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# Epidural injection with saline for treatment of postspinal headache: comparison with epidural blood patch

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## Introduction

Postspinal headache (PSH) is among the important complications of spinal anesthesia [1] and can lead to a longer period of hospitalization. Epidural blood patch (EBP) has been reported to be an effective treatment in about 60%–90% of postdural puncture headaches [2–4]. Although EBP is a recognized treatment for PSH [5–7], this treatment has been associated with complications such as paresthesia, back pain [3], spinal subdural hematoma [8], and others [9]. In addition, we successfully treated a Jehovah's Witness with postspinal headache with a bolus of saline followed by continuous infusion into the epidural space. Bart and Wheeler [10] demonstrated that bolus epidural injection of saline had a lower success rate than EBP therapy for PSH. To our knowledge, no study has demonstrated the efficacy of epidural saline infusion (ESI) following bolus injection in treating postspinal headache. The purpose of this study was to compare the efficacy of ESI with that of EBP therapy for PSH.

## Patients and methods

After institutional approval and informed consent had been obtained, patients with a diagnosis of postspinal headache (i.e., intense postural headache >48 h, and no sign of infection) and a desire for active treatment were entered into the study during a prospective period of approximately 2 years. Patients were randomly assigned to receive either EBP therapy or ESI. The cause of the headache was spinal anesthesia in all patients. Spinal anesthesia using 0.24% dibucaine dissolved by *p*-butylaminobenzoyl diethylaminoethyl hydrochloride (Neo-percamin S) had been performed, at the L3–4 interspace, with the patient in a left decubitus position with the use of a 23 or 25 G spinal needle. More than one puncture attempt was required to perform spinal anesthesia in one patient. The surgical procedures of the patients were ceasarean section (two patients in EBP and two patients in ESI), appendectomy operation (four patients in EBP and five patients in ESI), and stripping of varix (two patients in EBP and one patient in ESI).

All procedures were done in the operating room under the monitoring of electrocardiography, noninvasive blood pressure, and pulse oxymetry. The patients in both groups were placed in the left lateral decubitus position, an 18 G Tuohy needle was inserted at the L4–L5 interspace, and the loss of resistance technique with 0.9% saline solution was applied to confirm that the needle tip had reached the epidural space. Then, in the EBP group, 10 to 15 ml of blood was withdrawn in an aseptic manner from veins on the dorsal and lateral aspect of the right foot and was slowly injected into the epidural space. In the ESI group, after 15 to 20 ml of 0.9% saline had been injected aseptically through the needle into the epidural space, an epidural catheter was inserted 3 cm cephalad for 3 h of continuous infusion of saline at 20 ml·h$^{-1}$. Subsequently, the patients remained at least 3 h in the supine position. If the patient complained of any symptoms during the epidural injection of saline or blood, this injection was ceased immediately.

Headache intensity was assessed by the patients using a Visual Analogue Scale (VAS), with 0 cm = none to 10 cm = worst pain imaginable, and was recorded by nurses 5 min after the patient assumed a sitting position at pretreatment, 15 min, 3 h, and 24 h after the epidural

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**Table 1.** Demographic data

| Variable | EBP group ($n = 8$) | ESI group ($n = 8$) |
|---|---|---|
| Age (yr) | 29.6 ± 9.8 | 29.1 ± 8.7 |
| Weight (kg) | 52.9 ± 9.7 | 54.1 ± 11.6 |
| Height (cm) | 152.7 ± 16.2 | 153.1 ± 18.6 |
| Male/female ($n$) | 1/7 | 0/8 |
| Spinal needle ($n$) | | |
| 23G | 1 | 1 |
| 25G | 7 | 7 |
| Interval: anesthesia to treatment of PSH (days) | 3.9 ± 1.1 | 3.6 ± 1.3 |

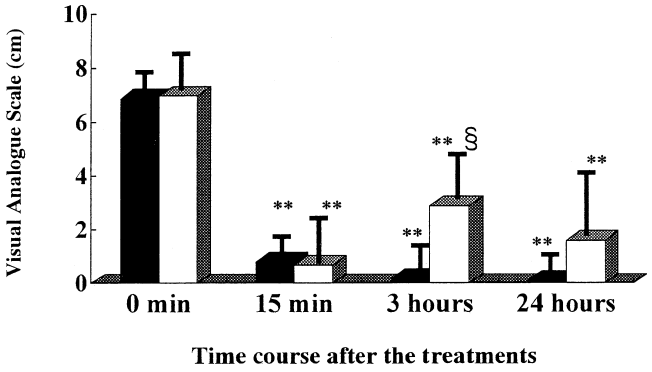


**Fig. 1.** Changes over time in the mean Visual Analogue Scale (VAS) of PSH after treatment with epidural blood patch (EBP) (*solid bars*) or epidural saline infusion (*open bars*) (ESI). *Bars* indicate SD. $^{**}P < 0.01$ *vs* pretreatment. $\S P < 0.05$ *vs* EBP group

**Table 2.** Difference in complications between epidural injection of blood and saline

| Variable | EBP group ($n = 8$) | ESI group ($n = 8$) |
|---|---|---|
| During epidural injection | | |
| Dysesthesia | 4 | 5 |
| 24 h after treatment | | |
| Back pain | 6* | 1 |

$^{*}P < 0.05$ *vs* ESI group

injection. A VAS score less than 1.0 cm 24 h after epidural injection was considered to indicate successful therapy for PSH in both groups.

VAS scores were presented as means ± SD. Comparisons between EBP and ESI using the VAS at each point were made by Mann-Whitney's U test. Serial changes in VAS data were analyzed with repeated-measures analysis of variance. Data on success rates 24 h after treatment and side effects of the epidural injections were analyzed by the Fisher test for exact probability. $P < 0.05$ was considered to indicate statistical significance.

