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Research Submission

Occipital Nerve Blocks: Effect of Symptomatic Medication Overuse and Headache Type on Failure Rate

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Objective.—To explore the effect of symptomatic medication overuse (SMO) and headache type on occipital nerve block (ONB) efficacy.

Methods.—We conducted a chart review of all of the ONBs performed in our clinic over a 2-year period.

Results.—Of 108 ONBs with follow-up data, ONB failed in 22% of injections overall. Of the other 78%, the mean decrease in head pain was 83%, and the benefit lasted a mean of 6.6 weeks. Failure rate without SMO was 16% overall, and with SMO was 44% overall ($P < .000$). In those who did respond, overall magnitude and duration of response did not differ between those with and those without SMO. Without SMO, ONB failure rate was 0% for postconcussive syndrome, 14% for occipital neuralgia, 11% for non-intractable migraine, and 39% for intractable migraine. With SMO, failure rate increased by 24% ($P = .14$) in occipital neuralgia, by 36% ($P = .08$) for all migraine, and by 52% ($P = .04$) for non-intractable migraine.

Conclusions.—SMO tripled the risk of ONB failure, possibly because medication overuse headache does not respond to ONB. SMO increased ONB failure rate more in migraineurs than in those with occipital neuralgia, possibly because migraineurs are particularly susceptible to medication overuse headache. This effect was much more pronounced in non-intractable migraineurs than in intractable migraineurs.

Key words: occipital nerve block, migraine, occipital neuralgia, symptomatic medication overuse, medication overuse headache, steroids

Abbreviations: MOH medication overuse headache, ON occipital nerve, ONB occipital nerve block, PCS postconcussive syndrome, SMO symptomatic medication overuse, TTP tender(ness) to palpation

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Occipital nerve block (ONB) has several advantages in treating headaches. It is a safe[1] localized treatment, usually with no systemic effects. Onset is rapid, as short as 5 minutes,[2,3] yet the effects of an ONB can last for weeks.[4]

Symptomatic medication overuse (SMO) is an increasingly well-described entity that occurs when symptomatic medications are used more than about 10 days out of the month. When SMO causes headaches, the headaches are called medication overuse headaches (MOHs).[5]

Little data exist on the interplay between SMO and ONB. Our index patient was a 42-year-old woman who described severe holocranial squeezing headaches, starting 4 years prior and gradually worsening such that at presentation they occurred daily, essentially whenever she did not take her pain medications. She was otherwise healthy.

She took hydrocodone, oxycodone, diclofenac, and naproxen, all on a daily basis. Pressure on either

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greater or lesser occipital nerve (ON) reproduced her headache pain. Pressure on other parts of her head and neck did not. Her neurological examination was otherwise unremarkable. An extensive prior workup was remarkable only for a small disk herniation at C5-6 not causing foraminal or central canal narrowing.

Bilateral greater and lesser ONBs resulted only in increased injection site pain for about 10 days. She then stopped all her analgesics, whereupon her headaches worsened for about 2 weeks, then returned to baseline over another week. ONBs performed 71 days after stopping analgesics eliminated her headache within a day, and she remained headache free for 7 days, although her headaches then gradually returned to baseline.

METHODS

This study was a retrospective analysis of 121 ONBs performed in our clinic from August 1, 2006 to July 31, 2008. Patients received ONBs if they had significant headache pain, if pressure on an ON reproduced their headache pain, and who understood the risks and benefits of the procedure and elected to proceed.

For each ONB, anywhere from 1-6, although usually 2-4, individual injections were performed, depending upon how many nerves, when palpated, generated the patient's headache pain. Injection sites were identified by identifying the area of greatest tenderness to palpation (TTP) along the superior nuchal line in the general vicinity of the target ON. Almost always, each nerve was injected with 1.5 cc of 0.5% bupivicaine and 60 mg of methylprednisolone acetate suspension. Patients were seen 1 week later for follow-up to determine efficacy. Duration of headache relief was subsequently determined on subsequent visits when the patient reported return of headache pain.

