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OBTURATOR NERVE BLOCK WITH AQUEOUS PHENOL REDUCES HIP ADDUCTOR SPASTICITY – A SINGLE CENTRE EXPERIENCE

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ABSTRACT

Aim: Spasticity is a cardinal symptom of upper motor neuron disorders. It affects different individuals differently. Spasticity in the hip adductor muscles can be very painful and may result in postural abnormalities and hip deformities that interfere with walking, transferring and perineal hygiene. The study aimed to assess the effectiveness of phenol obturator nerve block on hip adductor spasticity caused by the upper motor neuron lesions.

Materials and methods: This is a single-centre retrospective study of all patients with known spasticity in the hip adductors who were assessed suitable for phenol nerve block of the obturator nerve. All patients had Modified Ashworth Scale (MAS) and the distance between the right and left femoral condyles measured in the supine position with the hip and knee flexed called as intercondylar distance (ICD) recorded before the procedure, 6 weeks and 24 weeks after phenol nerve block. Nonparametric Friedman test of differences among repeated measures was conducted from data at 0, 6 and 24 weeks.

RESULTS:

Obturator nerve block was performed in 52 patients using 5% aqueous phenol. The procedure was bilateral in 38 patients and unilateral in 14 patients. There were 18 males and 34 females. There was a statistically significant difference between pre-injection MAS and intercondylar distance at 6 weeks and 24 weeks.

Conclusion: Phenol neurolysis of the obturator nerve helps in reducing hip adductor spasticity and helps in improving positioning and hygiene. With appropriate training, the procedure is simple and easy to perform without major complications.

KEYWORDS: Spasticity, Phenol, Neurolysis, Obturator nerve block

INTRODUCTION:

Hip adductor spasticity is a well-known complication in upper motor neuron disorders including Multiple sclerosis, Traumatic brain injury, Spinal cord injury and Cerebral palsy. If hip adductor spasticity is left untreated, it may lead to pain, deformity, postural abnormality and scissoring of the hip, which can ultimately result in difficulty in maintaining perineal hygiene leading to infection and skin breakdown^{1,2}.

The obturator nerve (ON) arises from ventral branches of second to fourth lumbar ventral rami. The nerve descends through the Psoas major emerging from its medial border at the pelvic brim to exit through the

obturator foramen, where it divides into anterior and posterior branches. The anterior and posterior branches of ON or common ON itself run between pectineus and obturator externus immediately after emerging from obturator canal. Beyond this point, they are separated by part of obturator externus and lower down by adductor brevis. Anterior obturator nerve branch innervates adductor longus, adductor brevis and gracilis muscles and rarely pectineus. It supplies sensory innervation to the hip joint and a small area of skin on the medial thigh, but in 50% cases, it does not provide any cutaneous innervation³. Posterior obturator nerve supplies multiple motor branches to adductor magnus and adductor brevis, occasionally obturator externus

and adductor longus. Posterior obturator branch gives sensory supply to the knee joint. The accessory obturator nerve is occasionally present (10%) which may give branches to supply pectineus, hip joint or may connect with anterior branch of obturator nerve³. The basic knowledge of the anatomy of the obturator nerve and its variable distribution to muscles and skin is important before performing any procedure to block it. Botulinum toxin injections (BoNT-A) are in fashion due to easy technique, fewer side effects, reversibility and more evidence in literature. Phenol used to be in clinical practice in the twentieth century but was gradually replaced by the use of BoNT-A. Phenol acts locally by denaturing proteins and by causing an anaesthetic effect. Phenol can be prepared in aqueous solutions or in glycerin. It causes both wallerian degeneration and axonal demyelination, leading to muscle denervation. It can also damage microcirculation around nerves, leading to occlusion of small blood vessels and fibrosis⁴. At different concentrations, it shows different actions. At 0.2% concentration, it is bacteriostatic and at 1%, it is bactericidal⁵. Between 1% to 7 % concentrations, it causes indiscriminate damage to efferent and afferent nerve fibers. At less than 1%, it has a local anaesthetic effect, which is completely reversible. The duration of the effective blockade after phenol injection is highly variable depending upon the concentration of phenol, total amount used, mode of application, method of injection and expertise of the clinician⁶. The most common side effects are post-injection burning or stinging sensation, dysesthesia, excessive motor weakness.

There is a need to revisit the use of phenol in clinical practice either alone or in combination with BoNT-A injections or where BoNT-A can't be used due to contraindications. We, therefore, conducted a retrospective study of all patients who underwent obturator nerve block with phenol at our institution between 2016 and August 2018 to determine whether phenol obturator nerve block is effective in producing and maintaining its effect in reducing spasticity.

