Post spinal puncture headache: diagnosis, risk factors and treatment

Cefaleia pós-punção espinhal: diagnóstico, fatores de risco e tratamento

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Matheus Manoel Diogo Lins
Graduating in Medicine
Institution: Universidade do Grande Rio (UNIGRANRIO)
AddressAv. Ayrton Senna, 2.200, Barra da Tijuca, CEP: 22775-003, Rio de Janeiro - RJ
E-mail: matheuslins@unigranrio.br

Alessandro Menezes Saldanha Feijo
Graduating in Medicine
Institution: Universidade do Grande Rio (UNIGRANRIO)
AddressAv. Ayrton Senna, 2.200, Barra da Tijuca, CEP: 22775-003, Rio de Janeiro - RJ
E-mail: alessandrofeijo@gmail.com

Amanda Cardoso Mohamed
Graduating in Medicine
Institution: Universidade do Grande Rio (UNIGRANRIO)
AddressAv. Ayrton Senna, 2.200, Barra da Tijuca, CEP: 22775-003, Rio de Janeiro - RJ
E-mail: amanda.mohamed@unigranrio.br

Daniel Henrique Baracho Zaidan
Graduating in Medicine
Institution: Universidade do Grande Rio (UNIGRANRIO)
AddressAv. Ayrton Senna, 2.200, Barra da Tijuca, CEP: 22775-003, Rio de Janeiro - RJ
E-mail: dzaidan@unigranrio.br

Felipe Dutra Silva
Graduating in Medicine
Institution: Universidade do Grande Rio (UNIGRANRIO)
AddressAv. Ayrton Senna, 2.200, Barra da Tijuca, CEP: 22775-003, Rio de Janeiro - RJ
E-mail: fdutra@unigranrio.br

Henrique Antonio Sayão Passos
Graduating in Medicine
Institution: Universidade do Grande Rio (UNIGRANRIO)
Address: Av. Ayrton Senna, 2.200, Barra da Tijuca, CEP: 22775-003, Rio de Janeiro - RJ
E-mail: henrique.sayao@yahoo.com.br

Ingrid Borges Alves
Graduating in Medicine
Institution: Universidade Estácio de Sá - Presidente Vargas
Address: Av. Pres. Vargas, 642, Centro, Rio de Janeiro - RJ, CEP: 20071-001
E-mail: ingrid.borgesalves@gmail.com

Marcella Lima Guimarães dos Santos
Graduated in Medicine
Institution: Universidade Estácio de Sá - Presidente Vargas
Address: Av. Pres. Vargas, 642, Centro, Rio de Janeiro - RJ, CEP: 20071-001
E-mail: mar.svp@gmail.com

ABSTRACT
Spinal anesthesia is one of the most used anesthetic techniques, having been in existence for over 100 years, and over time it has been improved by the development of a new needle design, gauge, tip shapes, as well as more precise indications and contraindications. However, even so, there are still possible complications due to this procedure, especially headache after puncture of the dura mater, and, because of that, this procedure carries with it a great increase of taboos and prejudices. Although it is clear that reducing the size of the dural perforation reduces CSF loss, thus making the incidence of headache less likely, there are many other issues to be clarified regarding the pathophysiology, treatment and prevention of post-dural puncture headache. How does needle design, size, and orientation influence CSF leakage through dural perforation? Can pharmacological methods reduce symptoms of post-dural puncture headache? Can epidural blood patch help in the treatment of post-spinal anesthesia headache? Can epidural blood patch act prophylactically? Does epidural saline solution reduce the rate of CSF loss? Thus, this article aims to answer these questions according to the most recent studies and make an objective review of post spinal anesthesia headache with an approach to pathophysiology, diagnosis, clinical scenario, risk factors, prevention and therapeutic options.

Keywords: post spinal puncture headache, spinal anesthesia, diagnostic, risk factors, treatment.

