

# Clinical characteristics of headaches attributed to diagnostic and therapeutic procedures

## Características clínicas das cefaleias atribuídas a procedimentos diagnósticos e terapêuticos

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### ABSTRACT

Headaches may appear after performing diagnostic and / or therapeutic procedures with close temporal relationship to these events. The objective of this research was to know the clinical characteristics of headache secondary to diagnostic and / or therapeutic procedures. We reviewed secondary headaches according to ICHD-3, and searched for those that arose after performing a diagnostic and / or therapeutic procedure. A total of 11 different diagnoses of headache attributed to diagnostic and / or therapeutic procedures were found. Some secondary headaches are due to diagnostic and / or therapeutic procedures.

**Keywords:** Secondary headaches; Diagnostic procedures; Therapeutic procedures.

### RESUMO

Cefaleias podem surgir após realização de procedimentos diagnósticos e/ou terapêuticos com estreita relação temporal com esses eventos. O objetivo desta pesquisa foi conhecer as características clínicas das cefaleias secundárias a procedimentos diagnósticos e/ou terapêuticos. Nós revisamos as cefaleias secundárias, de acordo com a ICHD-3, e buscamos aquelas que surgiram após a realização de um procedimento diagnóstico e / ou terapêutico. Foram encontrados 11 diagnósticos diferentes de cefaleias atribuídas a procedimentos diagnósticos e / ou terapêuticos. Algumas cefaleias secundárias são decorrentes de procedimentos diagnósticos e/ou terapêuticos.

**Descritores:** Cefaleias secundárias; Procedimentos diagnósticos; Procedimentos terapêuticos

### INTRODUCTION

Secondary headache is defined when a new headache occurs for the first time in close temporal relationship to an intracranial disorder<sup>1</sup>. The clinical presentation of all these disorders can be diverse and often mimics the characteristics of primary headaches, which may delay the diagnosis<sup>2</sup>.

Headache may appear as a side effect due to the performance of some diagnostic and / or therapeutic procedures, such as neurosurgery, endovascular treatments, puncture of the dura mater for cerebrospinal fluid (CSF) removal or injection of some substance, among others<sup>1</sup>.

Knowledge of the clinical characteristics of these headaches is important to improve diagnostic accuracy and therapeutic manage-

ment, as well as the development of prophylactic measures.

### METHODS

In this review, we examined the diagnosis of all secondary headaches, according to International Classification of Headache Disorders, Third Edition (ICHD-3)<sup>1</sup>. The headaches that appeared after performing a diagnostic and / or therapeutic procedure were selected. In addition, we seek articles related to these headaches in the main databases to better characterize them.

### RESULTS

A total of 11 different diagnoses of headache attributed to diagnostic and / or therapeutic procedures were found (Table 1).

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**Table 1.** Headaches attributed to diagnostic and / or therapeutic procedures, according to ICHD-3

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Acute or persistent headache attributed to craniotomy
Post-endarterectomy headache
Headache attributed to carotid or vertebral angioplasty or stenting
Headache attributed to cranial venous sinus stenting
Headache attributed to an intracranial endarterial procedure
Angiography headache
Post-dural puncture headache
Headache attributed to intrathecal injection
Dialysis headache
Headache attributed to radiosurgery of the brain
Post-electroconvulsive therapy headache

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## DISCUSSION

According to ICHD-3<sup>1</sup>, some diagnostic and / or therapeutic procedures may cause headache. In the following, these headaches that are considered secondary will be described.

### Acute or persistent headache attributed to craniotomy

A craniotomy is a neurosurgical technique, whereby part of the skull is opened or removed for access to treat conditions such as brain tumors, aneurysms, and arteriovenous malformations<sup>3</sup>.

Retrospective studies have shown that more than 30% of the patients submitted to this surgical procedure had headache attributed to craniotomy as an adverse event<sup>4-6</sup>.

However, when headache occurs after head injury surgery, it will be coded as acute headache attributed to moderate or severe traumatic head injury.

According to ICHD-3, this headache must have occurred within seven days after craniotomy, after the patient has regained consciousness or after discontinuation of medications that impair the ability to feel or report headache. In addition, headache should be resolved within three months of its initiation<sup>1</sup>.

Headache attributed to craniotomy is more common after surgery of the skull base compared to other locations. Usually, it is felt at the site of the craniotomy, but may be more diffuse and resemble tension-type headache or migraine<sup>1</sup>.

If headache resolved within three months after its onset, it will be classified as acute, but if it persists for more than three months, it will be called chronic. When headache following craniotomy becomes persistent, the possibility of medication-overuse headache needs to be considered<sup>1</sup>.

