Development of a protocol for the management of Obstetric Erb's palsy

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Abstract

Introduction: Erb's palsy is a paralysis of the arm caused by injury to the upper trunk (C5-C6) of the brachial plexus sustained during delivery as a result of a birth emergency known as shoulder dystocia. The other possible causes of this injury could be due to excessive pulling on the shoulder during vertex presentation, by the pressure on the raised arms during breech delivery or due to clavicle fracture unrelated to dystocia. The signs of it are sensory loss in the arm and paralysis & atrophy of the deltoid, biceps & brachialis muscles. The position of the limb is arm adducted & internally rotated, elbow extended, forearm pronated, wrist flexed & fingers extended. It is been documented by the results of a recent systemic review, where McNeekly& Drake (2003) found that there was no conclusive evidence showing a benefit of surgery in children with ObstetricBrachial Plexus Palsy (OBPP). Occupational therapy treatment of such patients aims at positioning, splinting, strengthening, facilitation & sensory reeducation. Hence it is very important to establish an effective & comprehensive management for such children.

Aim of the study: To develop a protocol for the management of erb's palsy.

Methodology: Eleven Congenital Erb's palsy patients, age not more than 2weeks who Clinically presented with typical policeman's tip hand and had no bony injury detected or reported were selected from SVNIRTAR occupational therapy department. All the patients were followed up at the age of one year. Study design was Pretest post test study design. The outcome measure used was Active movement scale (AMS).

Results:the results showed a significant improvement in the patients in all the components of active movement scale at pd"0.05 except in the components in shoulder internal rotation & forearm supination.

Conclusion: From the present study it can be concluded that the therapeutic intervention along with the splinting is effective in enhancing recovery in the erb's palsy patients.

Introduction

Erb's palsy is a paralysis of the arm caused by injury to the upper trunk (C5-C6) of the brachial plexus sustained during delivery as a result of a birth emergency known as shoulder dystocia. The other possible causes of this injury could be due to excessive pulling on the shoulder during vertex presentation, by the pressure on the raised arms during breech delivery or due to clavicle fracture unrelated to dystocia.(1,2) Statistics claim that more than 5000 babies are born each year with Erb's palsy. The nerves most commonly affected are the suprascapular nerve, musculocutaneous nerve and the axillary nerve. The signs of it are sensory loss in the arm and paralysis & atrophy of the deltoid, biceps & brachialis muscles. The position of the limb is arm adducted & internally rotated, elbow extended, forearm pronated, wrist flexed & fingers extended. Depending on the severity of the injury, surgery may be required.It is been documented by the results of a recent systemic review, where McNeekly& Drake (2003) found that there was no conclusive evidence showing a benefit of surgery in children with Obstetric Brachial Plexus Palsy (OBPP) (3). There is scant inconclusive evidence regarding the effectiveness of primary conservative management for infants with Erb's palsy as reported by Bialocerkowski, Kurlowicz, Vladusic& Grimmer (2005) (4). Vaz, Mancini et.al (2010) in their study observed that treatment based on constraint induced movement therapy has potential to promote functional gains for children with OBPP(5). Smania*et al* enrolled six children with Obstetric Brachial plexus palsy aged between 6-22months in a pilot study (unpublished) to evaluate the effects of modified constraint induced movement therapy (mCIMT) protocol focused on reducing learned non use of the affected arm. At the end of the treatment an improvement in use of affected arm was recorded in all patients (6).Okafor UA, Akinbo SR, Sokunbi OG, Okanlawon AO &Nornha CC(2008) compared the effect of functional electrical stimulation(FES) & conventional Physiotherapy in Erb's palsy children and commented that FES could contribute positively in

improving the functional outcome in these children as opposed to conventional Physiotherapy (7).

Rationale of the study: There are a lot of controversies over the conservative management of the Erb's palsy& there was no conclusive evidence showing a benefit of surgery in children with OBPP as reported by McNeekly& Drake (2003) (3) hence a trial was made to develop a protocol for the management of Erb's palsy.