For each ONB the following was recorded: headache diagnosis, absence or presence and type of SMO, whether the patient felt that the ONB helped, and if so the fractional decrease in headache pain and duration of pain relief. The main endpoint was whether a patient felt that their ONB set helped them. Non-responders were defined as those who did not think that their ONB set reduced their head pain. Headaches were classified following the IHS classification.[6] Occipital neuralgia, however, by definition responds to ONB, so using the remaining criteria, we defined occipital neuralgia as a stabbing pain with or without aching pain in the distribution of an ON, which is TTP. Only one patient meet Schulman et al's proposed definition for refractory migraine.[7] Therefore, we defined "intractable" migraines as those present at least 15 days in the past month and unresponsive to at least one prophylactic, criteria less strict than Schulman's, and which included 36% of migraineurs. Patients were classified as having postconcussive syndrome (PCS) if they had post-traumatic headache (5.1 or 5.2; pp. 58-60) with symptoms associated with post-traumatic syndrome such as depression, vivid dreams or nightmares, memory impairment, and decreased frustration tolerance. Patients with multiple headache types were assigned the headache diagnosis causing the most discomfort.

ANOVA with contrast analysis was used to compare ONB failure rate with and without SMO both for the overall population as well as for individual headache type subgroups. The Student *t*-test (2-tailed, unequal variance) was used for other statistics.

RESULTS

ONBs were performed on 80 women and 41 men, with a mean age of 42 +/– 12 years. SMO was present in 9 (22%) men and 23 (29%) women. Those with SMO were 43 +/– 12 years old and those without were 42 +/– 13 years old, on average.

Follow-up data were available for 108 ONBs for 71 women and 37 men with a mean age of 43 +/– 12 years. Of these 108, 25 (23%) were non-responders. For all responders, the mean decrease in head pain was 83 +/– 23%, and the mean benefit duration was 6.6 +/– 6.1 weeks. Patients with occipital neuralgia derived benefit for a longer mean time period, 8.9 weeks ($P < .05$) in spite of 36% of them (13 of 35) overusing analgesics. Three of 28 (11%) male non-overusers failed ONB, whereas 8 of 52 (15%) female non-overusers failed ONB ($P = .53$). Three of 9 (33%) male overusers failed ONB, whereas 11 of 19 (58%) female overusers failed ONB ($P = .50$). In other

words, SMO was associated with an increased risk of ONB failure of 22% for men and 42% for women. Female overusers were more likely to fail ONB than female non-overusers ($P = .0027$), and male overusers demonstrated a non-significant trend ($P = .23$) toward ONB failure compared with male non-overusers.

Effect of SMO by type of symptomatic medication overused on ONB efficacy is presented in Table 1. Risk of no response was 16% without SMO and 44% with SMO ($P < .000$). Risk of no response for opiate and NSAID overuse individually approached significance. Both triptan overusers had cluster headaches, and both responded to ONBs. The one acetaminophen/isometheptene/dichloralphenazone overuser derived no benefit.

Effect of ONB for specific headache types with and without SMO is presented in Table 2. Without SMO, ONB never failed in PCS, failed in 14% for occipital neuralgia, failed in 11% for non-intractable migraine, and failed in 39% for intractable migraine. The one patient meeting Schulman's proposed criteria for refractory migraine did not overuse symptomatic medications, and her head pain was eliminated although only for 3 days. With SMO, failure rate was 38% (24% higher) for occipital neuralgia, 63% (52% higher) for non-intractable migraine, and 50% (11% higher) for intractable migraine. ANOVA P was .003, indicating the presence of significant differences overall, but the only significant individual difference was the effect of SMO in increasing the risk of ONB failure for non-intractable migraineurs ($P = .04$)

DISCUSSION

Our ONB patients were roughly 3 times more likely to report no benefit from their ONB if they overused symptomatic medications. SMO-associated failure rate increase was greater for migraineurs than for those with occipital neuralgia, and was especially high as well as statistically significant for non-intractable migraineurs.

