

# Outcomes After Surgical Treatment of Spastic Upper Extremity Conditions



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## KEYWORDS

• Surgical outcomes • Cerebral palsy • Spastic hemiplegia • Treatment • Upper extremity

## KEY POINTS

- Surgical outcomes include motor function and limb positioning, sensory function, and effects on self-esteem.
- Single-event multilevel surgery for wrist flexion and ulnar deviation, forearm pronation, elbow flexion, and thumb-in-palm deformity yield improved limb positioning, motor function, and hygiene.
- Sensory dysfunction exists with high prevalence in children with cerebral palsy. It is unclear whether or not surgery improves sensory dysfunction and further investigation is necessary.
- The position of the upper limb is linked to self-esteem, with elbow flexion contracture deformity having the greatest impact. Surgical outcomes have been reported to have higher patient satisfaction when they address not only functional limitations but also aesthetics.

## INTRODUCTION

In general, surgical management for spastic upper extremity conditions focuses on improving muscle balance to maximize hand function.<sup>1</sup> The goals of surgical management must be based on shared decision-making with the child and family, taking into account the child's level of function. For example, the goals of operative management for a high-functioning child are improved joint position, improved grasp, release, and pinch, as well as improved cosmesis. In a lower functioning child, the goals are improved joint positioning and hygiene.<sup>1</sup> This article discusses surgical outcomes as they relate to function, stereognosis, and self-esteem or self-concept.

## OUTCOMES MEASURES

Validated outcome measures based on the World Health Organization's *International Classification of Functioning, Disability and Health (ICF)*<sup>2</sup> focus

on bodily impairment, activity limitation, and participation restriction. The following assessment tools measure constructs of the *ICF*:

- The Assisting Hand Assessment (AHA) video-based tests grade interaction with 22 test items on a 4-point scale.<sup>3</sup>
- The Shriners Hospital Upper Extremity Evaluation (SHUEE) includes dynamic positional analysis (DPA) and spontaneous functional assessment (SFA). DPA is a video-based test in which completion of 16 tasks is measured in terms of alignment of the elbow, forearm, wrist, thumb, and fingers.<sup>4</sup> The SFA rates spontaneous use and incorporation of the hemiplegic hand into bimanual activities based on 9 selected tasks.<sup>4</sup>
- The Box and Blocks Test measures the number of blocks that can be transferred over a barrier in 1 minute.<sup>5</sup>
- Grip and pinch strength is measured.

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Validated questionnaires include the following<sup>6</sup>:

- The Pediatric Outcomes Data Collection Instrument (PODCI) measures the percent of function on the 6 different scales of upper extremity function, mobility or transfers, sports or physical function, pain or comfort, happiness, and global function. A score of less than 80% is abnormal.<sup>6</sup>
- The Pediatric Quality of Life Inventory (PedsQL) parent version and the PedsQL cerebral palsy (CP) module reports percentage results of 4 and 5 domains, respectively.<sup>6</sup>
- For the Canadian Occupational Performance Measure (COPM), an occupational therapist administers a questionnaire to obtain performance and satisfaction scores based on an activity selected by the patient.<sup>6</sup>

## SURGICAL OUTCOMES

### **Motor Function and Limb Positioning Concepts**

Surgical outcomes include motor function, limb positioning, sensory function, and self-esteem. This section reviews postoperative motor function and limb positioning outcomes.

### **Single-Event Multilevel Surgery**

Most children undergo multiple, concomitant procedures in a single setting to correct the combined deformities of elbow flexion, forearm pronation, wrist flexion, and thumb-in-palm deformity (Fig. 1). Therefore, functional outcomes studies report on groups of subjects who have undergone a variety of procedures. Some studies show improved limb

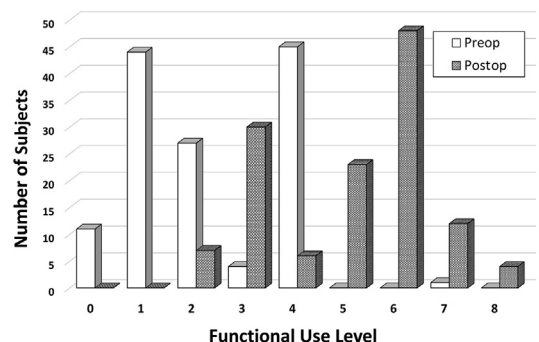


**Fig. 1.** Multilevel deformity in CP with elbow flexion, forearm pronation, wrist flexion with ulnar deviation, and thumb-in-palm deformity.

positioning but no improvement in functional outcomes, whereas other studies demonstrate improved postoperative functional outcomes. Smitherman and colleagues<sup>7</sup> found that single-event multilevel surgery for children with hemiplegic CP can significantly improve thumb, finger, wrist, and forearm segmental positioning, as well as spontaneous function; however, it does not significantly change their grasp-release ability.<sup>7,8</sup>

van Munster and colleagues<sup>9</sup> reviewed 8 studies and found that, although there was improvement in supination and wrist extension with tendon transfer surgery, there were no definitive improvements in hand function. Similarly, using the Jebsen-Taylor Hand Function Test at 3.6-year follow-up to assess function, hemiplegic subjects demonstrated statistically significant improvements in wrist, finger, and elbow positioning; however, this did not translate into a shorter time to test completion.<sup>9</sup>

During a 25-year period, Van Heest and colleagues<sup>10</sup> reported preoperative and postoperative functional outcomes of 134 subjects who underwent 180 operations (this represented 718 procedures individually tailored for each subject). The most common procedures performed during a single surgical intervention were pronator teres (PT) and biceps aponeurosis release; flexor carpi ulnaris (FCU), brachioradialis (BR), or extensor carpi ulnaris transfer to extensor carpi radialis brevis (ECRB) and first web space Z-plasty plus adductor and/or first dorsal interosseous tendon release, and a tendon transfer to abductor pollicis longus. The House functional assessment tool revealed that subjects had an average score of 2.3 preoperatively and 5.0 postoperatively, indicating an average improvement of 2.7 levels. In other words, operated hands went from a fair passive assist to a fair active assist that could grasp an object well<sup>10</sup> (Fig. 2).



**Fig. 2.** Number of subjects at each functional use level before (Preop) and after (Postop) surgery. (Data from Van Heest AE, House JH, Cariello C. Upper extremity surgical treatment of cerebral palsy. *J Hand Surg Am* 1999;24(2):323-30.)

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