In the abortive treatment of this headache, several drugs have been tried, such as infiltration of the scar with local anesthesia<sup>7</sup>, opioids, especially codeine and morphine, acetaminophen, non-hormonal anti-

inflammatories<sup>8</sup>, and sumatriptan<sup>9</sup>. There are few studies on prophylactic treatment of headache attributed to craniotomy<sup>10</sup>. The best therapeutic responses were with verapamil<sup>11</sup> and divalproex sodium<sup>12</sup>.

### Post-endarterectomy headache

This headache is caused by the surgical procedure of carotid endarterectomy. It develops within one week after of the carotid endarterectomy, but it is resolved within the first 30 days. Headache can occur without any other associated symptom or be a warning symptom preceding the focal deficits of (mostly hemorrhagic) stroke<sup>1</sup>.

Headache is unilateral, on the side of carotid endarterectomy, and may involve the neck and face. The headache has a pulsating character and a mild intensity. It manifests as cluster headache-like pain occurring once or twice a day in attacks lasting two to three hours<sup>1</sup>.

There are three subforms of post-endarterectomy headache, but they are not coded separately. The first is the most frequent (up to 60% of cases), a diffuse, mild and isolated headache, which occurs in the first days after surgery and is a benign, self-limiting condition; the second (up to 38% of cases), a unilateral cluster headache-like pain with attacks, lasting two to three hours, occurring once or twice a day and resolves in about two weeks; and the third, unilateral pulsating and severe pain occurring three days after surgery. This latter subform is part of the rare hyperperfusion syndrome, often preceding a rise in blood pressure and the onset of seizures or neurological deficits on or about the seventh day. Urgent treatment is required, since these symptoms can herald cerebral haemorrhage<sup>1</sup>.

Some studies have shown that headache occurs in 38% to 62% of patients undergoing endarterectomy. Usually, the location of the pain is on the same side of the surgical procedure. It has a dull or pressure character and a moderate to severe intensity. In more than 50% of patients there is no need for treatment<sup>13,14</sup>, but when it is part of the hyperfusion syndrome, treatment is an emergency as these symptoms may indicate a brain hemorrhage.

### Headache attributed to carotid or vertebral angioplasty or stenting

Carotid and vertebral angioplasty and/or stenting are performed to treat patients with cervical artery stenosis, but one-third of these patients develops headache. This headache is caused by the endovascular procedures of carotid or cervical angioplasty and / or stenting without arterial dissection. It develops within a week but resolves within a one month after angioplasty and / or stenting<sup>1</sup>.

Headache attacks usually occur within 10 minutes in which these procedures are performed. They are localized to the frontotemporal region, ipsilateral to the procedure, in pressure, mild intensity, and lasting a maximum of 10 minutes.

Studies show that carotid percutaneous transluminal angioplasty may cause arterial dissection, often resulting

in cervical, facial or cranial pain. However, the relative risk of painful dilation depends on individual risk factors, such as a history of myocardial infarction. In addition, the radiation pattern of pain depends on which carotid segment is dilated<sup>15</sup>.

Data on carotid angioplasty headache and diagnostic criteria are based on few studies. Despite the scarcity of data, this headache seems to be relatively frequent. In two studies, its occurrence ranged from 39% to 51%<sup>15,16</sup>.

### **Headache attributed to cranial venous sinus stenting**

In recent years, lateral sinus stenosis stenting has been used in the treatment of idiopathic intracranial hypertension. Suppression of stenosis may reduce intracranial pressure by decreasing the pressure in the upper longitudinal sinus. However, unilateral headache may be caused by the stent and on the same side of the cranial venous sinus stent<sup>17</sup>.

This headache develops within one week after the jugular or cranial venous stent has been performed. Headache is ipsilateral to the stenting and it resolves within three months<sup>1</sup>.

In one series of 21 patients stented for idiopathic intracranial hypertension, 10 patients exhibited 'stent-headaches' differing from those experienced before treatment, located at the site of the stent, in the mastoid region, and lasting about three weeks. These "stent-headaches" disappeared after 3 months of stenting<sup>17</sup>.

### **Headache attributed to an intracranial endarterial procedure**

Some studies have shown that balloon inflation in the intracranial arteries during therapeutic embolization of intracerebral arteriovenous malformations (AVMs) cause pain by distension of these vessels<sup>18</sup>. Probably, mechanical vessel distension activates the trigeminovascular nociceptive system in susceptible individuals<sup>19</sup>.

It is a unilateral headache directly caused by intracranial endarterial procedure, ipsilateral to the procedure and lasting less than 24 hours. Pain was described as brief, sharp or localized pressure of mild to moderate intensity, felt ipsilaterally to the manipulated vessel. This headache develops within one week and resolves within one month after the procedure<sup>19</sup>.

The occurrence of this headache during endovascular procedures is not yet well-defined. There is limited information to define its frequency, risk factors, pathogenesis and implications for future pain management<sup>19</sup>. In some evaluated procedures, the headache occurrence attributed to an intracranial endoarterial procedure ranged from 10.6% to 68.0%<sup>18-21</sup>.

