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UTILITY OF REAL-TIME ULTRASOUND-GUIDED INTERVENTION FOR TREATMENT OF TRIGEMINAL NEURALGIA - PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Trigeminal neuralgia is one of the most painful conditions occurring in the face. It causes sudden, severe, unilateral, sharp, stabbing, or burning pain along the distribution of the trigeminal nerve. Ultrasound imaging is helpful in localizing infraorbital foramina for giving superficial trigeminal nerve block.

Objectives: To evaluate the utility of real time ultrasound guided intervention for treatment of Trigeminal Neuralgia.

Methods: During the power Doppler examination, the Doppler frequency was set to 6.6MHz. 1% xylocaine, 0.25% ropivacaine) were injected using a 25-gauge 1.5-inch needle and for deeper nerveblocks, 3 to 5ml of the anaesthetic was injected using a 22- gauge 3-inch spinal needle after confirmation on aspiration.

Results: Statistically significant difference was observed when BNI pain scale was correlated with pre and post block timing ($p<0.001$). BNI pain score was correlated with block before and two weeks after and a statistically significant association was observed with a p value of < 0.001. Recurrent pain was experienced 30% of patients in our study. Neurolytic agent was needed by only 6.7% patients in our study. Increased utility of ultrasonography in identifying anatomical structure in relation to trigeminal neuralgia.

Conclusion: Real-time ultrasound guidance helps in identification of anatomical structures and visualizes an image of the spreading agent around the nerve. Real-time ultrasound guidance enables a high success rate for the block.

Keywords: Trigeminal neuralgia, infraorbital foramina, ultrasonography, ropivacaine, xylocaine.

INTRODUCTION

Trigeminal neuralgia is one of the most painful conditions occurring in the face. It causes sudden, severe, unilateral, sharp, stabbing, or burning pain along the distribution of the trigeminal nerve[1]. Trigeminal neuralgia at V2 (maxillary) area is reported to account for 37.8% of all trigeminal neuralgia cases, and 80% of trigeminal neuralgia at V2 can be treated with Infraorbital nerve block[2]. Trigeminal neuropathy due to herpes zoster, trigeminal postherpetic neuralgia,[3-10] painful post-traumatic trigeminal neuropathy,[11-14] or trigeminal deafferentation pain (eg, anesthesia

dolorosa)[15-17] must be distinguished from trigeminal neuralgia. Pain related to the mouth such as dental pain, first bite syndrome,[18] or burning mouth syndrome should be separately elucidated.[18,19] Other headache syndromes which should be diagnosed separately from trigeminal neuralgia include cluster headaches,[20] sphenopalatine neuralgia (Sluder's neuralgia), Short Lasting Unilateral Neuralgiform Pain with Conjunctival Injection and Tearing (SUNCT), and Short Lasting Unilateral Neuralgiform Pain with Cranial Autonomic Symptoms (SUNA).[11,21-24] Rare other forms of facial pain syndromes such as persistent idiopathic facial pain, pain of psychological origin, and central neuropathic pain should be distinguished from trigeminal neuralgia.[25-30]
Ultrasound imaging is helpful in localizing infraorbital foramina for giving superficial trigeminal nerve block[31,32]. Cadaveric studies suggest a high degree of accuracy of Ultrasound guidance during peripheral trigeminal nerve blocks[33]. A common cause of chronic facial pain syndrome is trigeminal neuralgia, which can be alleviated by injecting the superficial branches of the nerve, such as the supraorbital, infraorbital, and mental nerves, and deep injection of the maxillary nerve in the pterygopalatine fossa and/or the mandibular nerve posterior to the lateral pterygoid plate. Isolated entrapment of the above mentioned nerves is not rare, but treatments using palpation guidance can be challenging because substantial portions of the nerves lie underneath the skull bone. The use of high-resolution ultrasound facilitates real-time visualization of peripheral nerves
and adjacent soft tissue structures, such as tendons, ligaments, muscles, vessels, and subcutaneous fat[34]. The regional anatomy and ultrasound-guided injection techniques for the commonly affected branches of the trigeminal nerve, including the supraorbital, infraorbital, mental, auriculotemporal, maxillary, and mandibular nerves.

AIMS AND OBJECTIVES

AIM: To evaluate the utility of real time ultrasound guided intervention for treatment of Trigeminal Neuralgia.