Aim of the study: To develop a protocol for the management of Erb's palsy

Related literature: Most brachial plexus injuries occur at birth. Approximately one or two babies out of every 1,000 born are affected. The brachial plexus is comprised of five spinal nerve roots that exit the spinal cord in the neck. These roots extend through the axilla (arm pit) behind the clavicle (collar bone), and then branch into nerves that enable movement (motor branches) and sensation (sensory branches) of the shoulder, arm, and hand. The upper trunk of the brachial plexus consists of the C5-6 nerve roots, which exit the neck at the levels of the 5th and 6th cervical vertebrae, respectively. The middle trunk consists of the C7 nerve root, which exits the neck above the 7th cervical vertebrae. The lower trunk consists of the C8 and T1 nerve roots, which exit below the 7th cervical and 1st thoracic vertebrae, respectively. The most common mechanism of injury to the brachial plexus during birth is traction of the head and neck in a direction away from the site of injury. This results in a stretching of the affected nerve roots. Depending upon the degree of stretching, the resulting injury may be a praxis (stretch injury without tearing), rupture (partial tear), avulsion (complete tear off the spinal cord) of the affected nerve roots, or neuroma (in which scar tissue grows around an injured nerve which has tried to heal itself, and interferes with the nerve sending signals to the muscles). There are various types of surgical and non-surgical treatment available for children with brachial plexus injuries. The treatment required for any particular child will depend upon the nerve roots injured, and the severity. Management of brachial plexus injuries must start with an accurate diagnosis. Physical therapy and/or occupational therapy should be started as soon as possible, along with instructions to the parents on how to perform range of motion exercises with their child at home. Children who might not benefit from nerve reconstruction surgery may nevertheless be helped by another type of surgery involving muscle transfers, generally performed as early as age two and as late as age eight years of age, which may significantly increase function, even though nothing can be done to repair the damaged nerves.

Literature Review:

A. Santamato, F. Panza et.al in their study concluded that a combined treatment with botulinum toxin type A and modified constrained induced movement therapy has potential to promote functional gains for children with Obstretic brachial plexus palsy.

Margaret Storment, said that children are extremely adaptable and will always try to use uninvolved extremity to perform the task.

Susan E. Mackinnon, Dennis P Grogan et.al said in their study that no scientific evidence exists to support that transcutaneous electrical stimulation is useful in activating the muscles.

Brown KL observed in his study that conservative management yields good results.

C. G Curtis reported in her study that the active movement scale is a reliable & valid evaluation tool to evaluate the infants with obstetrics brachial plexus palsy.

John A. Grossman, Patricia DiTaranto et.al concluded in their study that when compared with the results of a study of 91 children who received non-operative treatment, the results of surgical intervention can improve the functional outcome in properly selected infants.

Okafor UA, Akinbo SR et.al commented in their study that functional electrical stimulation may be preferred to conventional therapy in the course of rehabilitation for an early resolution functions in Erb's paralysis.

Patricia DiTaranto, LilianaCampagna et.al in their study observed that 91 infants who sustained a brachial plexus birth injury were treated with only physical & occupational therapy. The children were evaluated at 3-month intervals and followed for a minimum of 2 years. Sixty-three children with an upper or upper-middle plexus injury recovered good to excellent shoulder & hand function.

McNeekly& Drake found that there was no conclusive evidence showing a benefit of surgery in children with Obstetric OBPP.

Bialocerkowski, Kurlowicz, Vladusic& Grimmer repoted in their study that here is scant inconclusive evidence regarding the effectiveness of primary conservative management for infants with Erb's palsy.

Al-Qattan designed a prospective study in which the indication for brachial plexus surgery in infants with Erb's palsy was the lack of active elbow flexion against gravity at 4 months of age.

Smania*et al* enrolled six children with Obstetric Brachial plexus palsy aged between 6-22months in a pilot study to evaluate the effects of mCIMT protocol focused on reducing learned non use of the affected arm. At the end of the treatment an improvement in use of affected arm was recorded in all patients

Methodology

All the eleven patients were selected from SVNIRTAR occupational therapy department. All the guardians of the children had given written consent for participating in the study. All the patients were followed up at the age of one year.

Study design: One arm prospective cohort before and after interventional study.

INCLUSSION CRITERIA: Congenital Erb's palsy

Age birth to 2weeks and neonates of both the gender were included in the study

Clinically presented with typical policeman's tip hand

No bony injury detected or reported

Exclusion criteria: Age of reporting more than 2weeks of age

Patients having signs of pre-ganglionic injury

Outcome Measure- Active movement scale: The Active Movement Scale (AMS) is a tool that relies solely on the observation of active limb segment movement without & against gravity. It is an eight point scale (0-7) with 0 being no contraction & 7 being full motion. The inter rater reliability of the study show that the AMS is a reliable scale for the evaluation of infants up to one year of age with obstetric brachial plexus palsy. It has also got a strong content validity.

