Ultrasound- Guided Hydro Dissection in the Management of Occipital Neuralgia

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Original Article

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ABSTRACT

Background: Conventional treatments for occipital neuralgia (ON) sometimes only provide short-term or partial relief, even though the condition is highly disabling. A new minimally invasive technique that shows promise is hydro dissection of the greater occipital nerve guided by ultrasonography—the work aimed to assess the efficacy of ultrasound-guided hydro dissection in the management of ON.

Methods: This single-arm interventional study was conducted on 50 patients aged 18 to 70 years old, both sexes, who had ON, scheduled for US-guided hydro dissection. The visual analog scale (VAS) was used to measure pain, the modified Rankin scale (mRS) was used to measure outcomes, and patient satisfaction was evaluated.

Results: Visual Analogue Scale (VAS) and Modified Rankin scale measurements were significantly lower immediately post-intervention, 1w and 1m than pre-intervention (P<0.001). Patient satisfaction score was significantly higher immediately post-intervention, 1w and 1m than pre-intervention (P<0.001). The percentage of improvement was significantly higher at 1w and 1m than at immediate post-intervention (P<0.001).

Conclusions: Ultrasound-guided hydro dissection presents considerable promise for individuals suffering from ON, demonstrating decreased pain levels, improved functional outcomes as measured by the Modified Rankin Scale, and increased patient satisfaction.

Key Words: Hydro dissection, modified rankin scale, occipital neuralgia, pain, satisfaction, ultrasound-guided.

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INTRODUCTION

Occipital neuralgia (ON) is a form of neuropathic pain distinguished by piercing pain paroxysms that radiate up the neck from the lowest point of the occiput or the upper cervical area[1]. The condition develops when the greater occipital nerve (GON), lesser occipital nerve (LON), and/or third occipital nerve (TON) are injured or irritated[2].

Situated between C2's atlas and lamina are where the dorsal root ganglion of both C2 and C3 is located; it is from this area that GON sprouts. There are various points where the GON might become trapped, such as where it penetrates the SSC muscle, in the space beyond the atlas and axis, in the area where the IOC and SSC muscles meet, or even after the nerve exits the trapezius muscular aponeurosis[3]. Paranesthesia and discomfort at the back of the head, the temporal area, and the outside of the ear are some clinical manifestations that can result from this. Cervicogenic headaches or ONs are other possible symptoms[4].

The traditional method of treating obstructive neuralgia (ON) includes the use of Nonsteroidal anti-inflammatory

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drugs, opioids, muscle relaxants, tricyclic antidepressants, postural exercises, manual treatment, and techniques such as transcutaneous electrical nerve stimulation (TENS)[5]. In addition to the risks associated with them, many drugs might not work at all[6].

One new and promising method for treating ON is ultrasound-guided hydro dissection of the GON[7]. Hydro dissection is a non-invasive method for removing adhesions or scar tissue from the GON that could put pressure on the nerve[8]. The procedure injects a tiny amount of fluid into the adjacent tissue, usually a sterile water or typical saline solution containing 5% dextrose. It may or may not require a local anesthetic solution[9].

In an outpatient setting, recent randomized controlled trials have shown that nerve hydrodissection can alleviate radicular symptoms associated with compressive neuropathy[10, 11] and carpal tunnel syndrome[12, 13]. Two case reports have described outpatient hydro dissection procedures for ON[3, 10].

AIM OF THE WORK

To ascertain whether ultrasound-guided hydro dissection effectively treated ON.

METHODS

This single-arm interventional study was conducted on 50 patients aged 18 to 70 years old, both sexes, who had ON based on complete neurologic examination reinforced by craniometrical scanning admitted to Kafr El-Sheikh University Hospitals and other private and governmental hospitals.

ETHICAL APPROVAL

The study was performed following the approval of the Ethical Committee of Kafr El-Sheikh University Hospitals (Approval Code: KFSIRB200-121). Any unexpected risks during the research were cleared to the participants and ethical committee on time. Before proceeding, the patient had to provide their signed informed consent.

Exclusion criteria were a patient's refusal to a specific procedure, persistent hypotension, coagulopathy, and non-occipital headache, as confirmed by clinical and radiological assessment.

A thorough medical history, physical exam, standard laboratory testing, and craniocervical x-ray, computed tomography (CT), or magnetic resonance imaging (MRI) scanning were all performed on each patient.

Technique:

The patient was positioned on their back with the ultrasound machine directly across them, allowing clear visibility. A linear transducer with a high frequency (10-5 MHZ) was placed transversely above the occipital protuberance and lightly touched. The transducer was subsequently advanced posteriorly along the midline until it identified the C2 spinous process's bifid bony surface. The lamina surface and the obliquus capitis inferior muscle (OCIM), which lies above it, were both made visible by lateral movement of the transducer.

