

Distal clavicle excision as a concomitant procedure with arthroscopic rotator cuff repair leads to inferior Patient Reported Outcomes Measurement Information System (PROMIS) scores at 2-year follow up

Alexander R Chait, Hashim Shaikh, Devon Anderson, Gabriel Anthony Ramirez, Sandeep Mannava¹

¹University of Rochester

INTRODUCTION: Acromioclavicular (AC) joint arthritis is common and associated with rotator cuff disease. Distal clavicle resection (DCE) for those with AC joint pathology in patients undergoing arthroscopic rotator cuff repair (ARCR) may affect overall surgical outcomes, which have historically been contradictory, however recent research suggests worse outcomes. Previous studies primarily used legacy patient reported outcomes (PROs) including the visual analogue scale (VAS) for pain and satisfaction, American Shoulder and Elbow Surgeons (ASES) score, and Constant Murley scores while using small patient populations. To date, no study has evaluated the effect of arthroscopic DCE during ARCR with Patient Reported Outcomes Measurement Information System (PROMIS) of Pain Interference (PI), Physical Function (PF), and Depression (D). The purpose of this study was to assess the influence of DCE as a concomitant procedure with ARCR on post-operative clinical PROMIS outcomes.

METHODS: Billing CPT codes identified 1382 patients who underwent ARCR over a two-year period. Those who met the inclusion criteria were divided into two cohorts: patients who had a concomitant arthroscopic DCE with ARCR (DCE) and patients who did not (non-DCE). Demographic and surgical data was extracted from the electronic medical record and PROMIS outcomes of PF, PI, and D were prospectively collected pre- and post-operatively up to 2 years. Minimally Clinically Important Difference (MCID) was set at 0.5 standard deviation from the PROMIS value. The average ADI value of the US was set at 50.0 and the average ADI value was based upon a patient's zip code census block. Baseline demographics and PROMIS outcomes were analyzed with a bivariate analysis. Differences in the pre-operative, post-operative, and delta (change in pre- vs. post-operative) of the PROMIS outcome between DCE and non-DCE cohorts were analyzed with a multi-variate linear regression. The role of independent variables in achieving MCID was assessed with a multi-variate logistic regression analysis. The Hosmer-Lemeshow score was used to determine "goodness of fit" for logistic regression and statistical significance was set at a value of $p < 0.05$.

RESULTS: A total of 873 patients met the inclusion criteria and were divided into two cohorts, 349 patients who had a concomitant arthroscopic DCE with ARCR and 485 patients who did not have a concomitant DCE at the time of ARCR. All 873 patients had concurrent subacromial decompression and a total of 834 patients were included for final data analysis. There were statistically significant differences in the baseline demographics of the DCE cohort compared with the non-DCE cohort in terms of the average ADI ($p < 0.001$) and gender ($p < 0.001$). (Table 1) Bivariate analysis demonstrated a statistically significant difference in average post-operative PROMIS PI scores ($P < 0.05$) and delta PROMIS D scores ($p < 0.004$) in the DCE compared with the non-DCE cohort. No significant differences were observed in the average pre-operative PROMIS PI, PF, and D, post-operative PROMIS PF and D, and delta PROMIS PI and PF scores. (Table 2) Multivariate linear regression demonstrated a statistically significant difference in the pre-operative PROMIS D scores ($\beta = -1.9191$, $p < 0.003$), average post-operative PROMIS PF ($\beta = -1.2467$, $p < 0.05$) and PI ($\beta = 1.782$, $p < 0.01$) scores, and delta PROMIS D ($\beta = 2.24$, $p < 0.005$) and PF ($\beta = -1.5407$, $p < 0.05$) scores of the DCE compared with the non-DCE cohort. No significant differences were observed in pre-operative PROMIS PI and PF, post-operative PROMIS D, and delta PROMIS PI scores. Multi-logistic regression analysis of MCID for PROMIS PI scores demonstrated an AUC of 0.66 and a Hosmer-Lemeshow goodness of fit test demonstrated significance $p < 0.04$. Patients who received DCE had significantly decreased odds (OR: 0.51 95 CI: 0.30 to 0.84) in achieving MCID for PROMIS Pain Interference when compared to patients who did not receive a DCE with ARCR. MCID for PROMIS PF and D were not significant.

