of health systems providing care while delivering maximum value without compromising outcomes in patients with rotator cuff tears.

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