Association of Angiotensive-Converting Enzyme (ACE) Inhibitors and Angiotensin Receptor Blockers with Postoperative Stiffness after Arthroscopic Rotator Cuff Repair: A Retrospective Cohort Study

Andres Ruben Perez, Henson Destine, Anya Hall, Kevin Blake Freedman[1], Fotios Paul Tjoumakaris, Neel Patel[2]
[1]Rothman Institute, [2]Univ of Pittsburgh Medical Center

INTRODUCTION: Postoperative stiffness following arthroscopic rotator cuff repair (aRCR) is a major cause of morbidity reported in up to 23% of postoperative patients. Angiotensive converting enzyme inhibitors (ACEi) and angiotensin receptor blockers (ARB), medications commonly used to treat hypertension, affect TGF-β, an essential regulator of both the inflammatory process and tissue healing that has been linked to the development of tissue fibrosis. The purpose of this study is to determine if there is an association between ACEi/ARB usage and postoperative range of motion (ROM) following aRCR, to determine if ACEi/ARB usage has any association with postoperative patient-reported outcome measures (PROMs) following aRCR, and to determine if ACEi/ARB usage has any association with the need for follow-up shoulder procedures following primary repair.

METHODS:

This was an IRB approved retrospective cohort study examining all patients at a single institution undergoing primary aRCR from 1/1/2016 – 12/31/2019. Patients were identified by CPT codes and included if they had a minimum of 1-year postoperative follow up and documented ROM outcomes. Patients with concomitant adhesive capsulitis, calcific tendinosis, glenohumeral arthritis, labral tears, prior history of shoulder surgery, previous history of humeral fractures, workmens' compensation claims, age under 18, irreparable rotator cuff tear, history of substance abuse, or on dialysis were excluded. Patients were then separated into two groups based on usage of ACEi/ARBS (case group). Demographic information, medication usage, concurrent diagnoses, and follow-up procedures were collected via chart review. Physician and physiotherapy notes were examined to determine ROM (flexion, abduction, internal rotation (IR), and external rotation(ER)) (figure 1). PROMs were assessed through the American Shoulder and Elbow Surgeons (ASES), Single Assessment Numeric Evaluation (SANE) and Simple Shoulder Test (SST).

RESULTS:

A total of 185 patients met criteria, 72 taking ACEi/ARB (45 ACE, 27 ARB) and 113 controls (Table 1). No significant difference was found in demographics between the groups. Preoperatively, patients on ACEi/ARBs had significantly decreased active flexion (p=.022), IR (p=.002), and abduction (p<.001). Postoperatively, the case group had significantly decreased 6-month active ER (p=.015) that resolved by 12 months, and 6-month active abduction (p=.047) that also resolved by 12 months; although not significant, there was a trend toward significance seen with 6 months active IR (p=0.054). All other ROM measurements at different timepoints were not significant. There was a significant decrease in postoperative SST scores in the case group (p=.004), with no significance found in the other PROM scores. No significant differences were found in the reoperation rates between the groups following primary repair (revision surgery, capsular release, etc.) or for postoperative complications such as adhesive capsulitis.

Further subgroup analysis comparing individual medication classes against controls showed significant decreases in range of motion in the preoperative and postoperative time frame. When compared against each other, significant differences were also seen in ER, with more unfavorable range of motion parameters in the ACEi cohort (Table 1).

DISCUSSION AND CONCLUSION: Patients on ACEi or ARB medications are at an increased risk of decreased ROM before and after aRCR. Subanalyses revealed that this effect was more pronounced with ACEi than with ARBs. Surgeons should use this information to guide patient education perioperatively and postoperative rehab following aRCR.

Figure 1: Ordinal Classification for Internal Rotation

Table 1. ACEi and ARB Preoperative and Postoperative ROM

	Control	ACEi + ARB	ACE	ARB	ACEi vs ARB
N	113	72	45	27	
Flexion					
Preoperative (°)	139	**124***	**119***	133	
6 week Postop (°)	103	97.2	88.8	104	
3 month Postop (°)	138	130	128	133	
6 month Postop (°)	154	151	151	150	
12 month Postop (°)	161	156	155	158	
Abduction					
Preoperative (°)	139	**99.6***	**92.2***	**110***	
6 week Postop (°)	69.7	87.6	60	96.8	
3 month Postop (°)	117	111	102	122	
6 month Postop (°)	146	**131***	**127***	141	
12 month Postop (°)	159	158	154	162	
ER					
Preoperative (°)	50.4	47.8	**43.1***	55.2	**
6 week Postop (°)	41.3	31.7	37.1	28.2	
3 month Postop (°)	52.9	44.7	**39.3***	53.2	**
6 month Postop (°)	56.4	**48.6***	**43.4***	55.7	**
12 month Postop (°)	64.5	58.2	**52.3***	67.6	**
IR					
Preoperative (°)	5.86	**4.5***	**4.53***	**4.46***	
6 week Postop (°)	4.39	4.36	4.26	4.12	
3 month Postop (°)	5.09	4.45	4.54	4.33	
6 month Postop (°)	6.04	**5.24***	**5***	5.5	
12 month Postop (°)	7	6.27	5.75	6.57	

All p-values are compared to their control counterparts
*** indicates significance of p ≤ 0.05**
**** indicates significance of p ≤ 0.05 when comparing ACEi vs ARB**