



Insurance status is not a predictor of rotator cuff tear magnitude

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Background: Rotator cuff tear (RCT) chronicity is an important factor in considering treatment options and outcomes for surgical repair. Many factors may contribute to delayed treatment, including timely access to care due to insurance status. The purpose of this study was to evaluate the relationship between the magnitude of RCT on presentation and insurance status. We hypothesize that publicly insured patients will have a greater incidence of chronic RCTs and shoulder pathology on initial presentation.

Methods: Retrospective chart review of patients undergoing RCT repair at an academic tertiary care institution from 2005 to 2019. Demographic data, including age, race, sex, and insurance carrier, were collected. Insurance carriers were categorized into public (Medicare and Medicaid) or private insurance coverage. Individual magnetic resonance imaging were then reviewed by a board-certified musculoskeletal radiologist for supraspinatus (SS), infraspinatus (IS), subscapularis, and biceps tendon tears, as well as acromioclavicular arthritis. In addition, rotator cuff atrophy was evaluated by the scapular ratio. Univariate analysis of variance and logistic regression analyses were used to compare demographics and rotator cuff pathology between those with Medicaid and Medicare, as well as between publicly and privately insured patients.

Results: Of the 492 patients in this study, 192 had private insurance, and 300 had public insurance (Medicaid: 50 and Medicare: 250). Insurance status was not found to be associated with differences in RCTs between Medicare and Medicaid patients. Those with Medicaid or Medicare (public), presented more frequently with SS or IS atrophy (SS atrophy, $P = .002$; IS atrophy, $P = .039$) than those with private insurance. However, after adjusting for age, no significant differences in rotator cuff tendon tear or atrophy frequencies were found between insurance groups.

Conclusions: Patients with private and public insurance tend to present with similar chronicity and magnitude of RCTs. Insurance status does not appear to influence timely access to surgical care for patients with RCTs at an academic medical center.

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Rotator cuff tears (RCTs) are among the most common orthopedic injuries, affecting as many as 17 million people in the United States, prompting 200,000 to 300,000 repairs each year.^{25,27} The results of arthroscopic rotator cuff repairs are generally favorable; however, numerous documented factors, including age, magnitude

of cuff tear, number of torn tendons, degree of atrophy, workers compensation status, and delayed time to repair, place the patient at high risk of treatment failure.^{1,8,10,39}

Insurance status is becoming an increasingly recognized barrier to receiving timely and optimal medical care.^{7,4,9,13,18,30} Prior studies have demonstrated disparities in access to orthopedic services for privately versus publicly insured adult patients, especially those insured by Medicaid.^{4,9,13,18,22,30,38} However, the link between insurance status and tear magnitude has not yet been evaluated in adults with rotator cuff tears (RCTs). The purpose of this study was to investigate the relationship between insurance status (Medicaid or Medicare vs. privately insured patients)¹⁴ and rotator cuff

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disease at the time of presentation to an orthopedic surgeon, measured by complete cuff tears and atrophy. The secondary outcomes include the incidence of acromioclavicular (AC) arthritis and biceps tendon (BT) tears. The authors hypothesize that publicly insured patients will more frequently present with shoulder pathology suggestive of chronic RCTs than privately insured patients and also have more concomitant biceps pathology.

Methods

This retrospective review examined adult patients who were treated at a tertiary referral academic hospital for RCT between 2005 and 2019. Institutional review board approval was obtained before the study. Patients who underwent rotator cuff repair were identified by Current Procedural Terminology (CPT) codes 23410, 23412, 23420, and 29827. To be included, patients required a record of an insurance provider (Medicaid, Medicare, or private insurance group) and available magnetic resonance imaging. Demographic data, including age, race, gender, and insurance carrier, were also collected. Patients were allocated into groups based on insurance type: Medicare, Medicaid, public (Medicare + Medicaid), or private.

