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# GREATER OCCIPITAL NERVE BLOCKADE IN CERVICOGENIC HEADACHE

*MAURICE B. VINCENT*, RENATO A. LUNA**, DENISE SCANDIUZZI***, SÉRGIO A. P. NOVIS*****

ABSTRACT - Cervicocogenic headache (CeH) is a relatively common disorder. Although no ideal treatment is available so far, blockades in different structures and nerves may be temporarily effective. We studied the effects of 1-2 mL 0.5% bupivacaine injection at the ipsilateral greater occipital nerve (GON) in 41 CeH patients. The pain is significantly reduced both immediately and as long as 7 days after the blockade. The improvement is less marked during the first two days, a phenomenon we called "tilde pattern". GON blockades may reduce the pool of exaggerated sensory input and antagonize a putative "wind-up-like effect" which may explain the headache improvement.

KEY WORDS: anaesthetic blockade, bupivacaine, cervicogenic headache, greater occipital nerve.

**Bloqueio do nervo occipital maior na cefaléia cervicogênica**

RESUMO - A cefaléia cervicogênica (CeH) é condição relativamente comum. Embora ainda não exista tratamento ideal, a CeH pode ser temporariamente controlada mediante o bloqueio de diferentes estruturas cervicais, incluindo nervos. Neste estudo, 41 pacientes com CeH tiveram o nervo occipital maior (GON) ipsilateral bloqueado com 1-2 ml de bupivacaína a 0,5%. A dor foi significativamente reduzida tanto imediatamente quanto até 7 dias após o bloqueio. A melhora foi menos marcada nos primeiros dois dias, determinando um padrão que nós denominamos "tilde pattern" (padrão til). É possível que o bloqueio do GON reduza a quantidade de aferências sensitivas exageradas e antagonize um eventual efeito "wind-up", justificando a melhora da cefaléia por prazos mais longos.

PALAVRAS-CHAVE: bloqueio anestésico, bupivacaína, cefaléia cervicogênica, nervo occipital maior.

Cervicogenic headache (CeH) is a syndrome characterized by intermittent or continuous headache of cervical origin[1-4]. The pain is unilateral, does not change to the contralateral side from one attack to another as migraine, and usually spreads up from the posterior part of the head to the frontal area, where it is usually more intense. In some patients, a vague pain may also irradiate to the ipsilateral arm. The cervical bursting is the most important feature of CeH. Attacks may be precipitated by cervical movements or awkward positions, or by digital pressure over trigger areas at the posterior part of the neck, such as the greater occipital nerve (GON) or the C2 area[5,6].

No effective treatment for CeH has been found so far. Manipulation of the cervical spine was considered effective[7], but this method lacks validation. Operative neurolysis, avulsion and/or decompression may reduce the symptoms but recurrence usually occurs[8]. Percutaneous radio-frequency denervation at the occipital territory may be effective in some cases[9]. Upper cervical roots decompression was reported to reduce the pain in patients with permanent hemicrania[10].

Setor de Cefaléias, Serviço de Neurologia, Hospital Universitário Clementino Fraga Filho, Universidade Federal do Rio de Janeiro, Brasil: *Professor adjunto; **Interno; ***Mestranda; ****Professor Titular. Aceite: 27-julho-1998.

Dr. Maurice Vincent - Av. das Américas 1155/504 - 22631-000 Rio de Janeiro RJ - Brasil. FAX +5521 494 3648. E-mail: vincent@unisys.com.br

Blockades at different cervical structures, including nerves, may abate cervical-related headaches temporarily. At least for diagnostic purposes, greater occipital nerve blockade seems to be particularly important[2]. We investigated the effect of GON blockade in a group of cervicogenic headache patients. This procedure may inhibit attacks in some patients for a relatively long time.

## METHODS

Forty-one CeH patients, (39 females, 2 males) diagnosed according to Sjaastad and co-workers[2], were instructed to daily record the level of pain for a week both before and after the injection using visual analogue scales (VAS, 0-100). After 7 days recording, the subjects were submitted to a 1-2 mL 0.5% bupivacaine injection at the ipsilateral greater occipital nerve[11]. Blockades were accepted if anaesthesia over the GON distribution (tested with a pin) was obtained. The level of pain was estimated just before and at 0, 15, 30, 45, 60, 75, 90, 105 and 120 minutes after injection. Pain killers were allowed during the week previous to the injection only in case of intolerable pain. A week average pain was estimated for the periods before and after the blockade. The number of days with pain were also counted, as well as the number of days with pain greater than 50 (VAS). Thirty-three subjects filled in the forms during the two weeks before and after injection. Thirty-eight patients had the pain properly recorded during the first two hours after the procedure. In 35 patients data were available from injection until the end of the second week of the study.

