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# Cervicogenic headache: Prevalence and response to local steroid therapy

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**Key words:** Cervicogenic headache, unilateral headache, local steroids, "cervico-trigeminal relay".

## ABSTRACT

*Cervicogenic headache (CEH) has been said to be common among patients with idiopathic headache, but no information exists as to its prevalence among those who have not suffered whiplash or head injury. This study was designed to answer this question and in addition to determine whether headache relief could be achieved by blockade of the occipital nerves (greater and lesser occipital - GON, LON) in the upper neck, on the side habitually affected by the headache. Among 796 patients with idiopathic headache, 128 or 16.1% were found to be suffering from CEH. They were predominantly female, as in the case of migraine, older than the migrainous group (49.5 years as against 34.7 years), respectively, and with a monthly headache frequency of 18, against 6.9 in the case of migraine.*

*Injections of depot methylprednisolone into the region of the GON and LON produced complete relief of headache in 169 out of 180 patients with CEH for a period ranging from 10 to 77 days, the mean duration of relief being 23.5 days. However, similar relief of headache could be achieved in patients with attacks of strictly unilateral migraine or cluster headache, suggesting that local steroid injections by blocking the cervico-trigeminal relay, can arrest other forms of unilateral headache.*

## Introduction

There appears to be considerable controversy as to the correct term for headaches affecting the occipital or suboccipital regions of the head, with or without radiation to the more anterior parts, such as the frontotemporal and/or ocular areas.

This fact assumes some importance as it is common experience among physicians dealing with migrainous patients that in some, the character of their headache changes over a period. Initially, such headaches have features generally ac-

cepted as migrainous, i.e. attacks of alternating hemicranial pain, throbbing in quality, most marked in the frontotemporal area, commonly associated with gastrointestinal symptoms (e.g. anorexia, nausea or vomiting), and usually controlled to a lesser or greater extent by antimigrainous medication. After some years - rarely quickly but more commonly insidiously over several months - the pain changes in character. It develops a constant, dull aching, non-pulsatile quality, is more severe than previously, spreads to the occipital area, and now a complete attack is situated in the occipital, frontotemporal and ocular regions and has few or no accompaniments. Attacks are nearly always more frequent than in the past, often of almost daily occurrence, and always occur on the same side of the head. The only migrainous feature that remains now is the hemicranial nature of the headache. Preventive antimigrainous therapy is of little value and neither oral analgesics nor ergotamine-containing preparations are as effective as previously (1). At the same time, there is a group of patients in whom such headaches develop *de novo*, without a prior history of migraine.

The question that arises is: does this change in the character of the headache represent the natural course in the evolution of migraine, or does it represent the operation of a trigger factor, which so far has played a minor role or no role in initiating headache attacks? If that is so, what is the nature of such a trigger factor?

It is suggested that the new factor that operates in such cases is irritation of neural structures in the upper part of the cervical spine, the role of which has been underestimated in the causation of headache. After all, it has long been accepted that cervical spondylosis can cause pain referred to the orbit and frontal regions. Experimental stimulation of various structures of the neck in man can produce pain in the anterior parts of the

head. Orbital and frontal pain was produced by stimulation of the C1 dorsal rootlets (2); forehead pain was elicited by stimulation either of neck muscles close to their insertion to the occiput (3) or midline soft tissues between the occiput and the C1 vertebra (4). These clinical observations have been explained on the basis of overlap of central connections between the spinal nucleus of the trigeminal nerve and upper cervical nerves within the spinal cord. On descending through the pons and the medulla, the spinal trigeminal nucleus becomes both morphologically and functionally associated with the upper cervical segments and its cells form a column continuous with the column of cells forming the posterior horns as far down as C2 (5) and perhaps as far down as C4 (6). In fact, this "cervico-trigeminal relay" (CTR) (Fig. 1) is accepted as the main pain centre for the head, and pain impulses from the neck may thus be referred to the frontotemporal region and vice versa (7).

The oldest term for headaches in the occipital and/or suboccipital regions is "occipital neuralgia". It was initially introduced in 1821 by Beruto y Lentijo and Ramos [as mentioned by Perelson (8)]. The term was meant to denote irritation

of the greater occipital nerve (GON) and, possibly, the lesser occipital nerve (LON), though the pain in most cases does not have the neuralgic quality that the name implies. In fact, the definition of the International Headache Society (IHS) 1988 (9a), describes occipital neuralgia as paroxysmal jabbing pain in the distribution of the greater or lesser occipital nerves, accompanied by sensory changes in the affected area, but it is also stated that an aching pain may persist between paroxysms. The condition is relatively rare, whereas unilateral headaches of occipito-nuchal origin with or without fronto-temporal radiation are far more common.