Individual magnetic resonance imagings were reviewed by board-certified musculoskeletal radiologists (MBF, CAN, BMP, and RZB). Images were analyzed based on degree of supraspinatus (SS), infraspinatus (IS), or subscapularis (SSc) tendon tears. Degree of RCT was characterized as intact, partial, or full thickness (complete). For analysis, we dichotomized pathology into complete and partial/none.²⁶ Rotator cuff atrophy was evaluated by measuring the scapular ratio, as previously described.²⁹ AC joint pathology and BT tears were also evaluated. AC arthritis was graded as normal or advanced with encroachment.

Data were analyzed using SAS (SAS Institute Inc., Cary, NC, USA). Descriptive statistics were performed to evaluate differences based on age, sex, and gender. Logistic regression analyses were performed, and relative risk (RR) ratios were obtained to compare the odds of rotator cuff, BT, and AC joint pathology between insurance groups. Because of the well-known association of age-related degeneration of rotator cuff musculature,^{15,28,36} the logistic regression analysis was adjusted for the potential confounding effect of age. Significance was established with an alpha of 0.05.

Results

A cohort of 492 patients were included in this study, with 192 privately and 300 publicly insured (Medicaid: 50 and Medicare: 250) individuals. The study population was 49.7% female and 50.3% male. The racial distribution was 33.1% African American, 2.1% Asian, and 63.6% Caucasian, which was similar between insurance groups ($P = .89$). Age distribution between insurance groups was significantly different, with Medicare patients (70.4 ± 9.8) being significantly older than Medicaid (62.6 ± 11.3 years) and privately insured patients (60.7 ± 10.5 years; $P < .001$). Significantly more publicly insured patients were found to be > 70 years of age than privately insured (public: 42.0%, private: 8.6%; $P < .001$; [Table I](#)).

Individual rotator cuff tears

There were no significant differences in the rate of complete SS, IS, or SSc tears between Medicare and Medicaid patients ([Table II](#)). When comparing privately and publicly insured patients, there were significantly more complete IS tears among publicly insured patients (public: 22.3% and private: 15.1%; $P = .031$). However, after

age adjustment, there was no significant difference between insurance groups ($P = .172$; [Table III](#)).

Rotator cuff atrophy

Although Medicaid patients presented more frequently with SS (30.0% vs. 18.0%) and IS (19% vs 14%) atrophy than Medicare, statistical significance was not reached ([Table II](#)). However, publicly insured patients were more likely to have SS (public: 12.3%, private: 7.3%; $P = .002$) or IS (public: 17.7%, private: 11.5%; $P = .039$) atrophy than privately insured patients. However, age adjustment indicated no difference in SS ($P = .488$) or IS ($P = .356$) atrophy between private and public insurance holders ([Table III](#)).

Multiple rotator cuff tears

Medicaid patients demonstrated a greater frequency of 2 tendon (SS and IS) tears than Medicare (Medicaid: 20.6%, Medicare: 13.3%); however, this difference did not reach statistical significance. In addition, no differences were found with 3 tendon (SS, IS, and SSc) tears between the groups ([Table II](#)). Similarly, more 2 tendon tears were recorded among publicly insured (public: 19.0%, private: 14.1%), but this was not statistically significant ([Table III](#)).

Multiple rotator cuff tears with atrophy

No statistically significant differences in 2 or 3 tendon tears with isolated or combined SS and IS atrophy were observed between Medicare and Medicaid patients ([Table II](#)). Publicly insured patients, however, presented with a greater frequency of 2 tendon tears with SS (public: 12.3%, private: 7.3%; $P = .049$) or IS (public: 11.0%, private: 5.7%; $P = .031$) atrophy than privately insured. After age adjustment, there was found to be no significant difference between groups double tears with SS ($P = .374$) or IS ($P = .182$) atrophy. Two tendon tears with SS and IS atrophy approached significance ($P = .051$). Patients presented with no statistically significant differences in 3 tendon tears with atrophy ([Table III](#)).

BT tears

Medicaid patients presented more frequently with complete BT tears than those with Medicare (Medicaid: 31%, Medicare: 19%; $P = .021$). After age adjustment, Medicaid patients maintained a significantly greater risk of presenting with bicep tendon tears (RR: 1.8 [1.1–3.0]; $P = .027$; [Table II](#)).