Lastly, the transducer was slightly twisted so that its medial edge met the spinous process of C2, and its lateral edge met the transverse process of C1; this was done to align with the OCIM fibers. A little hypoechoic oval structure may be discerned as the GON in the fascial plane that divides the semispinalis capitis (SSC) from the OCIM.

A skin wash with 1-2 mL of 1% lidocaine was applied to the patient's skin after it had been appropriately prepared and wrapped in a sterile sheath to ensure their comfort. Inserting a 25 g 1.5 in needle in-plane from the side to the middle allowed the tip to be seen within the fascial plane immediately outside the GON. The needle was linked to a 10-ml syringe containing one ml of 1% lidocaine and nine ml of normal saline. After a negative aspiration, a progressive injection filled the fascial plane with 5 mL of solution. The OCIM and SSC muscle bellies were then peeled away from the GON.

The use of a visual analog scale (VAS) for pain evaluation following surgery was communicated to each patient. There is "no pain" with a VAS level of 0 and "the worst pain imaginable" at a VAS score of 10[11].

For outcome prediction, patients are graded on the modified Rankin scale (mRS) of 0–6. A good functional outcome is often scored between 0 and 2, whereas a poor functional outcome is scored between 3 and 6, according to the mRS[12].

On a 5-point Likert scale, patients will be questioned to rate their level of satisfaction: 1 for severely dissatisfied, 2 for dissatisfied, 3 for neutral, 4 for satisfied, and 5 for extremely satisfied[13].

VAS, mRS, and patient satisfaction were measured pre-intervention, immediate post-intervention, 1 week, and 1 month.

The primary outcome was the VAS. The secondary outcomes were mRS and patient satisfaction.

Sample size calculation:

G*Power 3.1.9.2 (Universitat Kiel, Germany) was employed to calculate the sample size. A pilot study was conducted with five cases in each group and discovered that the average VAS score before the intervention was 6.2 ± 3.11 and 3.2 ± 1.92 one week after the intervention. The following factors were considered when determining the sample size: Group ratio of 1:1, effect size of 1.161, 95% confidence limit, 95% power of the study, and eight cases were included to overcome dropout. Consequently, we enrolled 50 patients in this study.

Statistical analysis

SPSS v26 (IBM Inc., Chicago, IL, USA) was used for statistical analysis. The quantitative parametric data was presented using the mean and standard deviation (SD). We used the Wilcoxon test to examine quantitative non-parametric data, which is shown as the median and interquartile range (IQR). Frequency and percentage (%) were employed to represent qualitative variables. Bonferroni correction was used for multiple comparisons. Statistical significance was established with a two-sided *P value* of less than 0.05.

RESULTS

Demographic data and comorbidities were enumerated in this table. (Table 1)

Table 1: Demographic data and comorbidities of the studied patients.

		(*n*=50)
	Age (years)	39.8 ± 15.36
Sex	Male	21 (42%)
	Female	29 (58%)
	Weight (kg)	84.7 ± 14.04
	Height (m)	1.69 ± 0.06
	BMI (kg/m^2)	29.7 ± 5.08
	DM	14 (28%)
Comorbidities	Hypertension	17 (34%)
	Smoking	13 (26%)

Data are presented as mean ± SD or frequency (%), BMI: Body mass index, DM: Diabetes mellitus.

VAS and Modified Rankin scale was significantly lower immediately post-intervention, 1w and 1m than pre-intervention (P<0.001). Patient satisfaction score was significantly higher immediately post-intervention, 1w and 1m than pre-intervention (P<0.001). (Table 2)

Table 2: VAS, mRS, and patient satisfaction score of the studied patients.

	Pre-intervention	Immediate post-intervention	1w	1m
VAS	7 (6-8)	3 (2.25-4)	2 (1-2.75)	1 (1-2)
P value		<0.001*	<0.001*	<0.001*
mRS	3 (2-4)	1.5 (1-3)	1 (0-2)	1 (0-1)
P value		<0.001*	<0.001*	<0.001*
Patient satisfaction score	2 (1-2)	3 (2-3)	4 (3-4)	4 (4-5)
P value		<0.001*	<0.001*	<0.001*

Data are presented as median (IQR). *Significant as *P value*≤0.05. VAS: Visual Analogue Scale, mRS: Modified Rankin scale.

The percentage of improvement was significantly higher at 1w and 1m than at immediate post-intervention (P<0.001). (Table 3)

Table 3: Percentage of improvement of the studied patients.

	Immediate post-intervention	1w	1m
% of improvement	15 (30.0%)	34 (68.0%)	39 (78.0%)
P value		<0.001*	<0.001*

Data are presented as frequency (%), *Significant as *P value*≤0.05.