Recently, such headaches have been more accurately described with respect to their clinical features and trigger factors and given the more descriptive term of "cervicogenic headaches" (10). The term comprises headaches predominantly without side-shift, in which pain can be brought on by neck movement or sustained abnormal head postures, or pressure over the ipsilateral occipital nerve. The pain always begins in the neck, has either a fluctuating but continuous quality or occurs in circumscribed episodes of variable duration. There is usually a history of whiplash

injury. The entity has not yet been accepted by the IHS in the classification of headache, although widely accepted and used by workers in the field. The current view is that such headaches can arise from painful disorders of one or more structures in the upper neck leading to irritation of the upper three cervical roots or their nerves and branches thereof. Such structures include the dura mater of the posterior cranial fossa, the vertebral arteries, the periosteum of the occipital condyles, any of the upper cervical synovial joints and muscles, and even the C2-3 and C3-4 intervertebral discs (11).

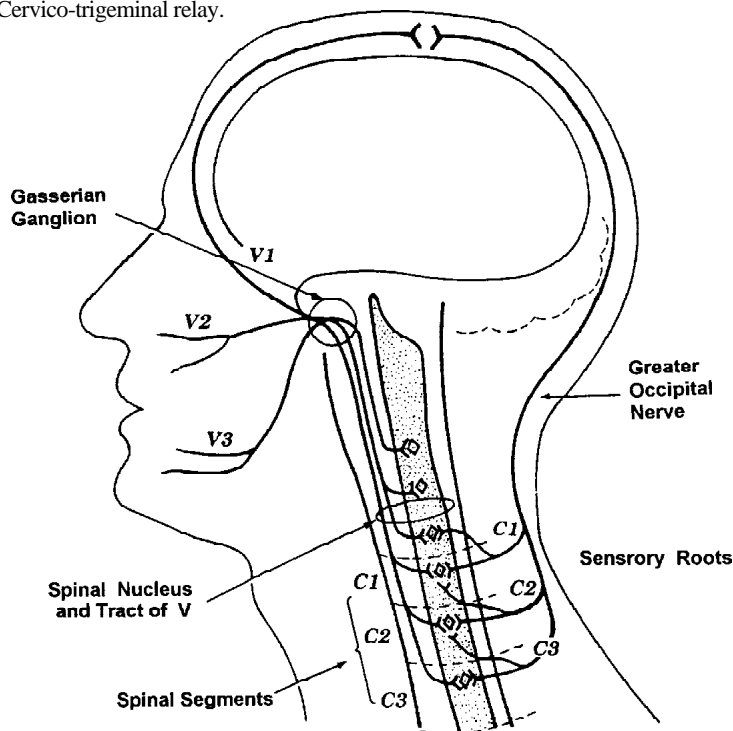
The purpose of this study was to: (1) assess the prevalence of CEH among patients with idiopathic headache, but without a previous history of head trauma or whiplash injury, as had been the case in all previous studies so far published, and (2) observe whether the blocking effect of local corticosteroids into the region of the GON and LON produces any headache relief in such patients.

**Patients and methods**

Patients included in the study were outpatients suffering from primary or idiopathic headache and seen at the Neurology Clinic or private consulting office for the first time because of their complaint. A total of 796 such patients were collected in the period 1989 to 1995. Those with a prior history of whiplash injury were not accepted, unless this had occurred 10 or more years previously and any such headache the patient might have suffered as a result had cleared up before the current headache made its appearance. Patients were divided into four groups. Those with: (1) migraine (M); (2) migraine episodes occurring between attacks of cervicogenic headache (M-CEH); (3) cervicogenic headache only (CEH); and (4) tension-type headache (TTHA). Patients with cluster headache were excluded, as the periodicity of that variety of headache makes clinical comparison with headaches described above impossible.

The definitions of migraine and tension-type headache used were according to those of IHS Classification 1988 (9b), whilst those for occipital neuralgia and migraine with CEH were as follows:

Fig. 1. Cervico-trigeminal relay.



