



# Evaluation of affecting factors and the effectiveness of treatment in cases with post-dural puncture headache who underwent epidural blood patch

## *Epidural kan yaması uygulanan dural-punksiyon sonrası baş ağrısı olgularında etkileyen faktörler ve tedavi etkinliğinin değerlendirilmesi*

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### Summary

**Objectives:** We evaluated post dural puncture headache (PDPH) cases and the contributing factors and monitored the treatment response with epidural blood patch (EBP), and other therapies.

**Methods:** In this retrospective study, 77 PDPH cases treated with EBP were included. Patients were evaluated in terms of age, gender, type of surgery, type and diameter of the needle used for dural puncture, number(s) of dural puncture, onset of punctural headache, any conservative therapies for PDPH, number(s) of EBP application, analgesia quality at the 10th minute and 2nd hour after EBP application, and radicular pain during procedure.

**Results:** The mean age of 77 patients (46 female, 31 male) was  $31.5 \pm 11.3$ , and the most common surgery performed was cesarean section. More than one attempt was applied in 48 patients. In 37 cases, a 22G spinal needle was used, while a 25 G spinal needle was used in 20 cases. The mean duration of the headache was  $3.1 \pm 1.3$  days for female patients and  $4.6 \pm 2.3$  days for male patients ( $p=0.020$ ). VAS significantly decreased and patient satisfaction significantly increased after the 10th minute in patients who had EBP ( $p=0.001$ ). In only one case (2%), the second EBP was needed for pain relief. Transient radicular pain was observed in 17 cases (22.07%) at administration of EBP.

**Conclusion:** In PDPH cases, EBP is an effective and relatively safe method, especially in obstetric patients. We reported that the PDPH symptoms presented earlier in female patients. A preference of a small diameter needle (less than 22 G) and avoidance of multiple attempts is important for spinal anesthesia.

Key words: Epidural blood patch; post dural puncture headache; radicular pain; surgery.

### Özet

**Amaç:** Dural punksiyon sonrası baş ağrısı (DPSB) olguları, katkıda bulunan faktörler, epidural kan yaması (EKY) tedavisi ve tedaviye yanıtları değerlendirildi. Bu çalışmada amacımız EKY uygulanan DPSB olgularını incelemektir.

**Gereç ve Yöntem:** Bu geriye dönük çalışmada, EKY uygulanmak suretiyle tedavi edilen 77 DPSB olgusu dahil edildi. Olgular yaş, cinsiyet, geçirilen operasyonun tipi, kullanılan iğnenin tipi ve çapı, spinal girişim sayısı, EKY uygulaması sırasında radiküler ağrı, sonrasında analjezi kalitesi ve olgu memnuniyeti açısından değerlendirildi.

**Bulgular:** Yetmiş yedi olgunun (46 kadın, 31 erkek) yaş ortalaması  $31.5 \pm 11.3$  ve en yaygın yapılan cerrahi sezaryan idi; 48 olguda birden fazla girişim yapılmıştı, 37 olguda 22 G, 20 olguda 25 G spinal iğne kullanılmıştı. Baş ağrısı süresi kadın hastalarda ortalama  $3.1 \pm 1.3$  gün, erkek hastalarda  $4.6 \pm 1.3$  gündü ( $p=0.020$ ). EKY uygulanan olgularda 10. dakikadan itibaren VAS anlamlı derecede azalırken, olgu memnuniyeti anlamlı olarak arttı ( $p=0.001$ ). Sadece bir (%1.29) olguda iki defa EKY'ye ihtiyaç duyuldu. Geçici radiküler ağrı EKY yönetiminde 17 olguda (%22.07) oldu, ancak 5-10 dk içinde geriledi.

**Sonuç:** DPSB'li olgularda EKY özellikle obstetrik olgularda etkin ve güvenilirdir. DPSB semptomlarının kadın hastalarda daha erken görüldüğünü saptadık. Spinal anestezi uygulamalarında 22 G'den daha küçük çaplı iğneler tercih edilebilir ve birden çok denemeden özenle kaçınılabilir.

Anahtar sözcükler: Epidural kan yaması; dura punksiyonu sonrası baş ağrısı; radiküler ağrı; cerrahi.

