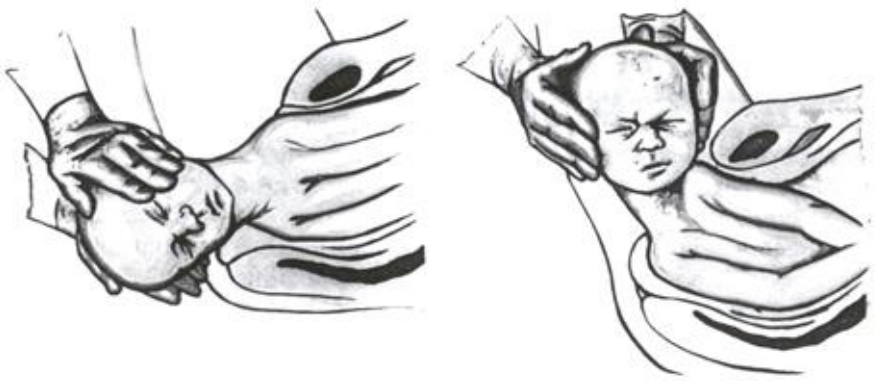
CURRENT CONCEPTS IN THE MANAGEMENT OF OBSTETRICAL BRACHIAL PLEXUS INJURIES

The existence of birth palsies of the upper limbs has been noted for a very long time. However, there have existed several misconceptions about the prognosis and eventual functional recovery. All forms of palsy noted at birth are termed “Erb’s palsy.” Most doctors feel that these injuries always recover spontaneously and such babies always “do well” in the long-term. Often, “physiotherapy” is the only treatment prescribed and we see patients who have continued such supervised exercises till adulthood in the presence of deformities.

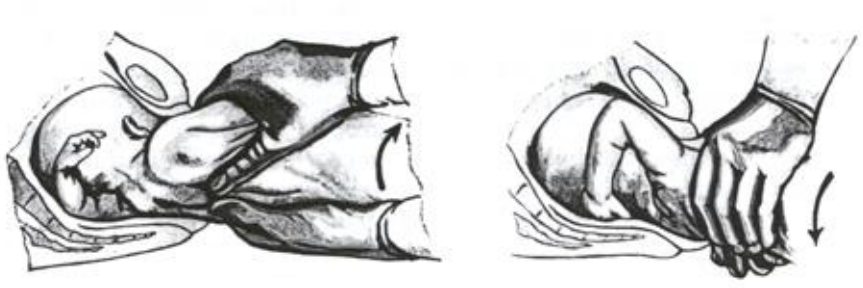
In fact, such rigid notions are no longer true. It is now established that these palsies result from stretching of the roots and trunks of the brachial plexus in their course across the posterior triangle of the neck. Such injuries are more common with large babies (high birth-weight) with shoulder dystocia. The lateral bending and stretching of the neck that occurs when the shoulders get trapped at the pubic arch are responsible for the stretching force. This is particularly true for vertex presentations. Such forces are often generated in breech deliveries, even with lower birth-weights of 2-4 kg. Application of forceps has often been implicated with litigation. However, this could, in fact, have reduced the time of delivery and, concomitantly, the extent of injury. Such traction injuries have also been noted in babies delivered by caesarian section. However, it is not clear whether this was due to incorrect handling during delivery or excessive delay in taking the decision to operate. It is, however, established that direct pressure applied by the obstetrician with his fingers or through the forceps are not responsible for these injuries.



The injury starts with involvement of the C5 and C6 roots. Greater forces produce C567 palsies and, often, C5T1 or total palsies. The severity of injury also varies. Most often,

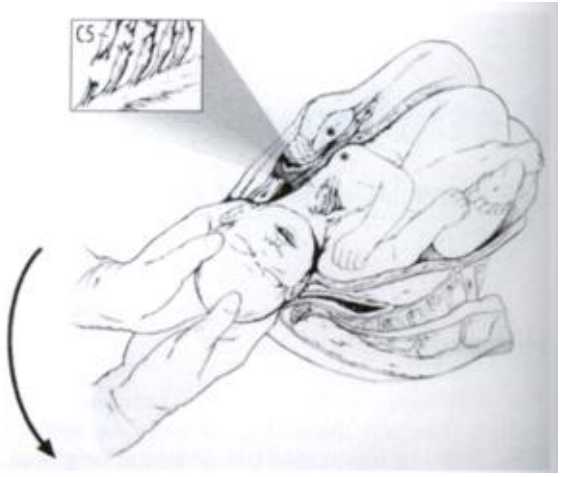
the epineurial and perineurial sheaths of the nerves remain intact with a good prognosis for early recovery. However, the forces can and often do result in tearing of the nerves. The upper roots are usually ruptured outside the inter-scalene triangle while the C8T1 roots are susceptible to being pulled off the spinal cord (root avulsions) with no hope of spontaneous recovery.