## (A) Cervicogenic headache (CEH)

1. Unilateral nuchal-occipital headache, continuous or paroxysmal (neuralgic), with or without anterior radiation.
2. Headache occurring persistently on one side of the head (side-locked).
3. Circumscribed tenderness of the GON on the affected side as it crosses the superior nuchal line (SNL).
4. Sensory changes in the distribution of the GON (pin-prick appreciation); i.e. hypo- or hyperalgesia or dysaesthesiae.
5. Precipitation of headache by neck movement or GON pressure.
6. Relief of acute attacks by blocking the GON with local anaesthetic (9a).

## (B) Migraine with cervicogenic headache (M-CEH)

1. A history of established migraine in the past.
2. Recent increase in frequency/severity of headache with occipital radiation/origin of pain.
3. Headache always or predominantly on the same side of the head.
4. Circumscribed tenderness of the GON on the affected side as it crosses the SNL.
5. Absence of sensory changes in the area of distribution of the GON on that side.

A full medical and headache history was obtained from all patients, and head or whiplash injury was enquired for in particular. Anyone with such a history of less than 10 years previously was not accepted into the study. Organic disease of the brain or spinal cord was excluded by physical examination and, if indicated, by appropriate investigations. Sensory changes in the distribution of the GON and LON to pain by the use of needle pricks over the area (pin prick appreciation), were categorised as hypo-, hyperalgesia or dysaesthesiae.

All patients diagnosed as M-CEH or CEH and 50 patients with migraine had their pain threshold sensitivity measured by pressure algometer in kg/cm<sup>2</sup> over the point where each GON crossed the SNL on both sides.

A total of 180 patients were included in the study of the effects of corticosteroids injected locally into the region of the GON and LON during the course of

cervicogenic headache. These were made up of the 128 patients from the present prevalence study, which was concluded in December 1995, and the subsequent 52 patients with the condition seen before March 1998.

All patients had their point of exit of the GON onto the scalp located at the upper part of the neck by means of a nerve stimulator. In the majority of patients this was found to be 3-12 mm medial to the midpoint of the line joining the occipital tubercle and the mastoid tip on the headache side. However, since that area generally has a small bulk of muscle, the needle was inserted about 10-15 mm below that point, where there was sufficient muscle bulk, thought suitable to hold the deposited steroid.

The site of the injection was prepared by instilling a local anaesthetic, 3-4 ml 1% lignocaine, into the skin and the deeper tissues. About 5 min later, 160 mg (4 ml) methylprednisolone acetate in propylene glycol (Depomedrol, Upjohn) was injected at the site. The steroid was not injected if at the time the patient happened to be suffering from an attack of headache, until or unless the patient noted more than 75% relief of that headache after the local anaesthetic. The needle was directed about 15 degrees towards the occiput, until the resistance of bone was felt, thus making certain that the spinal subarachnoid space was not entered into. The needle was withdrawn a few mm and one third of the solution was deposited. The tip of the needle was then withdrawn just under the skin and

the needle was directed 15 degrees medially and again laterally, to deposit the second and last third of the steroid solution. On completion of the injection, the area was massaged vigorously in order to spread the steroid solution and make sure that it bathed the nerve trunk. Light pressure was maintained with a wad of cotton wool until the bleeding from the needle tract stopped and the patient was asked to stay in the waiting room for 15 min, and was then allowed to leave. Patients were asked to keep a headache chart and were followed up at fortnightly intervals, when their response was assessed. Each patient was given a second injection when the headaches returned, and the mean duration of relief for the group was calculated from the results of the 360 injections in the 180 patients.

To exclude the possibility that neither the local anaesthetic nor the systemic effects of the injected corticosteroid were responsible for the period of headache relief, 50 patients were given LA only into the region of the GON and LON and another 50 were given an intramuscular injection of 160 mg Depomedrol, and the degree and duration of relief was noted. Further, to observe the effect of local corticosteroids on the course of other unilateral headaches, 20 patients with chronic cluster headache and 20 with one or two migraine attacks weekly, predominantly on the same side of the head, were also given 160 mg Depomedrol into the region of the GON and LON, and the duration of headache relief was also noted.