DISCUSSION AND CONCLUSION: The baseline pre-operative PROMIS PI, PF, and D outcomes between the DCE and non-DCE cohorts were not significantly different. Patients who had concomitant DCE with ARCR demonstrated worst post-operative PROMIS PF and PI scores as well as worse delta PROMIS PF and D scores compared to those who did not have DCE. The multivariate regression analysis of those who had a DCE demonstrated decreased post-operative PF when compared to their pre-operative scores when all other variables were controlled, which was not seen in the non-DCE cohort. Furthermore, patients who received a concomitant DCE with ARCR had worse odds of achieving a MCID in terms of PROMIS PI. Additionally, those who received an ARCR with concomitant DCE had a statistically significant higher level of socioeconomic deprivation assessed by ADI although it did not influence outcomes. Our results with PROMIS outcomes are consistent with the current literature demonstrating that patients who had ARCR and DCE had worse post-operative surgical outcomes and satisfaction than those who did not have DCE, which can be related to the common failures and destabilization of the AC joint during DCE leading to more pain and worse functioning culminating in depression. Future research is needed to understand the impact of DCE with ARCR on range of motion and determining symptomatology specific to AC joint pathology.

Table 1. OLS in Six ACE Domains

Domain	ACE	Mean	SD	SE	95% CI	P-Value
Family ACE	Parent	15	10.5	0.5	14-16	<0.001
	Spouse	15	10.5	0.5	14-16	<0.001
	Child	15	10.5	0.5	14-16	<0.001
School ACE	Teacher	15	10.5	0.5	14-16	<0.001
	Classmate	15	10.5	0.5	14-16	<0.001
	Principal	15	10.5	0.5	14-16	<0.001
Work ACE	Supervisor	15	10.5	0.5	14-16	<0.001
	Colleague	15	10.5	0.5	14-16	<0.001
	Customer	15	10.5	0.5	14-16	<0.001
Community ACE	Neighborhood	15	10.5	0.5	14-16	<0.001
	City	15	10.5	0.5	14-16	<0.001
	Country	15	10.5	0.5	14-16	<0.001
Partner ACE	Partner	15	10.5	0.5	14-16	<0.001
	Partner's Family	15	10.5	0.5	14-16	<0.001
	Partner's School	15	10.5	0.5	14-16	<0.001

Table 2. Unadjusted OLS Models of Six ACE Domains

Variable	ACE	Mean	SD	SE	95% CI	P-Value
Physical Function, Preop	ACE	42.89	7.86	0.42	41.97-43.81	<0.001
	ACE ²	-0.12	0.01	0.00	-0.13-0.11	<0.001
Physical Function, Postop	ACE	42.17	8.79	0.42	41.25-43.10	<0.001
	ACE ²	-0.12	0.01	0.00	-0.13-0.11	<0.001
Pain Interference, Preop	ACE	58.40	9.40	0.42	57.56-59.24	<0.001
	ACE ²	-0.01	0.00	0.00	-0.01-0.01	<0.001
Pain Interference, Postop	ACE	58.90	9.40	0.42	58.06-59.74	<0.001
	ACE ²	-0.01	0.00	0.00	-0.01-0.01	<0.001
Depression, Preop	ACE	44.84	12.18	0.42	43.99-45.69	<0.001
	ACE ²	-0.01	0.00	0.00	-0.01-0.01	<0.001
Depression, Postop	ACE	45.30	10.73	0.42	44.46-46.14	<0.001
	ACE ²	-0.01	0.00	0.00	-0.01-0.01	<0.001