OBJECTIVES:

1. To determine effectiveness of ultrasound in identifying the Anatomical structures like supraorbital notch, infraorbital notch, mental foramen, zygomatic arch, pterygopalatine fossa, infraorbital fissure, lateral pterygoid plate and sphenopalatine artery.
2. To assess failure rates in injections in and around the Anatomical structures like supraorbital notch, infraorbital notch, mental foramen, zygomatic arch, pterygopalatine fossa, infraorbital fissure, lateral pterygoid plate and sphenopalatine artery.
3. To assess Safe use of Neurolytic agent in trigeminal blocks like supraorbital, infraorbital, Mental, Auriculotemporal, Maxillary and Mandibular Nerve block.

MATERIAL AND METHODS

After approval from Institutional Ethical Committee of Government Medical College, Srinagar, this study was conducted in the Pain Clinic, of Government Medical College Srinagar, over a period of 18 months starting from December 2019. Study was done in Pain Clinic of GMC associated S.M.H.S hospital over a period of 18 months.

Inclusion Criteria: -

1. Patients who came to pain clinic for, Pain due to trigeminal Neuralgia.
2. Direct and Referral Patients from other associated hospitals were included in the study and Patients who are not relieved with medication alone.

Exclusion Criteria

1. patient refusal
2. Allergy to local Anaesthetic
3. Trauma to face Ipsilateral distorting the anatomy
4. Any congenital Anomaly of face

Pre and post procedure Pain was assessed by **Barrow Neurological Institute Pain scale**, before the procedure, after 2 weeks and any recurrence at 2, 4, 6 months.

BNI pain scale: -

BNI Grade 1:- No trigeminal pain, no medication required. BNI Grade 2:- Occasional Pain, not requiring medication.

BNI Grade 3:- Some pain adequately controlled with medication BNI Grade 4:-Some pain not adequately controlled with medication BNI Grade 5:- Severe pain, not relived with medication.

After informed Consent, The patients included for block were taken to procedure room in pain clinic, i.v. cannula was placed, Multichannel monitor was attached. The patient was placed in supine position. After cleaning and draping facial area maintaining utmost sterility, A 10–18 MHz high-frequency linear transducer was used to scan superficial structures. To image deeper structures, such as the lateral pterygoid muscle and plate, a 1–5MHz curvilinear transducer was used. During the power Doppler examination, the Doppler frequency was set to 6.6MHz. 1% xylocaine, 0.25% ropivacaine) were injected using a 25-gauge 1.5-inch needle and for deeper nerveblocks, 3 to 5ml of the anaesthetic was injected using a 22-gauge 3-inch spinal needle after confirmation on aspiration. Any complications include bleeding, hematoma, infection, and hypersensitivity reaction to the injectate was noted. For longer pain relief, the deep injection was performed using alcohol (70%) for recurrent trigeminal neuralgia.

All patients were followed in pain clinic. Patient were observed for any side effects for paraesthesia, dysesthesia or double vision. Post procedure patient were put on Anti convulsants, anti depressants drugs according to the pain scale. This study done in collaboration with Neurology, Neurosurgery, E.N.T and Dentistry.

Statistical Methods: The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean±SD and categorical variables were summarized as frequencies and percentages. Graphically the data was presented by bar and pie diagrams. The comparison of BNI pain scale before and after block was done by employing Wilcoxon signed rank test. A P-value of less than 0.05 was considered statistically significant.

RESULTS

The present study was conducted in the Pain Clinic of Government Medical College, Srinagar on 30 patients with trigeminal neuralgia. The mean age of the study population was 56.6$\pm$13.07 years. Female constituted 70% of the study population. Pain was 73% on right side and 27% of left side. Maxillary block was given in majority of patients 63.3%. Before block 70% patients fall in grade V BNI score. After the block grade II BNI was majority of patients 60%. After two weeks of block pain 46.7% patients each had Grade II BNI score against 6.7% in Group I. Statistically significant difference was observed when BNI pain scale was correlated with pre and post block timing ($p<0.001$). Statistically significant difference was obtained when BNI pain score was correlated with block before and two weeks after with a p value of < 0.001. Recurrent pain was experienced 30% of patients in our study. Neurolytic agent was needed by only 6.7% patients in our study. Increased utility of ultrasonography in identifying anatomical structure in relation to trigeminal neuralgia.

