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C2/C3 nerve blocks and greater occipital nerve (GON) block in treatment of cervicogenic headache

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Abstract
Purpose: To evaluate C2/C3 nerve blocks and greater occipital nerve (GON) block in treatment of cervicogenic headache in patients referring to pain clinic of Amir Alam hospital.
Method: In this retrospective cohort, records of 58 patients with cervicogenic headache presenting to pain clinic of Amir Alam hospital during 2013were evaluated. The anesthetic blockade procedure was performed on C2/3 facet joint or greater occipital nerve (GON). Then the patient's headache relief after the treatment as a percentage of pretreatment headache, or by recording the difference between pre- and post-procedure headache intensity, as measured using a numeric rating scale (NRS) were compared.
Results: 58 patients mean age 41.56±10.24, mean duration of pain about 8.40±6.35 years were evaluated. The immediate response more than 50% to blocking in C2/C3 group was slightly more than GON group (18 patients vs 17) but the difference was not significant (P=0.54). NRS before and 1 week and 1month after treatment significantly decreased in both groups (P=0.001). Regarding NRS the difference between two groups 1 week after procedure was significant (P=0.01) but was not significant after 1 month (P=0.78). The pain reduction(frequency) one week after blocking in C2/C3 group was significantly more than GON group(53.79±19.71 vs 67.58±23.85,P=0.02),but 1month after blocking in C2/C3 group was less than GON group, the difference was not significant(33.10±19.65 vs 31.72±24.79,P=0.81).
Conclusion: this cohort study indicate C2, C3 and greater occipital nerve (GON) are effective techniques for cervicogenic headache relief in short term. Moreover we detected C2/C3 blocks are significantly more effective than GON in short term.

Keywords: cervicogenic headache, C2/C3, greater occipital nerve (GON), nerve blocks, NRS

Introduction

Pathology and injuries in bone and soft tissue in upper cervical spine are known reason of headache. It is well described that the signals of afferent nociceptive that come from structures at or above C3 pass through the trigeminocervical nucleus and make the anatomical basis for cervicogenic headache [1-4]. Previous study confirmed cervicogenic headache most usually comes from the C2/3 facet joints [5-8]. Moreover, the main dorsal ramus of C2 after passing the posterior part of the C1/2 facet joint makes the greater occipital nerve [9-10]. Cervicogenic headache is a disorder due to occipital nerves and/or the upper spinal vertebrae impingement or entrapment [11-13]. The prevalence of cervicogenic headache in general population is about 2.5% [14, 15] to 4.1% [16] and its prevalence in patients with chronic headache is about 15-20% [13]. and some studies indicated the female predilection(17). Cervicogenic headache was presented by Sjaastad in 1983 [18]. Cervicogenic Headache International Study Group (CHISG) has defined the clinical diagnostic criteria comprising restricted cervical movement, response to anesthetic blockades, ipsilateral neck, shoulder, or arm pain, unilateral headache, painful neck movement, sustained awkward head positioning, and/or external pressure over the upper cervical or occipital region [11]. However International Headache Society has defined the cervicogenic headache based on any correlation between pathology in cervical region and headache [1]. For diagnosis and treatment of cervicogenic headache some procedures comprising dorsal rami injections from C1 - C7, cervical facet joint blocks (atlanto-occipital joint to the C) [6, 7] and lesser and greater and third nerve block have been applied [19], however the results are not consistent so in this cohort we evaluated the therapeutic efficacy of greater occipital nerve and C2/C3 blockades in cervicogenic headache relief in patients referring to pain clinic of Amir Alam hospital.

Materials and Methods

In this retrospective cohort records of 58 patients with cervicogenic headache presenting to pain clinic of Amir Alam hospital during 2013 were evaluated. The ethical committee of Tehran University of medical sciences approved the study protocol. The criteria for enrollment were cervicogenic headache based on Sjaastad [5] definition): [1] unilateral pain starting in the neck and radiating to the frontotemporal region, [2] pain exacerbated by neck movement, [3] limited cervical range of motion (CROM), [4] at least one joint tenderness in upper cervical spine (C1-C3), and [5] at least 1 per week headache for 3 months. The anesthetic blockade procedure was performed on C2/3 facet joint or C2 (the greater occipital nerve) for all patient. The patients were tightly controlled during procedure. A short beveled spinal needle 2.5-inch, 25-gauge, was used and 1 mL of a mixture including 0.5 mL of bupivacaine 0.25% and 0.5 mL of triamcinolone (20 mg) was injected into the C2,C3 facet joint and C2 dorsal ramus (the

origin of the greater occipital nerve).
The Outcomes were calculated either by asking the patients about their headache relief after the treatment as a percentage of pretreatment headache, or by recording the difference between pre- and post-procedure headache intensity, as measured using a numeric rating scale (NRS) of 0 to 10 (with 0 being no headache and 10 being the most severe headache).