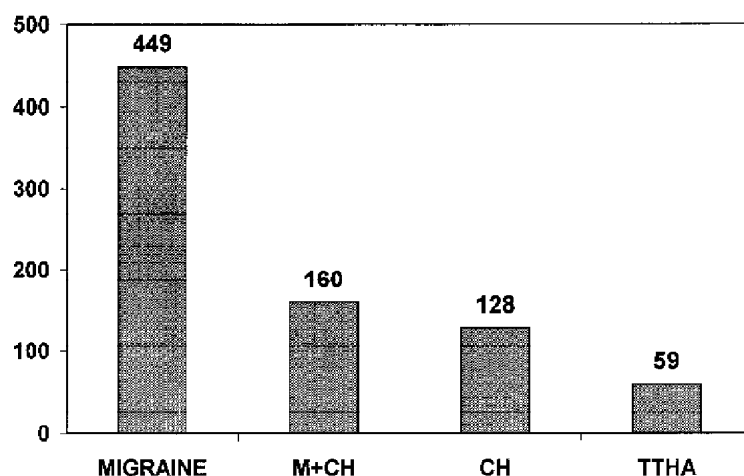


Fig. 2. Idiopathic headache - 796 patients. Number of patients per headache type.

**Results**

*Prevalence and clinical features of cervicogenic headache*

Out of the total number of 796 patients, 128 or 16.1% were found to be suffering from CEH (Fig. 2). As a group, patients with CEH were older than the other three groups (mean age 49.5 yrs.), and apart from the patients with TTHA, had the highest headache frequency per month in comparison to the rest of the patients (Fig. 3). There was a 3:1 predominance of females, as was the case in migraine and M-CEH, whilst as a group the patients with CEH had the highest incidence of unilateral headache (73.4%) (Table I). Whilst headache was most frequently occipital, temporal and frontal in CEH and M-CEH, in the case of migraine this was mostly frontal and temporal (Table II). The pain threshold of the GON ipsilateral to the headache was somewhat reduced in M-CEH, but was most marked in those with CEH, all of whom demonstrated, in addition, sensory changes in the area of the nerve (Table III).

*Local corticosteroid injection of the GON/LON in cervicogenic headache*

The results of the study are summarised in Table IV. Of the 180 patients, 169 or 90.6% derived significant pain relief, ranging from 10 to 77 days, the mean duration of headache freedom being 77 days. Relief of headache was experienced almost immediately by those who were suffering from headache at the time of injection of the local anaesthetic, and the duration of such relief ranged from 1.6 - 3 hours. The beneficial effect of the local steroid was not felt until 16 - 25 hours after the injection.

The commonest side effect following the injection was a sensation of fullness in the occipital region, lasting 2 - 3 days, whilst 8 patients complained of some degree of dizziness and uncertainty of gait for 22 - 48 hours after the steroid injection. The second injection was given when the patient's headaches returned with a frequency greater than three times weekly.

The intramuscular injection of Depomedrol given to 50 patients with CEH produced no headache relief, and the headaches returned to each patient's pre-

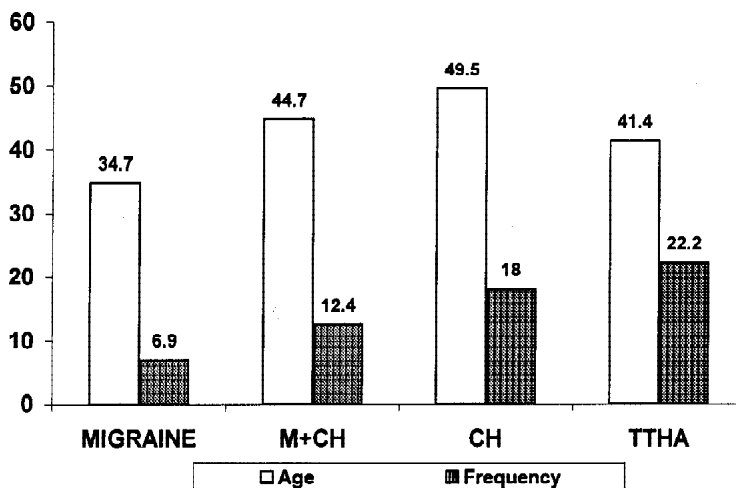


Fig. 3. Idiopathic headache - 796 patients. Age (years) and headache frequency (per month).

Table I. Clinical features of 796 patients with idiopathic headache.