Table 1: Various parameters of study patients			
		Number	**Percentage**
Age (Years)	< 40	4	13.3
	40-49	5	16.7
	50-59	6	20.0
	60-69	9	30.0
	≥ 70	6	20.0
	Mean±SD (Range)=56.6±13.07 (30-75 Years)		
Gender	Male	9	30.0
	Female	21	70.0
Side involved	Right	22	73.3
	Left	8	26.7
Type of block	Maxillary	19	63.3
	Mandibular	3	10.0
	Maxillary+Mandibular	5	16.7
	Infra orbital	2	6.7
	Mental	1	3.3
BNI pain scale before block	Grade I	0	0.0
	Grade II	0	0.0
	Grade III	2	6.7
	Grade IV	7	23.3
	Grade V	21	70.0
BNI pain scale after block	Grade I	8	26.7
	Grade II	18	60.0
	Grade III	4	13.3
	Grade IV	0	0.0
	Grade V	0	0.0
BNI pain scale after two weeks	Grade I	2	6.7
	Grade II	14	46.7
	Grade III	14	46.7
	Grade IV	0	0.0
	Grade V	0	0.0

Table 2: BNI pain scale before and after block				
BNI pain scale	**Before Block**		**After Block**	
	No.	**%age**	**No.**	**%age**
Grade I	0	0.0	8	26.7
Grade II	0	0.0	18	60.0
Grade III	2	6.7	4	13.3
Grade IV	7	23.3	0	0.0
Grade V	21	70.0	0	0.0
Total	30	100	30	100
Z-value=4.898; P-value <0.001*				

Table 3: BNI pain scale before block and after 2 weeks of block				
BNI pain scale	**Before Block**		**After 2 weeks**	
	No.	**%age**	**No.**	**%age**
Grade I	0	0.0	2	6.7
Grade II	0	0.0	14	46.7
Grade III	2	6.7	14	46.7
Grade IV	7	23.3	0	0.0
Grade V	21	70.0	0	0.0

Total	30	100	30	100
Z-value=4.885; P-value <0.001*				

Table 4: Recurrence of pain and requirement of neurolytic agent			
		Number	**Percentage**
Recurrence of pain	Yes	9	30.0
	No	21	70.0
Requirement of neurolytic agent	Yes	2	6.7
	No	28	93.3

Table 5: Failure rate of various blocks			
Type of block	**N**	**Failure rate**	
		No.	**%age**
Maxillary	19	0	0.0
Mandibular	3	0	0.0
Maxillary+Mandibular	5	0	0.0
Infra orbital	2	0	0.0
Mental	1	0	0.0

DISCUSSION

Trigeminal neuralgia (TN) is a fairly common condition, with an incidence rate of 5.7 per 100,000 women and 2.5 per 100,000 men. The usual age range is around 50 to 70 years. TN is uncommon in young adults and rare in children.[35] There are two varieties of TN: type 1 (classical TN) and type 2 (atypical TN). Occurrence of pain in type 1 is intermittent as described earlier. In type 2, the pain is constant with less severity and is described as burning or pricking, rather than a shock. A subset of patients can progress from type 1 to type 2 TN over time; thus, both types may coexist in the same person. A more recent and simple classification of TN has categorized TN into three types for simplicity of treatment options: possible TN, classical TN, and idiopathic TN.[36]

The results of the present study are discussed as:

In our study, most common age group affected was 60-69 years with a mean age of 56.6±13.07 years. Our youngest patient was 30 years of age while the oldest was 75 years. Jainkittivong A et al., (2011)[37] conducted a study to describe the clinical characteristics and treatment of trigeminal neuralgia (TN) in a group of Thai patients. The peak incidence (46.8%) was in the age range of 50–69 years with a mean age of 52.0±15.0 years. The onset of pain occurs most frequently in patients aged 50 years and older is also reported by Loh HS et al., (1998)[38], Loeser JD (2001)[39] and Darlow LA et al., (1992)[40]. There was female dominance in our study with 70% females versus 30% males. Our results are consistent with the findings of Jainkittivong A et al., (2011)[37] who had 58.51% females in their study with a female to male ratio of 1:1.5 and 1:1.7. In the present study, right side was involved in more patients than left side (73.3% versus 26.7%). In their study Jainkittivong A et al., (2011)[37] and Herta J et al., (2021)[41] confirmed that pain occurred on the right side of the face more often than on the left side which is consistent with the findings of the present study.

Trigeminal neuralgia at V2 (maxillary) area is reported to account for 37.8% of all TN cases, and 80% of TN at V2 can be treated with infraorbital nerve block (Kato Y et al., 1975)[42]. In our study, maxillary block was seen in 63.3% (n=19) patients with mental in the least 3.3% (n=1). The most affected nerve branches were a combination of the maxillary nerve (V2) and the mandibular nerve (V3) (31%), followed by an isolated involvement of V3 (19.3%) and V2 (18.7%) in a study

conducted by Herta J et al., (2021)[41].