Data Analysis
The data were interred in SPSS version 21. Categorical data were presented as numbers (%), and continuous data as mean ± SD. We used the Chai_2 or Fisher's exact test to compare categorical variables and the Student's *t* test, the paired *t* test, or the Mann-Whitney's rank sum *U* test to compare continuous variables.. $\alpha < 0.05$ was consider significant

Results
In this study 58 patients 25 male and 33 female mean age 41.56±10.24 and mean duration of pain about 8.40±6.35 years were evaluated. The C2/C3 blocking was performed for 29 patients and greater occipital nerve (GON) blocking for 29 patients. Pain in 40 patients was unilateral and in 18 patients was bilateral (table 1).The immediate response more than 50% (frequency)to blocking in C2/C3 group was 60.5% and was slightly more than GON group (18 patients vs 17) but the difference was not significant (P=0.54) (table2). NRS before and 1 week and 1month after treatment significantly decreased in both groups (P=0.001). Regarding NRS the difference between two groups 1 week after procedure was significant (P=0.01) but was not significant after 1 month (P=0.78) (table3). The pain reduction (frequency) one week after blocking in C2/C3 group was significantly more than GON group(53.79±19.71 vs 67.58±23.85,P=0.02).on the other hand the pain reduction one month after blocking in C2/C3 group was less than GON group but the difference was not significant(33.10±19.65 vs 31.72±24.79,P=0.81)(table2,3). Time to drug therapy after blocking was the same in two groups and the most of patients in two groups needed treatment for pain relief during two months after procedure (Table2).The satisfaction rate in two groups was the same (p=0.88).in this regard the most of patients (32 patients, 16 in each group) declared low satisfaction and in 25 patients (12 in GON, 13 in C2/C3) the satisfaction was moderate. We did not detect any adverse effect related to procedures in two groups however two patients in C2/C3 showed transient and mild adverse effect (table 2).the procedure was repeated in 10 patients in C2/C3 and in 11 patients in GON group (Table4).

Table 1: The patients characteristics (data are presented as frequency and mean ±SD

Variables		Mean±SD	Minimum	Maximum
Age		41.56±10.24	21	64
Sex	Male	25(43%)		
	Female	33(57%)		
NRS		5.27±2.94	1	10
NRS minimum		3.16±2.41	0	10
NRS maximum		8.36±1.91	0	10
Duration of pain (year)		8.40±6.35	0.5	22
side		left	20(34.5%)	
		right	20(34.5%)	
		bilateral	18(31%)	
Pain quality		Burning pain	23(39.6%)	
		paresthesia	2(3.4%)	
		Dull pain	27(46.6%)	
		Other	6(9.5%)	
Allodynia		yes	18(31%)	
		no	40(99%)	
Hyperalgesia		yes	1(1.7%)	
		no	57(98.3%)	
Autonomic symptom		yes	26(44.8%)	
		no	32(55.2%)	
Surgery Hx		yes	3(5.5%)	
		no	51(88%)	
Augmantentative		Eating	1(1.7%)	
		Speaking	4(6.9%)	
		Nervousness	30(51.7%)	
		Heat	4(7%)	
		Cold	3(5.2%)	
		Other	15(26%)	
Decreasing		No	16(27.6%)	
		Rest	14(24.1%)	
		Analgesic	25(43%)	
		Other	3(5%)	
Underlying disease		Yes	25(43.1%)	
		No	33(56.9%)	

Addiction	Yes	0	
	No	58(100%)	
Visited by	No	29(50%)	
	Neurologist	28(48.3%)	
	Neurosurgeon	1(1.7%)	
Duration of pain episodes	Hours	32(55.2%)	
	Permanent	26(44.8%)	
Drug therapy before blocking	No	22(38%)	
	Gabapentin	22(38%)	
	Pergabalin	32(55.2%)	
	Amitriptyline	2(3.4%)	
	others	28(48.3%)	
Response to previous treatment	<50%	56(96.6%)	
	>50%	1(1.7%)	
Drug therapy after blocking	No	30(51.7%)	
	Pergabalin	23(40%)	
	Amitriptyline	2(3.4%)	
	Other	3(5.2%)	

Table 2: The difference between two techniques after performing the procedures the data are presented in frequency and Mean±SD