	Migrane	Migrane + CEH	CEH	TTHA	Total
Patients (no.)	449 (56.4%)	160 (20.1%)	128 (16.1%)	59 (7.4%)	796
Female	327 (77.4%)	119 (74.4%)	95 (74.4%)	33 (55.9%)	594
Mean age (yrs.)	34.7	44.7	49.5	41.2	
Headache duration (yrs.)	9.5	8.1	8.2	9.9	
Unilateral headache	167 (37.2%)	107 (66.1%)	94 (73.4%)	5 (8.5%)	373
Headache frequency (per mo.)	6.9	12.4	18.0	22.2	

CEH = Cervicogenic headache; TTHA = Tension type headache

Table II. Location of pain in idiopathic headache (expressed as no. of patients and percentages).

	Migraine		Migraine + CEH		CEH	
Total number	449	%	160	%	128	%
Frontal	295	65.7	115	71.5	90	70.3
Temporal	269	59.9	111	69.4	90	70.3
Parietal	48	10.7	29	18.1	35	27.3
Occipital	202	45.0	126	78.7	108	84.4
Ocular	188	41.9	93	58.1	80	62.5
Nuchal	37	8.2	21	13.1	18	14.1

CEH = Cervicogenic headache

Table III. Pain sensitivity of the GON in patients with idiopathic headache.

	Migraine + CEH	CEH	Migraine
Total number (no.)	160	128	50
Previous migraine	All	59 (46.1%)	All
Sensory changes	None	All	None
Hypoalgesia	—	50	—
Hyperalgesia	—	34	—
Dysaesthesiae	—	44	—
Pain threshold (kg/cm <sup>2</sup> )			
Headache side	2.7	1.8	R3.9
Headache-free side	4.0	3.7	L3.6

CEH = cervicogenic headache.

**Table IV.** Effect of local corticosteroids in cervicogenic headache.

Number of patients	180	
Female/Male	114/66	
Age in yrs: Range (mean)	16 - 82 (48.5)	
Headache (frequency/month)		
Daily	76	
16+	37	
8 - 16	31	
4 - 7	21	
2 - 4	15	
Duration	Hours - 3 days	
Depomedrol 160 mg GON/LON	180	
Headache relief	169	
Duration relief in days: Range (mean)	10 - 77 (23.5)	

injection frequency in less than 35 hours. On the other hand, the injection of local anaesthetic into the region of the GON/LON in patients suffering at the time an acute attack of CEH, chronic cluster headache or unilateral migraine, produced relief in the majority, whilst the injection of Depomedrol in patients with the last two types of headache produced headache-freedom in all 20 of the patients with chronic cluster headache and in 18 out of 20 of those with unilateral migraine. The mean duration of headache-freedom was 32.0 and 30.1 days, respectively (Table V).

### Discussion

At the present state of our knowledge regarding the mechanism of headaches arising from the various pathological processes in the neck, no clear-cut statement can be made as to which particular pathological entity is most commonly responsible for the attacks of headache.

Rather, it appears more likely that such pathological processes increase the afferent nociceptive input along the upper three cervical nerves and their component nerve roots into the cervicotrigenal relay (CTR), eventually leading to activation of the trigeminovascular system (TVS) (12, 13) and a secondary vascular headache of the migraine type. That there may be activation of the TVS in headaches arising from irritation of structures in the upper part of the neck, is suggested by the fact that the latencies of the blink reflex in patients with cervicogenic headache is significantly shorter on the symptomatic side than is the case in patients with migraine or TTHA (14). Since both the CTR and TVS are paired systems, a unilateral headache may on occasion become bilateral (15), as there is evidence to suggest that there are cross-connections between the two sides (16) which can result in bilateral activation and bilateral headache.

There is ample proof that there are central connections between the CTR and the TVS within the brainstem. Neurones in both the trigeminal nucleus caudalis and the upper spinal cord respond to electrical and chemical stimulation of the cranial vessels. These responses are mediated by trigeminal pathways (17). A significant number of responsive units are found in the dorsolateral area (DLA) of the spinal cord, an area lateral to the dorsal horn at the upper cervical level, which contains the lateral cervical nucleus (LCN) (18) and receives trigeminal afferents (19), and which is thought to play a role in the central processing of nociceptive information, including that from the head.