MATERIALS AND METHODS:

Sample and Measure

This is a retrospective audit of all patients who underwent obturator nerve block with phenol during 2016 to Aug 2018 in the regional spasticity clinic. All the patients were assessed by a consultant in rehabilitation medicine in the spasticity clinic before a decision was made to inject phenol. There were several goals of the obturator nerve block recorded in every patient and the most common were ease of care, ability

to tolerate a T-roll in between the legs and improved posture in the bed and in the wheelchair.

Inclusion Criteria

All patients who presented to the spasticity clinic with known spasticity in the lower limbs were included in the study.

EXCLUSION CRITERIA

All patients who had clinical evidence of soft-tissue contractures of the hip adductors were excluded from the study. Similarly, patients with a history of dystonic posture, deep vein thrombosis in the lower limbs or a history of adverse reaction to the phenol were not considered for phenol nerve block.

INJECTION TECHNIQUE

All the patients attended the injection clinic where they were consented on the day of the procedure by the consultant in rehabilitation medicine. Patients who were on warfarin were advised to stop the warfarin three days before the procedure, and the International Normalized Ratio (INR) was checked on the day. Injections were performed only if the INR was less than three on the day. After the injections, patients were advised to restart their warfarin. The procedures were performed by either the consultant in rehabilitation medicine or by the specialist registrar in rehabilitation medicine under the consultant's direct supervision. Patients were placed supine on the plinth with the knees flexed at 90 degrees. An assistant helped to abduct the hips to facilitate access into the groin. Pubic tubercle was palpated with a finger and skin was marked with a marker about a finger breadth (1-2 cm) down and lateral to the pubic tubercle. This was the starting point to locate the nerve with a nerve stimulator. Once the nerve was located with a stimulator (a visible contraction of the hip adductors), the skin was marked again as an entry point for the needle. The antiseptic solution was used to prepare the skin, and 1% lidocaine (0.5 ml) was injected at the site of needle entry. We used a 22 G (80mm length) insulated nerve block needle for the procedure. The needle was inserted at 45 degrees and advanced while stimulating the nerve using a pajunk multistim SENSOR stimulator (1 mA current and 2Hz frequency). The lowest current that produced a distal motor response was identified, and 2 ml of 5% phenol was injected. The nerve was stimulated again, and if there was still a distal motor response another 1 ml of 5% injected. This was continued until there was no further distal motor response with increasing the current. The needle was withdrawn, and the entry point covered with a small plaster. All the patients were discharged after the procedure. Physiotherapy assessment was completed

before the procedure, and a post-injection stretching/positioning programme was in place after the injection.

FOLLOW UP

Post-procedure follow-up in the spasticity clinic was arranged at 6 and 24 weeks. The follow-up visits included measurement of the MAS of the hip adductors and ICD. Any side effects were also recorded at the follow-up visits.

STATISTICAL ANALYSIS

All statistical analyses were performed using the SPSS 24.0 (IBM SPSS, Chicago, IL, USA). Descriptive statistics were used to summarise the demographic data. Shapiro-Wilk test was used to confirm the normality of the data. As the data were skewed, the Friedman test (non-parametric) was used to measure the difference between repeated measures of MAS of the hip adductors and intercondylar distance. The level of statistical significance was set at $p < 0.05$.

RESULTS:

Fifty-two patients with spasticity were given an obturator nerve block using 5% aqueous phenol ($n=52$). There were 34 (65%) females and 18 (35%) males. Age range was 18-78 years with a mean age of 50.6 years. The procedure was bilateral in 38 (73%) patients and unilateral in 14 (27%) patients. Hence a total of 90 obturator nerves blocked were performed in the study. Majority of patients (15 patients, 28.8%, 14 females and 1 male) had the diagnosis of multiple sclerosis. The diagnostic groups are shown in Table 1.

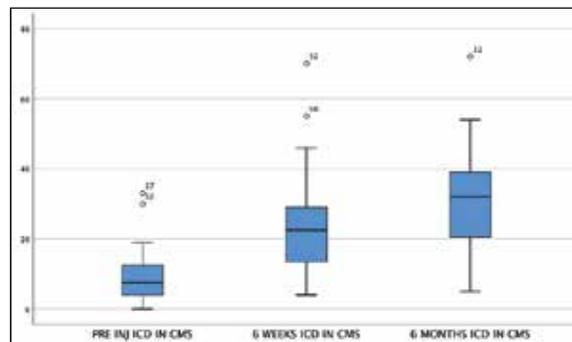
Table 1: Diagnostic Groups Obturator Nerve Block

| | | Female | Male | Total (Percentage) |
|--------------|----------------------------------|-----------|-----------|--------------------|
| Diagnosis | Multiple Sclerosis | 14 | 1 | 15 (28.8%) |
| | Stroke | 5 | 6 | 11 (21.2%) |
| | Subarachnoid Haemorrhages | 4 | 5 | 9 (17.3%) |
| | Cerebral Palsy | 6 | 3 | 9 (17.3%) |
| | Traumatic Brain Injury | 4 | 1 | 5 (9.6%) |
| | Other Upper Motor Neuron Lesions | 1 | 2 | 3 (5.8%) |
| Total | | 34 | 18 | 52 (100%) |