Intervention:

Stage 1: First 2 weeks

1. Handling and positioning:

- The arm was placed in shoulder abduction, external rotation and supination with the help of straps attached to the mattress.
- The arm was supported while carrying the child

2. Activities of daily living:

- Dressing: for dressing, start with the affected arm and for undressing start with the unaffected arm.
- Bathing and Hygiene: instruct the mother to keep the armpit always dry and clean.
- Feeding: always keep the affected arm flexed on the baby's chest (Shoulder abducted, internally rotated, elbow flexed) while feeding, and remind the mother to feed the baby from both side.

3. Very gentle passive range of motion (PROM) for shoulder, elbow, forearm and wrist joints (stabilize the proximal joint and move the distal one) were given every waking hour for 10 repetitions for shoulder flexion, abduction & external rotation, elbow flexion and extension, forearm supination and pronation and wrist flexion and extension .

Stage2: From 2 weeks to 4 month

1. The same was continued as per the instruction given during the first stage.

2. Gentle and slow PROM exercises were used to increase the joint flexibility, but it should be within the available ROM and 10 repetitions for each movement.

3. Active movements and strengthening were facilitated through age appropriate developmental activities initially in gravity eliminated positions (initiating shoulder flexion & abduction in supine position by showing rattles or toys from lateral side of the arm and proceeding to the lateral side of the head and encouraging the child to touch the rattle or toy, for elbow flexion and extension side lying position was used and the child was encouraged to put the hand into the mouth and back, for forearm supination and pronation the child was encouraged to touch an object on the therapist's hand and again returning back to the previous position for wrist flexion and extension the child is encouraged in supine position to move the wrist by giving painful stimulus on dorsum of the hand for flexion and on the palm for extension) and then advanced to against gravity positions (i.e the same activities done in sitting position). First eccentric contraction then concentric contraction was used for facilitating the motor control. All the activities were done every waking hour of the day for 10 repetitions.

4. Tactile stimulation was provided to the affected extremity by using different textured materials.

5. Joint compression and weight bearing exercises were used to increase the proprioceptive input and isometric muscle co-contraction.

Stage 3: From 4 months to 6 months

1. The same program was continued as per the above stages.

2. Encourage bimanual activities to prevent the neglect of the involved extremity which will lead to further complications or deformities and to prevent the learn non-use.

3. Constrained induced movement therapy (CIMT) was also used for these children by the age of 6months (6). In CIMT these children were forced to use the affected upper extremity as the unaffected upper extremity was placed in a mitt.

4. Splinting: at the age of 4months the children were splinted with airplane splint with elbow in extension, shoulder in flexion, abduction & external rotation. By the age of 6months the splint was modified to place the shoulder in flexion, abduction & external rotation along with elbow flexion & forearm supination.

Stage 4: From 6 months to 1 year

1. The same program for above stages was continued.

2. As the child grows strength and coordination are increased by active use of the affected arm using a verity of developmentally appropriate activities and specific functional skills.

Data Analysis

Statistical analyses were performed using the statistical package for social sciences, SPSS software (version-16.0). The means and standard deviations were calculated. Two tailed paired "t" test was used to find out the changes in the AMS scores within the group. The level of significance was set at *p*d"0.05.

Results

Graph-1

Showing the improvement in the upper limb function using the active movement scale (AMS)

