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Review

# Best time for the application of the "blood patch" technique for post-spinal anesthesia headache: a systematic review

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**Introduction**
With the puncture of the dura mater during spinal anesthesia, excessive cerebrospinal fluid (CSF) leakage can occur, leading to intracranial hypotension and, consequently, post-dural puncture headache. Currently, there are symptomatic supportive treatments, but they do not provide complete relief. The epidural blood patch has emerged as a treatment option with proven success, but there are still questions about the best timing for its use.

**Objective**
To identify the best timing for the application of the epidural blood patch.

**Method**
Systematic review of clinical trials and randomized clinical trials on PubMed from 2000 to 2023.

**Results**
The review of the articles covers various topics on the use of the blood patch, including its effectiveness, comparison with conservative treatment, volume applied, timing of application, duration of supine positioning due to pain incapacity, and needle size. However, data regarding the timing of application were not extensively highlighted.

**Conclusion**
It was not possible to accurately determine the best timing for the application of the technique due to the lack of data, but its effectiveness is well-known, requiring further studies to better prescribe this treatment.

**Keywords:**
Headache
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## Introduction

Spinal anesthesia is a technique that blocks the neuroaxis, where the anesthetic is injected into the subarachnoid space, which contains cerebrospinal fluid (CSF). The puncture site is usually between the L3/L4 or L4/L5 spaces to avoid perforation of the conus medullaris, whose final third is located at the T12-L3 level, according to anatomical variations. The procedure is performed with the patient seated and the spine flexed, followed by asepsis of the back, palpation of the puncture site, placement of sterile drapes and administration of a local anesthetic. Afterward, the spinal needle is introduced until it penetrates the dura-arachnoid membrane, the site where the anesthetic will be injected. The most commonly used drugs are lidocaine, bupivacaine and ropivacaine. Spinal anesthesia is indicated for short-duration surgeries involving the lower abdomen, pelvis and lower limbs (1).

With the puncture of the dura mater during spinal anesthesia, excessive CSF leakage may occur, leading to intracranial hypotension and consequently, post-dural puncture headache (PDPH) (2). The incidence of PDPH can be as high as 25% (varies according to studies) depending on the type of needle, the operator's skill level and fatigue; it is the most common complication of spinal anesthesia (1). The condition may be accompanied by symptoms such as nausea, photophobia, tinnitus and pain at the puncture site. Currently, symptomatic medications are used for treatment, but they do not provide complete relief and may take days for the pain to fully subside (3).

In this context, a new technique has emerged to treat these cases, the epidural blood patch (EBP). The technique involves withdrawing approximately 20 ml of blood from the patient's arm and re-injecting it at the site of the spinal anesthesia puncture. This forms a blood plug, preventing the leakage of cerebrospinal fluid and causing a permanent increase in subarachnoid and epidural pressures, leading to the disappearance of the headache, in some cases even spontaneously. To date, its success rate ranges from 70-98% (3), but there are no studies identifying the most appropriate and optimal time for the application of this technique. Thus, due to the high incidence of PDPH and the proven effectiveness of this practice, it is crucial to discuss this topic in order to determine the most effective timing for EBP application.

## Objective

The effectiveness of the blood patch technique for post-spinal anesthesia headache is already well-established (3), but there are no studies addressing the most optimal timing for performing this practice. Therefore, the objective of this study is to identify the best timing to enhance the effect of this technique.

## Methodology

For this study, a search was conducted in PubMed to identify articles that report the timing of blood patch application and its effectiveness, using the following keywords: ((headache) OR (post puncture headache) OR (headache due to CSF hypotension) OR (headache after cranial hypotension)) AND (spinal anesthesia) OR (lumbar puncture) AND (blood patch). Only Clinical Trials and Randomized Clinical Trials from 2000 to 2023 were selected, yielding 31 results. Twenty-four articles were excluded based on the Abstract for the following reasons: 10 articles compare the effectiveness of other methods and only mention the blood patch as the gold standard (1, 4, 5, 7, 8, 17, 18, 22, 23, 25), 1 compares only the volume of autologous blood applied (3), 6 compare only the needle size in the application (11, 12, 13, 14, 28, 29), 3 compare two types of anesthesia and only mention the blood patch as a treatment option (2, 26, 31), 1 is about the use of blood patch post-other procedures - craniotomy (20) and 3 do not mention the blood patch in the abstract (24, 27, 30). Following this, the remaining 7 articles were read in full. Two additional articles were excluded: 1 could not be fully accessed (10) and 1 was the description of the initial project (17) of a previously selected article, with only the study with results being included in the research (6).

