Obturator Nerve Blocks Using 5% Aqueous Phenol for Treatment of Adductor Spasticity in Children with Cerebral Palsy and Its Effects on Spasticity and Function

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Abstract

Study design: Before-after treatment trail.
Place of study: Institute of Post Graduate Medical Education and Research, Kolkata.
Duration of study: 1st April 2013 to 31st September 2015.
Study population: OPD patients attending Dept. of PM&R at Institute of Post Graduate Medical Education and Research, Kolkata.
Intervention: Forty children aged between 6 and 12 years, suffering from diplegic CP with hip adductor spasticity were given bilateral obturator nerve blocks with 5% aqueous phenol after localisation by electrical stimulation.
Results: Subjects were assessed before intervention and after intervention at 1week, 1 month and 3 months. There was statistically significant improvement in all the outcome parameters of spasticity measured by modified Ashworth scale, gait speed measured by 10 metre walk test and perineal hygiene measure by Likert scale.

Key words: **Cerebral palsy, spasticity, phenol.**

Introduction:

Cerebral palsy (CP) is a common neuromuscular disability affecting children all over the world. Over the years there have been massive improvements in perinatal and neonatal care, but the incidence rate has remained almost constant at 1.5 to 2.5 per 1000 live births[1].

Adductor spasticity is a common condition affecting these children causing difficulties in normal gait, maintenance of perineal hygiene and other activities of daily living [2,3].

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There are many ways to control spasticity in CP patients egoral drugs such as baclofen, benzodiazepines, Tizanidine etc., different types of orthosis such as ankle foot orthosis(AFO),different types of hip abduction orthosis, serial casting can also be used for control of spasticity. Along with these methods local control of spasticity can be done by targeting specific nerves and muscles by phenol or alchohol solutions. Botulinum toxin is also used to target specific muscles for control of spasticity. Phenol causes chemical neurolysis when used in concentrations of 3% and above[4].In this study we have used 5% aqueous phenol for control of adductor spasticity by nerolysing the obturator nerve (ON) [5].

Aims and Objectives:

1. To compare spasticity of hip adductor muscles before and after block by modified Ashworth scale (MAS).
2. To evaluate the effects of obturator nerve blocks on maintenance of perineal hygiene by Likert scale.
3. To evaluate the effects of obturator nerve blocks on gait speeds by 10 metre walk test.

Materials and Methods:

Sample Size -- MAS was taken as the most important parameter for detecting sample size. It was calculated that at least 40 subjects would be needed to detect statistically significant changes in values of MAS.

Study Area – Department of Physical Medicine and Rehabilitation IPGME&R and SSKM Hospital, Kolkata.

Study Population – Spastic cerebral palsy children attending OPD of Dept. of PMR at SSKM Hospital, Kolkata were included in the study after screening through inclusion and exclusion criteria.

Study Design – Before-after treatment trial.

Study Duration – 1st April 2013 to 31st September 2015 (18 months).

Before the start of the study clearance of the Institutional Ethics Committee (IEC) was taken. Informed written consent was taken from each patient/parents.

Inclusion Criteria.

1. Children with cerebral palsy having predominantly hip adductor spasticity and less involvement of other lower limb muscles such as hamstring and gastrosoleus.
2. Patients who could do independent ambulation.
3. Children in age group of 6-12 years.
4. Children who were taking conventional physiotherapeutic interventions for at least 3 months.

Exclusion Criteria.

1. Children with fixed adduction deformity of hip.
2. Patients with significant mental retardation, cortical blindness and deafness etc. who will not be able to follow instructions.
3. Patients with past history of convulsion.
4. Patients with history of sensitivity of phenol.

Children who had independent ambulation were included in the study as otherwise gait parameters could not be taken. Only those children who were aged between 6 years and 12 years were included in the study for standardisation of 10 metre walk test, as children outside this age group will have physiologically different gait parameters.

Patients with already tightened hip joint capsule or already shortened hip adductor muscles (MAS-4) were not included in the study as neurolysis of obturator nerve (ON) will not cause any effect in them resulting in false negative cases.

Study Parameters – Modified Ashworth scale for spasticity, Likert scale for perineal hygiene and10 metre walk test for improvement in gait parameters.

Study Tools – Disposable syringe and needles, sterile gloves, rectified spirit, sterile gauze pieces, 5% aqueous phenol, Teflon coated regional analgesia needle (35 and 50mm), a small percutaneous direct current stimulator for nerve localisation, a 10 metre walkway, a stopwatch.

