SCIENTIFIC ARTICLE

Combined Elbow Release and Humeral Rotational Osteotomy in Arthrogryposis

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Purpose The purpose of this study was to determine if a simultaneous posterior elbow release and humeral osteotomy to correct both the elbow extension contracture and the humeral internal rotation contracture in children with arthrogryposis can produce similar results as a posterior elbow release alone.

Methods This study was a retrospective chart review of consecutive patients with arthrogryposis treated surgically for elbow extension contracture between 2007 and 2014. A total of 43 procedures in 36 patients had adequate available follow-up data and were included in the study. The postoperative range of motion reported was measured at the early follow-up (3–6 months), midterm follow-up (between 1 and 2 years), and the most recent long-term follow-up (after 2 years) from the date of surgery. Patients were grouped into 2 groups (simultaneous and release) based on the necessity of performing an ipsilateral humeral rotation osteotomy at the time of the release.

Results At early follow-up, patients in both groups increased their total arc of motion. There was a significant difference in extension and arc of motion at midterm follow-up (between 1 and 2 years) between the simultaneous and the release groups with the simultaneous group significantly losing both terminal extension and total arc of motion. At more than 2 years follow-up, there remained a statistically significant difference in arc of motion, with the release group having a significantly larger arc of motion. Patients who underwent dual plating had a much larger arc of motion at early follow-up than the K-wire or single-plate fixation group, despite having similar preoperative extension, flexion, and arc of motion. This difference was also significant at late follow-up.

Conclusions Patients with posterior release alone had significantly greater improvement in total arc of motion and significantly better elbow extension than patients who underwent a simultaneous humeral osteotomy. However, rigid fixation with early mobilization may yield results comparable with the release alone group. *(J Hand Surg Am. 2017;■(■):1.e1-e9.*

Type of study/level of evidence Therapeutic IV.

Key words Arthrogryposis, elbow flexion contracture, humeral osteotomy, posterior elbow release.

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ARTHROGRYPOSIS IS A DESCRIPTIVE TERM for any patient born with contracture of multiple joints. There are multiple subtypes of arthrogryposis, including syndromes with congenital contractures. The extent and severity of contracture varies between diagnoses and from patient to patient.[1] Overall, 25% of patients may have elbow involvement and 19% shoulder involvement.[2] The most common diagnosis is

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amyoplasia congenita, which is a sporadic (non-heritable) condition often characterized by nearly symmetrical limb involvement. The upper extremity typically assumes a posture of shoulder adduction, shoulder internal rotation, elbow extension, and wrist flexion. This posture is due to hypoplasia or aplasia of muscles throughout the limbs.[1] The contractures are present at birth and improve variably with time. Maximal gains without intervention are typically made in the first 2 years.[3]

The elbow extension contracture in arthrogryposis prevents the child from bringing the hand to the mouth for functions such as eating. Internal rotation contractures that prevent external rotation to less than 30° shy of neutral can limit bimanual tasks and force a cross-over grasp pattern (Fig. 1).[1] Internal rotation may also contribute to preventing the hand from reaching the mouth. When nonsurgical treatments fail to allow the patient to self-feed, a combination of surgeries (humeral osteotomy to improve the external rotation arc of motion of the arm[4] and posterior elbow release to improve elbow flexion[5]) can be done to improve these problems.

Posterior elbow release improves passive elbow flexion and thus ability to bring the hand to the mouth.[5] However, for patients with elbow extension contractures who also have fixed shoulder internal rotation contractures, a release at the elbow will achieve only limited functional gains. With the shoulder internally rotated, it is impossible for the child to use elbow flexion to reach the mouth or face. Unlike the elbow, soft tissue releases have not been shown to be effective in improving shoulder range of motion.[4] Humeral osteotomy is therefore recommended to permit the arm to be rotated into greater external rotation.[4] Although osteotomy does not increase the actual arc of motion, it does allow that arc to be placed in a more usable space for the patient.

Because these 2 problems (internal rotation contracture and elbow contracture) often coexist, and because they may both be addressed via a common surgical approach, it has been our practice to perform both procedures simultaneously when indicated. However, the rehabilitation protocols for these 2 procedures may conflict. Contracture releases mandate immediate and aggressive postoperative mobilization to preserve the gains that are made. However, the healing of osteotomies may require different degrees of immobilization depending on the method of fixation used.

To determine the effect of combining these procedures, we have compared our results from recent years during which simultaneous procedures have been performed with the results from patients at our institution who had separate procedures. In particular, we were interested in whether similar gains were made in elbow range of motion. We hypothesized that patients who undergo release alone will have improved range of motion at long-term follow-up compared with patients who underwent simultaneous release and humeral osteotomy. Further, we hypothesized that a more rigid fixation construct allowing for earlier initiation of range of motion will result in similar range of motion gains compared with those in patients who underwent release alone.

FIGURE 1: Clinical photograph demonstrates cross-over grasp. (Used with permission of Shriners Hospitals for Children—Philadelphia. All rights reserved.)

MATERIALS AND METHODS

This study was a retrospective chart review of patients with arthrogryposis treated surgically for elbow extension contracture between 2007 and 2014 at our institution. The study was approved by our institutional review board, and the guardians of all patients signed informed consent regarding the use of their deidentified data in the study. All surgeries were performed by 1 of the 2 senior authors (S.H.K. and D.A.Z.). We reviewed the medical records for age,