RESUMO
A raquianestesia é uma das técnicas anestésicas mais utilizadas, com mais de 100 anos de existência, e, ao longo do tempo, vem sendo aprimorada com o desenvolvimento de um novo desenho de agulha, calibre, formato de ponta, além de indicações e contraindicações mais precisas. Entretanto, mesmo assim, ainda existem possíveis complicações decorrentes desse procedimento, especialmente cefaleia após a punção da dura-máter, e, por isso, esse procedimento traz consigo um grande aumento de tabus e preconceitos. Embora esteja claro que a redução do tamanho da perfuração dural reduz a perda de LCR, tornando assim menos provável a incidência de cefaleia, há muitas outras questões a serem esclarecidas com relação à fisiopatologia, ao tratamento e à prevenção da cefaleia pós-punção dural. Como o desenho, o tamanho e a orientação da agulha influenciam o vazamento de LCR por meio da perfuração dural? Os métodos farmacológicos podem Os métodos farmacológicos podem reduzir os sintomas da cefaleia pós-punção dural? O adesivo sanguíneo epidural pode ajudar no tratamento da cefaleia pós-anestesia espinhal? O adesivo sanguíneo peridural pode ter ação profilática? A solução salina peridural reduz a taxa de perda de LCR? Assim, este artigo tem como objetivo responder a essas perguntas de acordo com os estudos mais recentes e fazer uma revisão objetiva da cefaleia pós-raquianestesia com uma abordagem da fisiopatologia, do diagnóstico, do cenário clínico, dos fatores de risco, da prevenção e das opções terapêuticas.
Palavras-chave: cefaleia pós-punção espinhal, anestesia espinhal, diagnóstico, fatores de risco, tratamento.

1 INTRODUCTION

Headache is a common symptom that has many different causes and pathophysiological mechanisms.

Its triviality is reflected by the frequency of complaints at medical appointments and reasons for missing work.[5]

Headache is a universal symptom in humans. It is estimated that 94% to 100% of people will have or have had some type of headache throughout their lives[5,7].

Headaches are a type of pain referred to the surface of the head from its deep structures[7].

The painful sensitivity of the head comes from primary trigeminal afferent nerves, responsible for the innervation of blood vessels, mucous membranes, muscles and tissues[7].

The headache pain pattern is the referred type and occurs when peripheral nociceptors are stimulated, which may occur due to tissue damage, visceral distension, compression, among other factors. This painful stimulus may be caused by injury or inappropriate activation of pain production pathways in the Central or Peripheral Nervous System[7].

A system developed by the International Headache Society characterizes headaches as primary or secondary[7,14].

The most common primary headaches[6,7] are those in which the disorder consists of the headache itself and its manifestations. Headache of primary cause is more related to considerable disability and/or reduced quality of life7. The main forms are migraine (migraine), tensional and in clusters[5,7].

Secondary headaches[6,7] are caused by exogenous causes, that is, they are caused by some other disease known to be capable of causing it, such as brain tumors, cranial trauma, meningitis, stroke, hydrocephalus, aneurysms, among others[6,7]. Post-spinal anesthesia headache is included in this classification[2,7]. These types of headaches can have a mild course, such as in cases of upper respiratory tract infections, or a severe course that, despite being less common, must have an effective surveillance in order to know the etiology and thus provide the correct treatment[7].

In this article, we will address a specific type of headache, post spinal anesthesia, which can be classified as secondary, of the postural type, and its etiology is the low volume of cerebrospinal fluid after lumbar puncture.

It is known that the advantages of using regional anesthesia over general anesthesia in certain cases is a consensus among anesthesiologists.

Spinal anesthesia is a simple anesthetic technique, which consists of injecting doses of anesthetic solution into the subarachnoid space, causing a conduction block in nerve endings, reaching motor, sensory and sympathetic modalities below the chosen level[4].

On August 16, 1898, surgeon Augusto Karl Gustav Bier performed the spinal anesthesia technique for the first time, achieving 45-minute analgesia with 3 ml of 0.5% cocaine injected into the patient's subarachnoid space for extraction surgery of tumor of tuberculous origin in the knee of a patient at the

Royal Surgical Clinic in Kiev, Germany. He observed vomiting and headache in the patient's post-surgery period. He decided to test it in five other patients and all of them had post-spinal anestesia headache. The surgeon himself, in order to better understand the anesthetic technique, decided to inject himself and his assistant Hildebrant with an injection of cocaine (5 mg in 3 ml of distilled water). After the procedure, they described a disabling headache with worsening in the standing position and disappearance of the symptom in the supine position. He correctly assumed that the cause of the headache would be the loss of CSF and the erect position due to the consequent traction of brain structures (vessels and meningeal structures)[4].