Study Techniques – Selected patients were given bilateral obturator nerve block using 5% aqueous phenol. The patients were placed in supine position, with legs abducted. A mark was made on the skin 1 to 2 cm. medial to the femoral artery just below the inguinal ligament. This mark was used to indicate the direction of the needle toward the obturator canal. The adductor longus tendon was then identified near its insertion site at the pubis. The Teflon coated needle was attached to an out syringe which contained 5% aqueous phenol. Generally in case of small children 35mm needle was used, however in case of little older and bulky children 50mm size of needle was used. The needle was introduced behind the adductor longus tendon and directed laterally, with a slight posterior and superior inclination toward the skin mark. The needle was advanced until adductor muscle contraction was elicited with a nerve stimulator. Then the needle was manipulated to a point where maximum contraction was visible with minimum current applied by the nerve stimulator. After negative aspiration, phenol solution was injected.

The patients were assessed before giving the blocks and after 1week, 1month and 3months of blocks.

For measurement of hip adductor spasticity modified Ashworth scale was used (Table 1) [6].

For ease of statistical calculation 1+ was taken as 2 to make it an ordinal scale.

Table 1 : *Showing MAS Description*

Score	MAS Description
0	No increase in muscle tone
1	Slight increase in muscle tone manifested by catch and release or minimal resistance at the end of ROM
1+	Slight increase in muscle tone manifested by catch and minimal resitance throughout the remainder of ROM
2	More marked increase in muscle tone through most of ROM but affected parts moved easily
3	Considerable increase in muscle tone, passive movement difficult
4	Affected parts rigid in flexion and extension.

For measurement of perineal hygiene Likert scale was used (Table 2)[7].

Table 2 : *Liker Scale Description*

Score	Description
1	Can be performed without difficulty
2	Can be performed with little difficulty
3	Can be performed with moderate difficulty
4	Can be performed with great difficulty
5	Cannot be performed

For measurement of gait speed 10 metre walk test was used[8,9]. A clear 10 m walkway was made with two lines at 2m and 8m , this was done to record the speed at middle 6m of the walkway to negate the effects of acceleration and deceleration. Data were recorded at normal comfortable walking speed.

Results:

Forty children were included in the study in age group of 6 to 12years of which 15 were male and 25 female.

MAS for hip adductor muscle spasticity, Likert scale for perineal hygiene and speed in metre/sec for 10 metre walk test were analysed by repeated measures ANOVA followed by Tukey's multiple comparison test. Statistical calculation was done by Graphpad Prism 5 software.

For hip adductor spasticity it was seen that most of the improvement occurred in the 1st week itself as reflected by mean difference of MAS between before block and at 1week follow-up being 1.400, after that there was sustained reduction of spasticity at 1month and 3 months, all the intergroup comparison were statistically significant except comparison between 1 week *versus* 1 month and 1m *versus* 3m. Effect of the blocks were maintained for the duration of study of 3months. The comparison between reduction of MAS at baseline and different stages of follow-up are depicted in Table 3.

In case of perineal hygiene there was statistically significant improvement at 1st week after ON block reflected by mean of Likert score before ON block being 3.025 and at 1week after injection being 2.10 , however between 1month (mean Likert Score-1.475) and 3 months there was no improvement (Fig 1).

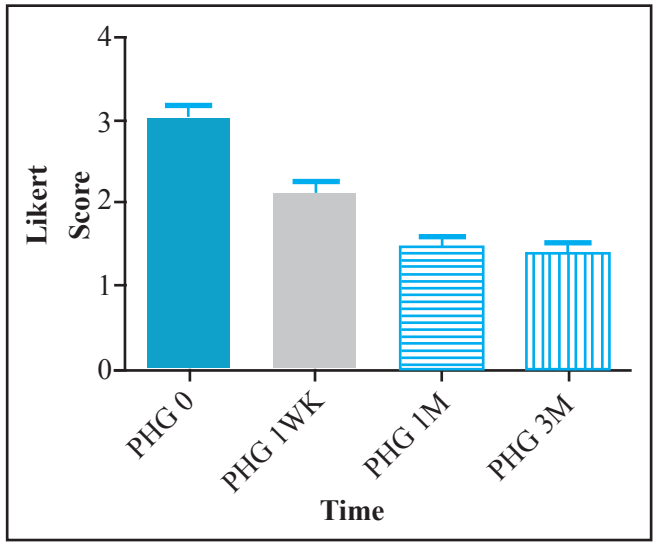

Fig 1 - Showing Perineal Hygiene

[PHG 0, PHG 1WK, PHG 1M AND PHG 3M denote the mean values of Perineal hygiene as measured by Likert scale at baseline, 1week, 1month and 3 months respectively]

In case of gait speed measured by 10m walk test it was observed that there was gradual increase of gait speed from 0.704m/s at baseline to 0.951 m/s at 3months, the increase in speed was statistically significant in all comparisons except 1week versus 1month and 1month *versus* 3 months (Table 4).