Orthopaedic surgeons generally tend to treat such palsies with masterly inactivity, splinting and physiotherapy. Although a large percentage of these injuries are benign and recover spontaneously over the first month without any specific treatment, this does not apply to all cases. Lack of recovery in external rotation of the shoulder and supination of the forearm has often led to internal rotation contractures, deformities and dislocations of the humeral heads and contractures in pronation with growth.Application of splints to hold the limb in abduction and external rotation have also resulted in contractures in the position held with functional deficits.



Early surgical treatment of these nerve injuries (at 1-3 months of age) has been attempted since the beginning of the twentieth century (Kennedy 1903, Clarke 1905, Lange 1912, Fairbanks 1913, Taylor 1920). However, their procedures were fraught with the risks associated with primitive anaesthesia and monitoring equipment. In addition, the surgery merely involved excision of the scarred sections of the nerves, end-to-end repairs using

the crude suture materials available then and the repairs were protected by holding the head close to the shoulder. The resulting tension when the head was moved produced fibrosis at the repair site and failure to restore function. These poor results discouraged further such endeavours for at least forty years. In the late 1960s, Millesi proved that the determinant factor in nerve repairs is absence of tension and that defects in peripheral nerves can be bridged using cables of nerve grafts harvested from dispensable cutaneous nerves. The pioneering efforts of Millesi, Narrakas and others in nerve reconstructive surgery for traction palsies in adults rekindled interest in obstetrical palsies. In 1981, Alain Gilbert and Tassin from Paris published a landmark study of forty-four children suffering from obstetrical brachial plexus palsy who were treated conservatively and were followed for more that ten years from birth. They identified different patterns of palsies observed at birth. In addition, the rate of recovery of different proximal muscles was correlated with the eventual function. They concluded that absence of recovery in the biceps (even slight contraction) at three months was inevitably associated with poor final function. Subsequently they studied 114 babies who were operated upon for nerve reconstruction at varying ages. They found that the ideal age for surgery was around three to four months. The results of surgical reconstruction at 3-4 months of age were found to be distinctly superior to those observed in similar babies treated conservatively.



These landmark studies are considered the basis for current management of obstetrical palsies.

CURRENT MANAGEMENT:

A trained observer must evaluate these babies right from birth. A quiet atmosphere is essential for determination of intact or recovered functions. These observations must be carefully documented and compared to the results of subsequent evaluations. The parents must be explained about the nature of the injury and the prognosis. The possibility of early surgery must be discussed from the very beginning.

PATTERNS OBSERVED:

1) C56 PALSIES: These result in loss of shoulder function and of active elbow flexion. Thus, the limb lies by the side of the patient with the elbow extended, the

forearm pronated and the fingers and wrist in flexion (the classical "policeman's" or "waiter's tip" attitude). The retained pectoralis major and subscapularis muscles hold the shoulder in internal rotation. This is the classical ERB'S PALSY (named after the ERB who determined the muscles innervated by the upper trunk by stimulating the confluence of the C5 and C6 roots in the neck). This condition is inevitably associated with absent deep reflexes.

2) C5T1 PALSIES:
This is the next most common pattern where all the roots are affected. The C8T1 roots are the sites of major damage and are often avulsed. Presence of a Horner's syndrome (miosis, ptosis, enophthalmos) points towards an avulsion of the T1 root. The limb lies totally flail by the side of the baby.

Initial Care

There is no need for application of splints. Vigorous mobilization of the limb must be avoided for the first three weeks. The clinical status must be reviewed weekly. After three weeks, gentle mobilization of the shoulder, elbow, wrist and fingers is started in order to avoid contractures. Proper hygiene for the axillary folds, palm and inter-digital clefts is essential.