With the popularization of spinal anesthesia and advances in anesthetic techniques, new needle design, gauge and tip shape reflected in a significant decrease in post spinal anesthesia headache, however, this condition has an incidence ranging from 0.4 to 80%[1], depending on of the presence of certain risk factors that will be discussed in the article, and requires a medical evaluation in order to recognize this clinical condition, trace possible differential diagnoses and elaborate an appropriate therapeutic approach.

2 PATHOPHYSIOLOGY

The pathophysiology of post spinal anesthesia headache is due to the consequent loss of CSF greater than its production. CSF is formed in the cerebral ventricles by invagination of veins in the intradural space, mainly by the choroid plexuses, responsible for about 60% of its production, and other structures responsible for 40%.

The total volume of CSF is approximately 150 ml and the production speed is 0.35 ml.min-1, corresponding to 500 ml.day-1. It is estimated that a volume equal to the total is secreted every four hours.

The CSF pressure measured in the sitting position is about 40 cm H2O and, in the supine position, it is 5 to 10 cm H2O. Therefore, procedures such as spinal anesthesia can cause CSF

leak, causing a greater loss than production resulting in traction of brain structures such as meninges, nerves and cranial vessels, which will significantly worsen in the upright position.

Studies support the hypothesis that CSF loss is responsible for post-spinal anesthesia headache. In particular, a study that submitted a group of volunteers to the removal of 15 to 20 ml of CSF, with na immediate result of headache with the same characteristics as post spinal anesthesia.[11]

In addition to the basic mechanism of traction of brain structures (vessels and meninges), the loss of CSF will lead to painful symptoms due to cerebral venodilation, since a lower intracranial CSF pressure will lead to compensatory dilation of pain-sensitive intracranial venous structures, causing headache from standing position.

3 CLINICAL RESOURCES

Headache and low back pain are the most frequently reported symptoms.

About 90% of headaches will occur within 3 days after the procedure, and 66% will start within the first 48 hours. Headache may appear immediately after using the anesthetic technique and, rarely, it may develop between 5 to 14 days.

3.1 CLINICAL MANIFESTATION

As described, headache is the most frequent complaint, but it is not the only one either. Nausea, vomiting, hearing loss, tinnitus, dizziness, dizziness and paresthesia of the scalp and upper part and pain in the lower limbs, as well as visual disturbances such as diplopia or cortical blindness, have been reported. Cranial nerve palsies are not uncommon [10].

Literature describes this headache as severe, "burning and spreading like hot metal."

It mainly affects the frontal and occipital areas and this pain is able to radiate to the neck and shoulders[10].

This discomfort in the temporal area and the presence of neck stiffness have also been reported.

This headache has as worsening factors the adoption of the upright posture and, as improvement factors, the supine position.

Worsening headache in the upright posture is a sine qua non of post-spinal anesthesia headache.

Unless a headache with postural features is present, the diagnosis of post-dural puncture headache should be questioned, as other severe intracranial causes of headache should be excluded [10].

4 DIAGNOSIS

It is very important to pay attention to the anamnesis of these patients. A history of spinal anestesia accompanied by symptoms of postural headache, neck pain, and the presence of neurological signs guide the diagnosis.

The International Headache Society defines post-spinal anesthesia headache as a secondary headache attributed to nonvascular intracranial disorder due to CSF hypotension. In addition, according to the document "International Classification of Headache Disorders (ICHD-II, 2004)" to be diagnosed as such, it must meet the following diagnostic criteria[1]:

- The headache should get worse within 15 minutes after the patient stands up and improve within

1) Be associated with one of the following symptoms: neck stiffness, tinnitus, hearing loss, photophobia or nausea.

2) Appear within five days of dural puncture.