Table 3 : *Showing Interpretation of MAS by Turkey's Multiple Comparison Test*

Tukey's multiple comparison test	Mean difference	If $p < 0.05$ yes or no	95% CI of difference
MAS 0 versus MAS 1 week	1.400	Yes	1.031 to 1.769
MAS 0 versus MAS 1 month	1.700	Yes	1.331 to 2.069
MAS 0 versus MAS 3 months	1.925	Yes	1.556 to 2.294
MAS 1 week *versus* MAS 1month	0.3000	No	-0.06939 to 0.6694
MAS 1 week *versus* MAS 3months	0.5250	Yes	0.1556 to 0.8944
MAS 1 month *versus* MAS 3months	0.2250	No	-0.1444 to 0.5944

[MAS 0 ,MAS 1week, MAS 1 month and MAS 3 months denote the mean values of MAS at baseline, 1week, 1month and 3months respectively]

Table 4 : *Showing Interpretation of Metre Walk Test by Turkey's Multiple Comparison Test*

Tukey's multiple comparison test	Mean difference	If $p < 0.05$ or not	95% CI of difference
10 metre walk test O *versus* 10 metre walk test 1week	-0.1173	Yes	-0.2119 to -0.02264
10 metre walk test O *versus* 10 metre walk test 1month	-0.1833	Yes	-0.2779 to -0.08864
10 metre walk test O *versus* 10 metre walk test 3months	-0.2470	Yes	-0.3416 to -0.1524
10 metre walk test 1week *versus* 10 metre walk test 1month	-0.06600	No	-0.1606 to 0.02861
10 metre walk test 1week *versus* 10 metre walk test 3months	-0.1298	Yes	-0.2244 to -0.03514
10 metre walk test 1month *versus* 10 metre walk test 3months	-0.06375	No	-0.1584 to 0.03086

[10MWT 0, 10MWT 1WK ,10MWT 1M and 10WMT 3M denote mean value of gait speed at baseline, 1week,1month and 3months respectively]

Discussion:

Phenol is a cheap and cost effective means to control spasticity, various studies have shown it to be potent measure of control of spasticity. However in the recent past especially after the advent of botulinum toxin, phenol has gradually fallen out of favour. One of the main concern of using phenol is that it can cause persistent painful dyesthesias,but if used in on obturator and posterior tibial nerve which are predominantly motor nerves with less sensory distribution chance of dyesthesia is very less[10]. So phenol in different concentrations is used to treat adductor spasticity and gastrosoleus spasticity. In our study of 40 children we administered 80 ON blocks with 5% aqueos solution of phenol, we did not get any case of persistent dysesthesia.

There was significant reduction in hip adductor spasticity as measured by MAS, the reduction in spasticity was apparent in the follow-up at 1st week after block. Effect of the blocks were maintained for the duration of study ie 3 months. Akkaya *et al*[11]. performed ON block using phenol in patients with severe hip adductor spasticity with the help of nerve stimulator and fluoroscopic guidance. They reported that the decrease in spasticity lasted for about 3 months[11]. Various studies about the period of effectiveness ranged from 3months to 1 months[12,13], so compared to botulinum toxin duration of effect is longer.

Veil *et al* [14] performed ON block through fluoroscopic guidance on 23 patients to see its effect on improvement of perineal hygiene and found there was significant improvement. Our study also showed statistically significant improvement in perineal hygiene as measure by Likert scale. In our study we used intra-adductor technique with electrical stimulation as guidance for ON block which was first used by Wassef[15]. Ofluoglu *et al* [16] did a retrospective study on 23 patients with adductor spasticity for gait parameters after phenol block, they did not find any change in gait speed or step length,there was increase in base of support which is expected. In our study we wanted to concentrate solely on the effect of obturator nerve block on speed of walking,it was seen that there was statistically significant improvement in walking speed after intervention, most of the improvements were seen during the 1st week follow-up itself in later follow-up improvement was less. The limitations of the study included short duration and small sample size we could not record the full duration of effect. Although care was taken during patient selection, many patients had varying degrees of involvement of other lower limb muscles such as hamstring and gastrosoleus in addition to adductor spasticity , these must have acted as confounding factors.

In conclusion our study has shown that phenol neurolysis is an effective means of improving spasticity and function when used for ON block without causing much adverse effects.

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