Total Response to blocking>50		**60.5%**		
		GON	C2/C3	P
Response to blocking	<50%	12(41.5%)	10(34.5%)	0.54
	>50%	17(58.5%)	18(62.5%)	
The number of procedures	1	18(62%)	18(62%)	0.52
	2	10(34.5%)	10(34.5%)	
	3	1(3.4%)	0	
Satisfaction	good	0	0	0.88
	moderate	12(43%)	13(44.8%)	
	low	16(57%)	16(55.2%)	
Adverse effect	yes	0	2(7.2%)	0.23
	no	29(100%)	26(92.8%)	
NRS	before	9.03±1.07	8.13±1.64	
	1 week after	2.48±1.73	3.65±1.54	0.01
	P	0.001	0.001	
	1 month after	5.55±2.73	5.38±1.85	0.78
	P	0.001	0.001	
Pain reduction after 1 week		53.79±19.71	67.58±23.85	0.02
Pain reduction after 1 month		33.10±19.65	31.72±24.79	0.81
Time to drug therapy after blocking(month)		1.72±0.75	1.70±0.90	0.93
Pain reduction after 1 week	Procedure repetition 1	46.66±18.14	63.68±2139	0.01
	2	66.00±1776	75.00±27.58	0.39
Pain reduction after 1 month	Procedure repetition 1	29.44±21	29.47±24.16	0.99
	2	39.00±15.23	36.00±26	0.76

Table 3: Pain frequency reduction after 1week and 1 month between 1 and 2 procedures in all patients

Pain reduction after 1 week	**1 Procedure**	**2 Procedures**	**P**
	55.40±21.42	**70.50±23.05**	**0.055**
Pain reduction after 1 month	29.45±22.72	37.50±21.24	0.40

Table 4: Pain frequency reduction immediately after treatment between 1 and 2 procedures in two groups.

Groups	**Procedure**	**1**	**2**	**P**
GON	<50	9(75%)	3(25%)	0.40
	>50	9(53%)	8(47%)	
C2/C3	<50	9(80%)	2(20%)	0.06
	>50	10(55.6%)	8(44.6%)	

Discussion

Specific diagnostic and therapeutic procedures for Cervicogenic headache are rare and this is most challenging issue for physicians. In this cohort study we evaluated the GON and C2/C3 blockades effect on pain relief in 58 patients with cervicogenic headache. 35 patients(60.5%) showed immediate headache relief more than 50% after procedures, that was less than Zhou *et al.* report that in a study on 31 patients showed headache relief >50% after treatment in 28 (90.3%) patients, with an average duration of 21.7 (1-90) days. Moreover they concluded that C2/C3 blockades is a tolerable and long effective technique in pain relief in patients with cervicogenic headache (20).In present study the mean pain frequency reduction one week after procedure was 60% and in C2/C3 group was significantly more than GON group (53.79±19.71 vs 67.58±23.85, P=0.02). on the other hand the

pain reduction one month after blocking was 32.5% and in C2/C3 group was less than GON group (33.10±19.65 vs 31.72±24.79, P=0.81). In summary our result indicated that two techniques decrease the pain frequency immediately post treatment and in the short-term (1 month after treatment). Moreover the pain intensity based on NRS significantly decreased after 1week (P=0.001) and 1 month (P=0.001) in both groups. Our results supported by Inan *et al.* that divulged GON and C2/C3 blocks are equally effective in pain reduction and repeated block in these patients had a long lasting effectiveness [21]. Another study by Bovim *et al.* detected that C2/C3 facet joint blockade decreased cervicogenic headache intensity, moreover this study compare the value of C2/C3 with C4/C5 and concluded little of value for C4/C5 blockade in treatment of cervicogenic headache [19]. In our experience the maximum effect of the treatment occurred 1 week after intervention and decreased after 1month however, in contrast to our findings Zhou *et al.* detected long term effectiveness for blocking procedure in patients with cervicogenic headache [20].

In current practice we repeated the nerve blockades in 20 patients (10 patients in each group) our results showed the percent of headache reduction in patients with repeated procedure 1 week after treatment was significantly more than patients with 1procedure (P=0.05), however the difference was not significant regarding immediately and one month after treatment(P=0.06,P=0.40,respectively). In contrast to our findings Inan *et al.* indicated that repeated procedure lead to long lasting headache reduction in patients [21]. Harmoniously another experience by Naja *et al.* was in agreement with Inan and indicated that repeated injection on occipital nerve relieve cervicogenic headache for long time(at least 6months) [22]. However the results of previous experiences are not consistent and some studies divulged that the evidence confirmed effectiveness of anesthetic blockades are scarce [23]. A possible explanation for such discrepancy is different patients sampling, methodology and different blocking technique.

In this practice the procedures were well tolerated by patients in two groups and only the mild and transient side effect occurred in two patients in C2/C3 blockade group. These findings supported by Zhou *et al.* that showed C2/C3 blockade is effective and tolerable technique in patients with cervicogenic headache [20].

Our practice confirmed the results of previous studies, however our study and previous reports in this filed suffer from some limitations. Our practice was a retrospective and uncontrolled study with short follow up duration (1 month). Further prospective controlled studies with longer follow up duration are required to validate findings reported here.

Conclusions

This cohort indicate C2/C3 and greater occipital nerve (GON) are effective techniques for cervicogenic headache relief in short term. Moreover we detected C2/C3 blocks are significantly more effective than GON in short term.

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