3) Spontaneously disappear within a week or within 48 hours after effective treatment of CSF extravasation, and if the headache persists, this relationship is questioned.

Some studies[14,15] question the diagnostic criteria for post-dural puncture headache (CPPD) established by the International Classification of Headache Disorders (ICHD-II, 2004).

The study by *Amorim and Valença*[14] noted that 15 of the 48 patients who developed postural headache could not be included as having post-spinal anesthesia headache, according to these criteria. The main reason for exclusion was the absence of symptoms accompanying postural-type headache.

In a similar study, *Vilming and Kloster*[15] prospectively evaluated 239 patients who underwent lumbar puncture and observed that 15% of patients with postural headache did not present symptoms associated with pain.

In case of doubt regarding the diagnosis of post-spinal anesthesia headache, other tests may lead us to confirm the clinical findings.

Diagnostic lumbar puncture may demonstrate low CSF opening pressure[10].

High dosage of CSF protein and an increase in lymphocyte count may also help us[10].

MRI may show: diffuse dural enhancement, with evidence of a flaccid brain; descent of the brain, optic chiasm and brainstem; obliteration of the basilar cisterns; and enlargement of the pituitary gland[10].

CT myelography, retrograde radionuclide myelography, cisternography, or thin-section MRI may be used to locate the spinal origin of the CSF leak[10].

5 DIFFERENTIAL DIAGNOSIS

We can see that the diagnosis of post-dural puncture headache is usually clear in the history of dural puncture and in the presence of severe postural headache.[10] However, we must first consider the possibility of alternative diagnoses[2], as severe intracranial pathology can mask itself as a post-dural puncture headache. Some authors even defend that its diagnosis can only be made after ruling out Other causes of headache[2].

These differential diagnoses include intracranial tumors, intracranial hematoma, pituitary apoplexy, cerebral venous thrombosis, migraine, chemical or infectious meningitis, psychogenic headache, migratory headache, tension headache, and metabolic changes.[2,10]

Furthermore, we must be aware that intracranial hypotension can lead to intracranial hemorrhage due to rupture of the bridging dural veins, and thus, the delay in diagnosis and treatment is dangerous.

6 RISK FATORS

6.1 NEEDLE TYPE

- Quincke is the needle with the highest frequency of CPR1. This occurs as a result of using the bevel transverse to the fibers leading to their section. This technique is widely used due to greater technical ease. It is advisable, when using these needles, to puncture the meninges with the bevel parallel to the longitudinal direction of the fibers. Thus, there will be a smaller section of these fibers, reducing trauma and loss of the CSF and, consequently, headache[1,2,10]

6.2 WHITACRE, SPROTTE E GERTIE MARX

We can reduce CSF leakage by using pencil point needles. This happens because they act by separating the fibers from the meninges instead of severing them. Consequently, this orifice will close more easily due to less trauma, thus reducing the incidence of post-spinal

anesthesia headache. Thus, we can say that this type of needle is the most suitable for patients at higher risk for headache [1,2,10]

6.3 ATRAUCAN

This type of needle leads to an incidence of post-procedural headache very close to Whitacre [1,2,10]

6.4 NEEDLE DIAMETER

It is one of the main factors in determining the incidence of post-spinal anesthesia headache. The diameter of the needle has a proportional relationship with the incidence, thus, the smaller the diameter of the needle, the lower the incidence of headache. [1,2,9.10]

This is precisely because of the size of the orifice formed after its application and, consequently, greater loss of CSF. [1,2,10]

Another explanation for the relationship between needle diameter and headache incidence is due to prior knowledge that the larger the diameter, the greater the probability of accidental puncture of the dura mater and, when this occurs, the chance of onset of post headache. spinal anesthesia rises to 75% to 80% of cases.[1]

6.5 NEEDLE ORIENTATION

Several studies reveal that needle orientation at the time of puncture is also related to the development or not of post-spinal anesthesia headache. Also, there is variation with the type of needle. Imbellone demonstrated that in Quincke-type models, punctures paramedian and parallel to the fibers of the dura mater cause a lower incidence of headache[2].