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## Introduction

Post dural puncture headache (PDPH) is still a considerable problem concerning anesthesiologists although it has been more than 100 years since its definition. It is one of the most common complications of neuroaxial anesthesia.<sup>[1]</sup>

PDPH was recognised after first spinal anesthetic in 1898 by Bier and his surgical resident Hildebrandt, who performed spinal anesthesia on each other.<sup>[2]</sup> There has been a significant decrease in the incidence of PDPH after the improvement of the pencil-point needles by Whitacre in 1951. Epidemiology, pathophysiology, clinical symptoms and treatment has improved since earlier 1898's.<sup>[2]</sup> PDPH is seen approximately 40% of the cases in which has dural perforation. Headache typically occurs 24-48 hours after the procedure and lasts for approximately 12 days. In some cases it has been reported that duration of headache lasts for months or even for more than a year. The headache in PDPH cases were localised to the frontal region, sometimes spreaded to occipital region, or both. In addition patients complain of nausea-vomiting, auditive and ocular symptoms, including tinnitus, vertigo, diplopia. The clinical statement sometimes can be accompanied by stiffness of neck and regional paresthesia.<sup>[3]</sup>

Conservative therapy and bed rest is the first choice of therapy in PDPH. Treatments include caffeine, paracetamol, sumatriptan and adrenocorticotrophic hormone, but there is little evidence to support their use. Applying epidural saline, blockage of occipital nerve, normobaric and hyperbaric oxygen therapy, epidural dextrane, placing subarachnoid catheter are the alternative choice of therapy. Autologous epidural blood patch (EBP) which was first described by Gormly in 1960 is the most effective therapy in patients who do not respond to conservative therapy.<sup>[2-4,5]</sup>

In this study we evaluated the PDPH cases that underwent EBP, who were referred to Algology Clinic of Gaziantep University School of Medicine, and their response to the therapy retrospectively.

## Materials and Methods

Seventy-seven PDPH cases who were referred to the

Algology Clinic of Gaziantep University, School of Medicine, Department of Anesthesiology and Reanimation from 5 different hospitals and treated with EBP between February 2002 and May 2012 were included in the study. Approval of the Institutional Review Board was obtained from the Faculty Ethical Committee.

Diagnostic criteria of International Headache Society for PDPH is admitted as inclusion criteria as follows:

'Headache that worsens within 15 minutes after sitting or standing and improves within 15 minutes after lying, with at least one of the following and full-filling criteria; neck stiffness, tinnitus, hyperacusia, photophobia, nausea and headache develops within 5 days after dural puncture'.<sup>[4]</sup>

In our clinic the routine procedure of PDPH treatment consists of bed rest (and/or intravenous hydration, laxatives, paracetamol and caffeine, oral caffeine drinks. EBP is performed to severe PDPH cases (VAS>8) who do not respond to the conservative therapy.

Cases who referred to our clinic are informed to the EBP therapy after taking detailed medical history and performed a physical examination. after routine monitorisation (non-invasive blood pressure, peripheral oxygen saturation and heart rate) EBP was performed at the same space as the previous spinal or epidural if possible. Once epidural is in place with 18G Touhy needle via loss of resistance technique, 15-20 ml of blood is withdrawn from the forearm. The blood is carefully and aseptically transferred to the anesthesiologist who injects it slowly (approximately in 10 seconds ) through the epidural needle. Before injecting autologous blood to the epidural space, 25 µg of fentanyl was injected for proving rapid analgesia.<sup>[6]</sup> Phlebotomy was first performed at the same time epidural space was first identified to avoid coagulation. The procedure continued since 15-20 ml of autologous blood was injected totally or since low back pain, neck pain, radicular pain spraded to legs or worsening headache occurs.

After the procedure, patients had routinely had bed rest in supine position for 2 hours while rou-

tine vital monitorisation is continued. Patients are evaluated clinically for intensity of headache and radicular pain with Visual Analog Scale (VAS) (0-10 cm, 0=no pain, 10=most severe pain ever felt) before procedure, 10 minutes after procedure at supine position and 2 hours after procedure at sitting position. Analgesia quality was evaluated and interpreted by both patient and anesthesiologist (perfect, good, enough, poor, bad).

Patients are evaluated for age, gender, type of the surgical operation performed previously, type and diameter of the needle used for dural puncture, number of dural puncture, onset of punctural headache, conservative therapies taken before for PDPH, number of application of EBP, analgesia quality 10 minutes and 2 hours after EBP application, radicular pain during procedure. Patients who have persistent PDPH after 48 hours of procedure second EBP is performed.

Repeated measures analysis of variances was used when the same parameter has been measured at more than two different times. Comparison of independent proportions and independent groups were performed by fisher exact test and student t test, respectively. Mean±standart deviation, frequencies and percentages were given as descriptive statistics. Analyses were performed using SPSS for windows version 11.5 and a p-value <0.05 was considered as significant.

## Results

Mean age of 77 patients (46 female, 31 male) was 31.5±11.3 (min 17, max 53). There was a statistically significant difference between the groups in terms of gender (p<0.05). The patients were mostly referred from the obstetrics and gynecology clinic and 31 of them underwent a cesarean section (Table 1) and the distribution of obstetric and non-obstetric cases was not significant (p>0.05).