## Results

Sixteen patients, eight per group, were enrolled in this study. The mean ages in the EBP and ESI group, at the time of this study, were 29.6 ± 9.8 years (range, 48–16) and 29.1 ± 8.7 years (range, 41–18), respecively. There were no differences in the demographic data (Table 1).

The time courses of the mean VAS scores are shown in Fig. 1. The VAS scores before treatment were not significantly different between the groups (6.9 ± 0.9 cm for EBP and 7.0 ± 1.3 cm for ESI; $P = 0.462$). All patients in both groups had experienced dramatic, complete or nearly complete relief of PSH immediately after treatment. There were significant decreases in the mean values of VAS when pretreatment values were compared with values at 15 min, 3 h, and 24 h. There were no significant differences between the two groups in VAS values at 15 min (0.83 ± 0.8 cm for EBP and 0.69 ± 1.0 cm for ESI, $P = 0.462$) and 24 h (0.13 ± 0.4 cm for EBP and 1.63 ± 2.8 cm for ESI, $P = 0.344$). However, the mean VAS value in the EBP group was lower than that in the ESI group 3 h after treatment (0.2 ± 0.6 cm for EBP and 2.9 ± 1.7 cm for ESI, $P = 0.002$). Two of the eight patients in the ESI group had recurrent PSH (those patients showed 5.8 and 5.0 cm on the VAS, respectively) and were thereafter administered EBP and achieved permanent relief. Thus, the success rate was 100% for EBP and 75% for ESI, with the difference not significant ($P > 0.05$).

Dysesthesia of the lower extremities occurred during the epidural injections in four of the EBP patients and five of the ESI patients; the symptoms were transient and ceased immediately after the injection. Back pain at 24 h after the treatment was experienced by six patients in the EBP and one patient in the ESI group ($P = 0.04$). No other side effects were detected in either group during or after the treatments (Table 2).

## Discussion

It is generally accepted that PSH results from continued leakage of cerebrospinal fluid (CSF) through a dural tear [5–7]. EBP is a widely used technique to treat PSH with a high success rate of 60% to 91% [2–4]. Some reports, however, have described the successful treatment of dural puncture headache with ESI after failed EBP [11–13]. Our study demonstrated that the combination of epidural injection and infusion of saline relieved PSH in 75% of patients, which was a lower rate of success than with EBP (100%).

The present study showed two important results of interest to anesthesiologists. The first is that PSH in all

patients ceased promptly after the initial treatment. The prompt relief of PSH is thought to result from the injected volume of saline or blood into the epidural space, which increased the pressure in the subarachnoid space. This increased pressure forces CSF inside the cranium and restores normal intracranial pressure [14]. Indeed, epidural injections of 10 ml of local anesthetic transiently increase CSF pressure [15]. Although the disappearance of PSH in the ESI group was transient in some cases and PSH recurred 3 h after treatment, the degree of PSH at that point was much less, with a mean VAS score of 2.9 cm, than at pretreatment. In six of eight patients in the ESI group, PSH continued to gradually improve and resolved completely or nearly completely by 24 h after treatment. This gradual, but certain, improvement of PSH during and after continuous infusion with saline into the epidural space is thought to be due to another mechanism, in which saline injected epidurally would permit dural edema and facilitation of physical apposition of the edge of the puncture site to heal the dura [6].

The second result is that back pain 24 h after treatment was less in the ESI than in the EBP group. Back pain after EBP appeared to occur in 20%–35% of patients, with an average duration of 27 days [16]. The mechanism of back pain remains unclear, but extensive subcutaneous hematoma, nerve root compression by extradural clots, and subarachnoiditis resulting from spread of blood into the subarachnoid space may be causative factors [17]. Therefore, it is reasonable that epidural administration of saline reduced the frequency of back pain after treatment in comparison with EBP.

It has been reported that neurological complications, such as paresthesia, back pain [6], spinal subdural hematoma [8], and others [9], are likely to occur during and immediately after the EBP procedure. In a recent study utilizing MRI technology, Beards et al. [17] demonstrated in symptomatic patients that EBP caused a compression over the dural sac and the nerve roots, by which some neurologic complications occurring after the EBP procedure may be caused. Therefore, it is possible that the injection of a large volume of saline could induce complications during or after the treatment. The optimal volume of saline injected into the epidural space is unknown at present for the treatment of PSH without any complications. Baysinger et al. [11] reported that two patients were treated successfully with 30–50 ml of saline infused epidurally over 10 min without any significant complications. Stevens et al. [12] also demonstrated successful treatment of PSH with ESI after failure of EBP and stated that the epidural infusion of large volumes of saline likely to cause complications should be avoided. In our study, injection of 15–20 ml of saline into the epidural space was carried out carefully with periodic monitoring for symptoms, and continuous infusion of saline at 20 ml·h$^{-1}$ was performed subsequently through an epidural catheter. In this study, any symptoms that occurred during the epidural injection of saline were transient and ceased immediately after the epidural injection. Therefore, we believe that 15–20 ml of saline injected into the epidural space should be a relatively safe and effective volume for prompt relief of PSH if careful attention is given during the epidural injection to detect symptoms.

In conclusion, our results demonstrated that ESI resolved PSH in 75% of patients, which is less than the 100% success rate with EBP, and that back pain after treatment with ESI was significantly less than with EBP. These data suggest that ESI followed by infusion is relatively efficacious for PSH without any complications. We consider that ESI is an alternative strategy to EBP for PSH.

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