6.6 NUMBER OF PUNCTURE ATTEMPTS

The greater the number of spinal puncture attempts, the greater the incidence of this complication, as they allow greater extravasation and greater loss of the CSF[1,2,10]

6.7 PREVIOUS HEADACHE

There is no consensus among authors that prior headache is a risk factor for CPR. However, patients who report it in their past pathological history, in general, are considered at high risk, because When they present it, it is more intense or of longer duration[1]

6.8 DEHYDRATION

Dehydration state indirectly leads to decreased CSF production and favoring its hypotension.[1]

7 AGE

Some studies reveal that post spinal anesthesia headache is reported in pediatric patients in an incidence of 5% to 15% in this age group. This incidence, after the introduction of thin-diameter needles, is observed in the range of 0.3% to 5%, between 18 and 50 years.

It was revealed that it occurs more frequently in young adults, being the most affected age group, for some authors, between 20 and 29 years old, and for others, between 30 and 49 years old.[1]

In the elderly, it is less common. It is believed that this is due to the generalized loss of elasticity in the meninges, resulting in a smaller orifice after perforation, reducing the loss of CSF. [1]

7.1 SEX

There is disagreement between authors. While some studies find a similar frequency between both sexes, others point to a higher frequency in women [1,2,10]

7.2 PREGNANCY

Most studies report that pregnancy is one of the most frequent risk factors for this type of headache [1,2,10].

Therefore, several measures can be used to prevent the occurrence of post spinal anesthesia headache.

The use of thin-diameter needles, pencil point needles, parallel puncture, reduced number of arachnoid puncture attempts are essential measures to prevent post-spinal anesthesia headache, especially in patients at high risk for developing it.[1,2, 9,10]

The traditional measure of keeping the patient on bed rest for 24 hours in the supine position and without a pillow has not shown any efficiency in preventing post-spinal anesthesia headache, although the adoption of this practice can delay the onset of symptoms.[2] The adoption of this protocol by 4, 12 or 24

hours after surgery did not reveal any relationship with the incidence of headache, even in obstetric patients[2]. In fact, some centers recommend resting in the supine position for up to 24 hours as a prophylaxis for post-spinal anesthesia headache, and in addition to being an ineffective measure [9,10], on certain occasions, as obstetric patients it is harmful because it prevents mothers from feeding and caring for their children, making it a distressing experience and hindering the early initiation of breastfeeding, which is fundamental for promoting the bond between mother and child[3]. Thus, the post spinal anesthesia protocol for cesarean should be relaxed by anesthesiologists and obstetricians to increase the comfort of the mother and newborn.[3]

8 TREATMENT

Generally, the cure takes place spontaneously in up to 7 days without the need for drug intervention.

Thus, the initial indication is only for conservative measures such as supportive treatment[2,16]. Symptoms are relieved in the supine position, however the incidence does not change, it only postpones the onset of symptoms[2].

Various therapies have been proposed such as analgesics, non-steroidal anti-inflammatory drugs, steroids, acid, abdominal compression, and forced hydration. However, none of these treatments proved to be really effective[2]. Therefore, supportive treatment is still recommended, consisting of rest, analgesics and/or non-steroidal anti-inflammatory drugs, antiemetics and hydration in order to try to control the symptoms, although they do not provide complete relief and reduce the need for a more aggressive therapy.

More recent studies investigate possible new therapies that go beyond supportive care. Basurto, Osorio and Bonfill evaluated the use of medications such as caffeine, sumatriptan, gabapentin, hydrocortisone, theophylline, adrenocorticotropic hormone, pregabalin and cosyntropin. [8]

Caffeine has been shown to be effective in the treatment of post-spinal anesthesia headache, decreasing the proportion of participants with persistent PDPH. Gabapentin, hydrocortisone and theophylline have been shown to decrease pain severity scores when compared to conventional treatment. There is no conclusive evidence for the other medications evaluated (sumatriptan, adrenocorticotropic hormone, pregabalin and cosyntropin).[8]

More accepted alternative treatments for headache such as the use of caffeine, gabapentin, hydrocortisone, theophylline, blood plug and saline solution seem to alleviate symptoms in some cases, but there is no indication for their routine use.