Our overall ONB results are generally consistent with previously reported observational data for migraine,[8-10] postconcussive headaches,[11] cluster headaches,[12,13] cervicogenic headache,[14,15] and multiple headache types.[16,17] Double-blinded randomized

Table 1.—Effect of Symptomatic Medication Overuse on Occipital Nerve Block Results by Type of Symptomatic Medication Overused

Group	SMO any type	Opiates	NSAID	Caffeine	Barbiturates	Acetaminophen	Triptans
For non-overusers							
Number of ONBs with follow-up	83	92	99	101	103	104	106
Fraction (N) of injections with no benefit	16% (13)	19% (17)	19% (19)	22% (22)	20% (21)	21% (22)	23% (24)
For those with a benefit							
Mean (SD) decrease in pain, %	85 (20)%	85 (20)%	83 (43)%	83 (23)%	83 (23)%	83 (23)%	83 (22)%
Mean (SD) duration of effect, weeks	6.1 (6.4)	6.0 (6.4)	5.7 (5.9)	6.1 (6.3)	6.0 (6.2)	5.9 (6.1)	6.0 (6.1)
For overusers							
Number of ONBs with follow-up	25	16	9	7	5	4	2
Fraction (N) of injections with no benefit	44% (11; $P < .000$)	44% (7; $P < .09$)	56% (5; $P < .08$)	29% (2)	60% (3)	50 (2)%	0% (0)
For those with a benefit							
Mean (SD) decrease in pain, %	71 (31)%	65 (34)%	73 (36)%	88 (13)%	90 (14)%	71 (6)%	65 (50)%
Mean (SD) duration of effect, weeks	5.5 (4)	6.0 (4.1)	7.7 (7.5)	4.9 (2.1)	5.3 (4.7)	8.3 (6.7)	0.7 (n/a; 1 patient)

P values are for the difference in failure rate between non-overusers and overusers for the particular type of symptomatic medication in that column.
SD, standard deviation; SMO, symptomatic medication overusers.

Table 2.—Effect of Symptomatic Medication Overuse on Occipital Nerve Block Results by Headache Type

Headache type	All migraine	Migraine (non-intractable)	Intractable migraine	Occipital neuralgia	Postconcussive syndrome	Cluster	Non-occipital neuralgia
Fraction (N) without SMO	82% (47)	78% (29)	86% (18)	64% (22)	100% (12)		100% (2)
Fraction (N) without SMO with no benefit	24% (11)	11% (3)	39% (7)	14% (3)	0% (0)		50% (1)
For those with a benefit							
Mean (SD) decrease in pain, %	87 (22)%	89 (21)%	73 (21)%	87 (21)%	86 (4)%		100.0%
Mean (SD) duration of effect, weeks	4.6 (3.9)	4.6 (4.3)	4.6 (2.8)	9.8 (10.3)	4.4 (0.7)		6.6
Fraction (N) with SMO	18% (10)	22% (8)	14% (2)	36% (13)		100% (2)	
Fraction (N) with SMO with no benefit	60% (6)	63% (5)	50% (1)	38% (5)		0% (0)	
For those with a benefit							
Mean (SD) decrease in pain, %	58 (43)%	77 (53)%	50 (30)%	79 (25)%		65 (50)%	
Mean (SD) duration of effect, weeks	1.5 (0.7)	1.5 (0.7)		6.9 (3.8)		0.7	
Failure rate increase with SMO	36% ($P = .08$)	52% ($P = .04$)	11%	24%			
Total number with follow-up	56	36	20	35			
Overall fraction (N) with zero effect	29% (16)	22% (8)	40% (8)	23% (8)			
For those with a benefit							
Mean (SD) decrease in pain, %	82 (26)%	86 (26)%	71 (21)	84 (22)%			
Mean (SD) duration of effect, weeks	4.4 (3.7)	4.2 (4.1)	4.6 (2.8)	8.9 (8.8)			

P values are for the differences between non-overusers and overusers for the particular type of headache in that column.
SD = standard deviation; SMO = symptomatic medication overuse.

