CASE REPORT

Early detection and rehabilitation in Erb-Duchenne paralysis in a child under the age of one-year: A Case Report from Lusaka, Zambia

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ABSTRACT

Erb-Duchenne paralysis is a neurological condition characterized by paralysis of the arm which occurs due to injury of the upper trunk of C5-C6 of the brachial plexus and can lead to disturbances in movement and sensation. Erb-Duchenne paralysis commonly presents with a *"Waiter's Tip"* deformity characterized by elbow extension, medial rotation of the arm, forearm pronation, and wrist flexion. Management of Erb-Duchenne paralysis may involve strengthening exercises, range of motion exercises, manual therapy, and neuromuscular electrical stimulation. However, in most cases, the diagnosis of Erb-Duchenne paralysis is not detected early enough for rehabilitation outcomes to be maximized. We herein report a case of a 6-months old child who had Erb-Duchenne paralysis in the left upper limb. The aim of this case report is to highlight the importance of early detection and rehabilitation of Erb-Duchenne paralysis. Furthermore, the report also discusses the physiotherapy techniques that can be used to optimize outcomes.

INTRODUCTION

Erb-Duchenne paralysis, or Erb's Palsy, is a neurological condition characterized by paralysis of the arm which occurs due to injury of the upper trunk of C5-C6 of the brachial plexus. Erb's Palsy is a common birth injury that can cause movement disability and cutaneous sensation disturbances in upper arm. The most known cause of Erb-Duchenne paralysis is traction on the neck during difficult labour and delivery, shoulder dystonia, cephalopelvic disproportion, instrument delivery, and excessive pressure over pulling on the infant's arm during breech delivery. Erb-Duchenne paralysis presents with elbow extension, medial rotation of the arm, pronation of the forearm and flexion of the wrist which appears as a *"Waiter's tip"* deformity. Interventions for Erb-Duchenne paralysis include strengthening exercises, range of motion exercises, manual therapy, and neuromuscular electrical stimulation. Most of the cases are self-limiting and

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recover with no permanent disability, but still some need rehabilitation or surgery in extreme cases. The rate of recovery in the first few weeks is considered to be a good indicator of recovery.[1] We present a case of a 6-months old female who presented with Erb-Duchenne paralysis in the left upper limb. The aim of this case report is to highlight the importance of early detection and rehabilitation of Erb-Duchenne paralysis. Furthermore, the report also discusses the physiotherapy techniques that can be used to optimize outcomes.

CASE PRESENTATION

A 6-months old female was referred for rehabilitation following a complaint of failure to use the left upper limb. The child's mother noticed that at age 4 months, the child was not able use the left arm when holding toys; the child was not able to reach out or support herself with both hands when crawling; and the child could not turn her head to the sides. The mother had a full-term pregnancy and attended antenatal care from five weeks of the pregnancy. During her pregnancy, the mother had high blood pressure and was taking iron supplements until her last antenatal care visit. The baby was delivered using forceps vaginal delivery with a birth weight of 3.8 kilograms. The baby cried immediately,but had jaundice and convulsions for 4 days.

At the time of examination, there was notable weakness in the left upper limb, particularly in the elbow flexors and wrist extensors. The child was diagnosed with Erb's palsy and later referred for physiotherapy management.

CLINICAL FINDINGS

On observation, the child looked generally healthy and of normal body weight. A close examination of the shoulder revealed a depressed left shoulder compared to the right one. The left arm was also medially rotated with the elbow in extension; forearm in pronation; and wrist in flexion— in classical *"Waiter's Tip"* position. Additionally, the left scapular appeared more prominent compared to the right one. In terms of function, the child was unable to grasp objects using the left hand.

Patient was afebrile to touch. The muscle tone was reduced in the left upper limb. No tenderness was noted around the left or right shoulder areas.

On examination of movements, the child has unilateral handling as she could not hold any object in the left hand, and could not bring the left upper limb to mid-line or bring hands together. However, movements were normal in the right upper limb and in both lower limbs.

Muscle weakness was noted in the shoulder abductors, elbow flexors and wrist extensors in the left upper limb. Range of motion was limited by pain in the left shoulder and left elbow.

Timeline

Child was seen for a period of four weeks before being transferred to another facility on grounds of social convenience. At the referral hospital, follow-ups have continued for an additional eight weeks, bringing the entire follow-up period to 12 weeks by the time of submission of this report.

Therapeutic Intervention

Weight bearing exercises were done to strengthen weak muscles in the left upper limb by placing the child in four-point kneeling for few minutes at a time. Joint approximation and passive stretching movements were done to stabilize muscle tone and to break the abnormal pattern. Stimulatory massage was done on the left upper limb. Splints or strapping the arm in elbow flexion, supination and external rotation of the shoulder was done including applying a cock-up splint intermittently. The child was encouraged to use the left upper limb while playing with toys or bringing food to the mouth. Home advice was given to the mother to practice and encourage right positioning and intermittent splinting of the left upper limb when the child is sleeping.

Follow-Up and Outcomes

The child was undergoing physiotherapy daily for the first two weeks and then twice per week thereafter. The child was followed up for one month. By week four, there was notable improvement in strength and range of motion in the left upper limb, especially shoulder rotation and wrist extension. The child was referred to another facility on social grounds and follow-up continued for 8 more weeks. By the time this reporting, steady improvement was consistent in the shoulder rotation, wrist flexion, and elbow flexion.