8.1 PSYCHOLOGICAL SUPPORT

It is important to discuss the possibility of headache before performing this procedure, although this discussion will not prepare the patient for the sensations they will feel if the headache develops [2].

It is important to give these patients a full explanation of the reason for the headache, the expected prognosis, and the available therapeutic options.

Obstetric patients who develop this complication are unhappy because it prevents them from taking care of their baby.[2,3]

8.2 POSTURE

Patients who develop post-spinal anesthesia headache should rest in the supine position to improve algesia. Most of the time the patient himself will have identified this. However, there is no clinical evidence to support the maintenance of the supine position before or after the onset of headache as a form of treatment or prophylaxis, serving only as supportive care. [2.9.10]

8.3 HYDRATION

Additional hydration aimed at restoring the lost CSF volume has been advocated over time as a therapy for post-puncture headache. Excessive hydration increases the urinary flow and forces the patient to walk to empty the bladder, thus being an inconvenience for the patient[2]. Lately, this therapeutic measure is no longer used.

8.4 CAFFEINE

Post-spinal anesthesia headache results in part from dilation of intracranial veins.[2,9,10]

Caffeine, being a methylxanthine, can act by increasing cerebral vascular resistance and decreasing blood flow through a direct action on the arteriolar muscles[2]. The use of caffeine as a treatment for post- puncture headache suggests that vascular distension, especially of the

intracranial arteries at the base of the brain, is the cause[2]. Therefore, caffeine relieves headaches by reflexively reversing cerebral vasodilation.

Some studies have demonstrated the efficacy of intravenous caffeine sodium benzoate in reducing cerebral blood flow in patients with post-puncture headache[12]. Another study, this time with 41 patients, 500 mg of caffeine was effective in the treatment of post-puncture headache when compared to placebo[13].

It should be noted that the use of caffeine can cause side effects as it has cardiovascular, muscle and central nervous system action[2].

The intravenous use of sodium caffeine benzoate is cheaper and easier to be performed than the administration of blood buffer, and at the recommended doses it did not cause adverse effects[2,12].

8.5 SUMATRIPTAN

Sumatriptan is a serotonin 5HT receptor agonist, promoting cerebral vasoconstriction similar to caffeine[2, 10].

Sumatriptan is recommended for the treatment of migraine and, more recently, for post-dural puncture headache. However, there are few case reports in which sumatriptan was used successfully to control post-dural puncture headache[10]

8.6 EPIDURAL BLOOD PATCH

The injection of blood fluid into the epidural space in order to close the puncture orifice was proposed by *Gormley* in the 60s, after pain relief in seven patients, including himself[2].

This therapeutic measure has its use suggested when the headache is moderate, severe or prolonged, not being recommended in other conditions[2].

Its method consists of forming a plug filling the dura mater, stopping the loss of CSF and simultaneously reducing the subarachnoid space by expanding the epidural space, eliminating the relative deficiency of CSF2.

The volume of blood tested ranged from 2 to 20 ml. It is known that increasing the volume of injected blood increases the effectiveness of the technique. Headache remission occurred in 98.3% within the first four hours after the swab with 10 ml of autologous blood and all patients were discharged within 24 hours[2].

The success of blood plugging seems to be well established, especially in accidental dural punctures with large-bore needles. *Imbelloni's* studies failed to clarify whether the blood patch should be performed early or even prophylactically[2]. In *Turnbull's* study, it is argued that the use of prophylactic blood plug after accidental dural puncture is a good option[10]e, it brings us a controlled trial in a group of patients with post myelogram headache and another post spinal anesthesia that confirms the benefit of prophylactic use of blood plug[10]

A study was carried out which demonstrated the effects of carrying out the blood plug. Through the use of magnetic resonance it was revealed that, from thirty minutes to three hours, the clot compresses the dural sac causing the deviation of the medullary cone and the cauda equina. The clot occupied four to five vertebrae and seven hours later, the mass effect had disappeared. Blood packing must be performed one or two segments below the original puncture, in the same space or in the space immediately above the perforation[2].

