ORIGINAL ARTICLE

Role of Physical Therapy in Improving the Functional Outcome of Infants with Erb's palsy due to Neurapraxia and Axonotmesis

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ABSTRACT

Background: The nerve roots from fifth cervical C5 nerve to first thoracic T1 form the brachial plexuses and upper brachial plexus lesion including C5, C6 and sometimes C7 is called Duchene, Erb's palsy.
Aim: To determine the role of physical therapy in improving functional outcome of an infant with Erb's palsy with neurapraxia and Axonotmesis
Study Design : Quasi Experimental design
Place and duration of study: The Department of Physical Medicine & Rehabilitation (PM&R) of the Children's Hospital & ICH Lahore from Nov 2016 to April 2017
Methodology: In this study thirty patients of Erb's palsy diagnosed on EMG & NCS having neurapraxia of upper brachial plexus injury were taken in Group A and other Thirty patients of Erb's palsy diagnosed on EMG & NCS having Axonotmesis of upper brachial plexus injury were taken in group B. Physical therapy sessions including positional training, EMS (for 03 months), P-ROM exercise, splints, A-ROM exercises, therapeutic ultrasound, sensory stimulation and activity programme according to functional level of infants were applied for six months.
Results: The patients of Erb's Palsy with neurapraxic injury showed 100% improvement regarding ROM and muscle strength and functional outcome whereas in axonotmesis group only 06 patients (20%) showed good functional recovery whereas 24 patients (80%) showed poor recovery. The difference between two groups in terms of recovery is significant (P value<0.05).
Conclusion: Physical therapy is more affective in improving functional outcome in infants with Erb's palsy having neurapraxic injury as compared to infants with Erb's palsy having axonotmesis injury. Recovery depends upon severity of lesion; more severe lesion showing lesser degree of recovery (P value<0.05).
Keywords: Erb's palsy, EMG & NCS, Axonotmesis, Neurapraxia, Rehabilitation management.

INTRODUCTION

The nerve roots from fifth cervical C5 nerve to first thoracic T1 form the brachial plexuses and upper brachial plexus lesion including C5, C6 and sometimes C7 is called Duchenne, Erb's palsy[1,2,3,4,5]. It is usually produced by increased distance between head and shoulder during delivery[6]. Most cases of Erb's palsy follow prolonged and difficult labour[7].The incidence of birth related brachial plexuses injuries occurred about 0.4% of infants born and among them most common is Erb's palsy with neurapraxia about 48%[8,6]. The infants with Erb's palsy typically lies with the shoulder adducted with internally rotated, elbow extended, forearm pronated and wrist in flexion (waiter's tip hand). Muscles involved in Erb's plays are supraspinatus, infraspinatus because the suprascapular nerve is formed at suprascapular notch i.e.Erb's point, other muscles are deltoid, biceps, brachialis , supinator and extensors of wrist and fingers[9,1,2]. The biceps and radial jerks are absent[1,2].

Upper trunk brachial plexuses injuries ranges from neurapraxia(conduction block and axon remains in continuity) and axonotmesis (damaged to individual axon within an intact sheeth) and neurotomesis (nerve is completely divided)[6]. These nerve lesions are detected on EMG & NCS study[1]. Patients of Erb's Palsy with Neurapraxia show full recovery whereas infants with Axonotmesis and neurotmesis show poor functional recovery with physical therapy treatment[4].

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Patients with poor functional recovery are referred for surgical opinion[10,1].

The objective of our study was to determine why with same physical therapy plan, some patients with Erb's palsy recover completely whereas others don't recover and also was the better management and prevention of further complications in Erb's palsy.

SUBJECT AND METHODS

This study was conducted at The Children Hospital & ICH Lahore in the Department of Physical Medicine & Rehabilitation (PM&R) over a period of six months from Nov. 2016 to April 2017. Informed consent was taken from parents or attendants to take data for research purpose after taking informed consent and approval from ethical committee. Thirty patients diagnosed with Erb's palsy with neurapraxia were taken in Group A and other thirty patients diagnosed with Erb's palsy with axonotmesis were taken in Group B. All of them underwent same physical therapy programme. Physical therapy techniques including EMS, therapeutic-ultrasound, positional training (aeroplane positioning), Splints (aeroplane splints, hand splints), P-ROM exercises, A-ROM exercise, sensory stimulation and activity programmes according to functional level were applied to all patients for six months[4,8,9].