DISCUSSION

ON is a type of headache distinguished by persistent pain in the occipital region, located at the cranium's lower part. Irritation or compression of the occipital nerves is a common cause of their involvement. Pharmacological pain management and nerve blocks are frequently implemented during treatment. One possible treatment option for this illness that has just been identified is ultrasound-guided hydrodissection[14].

An innovative method that can sometimes be utilized to free imprisoned nerves from scar tissue or fascia is nerve hydrodissection. Underrecognized but prevalent peripheral nerve entrapments cause significant pain. Because of mechanical irritation caused by impingement, transmission is changed. By hydrodissecting the constricting tissues, diluting and flushing out inflammatory mediators, and taking advantage of the anti-inflammatory effects of injectable corticosteroids, injections can help diagnose and treat the underlying nerve entrapment. Isolating the trapped nerve from the surrounding bone or tendons is achieved by injecting a significant amount of fluid into the deep fascial layers[9].

Our study showed that VAS and mRS were significantly lower immediately post-intervention, 1w, and 1m than pre-intervention. Patient satisfaction score was substantially higher immediately post-intervention, 1w and 1m than pre-intervention. The percentage of improvement was significantly higher at 1w and 1m than at immediate post-intervention.

A case report by Ryan and Harmon[3] showed that 30 minutes after the hydrodissection, the pain score dropped from 8/10 to 1/10.

According to ***Lam et al.***[15], the pain score dropped from 8/10 to 0/10 after the hydrodissection in case 1 and dropped from 9/10 to 1/10 after the hydrodissection in case 2.

A case report done by Rose[6] showed that 30 minutes after the hydrodissection, the pain score dropped from 9/10 to 1/10.

The study faced limitations due to the relatively small number of participants, the lack of a control group to compare, and the fact that it only involved one center. Additionally, the duration of patient follow-up was comparatively brief. Therefore, we suggested conducting more prospective multicenter studies to compare US-guided hydro dissection with nerve blocks or physical therapy and compare the cost-effectiveness of the intervention to other treatments with a larger sample size and an extended follow-up period to assess long-term efficacy and symptom recurrence.

CONCLUSIONS

Ultrasound-guided hydro dissection presents considerable promise for individuals suffering from ON, demonstrating decreased pain levels, improved functional outcomes as measured by the mRS, and increased patient satisfaction.

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Nil

CONFLICT OF INTEREST

The authors have no financial or proprietary interests in any material discussed in this article.

AUTHORS' CONTRIBUTION

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by [MAA], [AZ], [AMI], [HN], [MI] and [ASN]. The first draft of the manuscript was written by [MM] and [AE] and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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التجريد المائى الموجه بالموجات الفوق صوتية في إدارة الألم العصبي القذالي

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المقدمة: العلاجات التقليدية لالتهاب العصب القذالي توفر أحيانًا تخفيفًا مؤقتًا أو جزئيًا فقط، رغم أن هذه الحالة تعتبر من الحالات المعاقة بشكل كبير. تقنية جديدة ذات تدخّل طفيف تُظهر وعدًا وهي التقطيع المائي للعصب القذالي الأكبر بتوجيه التصوير بالموجات فوق الصوتية.

هدف الدراسة: تقييم فعالية التجريد المائى الموجه بالتصوير بالموجات فوق الصوتية في إدارة التهاب العصب القذالي.

الطرق: أُجريت هذه الدراسة التدخلية أحادية الذراع على ٥٠ مريضًا تتراوح أعمارهم بين ١٨ و ٧٠ عامًا، من كلا الجنسين، الذين يعانون من التهاب العصب القذالي، وكانوا مرشحين للتجريد المائى الموجه بالموجات فوق الصوتية. تم استخدام مقياس الألم البصري لقياس الألم، واستخدم مقياس رانكين المعدل لقياس النتائج، وتم تقييم رضا المرضى.

النتائج: كانت قياسات مقياس الألم البصري و مقياس رانكين المعدل أقل بشكل كبير فور التدخل، بعد أسبوعا واحد، وبعد شهرا واحدا مقارنة بما قبل التدخل. كما كان مستوى رضا المرضى أعلى بشكل كبير فور التدخل، بعد أسبوعا واحدا، وبعد شهرا واحدا مقارنة بما قبل التدخل(ب< 0.001). كانت نسبة التحسن أعلى بشكل كبير بعد أسبوع واحد وبعد شهر واحد مقارنةً بالفترة التي تلي التدخل مباشرة (ب< 0.001).

الاستنتاجات: يُظهر التجريد المائى الموجه بالتصوير بالموجات فوق الصوتية وعدًا كبيرًا للأفراد الذين يعانون من التهاب العصب القذالي، حيث يوضح تقليل مستويات الألم، وتحسن النتائج الوظيفية كما تم قياسها باستخدام مقياس رانكين المعدل، وزيادة رضا المرضى.