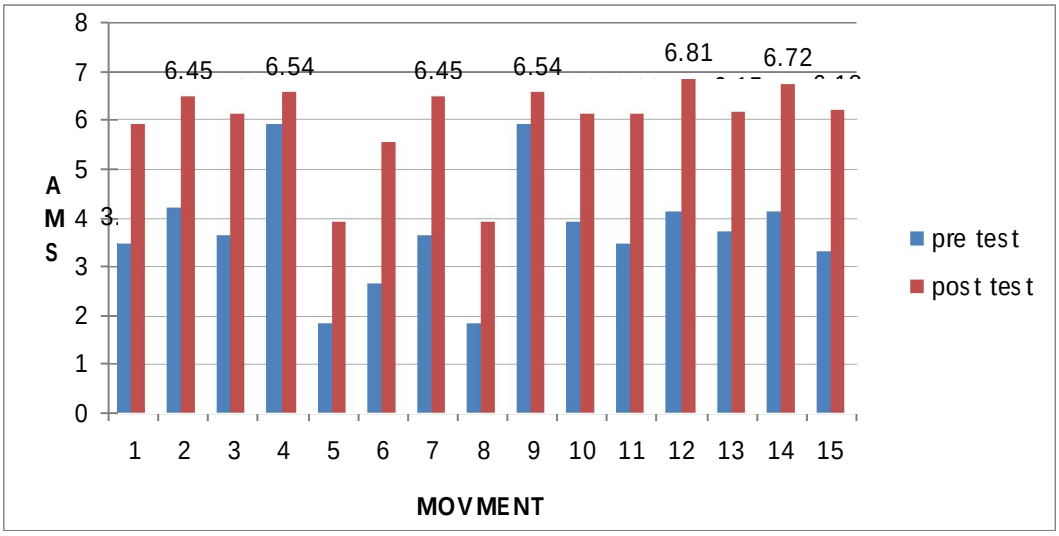

Table -1
Shows description of calibrations in the X-axis of graph-1.

1-Shoulder Flexion	2-Shoulder Adduction	3-Shoulder Abduction	4-Shoulder Internal Rotation	5-Shoulder External Rotation
6- Elbow Flexion	7-Elbow Extension	8- Supination	9- Pronation	10-Wrist Flexion
11- Wrist Extension	12- Finger Flexion	13-Finger Extension	14-Thumb Flexion	15-Thumb Extension

Table-2
Showing the pretest, post-test, mean difference t value and *p* value of the active movement scale (AMS).

Joint	Movement	Pretest	Post Test	Mean Diff	t value	*p* value
Shoulder	Flexion	3.45	5.9	-2.45455	-5.949	.000***
	Adduction	4.18	6.45	-2.45455	-4.980	.001**
	Abduction	3.63	6.09	-2.45555	-4.980	.001**
	Internal rotation	5.9	6.54	-0.63636	-2.055	.067*
	External rotation	1.81	3.9	-2.09091	-4.582	.001**
Elbow	Flexion	2.63	5.54	-2.90909	-7.420	.000***
	Extension	3.63	6.45	-2.81818	-5.429	.000***
Forearm	Supination	1.81	3.9	-0.63636	-2.055	.067*
	Pronation	5.9	6.54	-2.09091	-4.582	.001**
Wrist	Flexion	3.9	6.09	-2.04050	-3.546	.005**
	Extension	3.45	6.09	-2.63636	-5.581	.000***
Finger	Flexion	4.09	6.81	-2.72727	-5.817	.000***
	Extension	3.69	6.15	-2.46154	-5.687	.000***
Thumb	Flexion	4.09	6.72	-2.63636	-6.421	.000***
	Extension	3.27	6.18	-2.90909	-6.113	.000***

*Not significant, ** Significant & *** Highly significant

Table-2 shows that there is a significant improvement in the patients in all the components at *p*d"0.05 except in the components in shoulder internal rotation & forearm supination.

Discussion

The conservative management of Erb's palsy is controversial as per the available documents. In the present study it has been observed that with careful monitoring & changing the positioning, splinting, therapeutic exercises, forced use through CIMT all can greatly contribute in the management of Erb's palsy. However it is very important that the therapist must be alert enough to observe the recovery of the movements at each joint as per the guideline available as documented by M. Storment. According to her the finger flexion, finger extension, wrist flexion & wrist extension recovers by 3 months, shoulder flexion (45-90), shoulder abduction (45-90) & elbow flexion by 4 months, elbow extension by 5 months, shoulder flexion & shoulder abduction (90-160) by 8 months, shoulder external rotation by 12 months and supination by 15 months of age should be achieved. The improvement was not significant in shoulder internal rotation which was already having a high initial score of 5.9. The forearm supination also did not show a significant improvement which may be attributed to the age of the patients at 12 months and they had not reached the stipulated age of 15 months to show the full improvement. The patients were not followed up after the age of 12 months to comment weather there was any further improvement in the forearm supination or not.

Conclusion: From the present study it can be concluded that the therapeutic intervention along with the splinting is effective in enhancing recovery in the erb's palsy patients. The sample size was small so the effects cannot be generalized.

Limitation & Recommendation: The study should be carried out over a larger population. A control group may be added to increase the strength of the study.