placebo-controlled studies have also demonstrated efficacy of ONB in cluster headaches[18] and cervicogenic headache.[19] Also for cervicogenic headache, a single blinded study using saline injections as a control showed efficacy[3] as well as an open label randomized trial comparing C2-3 blocks with GON blocks and showing similarly drastic decreases in headache pain for both treatments.[20] One headache type reported to not respond to ONB is refractory tension type headache, in a prospective observational study in which neither ON TTP nor reproduction of headache pain with ON pressure were inclusion criterion.[21] Interestingly, we did not perform ONBs on anyone with tension headaches, possibly because nobody with tension headaches reported that pressure on their ONs reproduced their headache pain.

Several lines of evidence indicate that SMO causes headaches.[22-26] What is less clear is whether SMO renders other headache treatments less effective.

In this study, SMO was associated with a 3 fold increase in ONB failure rate. There are 3 possible explanations. First, the finding occurred by random change. Afridi et al retrospectively found that 20 of 31 (65%) migraineurs with SMO responded to the injections.[16] Since a total of 26 migraineurs responded, we deduce that 6 of 23 (26%) non-overusers responded, an actually smaller fraction.

This discrepancy could be related to several differences between our study and Afridi's. They injected patients with at least 15 headache days per month and who had failed at least 3 preventives, a more refractory group than our intractable migraine group. Comparing those with and those without SMO, our ONB failure rate was 52% higher for non-intractable migraineurs ($P = .04$), but only 11% higher for refractory migraineurs ($P = .87$), so it is possible that the more refractory the headache, the less SMO interferes with ONB. Our injection criteria and techniques are as described under "methods." For Afridi, neither reproduction of headache pain by pressure on an ON nor ON TTP were inclusion criterion. Afridi injected 3 mL of 2% lidocaine and 80 mg of methylprednisolone in a single injection 1-2 cm below the midpoint between the occipital tubercle and mastoid process, always unilaterally.

It is possible that Afridi's techniques are more effective for medication overusers or those with intractable headaches, and ours are more effective for non-overusers or those with non-intractable headaches.

Second, SMO could simply be a marker for headaches refractory to treatment. If so, one would expect a greater fraction of intractable migraineurs than non-intractable migraineurs to overuse analgesics. The opposite was true however, as 14% of intractable migraineurs overused analgesics whereas 22% of non-intractable migraineurs did so ($P = .83$). In addition, it does not explain why our index patient failed her first ONB, but then stopped her analgesics and then responded to the second.

The third possible explanation is that SMO increases ONB failure rate. By exclusion, we believe that this explanation is correct. SMO could increase ONB failure rate because SMO causes MOH, and MOH does not respond to ONB. Many authors have opined that MOH does not respond to prophylactic agents,[27-29] and one supporting prospective observational study involved patients who ceased symptomatic medications for 2 months. Those who were taking a prophylactic with no benefit at the start were compared with those who started a prophylactic during the 2-month period. From beginning to end of treatment, the former group experienced a 49% decrease in headache frequency and the latter experienced a 56% decrease in headache frequency ($P = .22$). The conclusion was that at the end of treatment, the 2 groups experienced an equivalent benefit from prophylactics, and that the former group's responsiveness to prophylactic therapy was restored by discontinuation of symptomatic medication.[30] Similar mechanisms may increase ONB failure rate with SMO.