Values are presented as mean ± SE. ANOVA for repeated measures, Student's t-test and Wilcoxon Signed-Rank test were used for statistical comparisons. P values greater than 0.05 were considered as non-significant.

## RESULTS

The procedure was well tolerated in general, and no side effect was recorded.

*Comparison between the week before and after the injection*

The mean 7-days pain before and after blockade (Fig 1) was 37.5±3.1 and 20.4±3.4 respectively (VAS, $p<0.0001$, n=33) The average reduction in the mean 7-days pain was 41.0±9.1% (n=33). As indicated in Figure 1, 28 out of 33 patients had a smaller average level of pain in the week following the blockade. All the 14 patients with a mean 7-days pain greater then 40 before the blockade improved, as compared with the mean 7-days pain after the blockade.

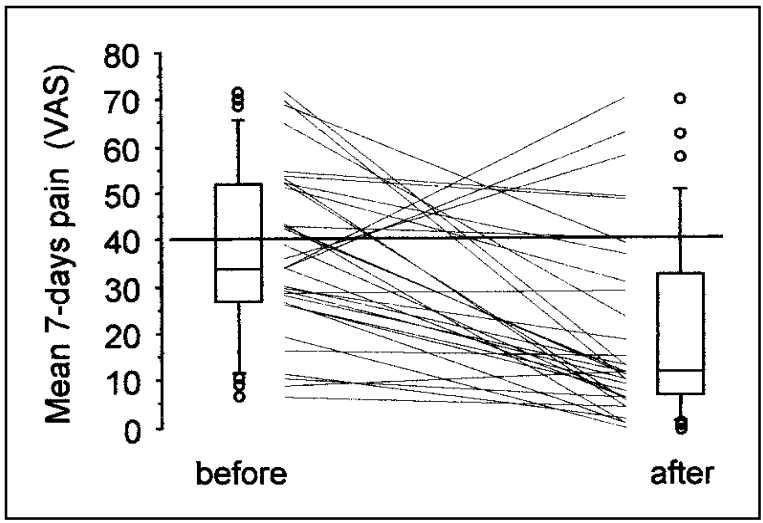


*Fig 1. Mean 7-days pain (VAS) before and after a 1-2 mL 0.5% bupivacaine injection at the greater occipital nerve in 33 CeH patients. Box and whisker plots (10,25,50,75 and 90 percentile ranks) are also shown. All patients with initial mean 7-days pain greater than 40 (above the dotted line) improved after the blockade.*

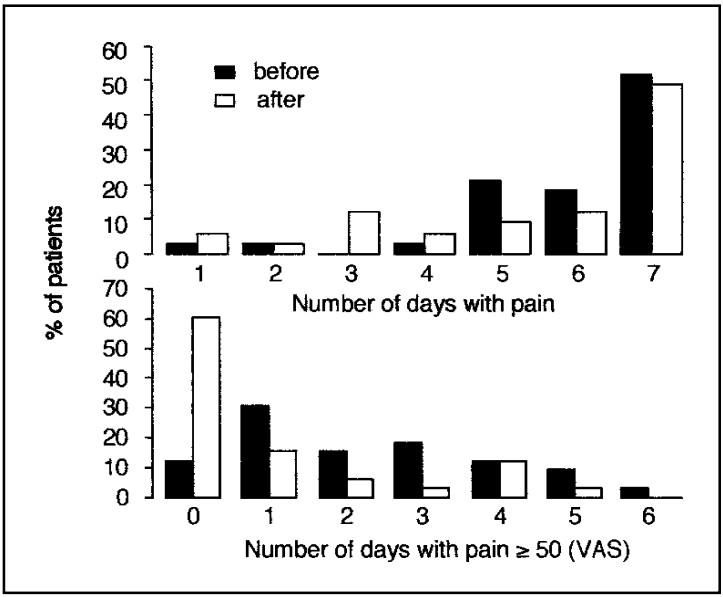


*Fig 2. Total number of days (upper panel) and number of days with pain greater than 50 (VAS, Lower panel) before (black bars) and after (white bars) a 1-2 ml 0.5% bupivacaine injection at the greater occipital nerve in 33 CeH patients. Values in % of patients.*

The number of days with pain before and after the blockade, respectively 5.9±0.2 and 5.3±0.3, were almost statistically different (p=0.0603). In contrast, considering the number of days with pain greater than 50 according to the VAS, values before and after the blockade were respectively 2.2±0.2 and 1.0±0.2 (p=0.0006) (Fig 2).