Spontaneous Recovery

Recovery in the fingers is often noted very early (2^{nd} to 7^{th} days). However, this usually indicates that the C78T1 roots were not affected. It is important to observe for recovery in the deltoid and biceps muscles. Less severe injuries of the C56 roots are usually associated with return of shoulder and elbow functions by the second month. External rotation of the shoulder and supination of the forearm are the last to recover. Hence, passive mobilization to maintain these movements is essential. **However, one must avoid tying the baby's hand to the cot or applying abduction splints. These often result in contractures that are difficult to correct subsequently.**

Severe Injuries

These are evident at birth in the presence of a totally flail limb with Horner's syndrome. These signs generally denote affection of all five roots with avulsions of the lower roots. **The prognosis for spontaneous return of normal function is nil.** Surgical reconstruction offers the only chance of restoration of some useful function in the shoulder, elbow and hand. One must counsel the parents about the gravity of the injury and stress the need for early surgery **(by three months of age).**

Even patients with C56 or C567 injuries can sustain ruptures of the roots or root avulsions. These are inevitably associated with a slower spontaneous return of proximal muscle function. **As mentioned above, the hand starts moving early and is NOT indicative of a better prognosis. If the deltoid (shoulder abduction) does not return by two months and the biceps (elbow flexion) by three months, surgery is necessary to restore proper continuity between the proximal and distal nerve stumps using nerve grafts in order to improve the quality of the eventual function.**

SURGICAL RECONSTRUCTION:

This is usually performed at **3-4** months of age. **Absence of biceps recovery is the single most important sign indicating the need for surgery**. This is confirmed on EMG (electromyography). This test must be performed by a person experienced in dealing with birth palsies.

Surgery involves resection of the scarred zone of injury in the posterior triangle of the neck, identification of good proximal stumps (ruptured ends of roots in the interscalene triangle) and distal stumps (above or behind the clavicle), interposition of nerve graft cables of both sural nerves and suturing under the operating microscope. In the presence of root avulsions, one of the available stumps is connected to the distal stumps as an intra-plexual nerve transfer. C5T1 injuries with 3-4 roots avulsed require the transfer of nerves from outside the brachial plexus for restoration of specific shoulder and elbow functions. Usually, the spinal accessory and intercostal nerves are utilized for this purpose.

COURSE FOLLOWING SURGERY:

After the first three weeks, nerve recovery occurs at the rate of around 1 mm/day or an inch per month. Hence, shoulder recovery is observed at three months and biceps shortly after that. Recovery continues to occur till three-four years after surgery. Sensation and motor control in the hand improves steadily over this period.

SECONDARY SURGERY AND CORRECTION OF DEFORMITIES

Unfortunately, the need for early surgery in obstetrical palsies is not widely known. Hence, babies who required nerve reconstruction get neglected. Lack of recovery in certain muscles such as external rotators of the shoulder results in contractures in internal rotation and, subsequently, bony deformities affecting the humeral head and the acromion. The child is unable to bring its hand to its mouth and lifts the shoulder in abduction during this movement. This is characteristically termed the “TRUMPET SIGN”. In addition, supination contractures of the forearm are common. Shoulder deformities require soft-tissue corrective surgery at three years. Further delay leads to bony deformation, which may warrant osteotomies for improvement of the position and function of the limb. Similarly, surgery is required to release the supination contractures and the biceps tendon has to be re-routed to improve pronation.

In the absence of early nerve surgery, spontaneous nerve re-growth often results in co-contractions i.e. simultaneous contractions of opposing groups of muscles

such as the biceps, triceps, deltoid and pectoralis major. This interferes with the use of the limb and is disabling. Disconnection of the musculocutaneous nerve (to the biceps) and nerve transfer using the intercostal nerves has been proposed by certain surgeons in Japan. Muscle transfers are also performed to improve the utility.

Even after nerve reconstruction surgery, secondary procedures may be necessary at 3 and 6-7 years of age to improve the utility of the restored functions.

C5T1 palsies carry a poor prognosis and the affected limb remains smaller and less useful. Nerve surgery improves the shoulder and eventual hand function. However, tendon transfers are very often required at later stages.

Without nerve surgery, such babies with complete palsy inevitably have very poor functions.

CONCLUSIONS

All birth palsies are **not** ERB'S PALSIES (C56). Birth palsies **do not always** do well on their own. Nerve reconstructive surgery is often required and must be performed early **(3-4 MONTHS OF AGE)**. Deformities at a later age necessitate corrective surgery at 3 and 6 years.