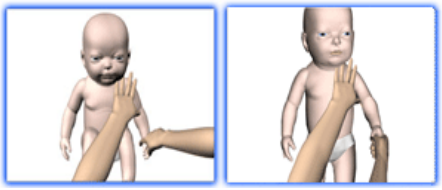
Nath Brachial Plexus
INSTITUTE

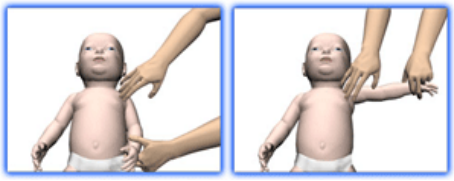
INFANT RANGE OF MOTION EXERCISES

SHOULDER FLEXION



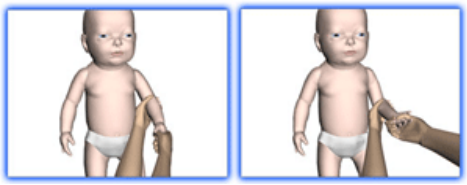
Infant is lying on his/her back. Stabilize shoulder with one hand and wrist with the other. Lift the arm up to the level of the shoulder, thumb leading, elbow straight.

SHOULDER ABDUCTION



Infant is lying on his/her back. Stabilize with one hand at the shoulder so that it doesn't come up and hold forearm with the other hand. Lift the arm sideways away from body, bring the arm straight out to the side.

FOREARM SUPINATION AND PRONATION

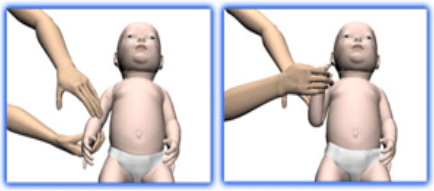


Infant is lying on his/her back, elbow bent and arm straight out to the side. Hold arm straight out to the side and hold the forearm with the other hand. Roll the forearm up, then roll the forearm down.

SHOULDER ROTATION

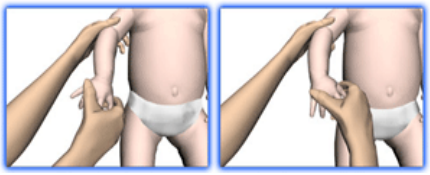
Infant is lying on his/her back. Stabilize the upper arm with one hand cupping the elbow and hold the wrist with the other hand. Roll the forearm and hand up, then roll the forearm and hand down.

ELBOW FLEXION AND EXTENSION



Infant is lying on his/her back. Stabilize with elbow and hold the wrist with other hand. Bend the elbow then straighten the elbow.

WRIST ABDUCTION AND ADDUCTION

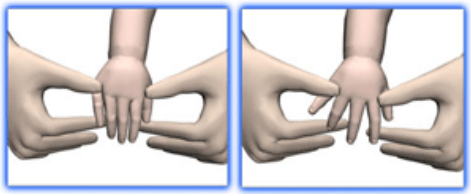


Infant is lying on his/her back. Stabilize the forearm with one hand and hold the child's hand with your other hand. Move the wrist from side to side.

FINGER FLEXION AND EXTENSION

Infant can be lying or sitting. Stabilize the wrist with one hand and hold the child's fingers with your other hand. Bend the fingers, then straighten the fingers.

FINGER ADDUCTION AND ABDUCTION



Infant can be lying or sitting. Hold the child's wrist straight with palm open and hold the fingers straight. Spread the fingers apart gently, then bring them back together.

Notes:

- **This is general listing of range of motion exercises for the upper extremity.**
- **Each infant and injury is different. Please follow the specific instructions given to you by your doctor.**
- **Having your physical therapist or occupational therapist train you and your family members on how to do range of motion exercises. If it's possible, video tape this seesion and refer back to it as needed. Have your therapist review your technique once a month and adjust as necessary.**
- **Do range of motion exercises with each diaper change.**
- **Do the exercises very gently. Closely watch the infant's face for signs of pain or discomfort.**
- **Do each motion 10 to 15 times and NOT to the end of the range of motion. Move into the range until mild resistance is felt and hold there for 30 seconds. Do not bounce into this stretch.**

BRACHIAL PLEXUS INJURIES

The term **"obstetrical palsy"** was first used by Duchenne in 1872, and the description of upper root injury was described by Erb in 1874. The first surgical management of obstetric brachial plexus injury (OBPI) was reported in the early 1900's although results were poor and mortality was high.

The majority of children with obstetric brachial plexus injuries have risk factors for a difficult delivery such as large size, use of forceps or vacuum, and shoulder dystocia.

The successful surgical treatment of brachial plexus injuries awaited the development of microsurgical techniques in the 1970's.

The modern surgical management of obstetric brachial plexus injury is generally based on the studies of A. Gilbert and J. Tassin in the early 1980's in France. Tassin followed 44 children with OBPI for a period of 5 years without surgery in order to determine the natural history of the injury. Based on this study, Gilbert and Tassin proposed several indications for surgery:

- **When the biceps and deltoid recover by 1 to 2 months, a full recovery is likely and no surgery is indicated.**
- **When the biceps and deltoid recover by 3 to 4 months, a reasonable outcome is likely and no surgery is indicated.**
- **Poor outcomes result if recovery begins after 3 to 4 months, and surgery is indicated.**

We basically follow these principles at The Nath Brachial Plexus Institute, although we do tend to wait until 4 or 5 months of age before recommending surgery. In our experience, this will allow maximum spontaneous recovery without losing time before muscle atrophy.