Compared with the privately insured group, publicly insured patients demonstrated significantly more BT tears than privately insured (public: 21.2%, private: 11.0%; $P = .003$). Age adjustment did not alter this association, as public insurance holders had an 80% greater risk of presenting with complete BT tears than privately insured patients (RR: 1.8 [1.1–3.0]; $P = .017$; [Table III](#)).

AC arthritis

No significant difference in the frequency of advanced arthritis was found between Medicaid and Medicare patients, as well as between the publicly and privately insured ([Table II](#) and [Table III](#)).

Discussion

In this retrospective review, we demonstrate that public insurance holders present more frequently with multiple RCTs with atrophy than privately insured patients. However, this appears to be more age related, as we found no difference in the degree of rotator cuff pathology or potential injury chronicity between groups after

Table I
Patient demographics.

Patient characteristic	Public		Private (%)	P value
	Medicaid (%)	Medicare (%)		
N	50 (10.2)	250 (50.8)	192 (39.0)	
Male	13 (46.4)	99 (47.1)	83 (59.7)	.253
Female	15 (53.6)	111 (52.0)	66 (40.3)	
Unknown	22	40	53	
Age (range)	62.6 ± 11.3 (42-85)	70.4 ± 9.8 (40-94)	60.7 ± 10.5 (28-90)	<.001
Race				
American Indian/Alaskan	0 (0)	1 (0.5)	0	.891
Asian	0 (0)	4 (1.9)	4 (2.7)	
Black or African American	8 (28.6)	75 (35.7)	48 (32.2)	
Multiple	0 (0)	1 (0.5)	0	
White	20 (71.4)	129 (61.4)	97 (65.1)	
Unknown	22	40	43	

Bolded values indicate significant P values where P < .05.

Table II
Rotator cuff pathology among Medicaid vs. Medicare patients.

Pathology characteristic	Medicaid	Medicare	Unadjusted, RR (95% CI)	P value	Adjusted for age, RR (95% CI)	P value
	n (%)	n (%)				
SS tear	31 (63)	173 (70)	0.88 (0.69-1.13)	.320	0.97 (0.76-1.24)	.798
IS tear	9 (18)	58 (24)	1.09 (0.95-1.27)	.222	1.09 (0.94-1.27)	.232
SSc tear	8 (16)	20 (8)	0.96 (0.86-1.08)	.514	0.96 (0.85-1.07)	.422
SS + IS tears	6 (13.3)	51 (20.6)	0.67 (0.31-1.46)	.313	0.70 (0.31-1.56)	.376
SS + IS + SSc tear	2 (4.4)	8 (3.2)	1.42 (0.31-6.47)	.650	1.75 (0.37-8.32)	.483
SS atrophy	9 (18)	73 (30)	0.54 (0.27-1.10)	.092	0.70 (0.34-1.42)	.322
IS atrophy	7 (14)	46 (19)	0.74 (0.34-1.63)	.456	0.74 (0.33-1.64)	.455
SS + IS tear AND SS atrophy	3 (6.7)	34 (13.3)	0.50 (0.16-1.56)	.234	0.54 (0.17-1.73)	.304
SS + IS tear AND IS atrophy	3 (6.7)	30 (11.8)	0.57 (0.18-1.76)	.332	0.57 (0.18-1.83)	.344
SS + IS tear AND SS + IS atrophy	3 (6.7)	26 (10.2)	0.66 (0.21-2.07)	.472	0.67 (0.21-2.20)	.511
SS + IS + SSc tear AND SS atrophy	1 (2.2)	8 (3.1)	0.81 (0.10-6.44)	.843	0.90 (0.11-7.63)	.926
SS + IS + SSc tear AND IS atrophy	1 (2.2)	5 (2.0)	1.42 (0.16-12.41)	.751	1.41 (0.14-13.69)	.769
SS + IS + SSc tear AND SS + IS atrophy	1 (2.2)	5 (2.0)	1.42 (0.16-12.41)	.751	1.41 (0.14-13.69)	.769
Biceps tendon tear	15 (31)	46 (19)	1.77 (1.09-2.87)	.021	1.78 (1.07-2.96)	.027
Acromioclavicular arthritis	5 (10.5)	45 (18)	0.63 (0.26-1.50)	.294	0.72 (0.29-1.75)	.464

CI, confidence interval; BT, biceps tendon; IS, infraspinatus; RR, relative risk; SS, supraspinatus; SSc, subscapularis. Bolded values indicate significant P values where P < .05.