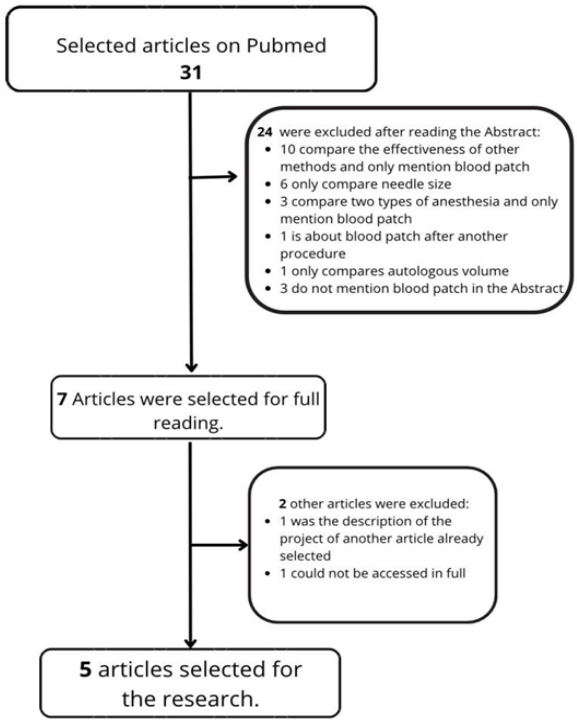


Figure 1. Diagram of the article selection process

## Results

Van Kooten et al. (4) conducted a study with 40 patients who underwent spinal anesthesia and experienced headaches after the procedure. As soon as they showed the symptom, they were referred to a neurologist to confirm the diagnosis and assess its severity. Other factors evaluated included age, sex, headache history, and the size of the puncture needle. Then, between 24 hours and 7 days, they were randomized into 2 groups: one considered active (19 participants), with the application of a blood patch, and the other considered control (21 participants), with conservative treatment (increased fluid intake and bed rest). The patients were reassessed after 24 hours and 7 days from the start of treatment to identify any improvement or worsening and to quantify the intensity of pain. Of the 19 patients in the active group, 11 still had headaches after 24 hours, and only 3 had mild pain after 7 days; thus, it was fully effective in 84.2% of the patients. Of the 21 patients in the control group, 19 still had headaches after 24 hours, and 18 still had them after 7 days; complete relief during this period occurred in only 14.28% of the patients. It was concluded that the treatment promotes complete resolution in most patients or significant reduction to the point of resuming their daily activities, and is recommended for post-puncture headaches.

Paech et al. (5) conducted a study with 121 pregnant women comparing the amount of autologous blood applied after the onset of post-puncture headache. The patients were divided into 3 groups: 41 received 15ml, another 41 received 20ml, and 39 received 30ml. The results were similar and better for those who received 20ml and 30ml. Regarding timing, 80 patients received the application 48 hours after the onset of symptoms and 41 before 48 hours; those with the later application had the best results. The participants were followed for five days and assessed for the persistence of pain and its severity, as well as the final outcome of pain reduction or cessation. Excluding patients with significant differences in symptoms ($P = 0.048$), the overall effectiveness of the three different volumes applied was 66.97%, with the 20ml group showing the best results at 73.2%. The authors also note that the application of larger volumes is associated with a higher incidence of lower back pain. Another important finding is that the treatment's effectiveness is lower in the obstetric population, possibly due to physiological changes during pregnancy and the postpartum period. With this study, the authors have not yet determined the ideal volume and timing for the best results of the technique and emphasize that the results obtained may not be applicable to the non-obstetric population.

Safa-Tisseront et al. (6) conducted a study with 504 patients who experienced post-puncture headaches and received a blood patch. Other associated factors were also evaluated, such as sex, age, weight, duration of symptoms, ocular and vestibulocochlear symptoms, needle size, and volume. The volume applied was at least 20ml, at a rate of 0.3ml/s; if lumbar pain occurred, an additional 2 ml was injected and then the procedure was stopped. The application was made between 1 and 10 days after the onset of symptoms, depending on the pain intensity and service availability, with the median being on the 4th day. Those who received the treatment earlier (between the 1st and 2nd day) were the patients who reported higher pain intensity, with 9% experiencing failure and 30% having incomplete relief. The worst results were recorded on the 3rd day, with approximately 12% failure. In total, 75% achieved complete relief, 18% had partial relief, and 7% experienced failure. It was concluded that the effectiveness of the blood patch application was 93%, with the failure rate being more related to the larger needle size.