Gilbert and Tassin also studied the functional outcome of another group of children following surgery when compared to the untreated 44 described by Tassin. Their conclusion was that surgery, including nerve grafting and neurolysis (removal of scar), did result in significant improvement in function. Over 1200 children and adults have undergone primary surgery, with Dr. Nath, on the injured nerves, and virtually all have shown improvement with no loss of function. The results we have witnessed are even superior to that of Gilbert and Tassin.

The concept that surgery will improve function in OBPI has been supported in many other studies worldwide.

At The Nath Brachial Plexus Institute, we believe strongly that surgical intervention in appropriate cases will maximize movement and sensation in the affected arm and hand. We believe that the key to our success is in careful selection of appropriate patients and timely surgical intervention with the latest techniques in nerve reconstruction.

LONG TERM OUTCOME

Brachial plexus injuries cause severe functional deficits in the affected extremity. The full extent of the arm and hand deficits may not be known for several years.

Additionally, upper body posture may be altered as a result of compensatory maneuvers used to deal with poor positioning of the shoulder and arm.

"Many parents have been told that "95% of these injuries get better without treatment" . Dr. Nath's 9 years of experience, over 5,500 evaluations and over 4,000 surgeries on children and adults with obstetric brachial plexus injuries has led us to believe that this estimate is overly optimistic.

A recent landmark report from the Children's Hospital at the very well respected Karolinska Institute in Stockholm, Sweden evaluated 105 children for functional outcome at 5 years of age following obstetric brachial plexus injury (Sundholm LK, Eliasson A-C, and Forssberg H. Obstetric brachial plexus injuries: assessment protocol and functional outcome at age 5 years.

The Swedish study evaluated motor and sensory functions as well as the overall use of the affected limb. The results indicated that "the eventual outcome from in upper-plexus lesions is more complex than is commonly believed". Occupational Therapists and a physician specializing in movement problems of children determined these outcomes.

The findings are quite compelling and very much in agreement with what we see in our clinic:

- **Children with no apparent deficits in shoulder, biceps or hand function by 3 months of age: 70% full recovery by age 5 years.**
- **Children with remaining deficits in shoulder, biceps or hand function by 3 months of age: 5% full recovery by age 5 years.**

It is important to understand the meaning of these results: even in the best case scenario, where no obvious deficits remain by the age of 3 months, fully 3 out of 10 children will have significant functional deficits by the age of 5 years if untreated. In children with remaining problems after the age of 3 months, over 9 out of 10 children will have residual deficits by 5 years. Overall, 66% of children, or 2 out of 3, had severe problems by the age of 5 years.

This information is critical in understanding the progression of the muscle imbalances that occur following brachial plexus injury. The 105 children in this study all received physical therapy and primary surgery where appropriate at the age of 3 to 6 months. None of the children underwent secondary or muscle transfer surgery by the age of 5 years.

It is these residual muscle imbalances that secondary surgery (including the quad procedure) attempts to correct. The surgery moves around muscles which cause the deformity to place them in a better position for overall function.

Dr. Nath has performed the Mod Quad surgery on over 2800 children and adults with excellent improvement in function in virtually all. Our overall improvement in arm abduction and flexion (lifting the arm over the head) has been 60-70 degrees, and in external rotation (placing the hand behind the head; throwing a ball) has been 40-50 degrees. We have not seen any other reports with results even close to these and certainly have not seen a series of patients this large reported elsewhere.

In summary, the arm function of children with brachial plexus injury is actually more affected than commonly thought. Even in the best group of children, those with no visible deficit by age 3 months, 30% will have residual, noticeable deficits by age 5 years. Those with visible deficits by the age of 3 months will have a 95% incidence of residual problems by age 5 years. This important study supports the idea that aggressive, including surgical, management of brachial plexus injuries may lead to better outcomes.

INJURY DIAGNOSIS

We believe that one of the most important questions to ask your doctors is how much experience they have with brachial plexus and Erb's injuries both in children and adults. If the answer is vague or they don't know how many of these cases they see or operate on each week, this should be cause for concern.

Remember, children with brachial plexus injuries are completely different from adults and require different management.

Although The Nath Brachial Plexus Institute itself is new in existence, Dr. Nath has treated thousands of children and adults in the last 9 years. He has developed and invented several new operations and therapy protocols for treatment of these injuries.

Ask also how many total brachial plexus operations in children are done per week and per year, and how many have been done in total. It is well established that the more numbers of a surgical procedure done, the better the patient's outcome, with fewer deaths and complications.

This seems obvious, and the principle has been shown in numerous studies.

We believe that improving the outcome of brachial plexus injuries will depend on basic science and clinical innovations that require a commitment to research. Our research endeavors range from outcome studies and epidemiology of brachial plexus injuries to nerve gene therapy studies supported by the National Institutes of Health.

TREATMENT BENEFITS

Results:

- **Nerve grafting: > 90% improve**
- **Nerve transfer: > 90% improve**
- **Tendon/ muscle transfers: > 95% with functional improvements**

Our main goal in recommending surgery in brachial plexus injuries is to restore as complete function as possible. We aim to make both arms as close to the same as possible. It is important to note that we are not talking about surgery for the sake of appearance.

Any extremity that does not look normal cannot function normally; therefore, normal appearance may be a side benefit of reconstructive surgery and is accompanied by improved function and growth.

Reconstructive surgery may involve operating on the nerves, the bones, the tendons, the muscles, the blood vessels and the skin, sometimes all in the same operation.

Our surgical team can perform all necessary procedures and our therapy team will be able to provide state of the art treatment for non- surgical and post-surgical patients.

We will talk with you about specific goals for your child. We are concerned about your child's total well-being. We will be glad to talk with you about emotional, social and vocational issues. Whenever you have questions, please ask us.

Dr. Rahul Nath

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