EMS was applied to weak muscles less than grade 3 to all patients after 3 weeks of injury and was upto 3 months[11]. Sensory stimulation of affected limb was performed by sensation exercises including rubbing object

with different textures to the child's arm such as blankets, fur, cotton and light brush[12,2].

Splinting of the affected limb is needed to prevent abnormal positioning of limb to prevent contractures[1,2]. Therapeutic ultrasound (intermittent mode) was applied to Erb's point for first 2 weeks to reduce oedema and inflammation. Functional activities of affected limb were started as soon as feasible. All patients were taking physical therapy sessions up to 3 months on daily basis. After3 months when EMS was stopped, they were on follow up after every 2 weeks and reassessment was done after every month. Information was gathered regarding gender, birth history, risk factors and recovery factors by using a questionnaire.

For assessing the patient muscular improvement, modified research council (MMRC) muscle grading system was used[13,14]. We assessed shoulder abduction, elbow flexion and supination by using muscle grading system[15]. This was suggested by Gilbert and Tassin. They simplified it to account for the difficulty encountered in examining these infants. To access the functional recovery level cookie test was applied[16].

All analysis was performed using SPSS version 24. Quantitative data such as age was calculated by using mean and standard deviation. Qualitative data including gender, side involvement, causes, associated congenital anomalies and complications were calculated by using frequency and percentages. Variables like prolonged obstructed labour, muscle grade and cookies test were analysed by chi square test. P value < 0.05 was taken as significant statistically.

RESULTS

In this six months study periods 60 patient of Erb's palsy with mean age 1.55 month and standard deviation 0.629 were included. Among them30 patients (50%) were with neurapraxia and other 30 patient (50%) were with axonotmesis. Right side involvement was seen in neurapraxic group (43%) and in axonotmesis group (53%) and left side involvement was seen in neurapraxic group (56%) and in axonotmesis group (43%).The patients with vertex presentation in neurapraxic group were (86%) and in axonotmesis group were (87%). The no of patients with breech presentation in both groups (neurapraxia and axonotmesis) were same[17]. Prolonged obstructed labour was seen in significant numbers 8(27%) Neurapraxia) and 26(87%) of Axonotmesis group) and the there was found association between prolonged obstructed labor and Erb's palsy with neurapraxia and axonotmesis ($P<0.05$)[7].All cases in our study were home (SVD) delivered and the ratio of home delivered infants in both groups (neurapraxic and axonotmesis was similar[18,6,17]. In either group no infant delivered through C-section.There were three mothers with diabetes mellitus presented in group A and not a single mother with diabetes mellitus was presented in group B. In neurapraxic group, all 30 patients (100%) showed marked improvement (upto M3) in shoulder abduction, elbow flexion and Supination while in axonotmesis group, only 06 patients (20%) showed good improvement where as 24 patients (80%) showed poor improvement in shoulder abduction, elbow flexion and Supination. No case of biceps brachii and Pronator contracture were seen in neurapraxic group whereas 02 patients (6.7%) with biceps brachii and pronator contractures were seen in axonotmesis group.

Poor functional outcome and frequent complications were seen in axonotmesis group. In neurapraxic injury only one side limb involvement was seen in all cases whereas in Axonotmesis group one case of bilateral limb involvement was seen. In group B, one case was presented with congenital torticollis whereas no associated birth injury was seen in group A. At last follow up, in neurapraxic group A, all 30 patients (100%) showed good recovery while in Axonotmesis group B, only 06 patients (20%) showed good results and 24 patients (80%) showed poor recovery. The difference between two groups in terms of recovery was significant ($P<0.05$)

Table1: Muscle Grading Scale:

Observation	**Muscle grades**
No contraction	M 0
Contraction without movement	M 1
Slight/complete movement with wt eliminated	M 2
Complete movement against the weight of the corresponding	M 3
Segment of extremity	