There was a statistically significant difference between pre-injection MAS and intercondylar distance at 6 weeks and 24 weeks. The median MAS before the obturator nerve block was 3 which dropped to 1+ at six weeks follow up and to 1 at 24 weeks follow up appointment. There was a statistically significant difference between MAS before the obturator nerve

block and at 6- and 24-weeks' interval (chi-square=86.6 and $p < 0.00$). The mean ICD before the obturator nerve block was 8.88 cm which increased to 22.98 cm at 6 weeks and to 30.46 at 24 weeks follow up (Figure 1). There was a statistically significant difference between the ICD before the obturator nerve block and at 6- and 24-weeks' interval (chi-square=74.7 and $p < 0.00$).

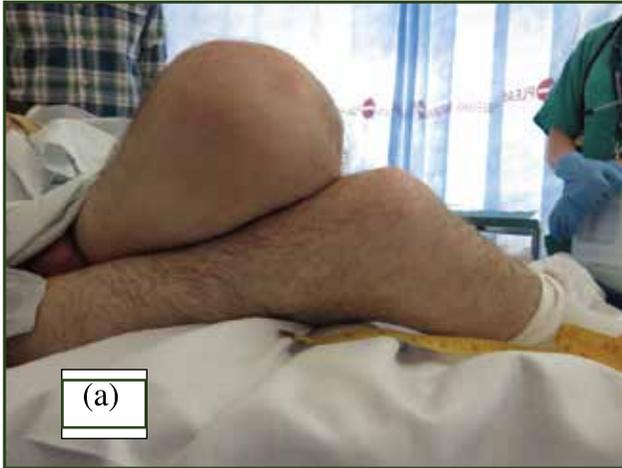
Figure 1: Improvement in Intercondylar Distance (ICD) in centimetres before procedure, 6 weeks and 6 months after the procedure



The duration of effects of the phenol, in our study, was maintained with 43 (82.6%) of patients demonstrated reduced spasticity at 6 months follow-up. The side-effects noted in our study group were minor and transient. Only 2 (3.8%) patients developed some minor bruising and pain around the injection site which resolved spontaneously within 48 hours. There was no incidence of neuropathic pain in our study.

DISCUSSION:

In the present study, we provided a description of phenol neurolysis of obturator nerve and its outcomes in reducing hip adductor spasticity in 90 nerves of 52 patients with various clinical disorders. We found a significant reduction in MAS score of hip adductors and increase in ICD after this procedure. The limitation of this study was that it was a retrospective analysis and follow up period was up to 24 weeks only, but on the other hand, the plus points were that the procedure was carried out in a single institution by the same clinician with clinical experience in the same field for more than fifteen years. Hence the bias of clinical expertise and variability in technique was minimized. In our experience, obturator nerve block with phenol is useful in reducing adductor spasticity in advanced multiple sclerosis, stroke, brain injuries, prolonged disorder of consciousness, cerebral palsy and other upper motor neuron disorders. The obturator nerve block using phenol is a clean procedure, which can be performed in an outpatient setting or inpatient facility.



There are promising results in recent past highlighting the importance of this less common procedure in achieving a reduction of spasticity without significant side effects^{7,8}. Obturator nerve block involving one of the branches or the common trunk is effective in reducing adductor spasticity. The choice of nerve depends upon the accessibility of the nerve, which can be impaired secondary to spastic posturing and expertise of the clinician performing the procedure. We performed the block of the common obturator nerve. However, selective anterior obturator branch block is also effective to a reasonable extent in reducing spasticity. The selective block can be easily performed under ultrasound guidance as the nerve can be easily blocked under the

ultrasound guidance. The duration of effect after ONB was followed up to 24 weeks in 82.6 % cases in our study. However, it varies from 2 months to 2 years in different studies, with the longest effect seen up to 36 months irrespective of underlying disorder^{7,9}.