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References:

1. Wikipedia, the free encyclopedia.
2. Ehab M. Abdel-Kafy, Hebatallah M. Kamal, Samah A. Elshemy, Effect of modified constrained induced movement therapy on improving arm function in children with obstetric brachial plexus injury. The Egyptian journal of Medical Human Genetics, 2013(14): 299-305.
3. McNeely P D and Drake J M (2003): A systematic review of brachial plexus surgery for birth related brachial plexus injury. Pediatric Neurosurgery 38: 57-67.
4. Bialocerkowski, Kurlowicz,Vladusic& Grimmer: Effectiveness of

primary conservative management for infants with obstetric brachial plexus palsy. International journal of evidence – based health care 2005; vol. 3(2): 27-44.

5. Vaz D V, mancini M C, do Amaral M F, de BritoBrandao M, de Franca Drummond A, da Fonseca ST. Clinical changes during an intervention based on constraint induced movement therapy principles on use of the affected arm of a child with obstetric brachial plexus injury : A case report. Occupational Therapy International, December 2010; 17(4), 159-67.

6. N. Smania, G.Berto, E.LA Marchina, C.Melotti*et al* : Rehabilitation of Brachial Plexus Injuries in adults and children. European journal of physical and rehabilitation medicine 2012, 48(3): 483-506.

7. Okafor UA, Akinbo SR, Sokunbi OG, Okanlawon AO & Noronha CC: Comparison of Electrical stimulation & conventional Physiotherapy in functional rehabilitation in Erb's palsy. Nigerian Quarterly Journal of Hospital Medicine 2008; 18(4): 202-205.

8. Patricia DiTaranto, LilianaCampagna et.al**.** Outcome following non-operative treatment of brachial plexus birth injuries. Journal of Child Neurology, February 2004; vol. 19 no. 2, 87-90.

9. Andrea Santamato, Francesco Panza et.al.Effect of botulinum toxin type A and modified constraint – induced movement therapy on motor function of upper limb in children with obstetrical brachial plexus palsy. Childs NervSyst (2011); 27:2187-2192.

10. John A. I Grossman, Patricia DiTaranto et.al. Multidisciplinary management of Brachial Plexus birth injuries: The Miami experience. Seminars in Plastic Surgery, 2004; 18(4): 319-326.

11. G. Evans-Jones, SPJ Kay et.al, (2002)**.**congenital brachial palsy: incidence, causes & outcome in United Kingdom & Republic of Ireland.

12. Margaret Storment. Guidelines for therapists: treating children with brachial plexus injuries.

13. Susan E Mackinnon, Dennis P Gragon 2010, http://emedicine.medscape.com/article/1259437.

14. Brown KL. Review of obsteretic palsies. Non-operative treatment. Clinical Plastic Surgery 1984; Jan; 11(1): 181-7.

15. Al-Qattan.The outcome of erb's palsy when the decision to operate is made at 4months of age, Plastic & reconstructive surgery 2000; Vol. 106, No 7, 1461-1465.

16. DenielaViiginiaVaz, Marisa Cotta Mancini et.al.Clinical changes during an intervention based on constraint-induced movement therapy principles on use of the affected arm of a child with obstetric brachial plexus injury: a case report. Occupational Therapy International 2010; Vol.17, No 4, 159-167.

17. Eng GD, Binder H, Getson P et.al. Obstetrical brachial plexus palsy outcome with conservative management. Muscle Nerve 1996; 19: 884-891.

18. Brady K, Gracia T. Constraint – induced movement therapy (CIMT): pediatric applications. DevDisabil Res Rev 2009; 15:102-111.

19. Morris DM, Taub E, Mark VW. Constraint induced movement therapy: characterizing the intervention protocol. EuraMedicophys 2006; 42:257-268.

20. Christine Glenn Curtis. The active movement scale: an evaluative tool for infants with Obstetrical brachial plexus palsy, 2000.

21. Foad S.L, Mehlman C.T, Foad M.B &Lippert.W.C: Prognosis following neonatal brachial plexus palsy: an evidence based review. Journal of Children's Orthopedics 2009; vol. 3(6): 459-463.

22. Badr, YaserM.D, O'Leary, Shaun M.D, Kline &Devid G. M. D: Management of one hundred seventy one operative & non operative obstetrical birth palsies at the Louisiana State University Health Sciences center. Neurosurgery 2009; Vol.65(4): A67-A73.