### **Angiography headache**

This headache is caused by intra-arterial carotid or vertebral angiography. It develops during contrast

injection or within 24 hours after angiography, lasting less than one hour. It disappears within 72 hours after angiography<sup>1</sup>.

The frequency of post angiography headache ranges from 30.2% to 39.1%<sup>16,22,23</sup>. Possibly a headache is due to irritation of the trigeminovascular system by contrast agents or mechanical stimuli, resulting in the release of vasoactive peptides<sup>24</sup>.

### **Post-dural puncture headache**

Headache occurring within five days of a lumbar puncture, caused by CSF leakage through the dural puncture. It is usually accompanied by neck stiffness and / or subjective hearing symptoms and it gets worse when the individual takes the upright position. It remits spontaneously within two weeks, or after healing from the leak with autologous epidural lumbar patch<sup>1</sup>.

Puncture of the dura-mater occurs during diagnostic or therapeutic procedures, spinal anesthesia or inadvertently during epidural anesthesia. After puncture, post-dural puncture headache may appear as a common complication in approximately 7.5% of the patients<sup>25,26</sup>.

### **Headache attributed to intrathecal injection**

Some drugs that act on the central nervous system such as analgesics, anesthetics, and antineoplastics are injected directly into the subarachnoid space, thus avoiding the blood-brain barrier. This route of administration is known as the subarachnoid or intrathecal route.

After intrathecal injection, the most common adverse effects are headache and low back pain<sup>27</sup>. Headache develops within four days of intrathecal injection and significantly improves within 14 days after intrathecal injection. Signs of meningeal irritation are present. In addition, headache experienced in both upright and recumbent postures<sup>1</sup>.

### **Dialysis headache**

Dialysis is a therapeutic procedure used by patients with kidney failure, where a machine replaces the diseased kidney and filters the blood, eliminating toxic substances such as sodium, potassium, urea and creatinine. Frequently, patients with chronic kidney disease experience headache during dialysis<sup>28</sup>, whose pathophysiology is still unknown.

The prevalence of dialysis headache varies between 27% and 73%<sup>28</sup>. This headache is characterized by developing during a hemodialysis session and resolving within 72 hours after the end of the dialysis session. Headache episodes cease altogether after successful kidney transplantation and termination of haemodialysis<sup>1</sup>.

Dialysis headache was described for the first time by Bana and Yap in 1972<sup>29</sup>, but its clinical characterization has been detailed improvement in recent years. In most patients, headache is pulsatile, located in the frontal region, moderate to severe intensity, and may be accompanied by nausea and vomiting<sup>30-33</sup>. There are

no controlled studies on the prophylactic or abortive treatment of dialysis headache.

## Headache attributed to radiosurgery of the brain

Brain radiosurgery is used in the treatment of brain injuries, such as arteriovenous malformations<sup>34</sup> and intracranial tumors<sup>35</sup>. In some primary headaches, such as refractory cluster headache, brain radiosurgery may also be useful<sup>36</sup>. Cerebral edema is the most frequent complication of this procedure<sup>37,38</sup>.

More rarely, headache may appear in a patient in whom radiosurgery of the brain has been performed. It develops within seven days, but it is resolved within three months after radiosurgery. There have been no validation studies of its diagnostic criteria. Currently, it is in the appendix of ICHD-3 (A5.7), but it is not better accounted for by another ICHD-3 diagnosis<sup>1</sup>.

Studies on this new headache do not provided detailed descriptions of its clinical features. In some cases, the headache syndrome was short-lived, occurred more than a year after the procedure and resembled migraine or thunderclap headache<sup>1</sup>.

## Post-electroconvulsive therapy headache

Electroconvulsive therapy (ECT) is commonly used in the treatment of various psychiatric disorders, such as severe depression, schizophrenia, and bipolar disorders. Headache is the main adverse effect resulting from this therapeutic procedure. Its incidence varies from 26% to 85% and makes it difficult for the patient to continue with this treatment<sup>39</sup>.

This headache occurs when a course of electroconvulsive therapy (ECT) has been given in a headache-free patient to treat an epileptic seizure. It is necessary that headache has developed after  $\geq 50\%$  of ECT sessions; each headache has developed within four hours after ECT; and each headache has resolved within 72 hours after ECT. There have been no validation studies of its diagnostic criteria. Currently, it is in the appendix of ICHD-3 (A7.6.3), but it is not better accounted for by another ICHD-3 diagnosis<sup>1</sup>.

Usually, post-ECT headache is treated with analgesics and / or non-steroidal anti-inflammatory drugs, but other optional treatments are being described. In some case reports, mirtazapine<sup>39</sup> and topiramate<sup>40</sup> were effective.

## CONCLUSION

Some secondary headaches are due to diagnostic and / or therapeutic procedures.

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