Surgical Management of Spasticity of the Elbow

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KEYWORDS

• Elbow flexion contracture • Spastic elbow • Biceps release • Biceps Z-lengthening

KEY POINTS

- A spastic deformity is characterized by increased tone of the involved limb.
- Spastic elbow flexion contracture is a common deformity encountered in patients with upper motor neuron injuries.
- It results in functional limitation of the affected upper limb and is aesthetically displeasing.
- Surgery aims at improving both function and cosmesis through various surgical techniques tailored to the degree of elbow flexion contracture, presence or absence of joint contracture, and soft tissue deficit.

INTRODUCTION

A spastic limb has increased tone that results from disinhibition of reflex arcs following a neurologic injury that affects the upper motor neuron, pyramidal, or extrapyramidal structures. Affected patients exhibit muscle contractures, clonus, and hyperreflexia.[1] A number of neurologic conditions can lead to spasticity of the upper extremity, including cerebral palsy (CP), stroke, multiple sclerosis, and injuries or tumors of the brain and spinal cord.

The typical posture of the spastic elbow in patients with spasticity is one of flexion. The main muscles responsible for this typical flexion deformity are the biceps, brachialis, and brachioradialis muscles (**Fig. 1**).[1] The flexed position of the elbow interferes with functional use of the hand, which requires elbow extension for functional activities and is aesthetically displeasing. As the elbow contracture worsens, hygiene problems can develop within the antecubital fossa. Moreover, there is a belief among many laypeople that flexed posturing of the elbow is associated with impaired intelligence.[2]

Before initiating treatment, it is important to understand the goals of the patient and caregivers. Generally, treatment is aimed at improving hygiene, activities of daily living, pain, and appearance. The ability of the limb to function after spasticity reduction is not predictable. It must be discussed with the patient and family that treatment of the spastic limb will not necessarily result in the acquisition of previously undeveloped skills. In addition, the function of antagonistic muscles is unpredictable, and treatment of the agonists without treatment of the antagonists may create additional problems.

The initial treatment of spasticity includes conservative management, therapy and splinting, oral medications (eg, baclofen and dantrolene), and injectable neurolytic medications (eg, Botulinum toxin [BTX] and phenol). These techniques are usually attempted before surgical intervention. Surgical goals vary based on current and expected function and severity of the deformity. Children with spasticity present a unique challenge, as surgical intervention may be required to allow more normal bone, joint, and muscle development. For hemiplegia, the goal is

Disclosure Statement: No disclosures.
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Hand Clin 34 (2018) 503–510
https://doi.org/10.1016/j.hcl.2018.06.007

Fig. 1. Elbow flexion contracture seen in a patient with upper motor neuron disease. This is only partially passively correctable.

functional use as a helper hand. In quadriplegia, the goals are to improve access for hygiene, changing clothing, and positioning. Further, cosmesis (ie, the resting posture of the upper extremity) is also a significant factor. For more functional patients, it is important to ensure that the patient and family are aware that although surgical intervention can lead to improved function, it may lead to some loss of strength.

INDICATIONS/CONTRAINDICATIONS

The care of patients with elbow spasticity requires a team effort, with input from the patient, caregivers, and therapists. The decision to proceed with surgical intervention for elbow spasticity should not be entered hastily. Conservative measures, including therapy and medications, should be attempted first; if possible, during the acute phase of the underlying brain/spinal cord lesion. The primary goal of conservative measures is to prevent stiffness and joint contractures. Passive range of motion is required before restoring active motion. Splints and soft supports, as well as passive motion exercises and stretching, are critical to maximizing the patient's functional status and future surgical options (Table 1).

Barus and Kozin[3] have previously published a helpful treatment algorithm for initial treatment of elbow spasticity, used at Shriner's Hospital of Philadelphia. BTX is administered (50–100 units to each affected muscle), followed by immobilization in a cast with the elbow positioned at its end-range of extension. The cast is maintained for a few weeks to allow full effect of the BTX. The therapist then works with the patient to improve passive range of motion, and strengthen the antagonist elbow extensors. Serial splinting or casting is then performed until the contracture is less than 30°. Working closely with the patients and assessing function as the BTX wears off can help determine if lengthening of the flexors will offer the patient a long-term solution.

Table 1
Surgical options and indications

Surgical Options	Indications
1. Biceps step-lengthening	Mild hemiplegia, mild deformity
2. Biceps Z-lengthening	Functional upper extremity with more severe deformities
3. Brachialis fractional lengthening	Functional upper extremity with more severe deformities
4. Brachioradialis myofascial lengthening	Added to complete transection of biceps and brachialis in severe flexion deformities
5. Capsular release	Joint contracture >45°
6. Rotational flap	If inadequate soft tissue coverage in severe contractures after muscular lengthening
7. Musculocutaneous neurectomy	Spastic elbow with no joint contracture
8. Tendon transfer (posterior deltoid-to-triceps or biceps-to-triceps)	Supple elbow joint, corrected contracture and patient desires elbow extension