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ORIGINAL ARTICLE

# Arthroscopic isolated capsular release for shoulder contracture after brachial plexus birth palsy: clinical outcomes in a prospective cohort of 28 children with 2 years' follow-up

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**Background:** The primary objective of this study was to evaluate improvements in external rotation after isolated arthroscopic capsular release in children with shoulder contracture due to brachial plexus birth palsy.

**Materials and methods:** This study included all children older than 2 years with a range of active external rotation limited to 30° or less and/or active anterior elevation (AE) limited to 90° or less secondary to brachial plexus palsy treated between 2011 and 2015. Passive glenohumeral motion, passive global (glenohumeral plus scapulothoracic) motion, active global motion for external rotation with the elbow at the side (ER1), AE, and internal rotation with the elbow at the side were recorded before and 2 years after surgery. Improvement was evaluated by comparing the preoperative and follow-up values. The operation performed was subscapularis-sparing arthroscopic capsular release.

**Results:** Thirty-five patients were included, and 28 completed 2 years of follow-up. The average changes in active global ER1, passive glenohumeral ER1, and passive global ER1 were +35° (range, −20° to +100°; $P < .0001$), +35° (range, +0° to +75°; $P < .0001$), and +26° (range, −15° to +60°; $P < .0001$), respectively. There were no significant changes in internal rotation with the elbow at the side or AE. The mean improvement in the aggregate Mallet score was 3.9 points (range, −3 to +9 points; $P < .0001$).

**Conclusions:** For children with shoulder contracture secondary to brachial plexus palsy, subscapularis-sparing isolated capsular release improves external rotation and functional scores and avoids any loss of active internal rotation but does not improve AE.

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**Level of evidence:** Level IV; Case Series; Treatment Study

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Approximately 20% of children with brachial plexus birth palsy have residual neurologic deficits.[5] The most frequently observed late deficits following obstetrical C5-C6 brachial plexus palsy are limitations to the external rotation (ER) and elevation of the shoulder,[5] which are both sequelae and complications (acquired stiffness) of the obstetrical palsy. These degrade upper limb function by restricting the orientational range of the hand, while the classic position adopted by the shoulder—in internal rotation, particularly evident when the child is running—is esthetically displeasing. A number of methods for shoulder release have been developed over the years to improve active ER motion. A recent meta-analysis has shown that open and arthroscopic techniques provide similar improvements in ER and aggregate Mallet scores.[15] An open anterior approach can be difficult in young children with severe contracture.[22] Arthroscopy is thus an attractive, less invasive, less scarring alternative.

The indications for arthroscopic surgery remain unclear, however. Existing arthroscopic studies differ in terms of both their inclusion criteria and the surgical technique used.[1,4,12,14,17,22] Subscapularis tenotomy has been criticized because it degrades active internal rotation.[1,12] There is no consensus as to the need for tendon transfer. Moreover, these previous studies did not adequately investigate the effects of surgery on anterior elevation (AE).

The primary objective of this study was to evaluate the gain in passive and active ER of the shoulder after isolated arthroscopic anterior capsular release in children with internal contraction after incomplete recovery from brachial plexus birth palsy. The secondary objective was to evaluate the gain in passive and active AE in children limited in this respect despite having a good range of ER.

## Materials and methods

### Study design

This was a single-center prospective observational study of all children treated for shoulder contracture secondary to brachial plexus birth palsy in the study center between 2011 and 2015.

### Study population

Patients received an initial assessment in a specialized surgery unit in a pediatric hospital and then underwent a multidisciplinary preoperative evaluation. Children were included if they were older than 2 years and had limited range of motion (ROM) of the shoulder secondary to brachial plexus birth palsy. The patients' range of active ER with the elbow at the side had to be 30° or less and/or their range of active AE had to be 90° or less. Patients were not included if they had already undergone secondary shoulder surgery or if the parents and/or children refused surgery. Patients were excluded during the follow-up period if they underwent any other shoulder operation and were counted as failures.

### Clinical analysis

The same clinician performed all the clinical evaluations and ROM goniometer measurements. Details of the primary operation performed, the Narakas classification of the lesion,[19,20] and the child's age were recorded. The same clinical assessment was performed preoperatively and at 6 weeks, 3 months, 6 months, 1 year, and 2 years of follow-up. At each appointment, the passive glenohumeral, passive global, and active global mobility ranges were recorded for the types of movement listed in Table I.

The glenohumeral and scapulothoracic components of the global ROM of the shoulder[11] were assessed separately. We observed that in some patients, increased use of the scapulothoracic joint compensated for shoulder stiffness, allowing close-to-normal mobility. Differentiation between the 2 components of the motion was therefore important.

Passive ER was measured with the elbow held at the side of the body and flexed to 90°. The examiner induced ER by maneuvering the child's forearm with one hand while stabilizing the scapula with the other. Passive ER was assumed to occur in the glenohumeral joint as long as the scapula was not mobilized. As soon as the scapula was mobilized, ER of the shoulder was assumed to occur in the scapulothoracic joint. The range of active ER was measured by holding the child's elbow flexed to 90° by the side of his or her body (with the examiner's index finger to avoid interfering with the motion) and then asking the child to move his or her hand out to the side as far as possible. The same procedures were used to measure ER with the arm in 90° of abduction (ER2), internal rotation with the arm in 90° of abduction (IR2), abduction (ABD), and AE. For active motion, both arms had to be moved simultaneously to avoid any rotation or inclination of the spine. For internal rotation with the arm at the side (IR1), the position of the second metacarpophalangeal joint along the column was recorded. For statistical analysis, these measurements were converted to numerical values using the Constant-Murley scoring system (Table II).[7] Dissociating glenohumeral and scapulothoracic motion was not feasible for IR1. We therefore only measured passive global IR1 and active global IR1. Shoulder function was assessed with the modified Mallet scale used by Bae et al[2]. This classification differs from the original one[16] by different drawings and a different description of the trumpet sign.

### Imaging

All patients underwent a preoperative magnetic resonance imaging (MRI) scan to determine the anatomic status of their shoulder. The MRI data were collected and analyzed by the same practitioner. To