Table III
Rotator cuff pathology among publicly and privately insured patients.

Pathology characteristic	Private insurance	Public insurance	Unadjusted, RR (95% CI)	P value	Adjusted for age, RR (95% CI)	P value
	n (%)	n (%)				
SS tear	126 (65.6)	205 (68.3)	1.03 (0.91-1.17)	.640	0.93 (0.82-1.05)	.237
IS tear	29 (15.1)	67 (22.3)	0.92 (0.85-0.97)	.031	0.93 (0.86-1.03)	.172
SSc tear	10 (5.2)	28 (9.3)	0.97 (0.92-1.01)	.158	0.97 (0.92-1.02)	.269
SS + IS tear	27 (14.1)	57 (19.0)	1.36 (0.90-2.08)	.147	1.18 (0.75-1.86)	.466
SS + IS + SSc tear	3 (1.6)	11 (3.7)	2.15 (0.60-7.73)	.239	1.70 (0.44-6.55)	.444
SS atrophy	31 (16.2)	82 (27.3)	1.67 (1.15-2.42)	.002	1.15 (0.78-1.71)	.488
IS atrophy	22 (11.5)	53 (17.7)	1.53 (0.96-2.43)	.039	1.27 (0.77-2.10)	.356
SS + IS tear AND SS atrophy	14 (7.3)	37 (12.3)	1.71 (1.01-3.07)	.049	1.30 (0.71-2.50)	.374
SS + IS tear AND IS atrophy	11 (5.7)	33 (11.0)	1.94 (1.01-3.74)	.031	1.61 (0.80-3.26)	.182
SS + IS tear AND SS + IS atrophy	10 (5.2)	29 (9.7)	1.87 (0.97-3.76)	.051	1.53 (0.73-3.21)	.264
SS + IS + SSc tear AND SS atrophy	3 (1.6)	9 (3.0)	1.72 (0.46-6.42)	.417	1.43 (0.35-5.80)	.615
SS + IS + SSc tear AND IS atrophy	2 (1.0)	6 (2.0)	1.62 (0.32-8.25)	.564	1.45 (0.26-8.27)	.673
SS + IS + SSc tear AND SS + IS atrophy	2 (1.0)	6 (2.0)	1.62 (0.32-8.25)	.564	1.45 (0.26-8.27)	.673
Biceps tendon tear	21 (11)	62 (21.2)	1.98 (1.25-3.13)	.003	1.83 (1.11-3.00)	.017
Acromioclavicular arthritis	30 (15.5)	51 (17.1)	1.10 (0.73-1.66)	.660	0.98 (0.62-1.53)	.923

BT, biceps tendon; CI, confidence interval; IS, infraspinatus; RR, relative risk; SS, supraspinatus; SSc, subscapularis. Bolded values indicate significant P values where P < .05.

adjusting for age. This finding suggests that insurance status may not act as a barrier to timely care and assessment for patients with RCTs.

Previous work has demonstrated that publicly insured patients are more likely to experience barriers to care, which may ultimately delay timely evaluation and treatment. This is notable even after

the enactment of the Affordable Care Act, which provided millions of previously uninsured adults with medical insurance.³ Recently, insurance status has been recognized in orthopedic literature as a potential limiting factor for timely evaluation and treatment of a variety of pathologies; however, this topic has become quite controversial and contested.^{12,16,24,32,35} More so, orthopedic

literature has reported inconsistent findings regarding the impact Medicaid expansion has had on access to care as discrepancies in reimbursement and care still persist.³⁷ However, studies have shown that in comparison to their privately insured counterparts, individuals with public health insurance disproportionately experience difficulty in access to orthopedic care.^{31,35,38} Shi et al also found that patients with Medicaid were denied (31%) for orthopedic procedures significantly more often than Medicare (2.2%) or privately insured (0.5%) patients.³⁴ Although the group pointed out that significantly fewer Medicaid rejections occurred in academic versus private settings (19% vs. 35%), academic institutions took longer to schedule appointments for Medicaid and Medicare patients.³⁴ Thus, such a combination of denied and delayed care can be detrimental for patient pain relief and functional recovery.