Electrical stimulation of the superior sagittal sinus (SSS) elicits pain resembling that of migraine in human subjects (20). Nerves supplying the SSS and certain other cranial vessels are part of the trigeminal system, larger fibres ending in the chief sensory nucleus of the nerve and the trigeminal nucleus caudalis, whilst small fibres descend in the descending tract of the trigeminal nerve as far down as the spinal cord. Stimulation of the SSS and GON in the anaesthetised cat showed convergent input into the DLA at the C2 level in two-thirds of nerve cells units studied. Since the LCN is concerned with nociception, the observed convergence of trigeminal and cervical afferents explains the co-existence of frontal and occipital pain in CEH, and even in migraine (21).

The surprising finding of this and other studies is the high incidence of cervicogenic headaches among patients with the idiopathic variety of the disorder. In a previous study from our department the prevalence was found to be 17.2% among 500 patients (22), whilst in two others it was 17.8% among 826 patients (23) and 13.8% among 5,520 patients (24). Cervicogenic headache, therefore, as a cause of daily or almost-daily headache, constitutes a major problem in headache management, both on the basis of its high prevalence and its poor response to most therapeutic regimes. So far, the most effective treatments have been interruption of the occipital nerves (GON, LON) or their component nerve roots or ganglia, either by means of a

**Table V.** Effect of local anaesthetic and corticosteroids on different varieties of idiopathic headache.

	Migraine	Chronic cluster headache	Cervicogenic headache
Patients (no.)	20	20	50
Local anaesthetic injection into GON/LON during headache			
Maximum duration of headache relief - 2.6 hrs (no. of pts.)	16	16	42
Corticosteroid injection (Depomedrol 160 mg)			
a) into GON / LON when headache-free			
Headache relief (no. of pts.)	18	20	See Table IV
Mean duration of headache relief (days)	30.1	32.0	See Table IV
b) intra-muscular			
Number of patients	---	---	50
Maximum duration of headache relief	---	---	None

block by corticosteroids, surgical division or radiofrequency thermocoagulation (25, 26). All forms of treatment are inevitably followed by the recurrence of pain, however, and the need of effective treatment of CEH remains a major problem in headache therapy.

The relief of CEH following injections of either local anaesthetic or Depomedrol, is in keeping with recently acquired knowledge of the neural connections between the cerebral vessels, the endogenous pain control system in the brainstem, the trigeminal nerve and its central and peripheral connections, and the upper cervical cord, which appears to modulate impulses from the head and neck (15). Whereas the mechanism of local anaesthetics in blocking peripheral nerves is well known, that of Depomedrol is more controversial. However, it is known that when the drug is injected near nerve trunks in experimental animals, it causes demyelination of nerve fibres (27). This appears to be a plausible explanation for both the nerve block and the prolonged duration of headache relief following the local injection of Depomedrol into the region of the GON/LON.

It is significant that local anaesthetic and local steroids into the region of the GON/LON relieve not only the headache of CEH, but also that of chronic cluster headache and of unilateral migraine. As a result, the effects of both drugs are not specific for CEH but only for unilateral headache. By blocking the occipital nerves they eliminate sensory input into the CTR, almost certainly reducing it to sub-threshold levels, thus preventing the remaining and reduced nociceptive input from reaching consciousness. Since both CTR and TVS have such intimate central connections in the brainstem and cervical cord, it is no wonder that the blockade of one system (in this case the CTR) eliminates unilateral headaches, irrespective of whether they are in the anterior or posterior part of the head.

In spite of the spectacular relief of headache by local Depomedrol, the effect of the drug is transient, so that its value in the treatment of CEH is limited to providing patients with short periods of headache relief. The drug is of value when used to block individual cervical sensory nerve roots (11) - when injected

into the cervical epidural space (28), specific cervical nerves, or even facet joints (29) - for the purpose of locating the site of origin of pain in CEH when surgical or other physical procedures are contemplated.

The present study suggests that Depomedrol is of greater therapeutic value in the treatment of episodic cluster headache, where bouts last a few weeks rather than months, and where local steroid injections every 2 or 3 weeks on 1 to 3 occasions may see the patient through the bout without the need for systemic treatment with its attendant side effects.

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**Statistical data (ANOVA)**

1. Age	Migraine patients were significantly younger than patients in any of the other groups	F ratio	17,396	P = 0.001
2. Headache frequency	Migraine patients had significantly lower frequency than patients in any of the other groups	F ratio	72,857	P = 0.001