*Reduction of pain within 2 hours following the blockade*

Figure 3 shows the improvement during the first 120 minutes after the blockade in the 14 patients with pain greater than 50 (VAS) just before injection. The 21 patients with pain below 50 (VAS) just prior to the injection improved comparatively less, not just during the first 2 hours but also during the following week (Fig 4). A tendency to pain recurrence was seen in the first two days after the blockade, specially in the subgroup of patients with initial pain greater than 50 (VAS) (Fig 4). Reduction of the pain would however reappear in the following days.

## DISCUSSION

Blockades in different structures, either nerves, roots or joints, have been described as effective in some cases of headaches related to cervical structures[1,12-17]. The greater occipital nerve, the main sensory nerve of the C2 root, is one of the structures that may be blocked in CeH patients[11,14].

The present data show that CeH may be reduced not only during the few hours when anaesthesia is present, but also for at least 7 days after the injection. We have seen cases with relief lasting months or even years (data not shown). It is noteworthy that in CeH the pain usually is located with greater intensity to the forehead, an area not innervated by the GON. Taken together, data suggest anaesthesia “per se” does not explain headache reduction.

Repetitive C fibres afferent input facilitate further central pain processing. It has been demonstrated that, under increased sensory input, wide dynamic range neurons at the dorsal horn

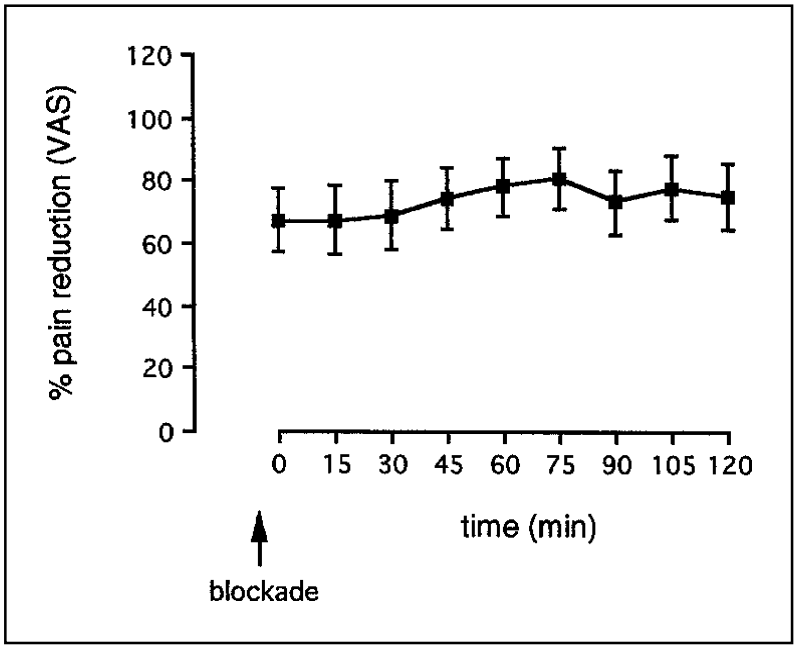


*Fig 3. Effect of a 1-2 ml 0.5% bupivacaine injection at the greater occipital nerve in 14 CeH patients with initial pain greater than 50 (VAS). Mean (squares) and SE (error bars) are shown as % of pain improvement.*