In our study BNI pain scale was used and before block majority of our patients i.e. 21 (70%) patients fall in grade V followed by grade IV in 7 (23.3%) patients and grade III in 2 (6.7%) patients. After the block grade II BNI was observed in majority of patients 60% (n=18) followed by grade I 26.7% (n=8) and grade III in 13.3% (n=4). After two weeks of block pain was assessed again using BNI pain scale and it was observed that 14 (46.7%) patients each had Grade II and Grade II pain scores while 2 (6.7%) patients had Grade I pain score. In the present study, BNI pain score was correlated before, after and two weeks after the block. 21 (70%) patients experienced Grade V of pain, but, post block majority of patients 18 (60%) had only Grade II as per BNI pain score. Statistically significant difference was observed when BNI pain scale was correlated with pre and post block timing ($p < 0.001$).

Statistically significant difference was obtained when BNI pain score was correlated with block before and two weeks after with a p value of < 0.001. Against grade V BNI pain score in 20 (70%) patients before block, pain score II and II was observed in 46.7% (n=14) patients after two weeks of block. Recurrent pain was experienced by 9(30%) patients in our study. Neurolytic agent was needed by only 2 (6.7%) patients in our study. Similar findings were observed by De M et al., (2019)[43] in his case series of 5 patients in which BNI pain scale was used and the severity of pain observed was Grade V before block and after the block changed to mild pain (Grade I BNI) and at two weeks after the block one patient experience grade II pain, another one experience grade III pain. Patients in a study by Takechi K et al., (2015)[44] experienced Grade V pain before the block that subsided after block and remained at Grade I and after 2 weeks of block pain severity of 4 patients remained static at Grade I but in 2 other patients Grade 2 pain severity was observed. Han KR et al., (2017)[45] did a study on 465 study subjects in which 99.4% experienced complete and immediate pain relief. Eighty one percent of the patients (376/465) during the first block succeeded with one injection and 14% (65/465) of the patients were pain free after a second injection on the second day of admission and 3.9% (18/465) of the patients had success with a third injection on the third day of admission. The three patient experienced continuous pain after the first block; they were believed to have alcoholic neuritis. All of the other 462 patients stopped pain medication immediately after the alcohol block. Seleim SM and Arakeep HM (2019)[46] also confirmed that before the block 7 (33.3%) patients complained of moderate pain and 14 (66.67%) complained of severe pain, but, post there was no pain in 15 (71.14%) patients, mild pain in 3 (14.3%) patients while moderate pain was experienced by 2 (9.5%) patients and severe pain in only 1 (4.8%) patients, which is confirmatory to the findings of the present study. Response according to the BNI Pain Intensity Scoring System was observed in a study by Gao L et al.,(2020)[47]. In their study a total of 91 patients (88.35%) experienced initial pain relief (BNI score ≤ IIIa) after OIAGG. The 6-month, 1 year, and 2-year pain relief rates (BNI pain scores I-IIIa) in the A and B group were 83.64%, 74%, 72%, and 90.91%, 87.67%, 83.41%, respectively. Post-operative group A and B BNI scores were both significantly improved compared with their respective preoperative BNI scores ($P<0.01$). Recurrent pain was experienced by 9 (30%) patients in our study. Takechi K et al., (2014)[44] conducted a case report of 6 patients in 3 patients experienced recurrence of pain. De M et al., (2019)[43] performed real-time US-guided infraorbital nerve block on 4 patients in which 2 patients complained of pain recurrence. Neurolytic agent was needed by only 2 (6.7%) patients in our study. De M et al., (2019)[43] also confirmed the use of neurolytic agent in their patients (0.3ml phenol).

CONCLUSION

- Real-time ultrasound guidance helps in identification of anatomical structures and visualizes an

image of the spreading agent around the nerve.

Real-time ultrasound guidance enables a high success rate for the block. Ultrasound-guided interventions for trigeminal neuralgia provide a safe effective solution for patients who are not responsive to or cannot tolerate oral medications and who are not appropriate candidates for surgery.

- The ultrasound-guided infraorbital nerve block has shown immediate pain relief and satisfaction in patients with trigeminal neuralgia having involvement of maxillary division and not responding to medical treatment.

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