Table2: Clinical findings

Factors		**Group A**		**Group B**	
		Neurapraxic		**Axonotmesis**	
		F	**Percentage**	**F**	**percentage**
Gender	Male	15	50	16	53
	Female	15	50	14	49
Side of paralysis	Right	13	43	16	53
	Left	17	57	13	43
	Bilateral	0	0	1	3
Torticollis (congenital)		0	0	1	3.33
Recovery up to M3	Shoulder abduction	30	100	6	20
	Elbow flexion	30	100	6	20
	Supination	30	100	6	20
Complications	Absent or poor shoulder abduction	0	0	24	80
	Absent or poor elbow flexion	0	0	24	80
	Weak or absent Supination	0	0	24	80
	Biceps contracture	0	0	2	6.60
	Pronator contracture	0	0	2	6.60

Table 3: Risk factors

Factors		Group A Neurapraxic		Group B Axonotmesis	
		F	Percentage	F	Percentage
Delivery	Home	14	47	16	53
	Hospital	9	30	8	27
	Clinic	7	23	6	20
Presentation	Vertex	24	86	26	86.60
	Breech	3	10	3	10
	Shoulder		0	1	3.33
Mode of delivery	SVD	30	100	30	100
	C-section	0	0	0	0
Prolonged obstructed labour		8	27	26	86.60
Maternal diabetes		0	0	3	10
Instrumentation	Forceps	3	10	5	16.60
	Vacuum extraction	0	0	0	0

Table 4: Major Predisposing Factor

	Neurapraxic Group A		Axonotmesis Group B		P-value
	Frequency	Percentage	Frequency	Percentage	
Prolonged obstructed Labour (present)	8	27	26	86	<0.05
Prolonged obstructed Labour (absent)	22	73	4	13	
Total patients	30		30		

Table 5: MMRC Muscle Grading System (Neurological Recovery and Functional Recovery)

Recovery	Neurapraxia Group A		Axonotmesis Group B		P-value
Muscle grade	F	%age	F	%age	
M0	0	0	4	13	<0.05
M1	0	0	7	23	
M2	0	0	13	43	
M3	30	100	6	20	
Cookie Test					
Poor (can't hold object & bring it to mouth	0	0	23	76	<0.05
Good (canhold object & bring it to mouth)	30	100	7	24%	

DISCUSSION

The incidence of birth related brachial plexuses injuries occurred about 0.4% of infants born and among them most common is Erb's palsy with neurapraxia seen in about 48% cases[6,8].

In our study there is no significant difference in gender in both groups likewise no significant difference in side involvement was seen in both groups. Prolonged obstructed labor was significant factor in both groups P<0.05[7]. All cases of our study were home delivered i.e., SVD and no case of C-section was observed and the ratio of home delivered infants in both groups (neurapraxic and axonotmesis) was almost same[6,17,18].

In Erb's palsy with neurapraxic group A, no other complication at the time of birth was seen where as Erb's palsy infants with axonotmesis group B, a case was also presented with congenital torticollis.

Physical Therapy interventions are more effective in patients of Erb's palsy with neurapraxia as compared to patient of Erb's palsy with axonotmesis.

In our study group A (neurapraxia, showed significant recovery. These results matched to the previous study[4].

In our study, axonotmesis group B, only 06 patients (20%) showed good recovery and 24 patients (80%) showed poor recovery. We found a significant association between recovery and severity of nerve lesion(P<0.05%). It means recovery depends upon severity of lesion. In neurapraxic group A, all patient recovered and show no further residual complication where as in case of axonotmesis group, two cases of Biceps brachii and pronator contractures were seen as residual complications.

CONCLUSION

Physical therapy interventions are more affective in improving the functional outcome of an infant of Erb's Palsy with neurapraxic injury as compared to infant of Erb's Palsy with axonotmesis injury. Recovery depends upon severity of lesion; more severe lesion showing lesser degree of recovery (p<0.05)[19].

The patients with poor functional recovery were referred for surgical opinion[20]. Proper assessment, multidisciplinary approach for management including proper implementation of physical therapy techniques and patient guidance regarding treatment is very effective for good management and prevention of complications[21].

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