Preoperative Local Bone Density and Scapula Spine Fractures After Reverse Shoulder Arthroplasty

Jay Micael Levin[1], Kaitlyn Ann Rodriguez, Prince Jeffrey Boadi, Joshua Kevin Helmkamp, Daniel Ehren Goltz[2], John R Wickman[3], Oke A Anakwenze[4], Christopher Klifto
[1]Duke Health, [2]Duke University, [3]Duke University Hospital, [4]Duke Orthopedics Arringdon

INTRODUCTION:
Scapular spine fractures are associated with significant declines in function and pain after reverse shoulder arthroplasty (RSA). Systemic osteoporosis, older age, female gender and other patient risk factors have been associated with scapula fractures, although there are no prior studies evaluating shoulder-specific bone density and the risk of developing a postoperative scapula spine fracture. Therefore, the purpose of this study is to evaluate the association between shoulder-specific bone density measurements obtained on preoperative computed tomography (CT) scans and the occurrence of scapular spine fractures.
METHODS:
Consecutive patients undergoing RSA between 2014 and 2021 and had a preoperative shoulder CT scan were included. Scapula spine fractures were identified using chart review of the electronic medical record and a systematic search of radiology reports to identify acromion or scapula fractures. Fractures were then classified on CT scan according to the Levy classification system. Preoperative CT scans were accessed and local bone density within the proximal humeral metaphysis, the glenoid vault, Levy zone 1 of the scapula, and Levy zone 2 of the scapula were recorded in Hounsfield Units (HUs). Scapula fracture cohort and the no fracture cohort were compared using standard statistical tests, including Student's t-test for continuous variables and Chi-square for categorical variables.
RESULTS:
Four hundred and thirteen patients were included in our study population, 11 of which sustained a postoperative scapula spine fracture (2.7%). There were no significant differences in terms of age, BMI, gender, handedness ($p>0.05$) between the fracture and no fracture cohorts. Primary indication for surgery was significantly different between the two cohorts ($p=0.006$), with rotator cuff arthropathy/rotator cuff tear being more common in the fracture cohort (72.7% vs. 40.0%), and osteoarthritis being more common in the no fracture cohort (39.3% vs. 9.1%). Although there were trends towards significantly lower proximal humeral (45 +/- 46 HUs vs. 74 +/- 84 HUs) and glenoid vault (195 +/- 80 HUs vs. 245 +/- 144 HUs) bone density in the fracture cohort, these differences did not reach statistical significance. There was no difference between Levy zone 1 and zone 2 scapula spine bone density when comparing between the two cohorts. Additionally, there was a trend towards a higher proportion of fracture patients having received a glenoid augment (27.3% vs. 12.4%, $p=0.147$), although this also did not reach significance.
DISCUSSION AND CONCLUSION:
Our study demonstrates that the overall rate of scapula spine fractures is rare and the only factor significantly associated with postoperative fracture is preoperative diagnosis of rotator cuff arthropathy. This is consistent with prior studies in demonstrating an association between rotator cuff arthropathy and scapula spine fractures. In regards to predicting fracture risk using local bone density measurements, there is a trend towards lower preoperative humeral and glenoid bone density in patients who sustained scapula fractures although there was no significant difference observed, likely secondary to the rareness of the outcome studied and therefore inadequate power. Future studies should seek to combine multi-institutional data in order to increase our ability to identify patients at high risk for fracture preoperatively.