Functional Outcomes and Gait Analysis with Surgical Resection of Heterotopic Ossification following Acetabular Fracture Surgery

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INTRODUCTION:
Acquired heterotopic ossification (HO) is a potential complication in patients who have experienced high-energy traumatic injury to the hip. Open reduction and internal fixation (ORIF) of acetabular fractures is among the most common causes of acquired posttraumatic HO. When symptomatic, HO causes impairment of range of motion and pain, severely impacting the patient's ability to sit and ambulate, limiting activities of daily living, and decreasing overall quality of life. Following acetabular fracture surgery, HO has a propensity to involve the hip abductor musculature, and when symptomatic requires resection to restore function. However, the implications of HO resection have not been previously determined. The purpose of this investigation is to objectively determine outcomes, both on gait and overall function, of patients who underwent resection of HO following previous ORIF of an acetabular fracture.
METHODS:
An institutional database of patients who had an acetabular fracture treated with ORIF between 2003 and 2019 was used to identify patients who underwent subsequent HO resection. These patients were then matched (based on age, time from injury, fracture pattern, surgical approach, comorbidities, and injury severity score) with patients who underwent ORIF of an acetabulum fracture but did not require resection of HO. At a minimum of one-year follow up from the definitive procedure, patients were asked to complete validated outcome surveys to determine their current limb-specific and whole-body level of function using the Harris hip score, Majeed Score, Iowa pelvic score, SF-36, and short form musculoskeletal assessment. All patients underwent formal gait analysis to determine hip kinetics, hip kinematics, temporal-spatial gait parameters, and abductor strength. Power analysis using the clinically important difference in internal hip abduction moment was performed to determine that a minimum of six patients would need to be enrolled in each group.
RESULTS:
A total of seven matched pairs (total fourteen patients) were enrolled in the study. There was no significant difference in demographics or injury characteristics between the seven patients who underwent HO resection and their matched pairs. Of the seven patients who underwent HO resection, there were no complications. Patients who underwent HO resection had a significant improvement in hip internal rotation (6.4 vs. 25 degrees, p=0.03), hip external rotation (6.4 vs. 32 degrees, p=0.002), and hip abduction (11 vs. 34 degrees, p=0.001) relative to preoperative examination. Four patients had a fixed flexion deformity preoperatively that resolved after resection. There were no differences between the two groups with respect to patient-reported outcomes. Gait analysis showed that gait velocity, stance width, and stride length were similar between the two groups. However, patients who underwent HO resection had significantly lower isokinetic hip abductor strength compared to the contralateral side (p=0.04, 60 vs. 83 N-m) while patients who had acetabular fracture surgery without subsequent resection did not (p=0.41, 80 vs. 92 N-m). While HO resection did not significantly alter hip *kinetics* (hip abductor moment), hip *kinematics* [hip adduction angle (p=0.02, 4.9 vs. 8.1 degrees) and pelvic tilt (p=0.01, -4.8 vs. -1.2 degrees)] were significantly altered. There were no side-to-side differences in either hip kinetics or hip kinematics in the group of patients that had acetabular fracture ORIF without HO resection.
DISCUSSION AND CONCLUSION: To our knowledge, this study is the first of its kind to examine the implications of HO resection after acetabular surgery on gait and functional outcomes. While resection of HO reliably leads to improved range of motion, its location invariably leads to weakness in hip abduction and alterations in hip kinematics. However, at a minimum of one-year from HO resection - these alterations do not seem to affect the temporal-spatial parameters of gait or patient-reported outcome measures. The long-term implications of these altered hip kinematics is unknown.