8.7 EPIDURAL SALINE INJECTION

Epidural administration of saline solution for post-spinal anesthesia headache relief precedes the use of a blood pack[2]. In 1950 it was reported that 99.5% of patients had immediate relief from post-spinal anesthesia headache by injecting an average volume of 82 ml of saline solution via the caudal or lumbar epidural route. It turned out that the magnitude and duration of this effect depended on the volume, velocity and injection site.

However, one study revealed that the introduction of 30 ml of saline solution into the patient's epidural space was less effective than the administration of 10 ml of autologous blood (blood buffer)[2].

In theory, an epidural injection of saline solution would produce the same mass effect as the blood plug and would prevent persistent loss of CSF while the dura mater was repaired[10]. As saline is a relatively inert and sterile solution, the injection or infusion of epidural saline seems to be a good alternative.

However, observations of pressures produced in the subarachnoid and epidural space show that, despite a large increase in epidural pressure, the consequent increase in subarachnoid pressure maintains differential pressure in the dura. The pressure rise is also not sustained and dissipates within 10 min[10]. There are no studies that are able to demonstrate a sustained increase in CSF pressure or accelerated closure of the dural perforation after the administration of

epidural saline solution. Thus, it is difficult to conclude from the evidence, therefore, that epidural saline administration will restore normal CSF dynamics[10].

9 DEXTRAN PERIDURAL

The use of 20 to 30 ml of dextran 40 was used[2] in a study for the treatment of spinal headache in 56 patients. Complete symptom relief occurred in all patients quickly, about two hours, without major complications. These findings have been proven as a prophylactic measure in post-puncture headache.[2]

Turnbull's study, on the other hand, shows us that the use of epidural Dextran is scarce in evidence to be recommended[10]. Studies recommending Dextran 40 conclude that the high molecular weight and viscosity of Dextran 40 are slower, so the sustained tamponade around the dural perforation allows for spontaneous closure. However, Dextran 40 is unlikely to act differently from saline injection into the epidural space. Any increase in pressure within the subarachnoid space, like saline solution, would only be transient. Histological inspection of the epidural space after administration of Dextran 40 does not demonstrate any type of inflammatory response that promotes the healing process. Evidence for epidural administration of Dextran in the treatment of post dural puncture headache is unproven and the theoretical argument to justify its use is poor[10].

9.1 SURGERY

There are case reports of persistent CSF leaks that did not respond to any type of therapy, being successfully treated by surgical closure of this dural perforation. This should be the last resource to be used[10].

10 CONCLUSION

Although spinal anesthesia has been used for over a century, post-spinal anesthesia headache remains a cause of morbidity for patients. The emergence of pencil point needles (Whitacre, Sprotte and Atraucan) and techniques such as paramedian introduction and parallel to the dura mater fibers in the use of needle with cutting bevel (quincke) helped in a lower incidence of headache.

Thus, prior knowledge of the risk factors for the development of this complication and the adoption of measures to prevent it, lead us to the correct choice regarding the material for the puncture and its techniques, especially in cases of patients at high risk for develop them.

Post-spinal anesthesia headache is a complication that should not be neglected given its morbidity and increased hospital stay. In the vast majority of cases, your healing will take place spontaneously.

Psychological support is essential. The presence of the anesthesiologist at the patient's side representes a security, contributing to definitively end the existing taboos and prejudices with spinal anesthesia.

There are several drug therapies, although the vast majority do not have reliable levels of evidence for their use. Patients with more severe headaches or those that are not relieved by conservative methods may resort to alternative treatments, among which the use of blood buffer and caffeine stands out. Gabapentin, hydrocortisone, and theophylline have been shown to decrease pain severity scores.

There is no conclusive evidence for the use of saline, epidural dextran, sumatrypan, adrenocorticotropic hormone, pregabalin and cosyntropin.

Ultimately, surgery to close the dural perforation can be recommended for these patients.

It is clear that the management of each case depends on its clinical characteristics and also on the exclusion of differential diagnostic hypotheses. Therefore, knowledge of clinical manifestations, risk factors, prevention and conventional as well as alternative treatment is essential for therapeutic success.

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