The widespread use of phenol as a neurolytic agent has largely been disregarded due to certain side effects like dysesthesia. But we have not found dysesthesia in any patient in our study. Previous studies on obturator nerve block for the treatment of hip adductor spasticity in adult patients reported that the complications were minimal, and pain and dysesthesia were not a problem even in patients with intact sensation¹⁰. Another study conducted by Ploypetch et al. using single event multilevel chemoneurolysis with combined BoNT-A and phenol didn't show dysesthesia in 146 procedures performed in patients with cerebral palsy¹¹. According to a retrospective study conducted by Karri et al. the commonly reported adverse events after phenol neurolysis in upper and lower extremity nerves were

pain in 4.10%, inflammation 2.73%, hypotension and dysesthesia in 0.68% only¹².

When treatment of adductor spasticity with oral medicines, physiotherapy, splinting and stretching is not sufficiently effective in reducing spasticity, then obturator neurolysis with aqueous phenol may be tried. In the era of BoNT-A, the role of phenol could be seen as adjunctive therapy or an added tool in the management of focal or multifocal spasticity¹³. A smart benefit-risk analysis may help to target large proximal muscles being supplied by easily accessible, predominantly motor nerves with phenol neurolysis and distal small muscles with botulinum toxin. The main clinical scenarios where we can use phenol is sensitivity or previous adverse reaction/ unsuccessful treatment with BoNT-A injections or when the total dose of BoNT-A injection exceeds the recommended dosage¹³. Phenol can also be used if a longer duration of action is sought with high efficacy or if we want to cut down the cost of the procedure, especially in developing and underdeveloped countries. We recommend using the obturator neurolysis with phenol as a first-line procedure in patients who are not mobile, not able to attend the clinic every 4-months and unable to afford BoNT-A in healthcare systems where the patients have to pay the cost of their treatment.

Various nerve localization techniques are used to guide the needle for this particular block, Electric stimulation (E-Stim) and ultrasound guidance are most commonly used. Accurate needle placement is the key to determine whether the block would be effective or otherwise. We used E-Stim of the target obturator nerve, which helped in precise localization of the nerve and dose adjustment⁷. Nowadays with advancement and the new trend of musculoskeletal ultrasound, more

and more nerve blocks are being performed under direct visualization, which can further increase the safety profile of this procedure and allow real-time visualization of the spread of solution^{8,14}. A similar study reported by Akkaya and colleagues in 2010 reported 90 obturator nerve blocks in 62 patients¹⁵. The primary outcome reported were pain, spasticity and hygiene at first week, first, second- and third-month post-injection. Pain was significantly decreased in first week, first month and second month's follow-up. The Ashworth Scale improved in the second and third month. The hygiene score decreased drastically in the first week and the first and second months but worsened in the third month. The duration of action in this study was significantly less than in our study.

Ofluoglu et al. in 2003 published their findings of phenol obturator nerve block in mobile patients with adducted gait pattern. They utilized temporospatial gait parameters and found that there was improvement in the width of the base of support without immediate change in velocity or step length¹⁶. In our clinical practice, we do not inject obturator nerve with phenol directly if the patients are mobile or are able to manage independent transfers. We proceed with a trial local anaesthetic obturator nerve block first, followed by the phenol nerve block to avoid any deterioration in walking and/or transfer ability. The trial anaesthetic nerve block has also been described in posterior tibial nerve block for ankle plantarflexor spasticity¹⁷.

Further studies are needed to explore the effects of obturator nerve phenol block in mobile patients with severe adductor spasticity, to compare long term benefits after phenol versus BoNT-A injections and to see the prevalence of dysesthesia after this procedure, which is the main reason of phenol neurolysis to be less popular. It is also important to know the exact dosage of the phenol capable of producing the desired anti-spasticity effects by minimising the side-effects. The technique of obturator nerve block by using the nerve stimulator can be learned easily by experienced physicians with appropriate training. The rehabilitation physicians who have skills to use ultrasound scan can also learn to inject the anterior and posterior branches of the obturator nerve individually with the ultrasound. However, in severe spasticity where access to the groin is difficult due to the scissoring of the hip, both ultrasound and electric nerve stimulation can be technically difficult. In such circumstances, a landmark technique can be utilized to inject phenol to the obturator nerve¹⁸ without significant complications. Further research is needed to explore the long-term benefits, duration of effect and side-effect profile of

phenol while managing spasticity.

CONCLUSION:

Obturator nerve block with phenol is effective in reducing hip adductor spasticity with minimal side-effects. It is cost effective and reduces frequent clinic visits not only suitable for countries with struggling economy, but in rich/developed countries as an adjunct to BoNT-A. With appropriate training, the procedure is simple and easy to perform without major complications.

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Sarah Razaq; concept, data collection, data analysis, manuscript writing, manuscript review

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Muhammad aleem Arshad; data collection, data analysis, manuscript writing, manuscript review