Pathoanatomical Considerations and Implications of Heterotopic Ossification Following Surgical Treatment of Elbow Trauma

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Purpose: This work was undertaken to develop a pathoanatomical classification system of heterotopic ossification (HO) following surgical treatment of elbow trauma based upon pre-excision imaging.

Methods: 36 patients who had undergone excision of HO following initial surgical treatment of periarticular skeletal elbow trauma were identified. Pre-excision imaging studies (including elbow radiographs alone or combined with CT scans) were reviewed independently to identify common patterns of HO. Injury pattern, elbow range of motion (ROM) data, and surgical characteristics were analyzed. One-way analysis of variance with Tukey's post-hoc type 1 error adjustment was used to determine pairwise differences for the ROM data. Fisher's exact test was used to compare the relationship between surgical characteristics and AO fracture classification with the five HO patterns.

Results: Five patterns of HO were identified, including anterolateral elbow, anterior distal humerus, coronoid and olecranon fossae, proximal radioulnar joint (PRUJ), and posteromedial elbow/other. Significant differences were found between the five patterns when comparing pre-excision flexion arc (P = 0.0355), flexion arc gain (P = 0.0386), pre-excision rotation arc (P = 0.0014), and rotation arc gain (P = 0.0004). The PRUJ pattern had a significantly greater pre-excision flexion arc than the anterolateral pattern (95% confidence interval [CI]: 2.5-96.1). Comparing pre-excision rotation arc, the anterior pattern was significantly greater than the PRUJ pattern (95% CI: 25.6-228.4) and the fossae pattern was significantly greater than the anterolateral and PRUJ patterns (95% CI: 1.7-143.8 and 35.2-218.0, respectively). For rotation arc gained, the PRUJ pattern gained significantly more than the anterior and fossae patterns (95% CI: 19.8-192.2 and 42.8-198.2, respectively). Overall, the mean pre-excision flexion arc was 58° and improved to 100° at final follow-up (mean of 41 weeks) after excision of HO. The mean forearm rotation arc improved from 97° to 146°. The postexcision flexion and rotation arcs were not significant differently between the five patterns. There is a significant association between the five patterns and AO fracture classification. The anterior and fossae patterns were more often AO 13 than AO 21. Subjects with PRUJ and posteromedial/other patterns were exclusively AO 21, while subjects with the anterolateral pattern were divided between AO 13 (5 subjects) and AO 21 (9 subjects).

Conclusion: Several distinct patterns of HO about the elbow are identifiable and may have implications on elbow ROM and expected outcomes. Anterolateral HO appears to have restricted ulnohumeral and forearm motion. Anterior and fossae patterns were related to restricted ulnohumeral motion, while PRUJ HO was related to restricted forearm rotation. The postexcision flexion and rotation arcs are similar for all five patterns and comparable to previously published data regarding surgical treatment of elbow HO. Injury pattern may also be related to the subsequent morphology of HO. Anterior and fossae patterns develop more frequently following distal humerus fractures (AO 13) than proximal forearm injuries (AO 21). PRUJ and posteromedial/other patterns develop exclusively following proximal forearm injuries. The anterolateral pattern developed following either an AO 13 or AO 21 injury.

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