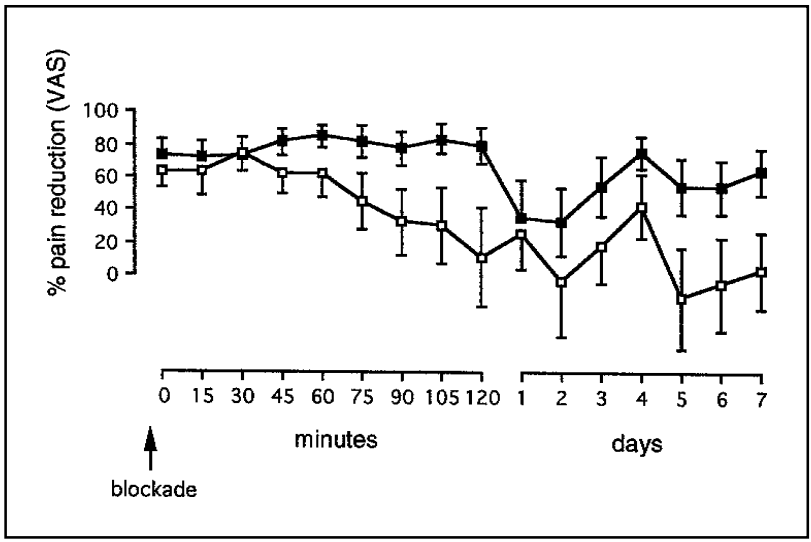


*Fig 4. Effect of a 1-2 ml 0.5% bupivacaine injection at the greater occipital nerve in 14 CeH patients with initial pain greater than 50 (VAS, black squares) and in 24 CeH patients with initial pain lower than 50 (VAS, white squares). Values shown as mean % of pain improvement ± SE.*

would respond comparatively more to sequential stimuli[18]. This phenomenon, known as "wind-up", is characterized by a time-dependent increase in spinal cord responsiveness to subsequent afferent input and underlies the phenomenon of secondary hyperalgesia[19]. This may explain post-operative pain reduction when C-fibre neurotransmitters release at the dorsal horn is prevented by regional anaesthetic procedures[20].

A similar phenomenon may justify why CeH is reduced for a relatively long time following a single blockade. The hypothetical source of the pain, located somewhere in the neck, would fire at abnormally higher levels and overstimulate pain processing centres at the dorsal horn, generating a wind-up-like phenomenon. The ongoing exaggerated nociceptive input would turn non-painful physiological impulses - generated for instance by turning the head or maintaining the neck fixed in a trigger position - into painful experiences. An abrupt reduction of the increased sensory input could break down temporarily this pain maintenance vicious circle until the primary lesion would reestablish the abnormally lowered pain threshold. That could also be the reason why different structures may be blocked with similar effects, since the importance of the anaesthesia is based on the reduction of the exaggerated total sensory input, rather than on the site of the blockade. Supporting this idea, reduction of pain outlasting the duration of the anaesthesia has been reported in blockades performed distally to a lesion[21]. That could also be the reason for the better results with simultaneous anaesthesia in different nerves[14].

Speculatively, synaptic changes induced by abnormally high sensory fibres firing rates could facilitate pain transmission. Repetitive nerve stimulation may increase synaptic transmission in experimental conditions[22]. Again, if a similar phenomenon occurs at the dorsal horn, a self-perpetuating pain could be produced.

The present study also shows that pain tends to get worse during the following 2 days after bupivacaine injection. Many patients claim spontaneously that the blockade is effective except during that period. Pain usually disappears immediately after injection, returns to levels sometimes greater than the original one during the following 24-48 hours, and then tends to disappear again for a variable period of time. We call this response "the tilde pattern" due to its resemblance to the tilde (~) mark. The mechanisms underlying this "tilde pattern" are obscure to us at the moment. It is possible that the pain observed at the 2nd and 3rd days is related to the trauma caused by the injection secondary to the distention the injected liquid produces in the vicinity, but apparently saline has no effect in pain reduction, at least in the first minutes[11]. Long term effects of saline injections were not tested so far.

Another interesting aspect is the relative lack of effect in patients with low or mild pain prior to injection. Patients with higher levels of pain in long terms as assessed by VAS before injection (mean 7-days pain over 40) and those with higher pain at the moment of injection (pain over 50) had a comparatively better outcome. If the mechanism underlying the CeH reaction pattern is a wind-up-like facilitation, this would explain why comparatively higher pain before injection is somehow required for the beneficial effects of bupivacaine.

In the present study, effects of anaesthesia were not compared to placebo. Bovim and Sand[11], however, found no CeH improvement with saline injections. The differences between groups with higher and lower pain and the "tilde pattern" should not be expected if the results were related to some sort of placebo effect. Nevertheless, controlled studies are required in order to determine to which extent a placebo effect plays a role in GON blockades.

In summary, this study suggests that in CeH patients blockade of the GON tend to reduce the pain in CeH both immediately and in long terms; that the pain has a tendency to recur during the first 2 days after the injection ("tilde pattern"); and that patients with higher level of pain tend to do better after a GON blockade, a phenomenon possibly related to a "wind-up-like" dorsal horn potentiation.

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