The Surgical Correction Of Forearm Pronation Contracture By Pronator Teres Re Routing.

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Abstract

6 cases of cerebral palsy with established pronation contractures of the forearm were subjected to a procedure of re routing of the pronator teres insertion by which the pronating action of the muscle was converted to supination. Post operatively the hand function of the operated upper limb improved in terms of grip strength, gain of reciprocal supination pronation and absence of recurrence of contracture. The procedure is recommended in established contractures and seems to be better than simple release that is usually performed.

Introduction

Cerebral palsy is defined as a disorder of motion or posture resulting from a fixed non progressive lesion of the immature brain. About 70% of patients of cerebral palsy have spasticity and are very prone to develop fixed muscle contractures.

Pronation contracture of the forearm is a common disabling condition in cerebral palsy. The true incidence of this condition is not clear. [1]. The condition can be caused by a variety of factors, the commonest being spasticity of the pronator teres muscle. It can be iatrogenically produced when the supinating power of the biceps is attenuated by biceps lengthening during surgical correction of fixed flexion deformity of the elbow. Patients with pronation contracture present late, usually late childhood or adolescence. This is because the contracture is ignored by the patient and care giver because very few acts of daily living except carrying weights are performed in the fully supinated position of the forearm. It is only when the child is forced to lift heavy weights as he grows older and the cosmetic consequence of a fixed pronated forearm with loss of normal carrying angle of the elbow are realized by the patient and the attendant, that treatment for this disability is sought. By then it is too late to expect splinting and physiotherapy to cure the condition. Release of pronator teres muscle is the most commonly described surgical procedure of this condition. Though this does alleviate the pronation contracture, active supination can never be regained and the hand remains disadvantageously placed in activities requiring supination. I studied the results of an uncommon procedure to convert the pronating action of the pronator teres to active supination in a small series of cerebral palsy patients.

Material and Methods

6 cases of cerebral palsy with established pronation contracture of the upper extremity were evaluated and subjected to surgery. Evaluation included assessment of type of disability, hand skill development and associated deformities. X-rays of the affected extremity, electrical stimulation of upper extremity muscles were also performed. Hand grip power was objectively assessed using standard BP cuff and mercury column. Power of supination was graded by conventional MRC grades. The range of supination was measured in degrees using goniometer. Measurements were done preoperatively and repeated 6 months after surgery. The surgery was performed by under general anaesthesia. The pronator teres muscle and tendon of insertion was dissected out. The tendon insertion was released and tendon re routed around posterior aspect of the radius and inserted into bone tunnels created at the new insertion site. Interosseous membrane release was performed in indicated cases. After surgery the limb was immobilized in above elbow cast in full supination. Active supination exercises were begun after 3 weeks. Night time splintage with custom made forearm wrist hand orthosis was continued for 6 months. The patients were reassessed after 6 months to note presence of contracture, ability to actively supinate the forearm and strength of hand grip.

Results

A total of 6 cases of spastic cerebral palsy with pronation contracture were operated. The male: female ratio was 2:1. The average age of the patients was 9.5 years. The right side was involved in 3 cases and 1 case had bilateral involvement. All the cases had well established pronation contracture with no active supination possible. 2 cases had passive

supination to mid prone position. Passive supination beyond mid prone position was not possible in any of the 6 cases. Post operatively all cases had regained passive full supination by 6 weeks. Hand grip strength improved by 38% at the end of 6 months. 3 of the 6 cases had regained grade 4 strength of supination (ability to supinated forearm against moderate resistance) by 6 months of re routing procedure. 1 case did not have active supination and had mid prone position of forearm at 6 months follow up. 4 of the cases were followed up for 1 year. No case developed recurrence of pronation contracture at the end of 6 months.

Discussion

Several factors need to be considered in the causation of the pronation contracture. Hyper tonicity and contracture of multiarticular muscles like the Flexor carpi radialis and palmaris longus along with hyper tonicity of pronator teres and pronator quadratus are most commonly implicated.[2] Serious secondary changes can also occur due to prolonged pronation contracture. These are posterior dislocation of the radial head and contracture of the interosseous membrane [3].

Lack of voluntary control, sensory impairment, muscular imbalances caused by spasticity and weakness, joint contractures, and articular instabilities all contribute to the upper extremity problem in CP. Activities that require supination like grasping a walker or a cane, balancing objects in the palm, washing the face are impossible. The correct treatment of this problem involves accurate assessment of the causative factors of the deformity, assessment of the existing muscular potential of the patient, duration and severity of the deformity. Children who have active pronation are good candidates for pronator to supinator transfer. The presence of strong pronator quadratus though a

deforming force is essential for certain activities of the hand. The pronator quadratus is a muscle, related to the skill movement of the forearm, providing smooth pronation movements. This muscle should ideally not be released in an attempt to fully correct the deformity. In treating the pronation deformity of the forearm, the most important point is how to achieve reciprocal voluntary pronation-supination. In order to preserve the reciprocal movements of supination-pronation in the forearm, pronation movements of the forearm would be necessary. If after the tenotomy of the pronator teres, adequate correction of the pronation contracture is not evident, the next step is careful release of the interosseous membrane. In 3 of the 6 cases this procedure had to be performed to correct the deformity. In 1 case the deformity persisted despite extensive release of the interosseous membrane and release of pronator quadratus was performed. This case did not do as well as the other cases in the series, underlining the importance of preservation of pronator quadratus in this condition.

It is very difficult to consider the treatment of pronation contracture of the forearm in isolation. They usually occur in conjunction with flexion deformity of the elbow, wrist and fingers especially in hemiplegic type of cerebral palsy. In such cases proximal release of the flexor-pronator origin is a recommended procedure described by Page in 1923 for correction of flexion deformity of the hand and wrist, and more recently by Inglis and Cooper. Remarkably the present small series of cases had predominantly pronation contracture with minimal involvement of the other joints. One likely explanation is that the parents reported that regular physiotherapy was provided to elbow and wrist since birth by the care givers in various institutions. Retrospectively it seems likely that special care to avoid pronation contracture was not provided.

In conclusion pronator tendon re routing is a very effective procedure for correcting pronation contracture. The dynamic nature of the transfer ensures that the deforming forces are converted to corrective forces [4]. Hence active supination is available to the patient and chances of recurrence are thus minimal.

References

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