Vilming et al. (7) evaluated 79 patients with post-puncture headaches. They were divided into 5 groups based on how long each patient remained in the supine position during a 24-hour period, depending on the intensity of the pain. Group 1 barely lay down, Group 2 lay down for less than half the day, Group 3 lay down for half the day, Group 4 lay down for more than half the day, and Group 5 remained lying down for almost the entire day. In the study, the blood patch was applied between the 2nd and 4th day, with the best results occurring on the 2nd day, showing only a 4% failure rate. However, it was not possible to determine the effectiveness percentage of the treatment on the 3 days of application, as the study only described the number of days the patients experienced pain, not the number of patients with symptoms. Additionally, the study notes that the use of this technique is not recommended within the first 24 hours by anesthesiologists due to a higher perceived risk of failure. It was concluded that the blood patch is indicated for patients who require supine position for more than half the day, as it shows greater efficacy and ease when applied between 24 and 48 hours after the puncture.

Hachimi et al. (8) evaluated 21 patients who received a blood patch for post-puncture headaches, with the aim of determining whether or not supine positioning was necessary after the procedure. The blood patch was indicated for patients who still had pain after 48-72 hours of clinical treatment (paracetamol, increased fluid intake, and bed rest). A total of 20ml of autologous blood was applied to the epidural space in 19 patients, while 16ml and 18ml were applied to the other two patients due to the onset of lower back pain. All patients experienced immediate pain relief and were able to stand up right away. It was concluded that there is no need to remain in the supine position after the blood patch application.

## Discussion

Analyzing the five articles reviewed, it is possible to infer that the highest failure rates are associated with the use of larger needles in spinal anesthesia, higher pain intensity, and longer time intervals before the application of the blood patch. Each study used a different time interval and classification for the effectiveness of the treatment, which are consolidated in Table 1.

Table 1 Overall effectiveness of the blood patch

| Author | n | Time | Result (%) |
|---|---|---|---|
| Van Kooten et al. (4) | 19 | 24h - 7 days | 84.2 |
| Paech MJ et al. (5) | 121 | <48h or >48h | 66.9 |
| Safa-Tisseront et al. (6) | 504 | 1 - 10 days | 93 |
| Vilming et al. (7) | 79 | 2 - 4 days | NR* |
| Hachimi et al. (8) | 21 | 48 - 72h | 100 |

*NR as no result can be inferred from the data presented.

The table demonstrates the percentage of treatment effectiveness amidst some adversities, with results that were not explicitly stated in the studies being calculated; except for those by Vilming et al. (7), as they only provided data regarding the number of days patients experienced headache, not the number of patients with this symptom.

Unfortunately, the studies do not provide information on how many blood patch applications were made on each day of the research, only a final overall number. Only Vilming et al. (7) indicate that the best results occurred around 48 hours, but it was not possible to obtain values or compare them with the other days; it also reiterates that the procedure is not recommended within the first 24 hours by anesthesiologists. Safa-Tisseront et al. (6) concluded that the worst results occurred on the 3rd day, but the highest pain intensities were also observed in the first days after the dural puncture, and it was noted that the larger needle size negatively affected its effectiveness. For Hachimi et al. (8), the applications were also performed 48-72 hours after the onset of symptoms, and all patients experienced complete and immediate relief. In the study by Van Kooten et al. (4), the intervals between applications were even longer, ranging from 24 hours to 7 days, and the number of interventions per day was not reported.

The reviewed articles align with the idea that applications should be made after 24 hours of the initial procedure, as earlier applications are associated with a higher percentage of failure.

Another important point is that everyone noticed better results with earlier applications, between 48 and 72 hours. However, these results were not quantified, only observed and described. The only study that contradicts this stance is that of Paech et al. (5), which identified 20 ml and 30 ml volumes with higher resolution rates, with the best results obtained after 48 hours. While not explicitly stating numerical quantities, it does caution that this may not be applicable to the non-obstetric population.

## Conclusion

After analyzing the articles, the effectiveness of the blood patch for headache following dural puncture is clearly evident. Unfortunately, it was not possible to precisely determine the optimal timing for the application of the technique, only that the first few days are associated with greater pain relief, which was observed but not documented. It is concluded that further studies should be conducted to clarify the most effective timing for blood patch application, thus resolving the uncertainty among many professionals regarding when to prescribe this treatment.

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