Despite previous reports, however, potential delays of care from public insurance status do not always impact the degree of pathology or surgical treatment plans. Johnson et al demonstrated that although publicly insured patients experienced a significant delay in care for meniscal tears, there were no differences in the rate of surgical management between these groups.²⁰ Goldstein et al evaluated pediatric patients with idiopathic scoliosis and similarly found no relationship between insurance status and disease magnitude at presentation.¹⁶ These findings are consistent with the present study, as we demonstrate that insurance status does not appear to significantly influence the degree of presenting rotator cuff pathology severity among similarly aged patients.^{11,23}

Lack of medical access and subsequent delay in care can have detrimental effects on treatment success and therapeutic options for RCTs. Multiple studies have demonstrated that numerous factors, including fatty degeneration, retraction, and number of tendons involved, can have a direct impact on outcomes following rotator cuff repair.^{2,6,19,21} Delaying evaluation and subsequent RCT treatment can promote and exacerbate these pathologies, making surgical management increasingly difficult and worsening outcomes.^{21,33} However, our study did not demonstrate that age-matched patients with public insurance were more likely than privately insured patients to present with radiographic evidence of chronic rotator cuff pathology.

Advanced age is a well-known risk factor for RCTs, as 44% of the general population aged >60 years have evidence of rotator cuff pathology, regardless of symptomatology.^{15,28,36} More so, patients aged >60 years are two-to-three times more likely to present with high-grade RCTs than younger individuals.¹⁷ With the mean age of our study population groups being greater than 60 (private: 60.7 years, public: 69.1 years), our cohort was at a high risk for pathology at baseline. Although we demonstrate differences in pathology frequency between groups, a greater proportion of publicly insured patients were aged >70 years (public: 42.0%, private: 8.6%). This older population likely had a higher frequency of pathology, which contributed to the difference between insurance groups.

Despite not finding a significant difference in rotator cuff pathology between insurance groups after age adjustment, we did note a maintained difference in bicep tendon tears, with public insurance holders having a higher frequency than their privately insured counterparts. This result is interesting in light of finding no difference in rotator cuff pathology between groups, as previous work has demonstrated that patients with bicep tears were significantly more likely to present with SSc and supraspinatus tears.⁵ This inconsistency is likely the result of differences in our analyses, as we focused on complete tendinous tears, whereas Beal et al. included partial and complete tears in their comparisons. Their approach may have increased the sensitivity for pathologic correlation.

This study is not without limitations. Being a retrospective study, there is a risk for confounding variables. Also, the sample

sizes for several tendon injury and atrophy groups were small, which could impact comparative analysis. Furthermore, only patients who underwent rotator cuff repair were included. Thus, our results may not translate to those receiving reverse shoulder arthroplasty or superior capsule reconstruction for massive irreparable RCTs, as well as patients pursuing conservative management. In addition, our findings may not be generalizable to nonacademic practices, as healthcare structure and insurance patterns may differ in regional variation. It should be noted that as a tertiary referral academic center, our hospital does not distinguish patients based on insurance status. As such, physician reimbursement is not correlated to collections and thus provides a theoretical equal access to care for all patients who present in our healthcare system. This is in direct contrast to the collections model for private practice physicians. Finally, we did not collect patient-reported factors that may have influenced delaying surgical evaluation and care for those with chronic pathology (ie, personal choice, distrust of medical system, family support for recovery, financial difficulties in having to stay off work, etc.) or time from injury to evaluation to quantify injury chronicity.

Conclusion

Insurance status does not appear to serve as a barrier to medical access for patients with RCTs at an academic medical center. Although patients subscribed to a public insurance plan more frequently presented with RCT suggestive of chronic pathology, advanced age was found to be a confounding factor in our results. Future studies are needed to better understand the impact insurance status plays on presentation to a private clinical setting.

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