Of the headache types studied, 2 groups, migraineurs and those with occipital neuralgia, contained both members with and members without SMO. Of these 2 groups, SMO was more likely to render ONBs ineffective in the migraineurs than in those with occipital neuralgia, as non-response rate increased by 52% ($P = .04$) in non-intractable migraine and 36% ($P = .08$) in all migraineurs vs 26% ($P = .14$) in those with occipital neuralgia. This finding may be related to the recently proposed idea that migraineurs are especially susceptible to MOH.[5] Interestingly, both of our cluster headache patients overused triptans, yet both responded to ONBs. Another observation in the above 2-month study of symptomatic medication withdrawal was that migraineurs' headache frequency decreased more (64%) than those with migraine and tension type headache (55%), who in turn derived a greater decrease than other diagnoses (39%) and tension type headache without migraine (30%).[30] Other evidence includes 8 patients who underwent total colectomy for Crohn's disease and who started daily opioids to control their bowel movements. Of these, the 2 patients with a history of migraine subsequently developed chronic daily headache, whereas the other 6 did not.[31] In addition, of 103 patients taking analgesics daily for arthritis, 8 had chronic daily headache, and all of these reported a history of migraine.[32] Also, 17 of 430 patient with cluster headaches developed chronic daily headache. All 17 took triptans daily. Five had a personal history of migraine; 7 reported migraines at least in a first-degree relative, 3 reported migraines at least in a second-degree relative, and the other 2 had parents with "headaches." Medication withdrawal was successful in all 13 patients who attempted it.[33] Even ignoring those without a personal history of migraine, 5 of 17 patients with MOH who also had migraines is double the 15% overall population prevalence of migraine,[34] at least suggesting an increased susceptibility of migraineurs to MOH. In other words, if MOH does not respond to ONB, and migraineurs are uniquely susceptible to MOH, then migraineurs may be especially more likely to fail ONB if they overuse analgesics.

These findings will allow practitioners and patients to make better informed decisions as to whether to proceed with ONBs. They also raise other questions that could be answered with the appropriate prospective trials, including whether ONBs could decrease the pain associated with SMO withdrawal, whether ON TTP or reproduction of headache pain with ON pressure should be prerequisites for performing ONB, and what the best medication for injection is and if it differs depending on headache type.

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REFERENCES

1. Young WB, Marmura M, Ashkenazi A, Evans RW. Expert opinion: Greater occipital nerve and other anesthetic injections for primary headache disorders. *Headache*. 2008;48:1122-1125.
2. Cook BL, Malik SN, Shaw JW. Greater occipital nerve (GON) block successfully treats migraine within 5 minutes [abstract]. *Neurology*. 2006;66:A42.
3. Bovim G, Sand T. Cervicogenic headache, migraine without aura and tension-type headache. Diagnostic blockade of greater occipital and supra-orbital nerves. *Pain*. 1992;51:43-48.
4. Ashkenazi A, Levin M. Greater occipital nerve block for migraine and other headaches: Is it useful? *Curr Pain Headache Rep*. 2007;11:231-235.
5. Bigal ME. Excessive use of analgesics is associated with the development of transformed migraine in the population – Results from the American Migraine Prevalence and Prevention Study. Oral presentation, Fifth Annual Headache Research Summit; February 19, 2008; Scottsdale.
6. Headache Classification Subcommittee of the International Headache Society. The International Classification of Headache Disorders, 2nd edn. *Cephalalgia*. 2004;24(Suppl. 1):8-152.
7. Schulman EA, Lake AE III, Goadsby PJ, et al. Defining refractory migraine and refractory chronic migraine: Proposed criteria from the Refractory Headache Special Interest Section of the American Headache Society. *Headache*. 2008;48:778-782.
8. Caputi CA, Firetto V. Therapeutic blockade of greater occipital and supraorbital nerves in migraine patients. *Headache*. 1997;37:174-179.
9. Gawel MJ, Rothbart PJ. Occipital nerve block in the management of headache and cervical pain. *Cephalalgia*. 1992;12:9-13.
10. Anthony M. Headache and the greater occipital nerve. *Clin Neurol Neurosurg*. 1992;94:297-301.
11. Hecht JS. Occipital nerve blocks in postconcussive headaches: A retrospective review and report of 10 patients. *J Head Trauma Rehabil*. 2004;19:58-71.
12. Peres MFP, Stiles MA, Siow HC, Rozen TD, Young WB, Silberstein SB. Greater occipital nerve blockade for cluster headache. *Cephalalgia*. 2002;22:520-522.
13. Scattoni LF, Stani D, Villani V, et al. Great occipital nerve blockade for cluster headache in the emergency department: Case report. *J Headache Pain*. 2006;7:98-100.
14. Vincent M. Greater occipital nerve blockades in cervicogenic headache. *Funct Neurol*. 1998;13:78-79.
15. Naja ZM, El-Rajab M, Al-Tannir MA, Ziade FM, Tawfik OM. Repetitive occipital nerve blockade for cervicogenic headache: Expanded case report of 47 adults. *Pain Pract*. 2006;6:278-284.
16. Afridi SK, Shields KG, Bhola R, Goadsby PJ. Greater occipital nerve injection in primary headache syndromes – Prolonged effects from a single injection. *Pain*. 2006;122:126-129.
17. Saadah HA, Taylor FB. Sustained headache syndrome associated with tender occipital nerve zones. *Headache*. 1987;27:201-205.
18. Ambrosini A, Vandenheede M, Rossi P, et al. Suboccipital injection with a mixture of rapid- and long-acting steroids in cluster headache: A double-blind placebo-controlled study. *Pain*. 2005;118:92-96.
19. Naja ZM, El-Rajab M, Al-Tannir MA, Ziade FM, Tawfik OM. Occipital nerve blockade for cervicogenic headache: A double-blind randomized controlled clinical trial. *Pain Pract*. 2006;6:89-95.
20. Inan N, Ceyhan A, Inan L, Kavaklioglu O, Alptekin A, Unal N. C2/C3 nerve blocks and greater occipital