Patient perspective

The child's mother reported some improvement in function in the child by week twelve of the rehabilitation.

Informed consent

Following assessment and examination, the attending clinicians explained the diagnosis, findings and treatment plan to the parents. The authors certify that they obtained all appropriate patient consent forms from the parents on behalf of the child. The parents agreed to have the physiotherapy commenced and agreed to the terms of attending treatment appointments.

DISCUSSION

This report discusses Erb-Duchenne paralysisina 6-month old female childand notes that other scholars have also recorded a higher female predominance in patients with brachial plexus injuries.[1,] This child was delivered using a forceps vaginal delivery at full-term. Anees *et al*[1] also established that Erb-Duchenne paralysis was directly related to forceps delivery which is a more frequent cause of Erb-Duchenne paralysis with shoulder dystonia. Birth procedures are important factors in the risk of mishandling during childbirth or excessive pressure or pulling of upper limb during C-section delivery causing lesion to nerve roots of C5 and C6.

Clinical examination of the shoulders revealed a depressed left shoulder compared to the right one. The left arm was also medially rotated with the elbow in extension; forearm in pronation; and wrist in flexion—in classical *"Waiter's Tip"* position. This is consistent with what literature has reported on clinical features of Erb-Duchenne paralysis.[1] In terms of function, the child has unilateral handling as she could not hold any object in the left hand, and could not bring the left upper limb to mid-line or bring hands together. This finding contrasts with what Awad *et al* found that children with Erb-Duchenne paralysis tend to have an absent Moro reflex with normal hand grasping.

Conservative treatment of neonatal brachial plexus palsy requires early diagnosis and follow-up, possibly within two to three weeks after the childbirth. For conservative treatment to be holistic, there is need for a multidisciplinary approach involving clinicians, clinical neurophysiologists, neurosurgeons, occupational therapists, and physiotherapists. Rehabilitation of brachial plexus injuries involves passive/active mobilization exercises, stretches, tactile stimulation with different textures, vibration and brushing techniques to promote sensory ability in the injured limb, bimanual activities, and electrical stimulation. These therapies aim to ensure the conditions needed for the functional recovery of the limb following nerve regeneration, and prevention of muscle wasting, sagging, joint deformities, and muscle contractures.[9] Smith *et al*. recommend that therapy be administered several times a week and, at home, as frequently as possible, for example at each meal or with every nappy change.

For the child in this report, weight-bearing exercises were done to strengthen weak muscles in the left upper limb by placing the child in four-point kneeling for few minutes at a time. Range of motion exercises were done for the left upper limb, and other limbs alike. Similarly, Massimino *et al*[5] found that the most effective exercises are by manual therapy or bilateral motor planning activities. This finding emphasizes the importance of prioritizing range in the rehabilitation of Erb-Duchenne paralysis to

prevent fixed deformities and contractures. Therefore, one session per day is essential to maintain range of motion of the limb and to enhance quick and full functional recovery. Progressive Neuromuscular Facilitation (PNF) was not used in this case despite evidence of its benefits in scapular stability and progressive resistive shoulder exercises.Splints or strapping the arm in elbow flexion, supination and external rotation of the shoulder was done including applying a cock-up splint intermittently. However, there is scarce data to support the use of intermittent splinting in children below age 1 year with Erb-Duchenne paralysis.

Although Okafor *et al*[6] found neuromuscular electrical stimulation effective for restoring muscle tone, range of motion, and strength in damaged muscles, it was not used in this child because it would have been difficult to obtain reliable patient feedback during treatment. Several other studies have assessed the efficacy of electrical stimulation versus traditional physiotherapy in the early recovery of function in babies after a brachial plexus injury, and have established that functional electrical stimulation may be preferable to traditional approaches in the rehabilitation of individuals with Erb-Duchenne paralysis in terms of improved range of motion and muscle strength.[6,] Some of the benefits of electrical nerve stimulation include excitation of both motor and afferent sensory nerve fibres; promoting nerve healing and regeneration; as well as restoring muscle properties tone, range of motion, and strength in damaged muscles.[13]

By week twelve into the rehabilitation, steady improvement was noted in muscle strength and range of motion in shoulder rotation, wrist extension, and elbow flexion. Unlike the progress in our case where elbow function started improving around week 8, Abid reported that the most obvious situation, and by far the most frequent, is when recuperation of biceps strength to +3 occurs within the first 4 weeks. This discrepancy in the improvement pattern could be attributed to how soon rehabilitation was commenced and not necessarily differences in interventions. When recovery of biceps strength to +3 occurs between the 1st and the 3rd month, progression is more often favourable. It is worth noting that brachial plexus injuries typically require a lengthy recovery period due to the complexity of the injuries and the slow recovery tempo. Studies show that complete recovery of overall function of the upper limb following Erb's palsy sometimes can only occur late over the child's first 2 years, and even when recovery is incomplete, the sequelae remain minimal without hindering the function of the limb involved.[13,15] During long-term rehabilitation, the degree of neurological recovery, psychological status, and complications of the affected limb vary widely, requiring the clinician to develop an individualized rehabilitation program, which requires a great deal of experience.

CONCLUSION

This case highlights the importance of early detection and rehabilitation in Erb-Duchenne paralysis. Furthermore, when treating these patients, physiotherapists must continually concentrate on recovering the patient's ability to externally rotate their arms and flex the elbow as these are important prognostic indicators.

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