nerve block in cervicogenic headache treatment. *Funct Neurol*. 2001;16:239-243.
21. Leinisch-Dahlke E, Jürgens T, Bogdahn U, Jakob W, May A. Greater occipital nerve block is ineffective in chronic tension type headache. *Cephalalgia*. 2005;25:704-708.
22. Katsarava Z, Schneeweiss S, Kurth T, et al. Incidence and predictors for chronicity of headache in patients with episodic migraine. *Neurology*. 2004; 62:788-790.
23. Wang SJ, Fuh JL, Lu SR, et al. Chronic daily headache in Chinese elderly: Prevalence, risk factors and biannual follow-up. *Neurology*. 2000;54:314-319.
24. Limmroth V, Katsarava Z, Fritsche G, Przywara S, Diener HC. Features of medication overuse headache following overuse of different acute headache drugs. *Neurology*. 2002;59:1011-1014.
25. Rabe K. Medication-overuse headache. *MMW Fortschr Med*. 2006;148:37-38.
26. Diener HC, Katsarava Z. Medication overuse headache. *Curr Med Res Opin*. 2001;17(Suppl. 1):17-21.
27. Grazzi L. Headache with medication overuse: Treatment strategies and proposals of relapse prevention. *Neurol Sci*. 2008;29:93-98.
28. Grazzi L. In-patient vs. day-hospital withdrawal treatment for chronic migraine with medication overuse and disability assessment: Results at one-year follow-up. *Neurol Sci*. 2008;29(Suppl. 1):S161-S163.
29. Fumal A. Medication overuse headache. *Rev Med Liege*. 2006;61:217-222.
30. Zeeberg P, Olesen J, Jensen R. Discontinuation of medication overuse in headache patients: Recovery of therapeutic responsiveness. *Cephalalgia*. 2006; 26:1192-1198.
31. Wilkinson SM, Becker WJ, Heine JA. Opiate use to control bowel motility may induce chronic daily headache in patients with migraine. *Headache*. 2001;41:303-309.
32. Bahra A, Walsh M, Menon S, Goadsby PJ. Does chronic daily headache arise de novo in association with regular use of analgesics? *Headache*. 2003; 43:179-190.
33. Paemeleire K, Bahra A, Evers S, Matharu MS, Goadsby PJ. Medication-overuse headache in patients with cluster headache. *Neurology*. 2006; 67:109-113.
34. Steiner TJ, Scher AI, Stewart WF, Kolodner K, Liberman J, Lipton RB. The prevalence and disability burden of adult migraine in England and their relationships to age, gender and ethnicity. *Cephalalgia*. 2003;23:519-527.