All PDPH patients were treated conservatively at first (including bed rest, oral and/or intravenous hydration, paracetamol and caffeine preparates) during their postoperative follow-up in the clinic which dural puncture was performed. The mean duration of the headache before referring to our Algology clinic was 3.1±1.3 days for female patients and 4.6±2.3 days for male patients (p<0.05).

Diameter of the needles used in dural puncture were 22G Quincke spinal needle for 37 patients (48.1%), 25 G Quincke spinal needle for 20 patients (26%), 26 G Quincke spinal needle for 3 patients (3.8%), 27 G Quincke spinal needle for 6 patients (7.8%) and 18 G Touhy epidural needle for 11 patients (14.3%). There was a significant difference between patients who underwent dural puncture with 22 G spinal needle and the other diameters (p<0.001). The 27 G spinal needle was less commonly used than 25 G spinal needle in PDPH patients in a sig-

**Table 1.** Distribution of cases according to surgical departments

Surgical departments	n	Percentage (%)
Obstetrics and gynecology	43 (obstetric cases=31)	55.8% (40.2% obstetric cases)
Orthopedia	17	22.1
Urology	10	13
General surgery	7	9.1

**Table 2.** Distribution of needle type used for performing epidural blood patch in order to treat post-dural puncture headache cases

Type of needle	n	Percentage (%)
Quincke	62	80.5*
Tuohy	11	14.3
Pencil-point	4	5.2

\*p=0.001: When Tuohy ve Pencil-point needles are compared.

**Table 3.** Evaluation of analgesic quality

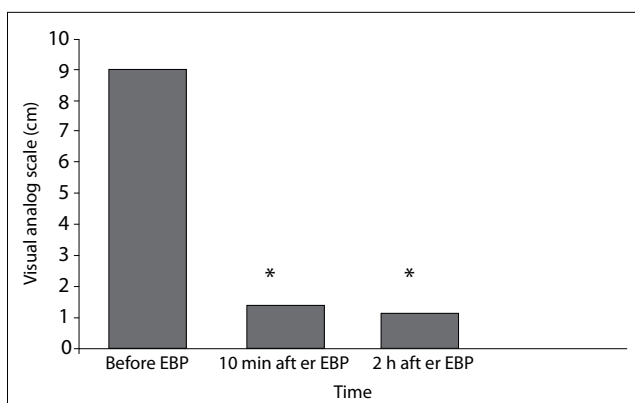
	Patient	Anesthesiologist
Perfect	68*	69*
Good	9	8
Enough	0	0
Poor	0	0
Absent	0	0

\* p=0.001

nificant manner ( $p<0.05$ ). Sharp-edged needles were used in 62 patients (80.5%) during dural puncture. Distribution of spinal-epidural needle types used at the first dural puncture were specified in Table 2. There was significant difference between the number of dural puncture attempts as single shot and more than one attempt, 29 patients and 48 patients, respectively ( $p<0.05$ ).

Analgesic quality evaluation of EBP is shown in Table 3. VAS significantly decreased and patient satisfaction significantly increased after the 10th minute in all patients who had EBP ( $p=0.001$ ) (Figure 1). Mean VAS scores evaluating analgesic quality before EBP, after 10 minutes and 2 hours after EBP were  $9\pm 0.5$  (min 7-max 10),  $1.44\pm 1.05$  (min 0-max 4),  $1.2\pm 0.80$  (min 0-max 3), respectively.

In 76 cases, PDPH was relieved at first administration of EBP, and in only one case second EBP was needed for pain relief. In this case VAS scores at 10th minute and second hour after EBP were 0. Success rate of EBP administration at once was 98.7% ( $n=76$ ).



**Figure 1.** Visual analog scale values before, 10 minutes after and 2 hours after epidural blood patch. \* $p=0.001$ : Compared VAS values before after epidural blood patch (EBP).

Transient radicular pain was observed in 17 cases (22.07%) at administration of EBP but pain was regressed in 5-10 minutes and none of the patients needed an further medication for pain relief.

## Discussion

In this retrospective study we observed that most of the patients were young and female and most of the patients had more than one attempt with large bore and sharp edge needle. Previous studies were mostly planned as prevalence studies and analyzed the association of the needle size or type and frequency of postspinal headache. But in this study, as a referral center for pain, we analyzed the characteristics of patients and the results of the intervention and treatment. Thus, we reported that the symptoms were presented earlier in female patients.

Factors that effect PDPH are age, gender, pregnancy, needle type, needle diameter and number of attempts.<sup>[7]</sup>

The exact mechanism of headache after dural puncture is unclear. It is most probably due to intracranial hypotension. This explanation is not sufficient. There are two possible explanations: Firstly low cerebrospinal fluid (CSF) volume depletes the cushion of fluid that supports the brain and its sensitive meningeal vascular coverings. This may explain the positional nature of headache. Secondly, decrease in CSF volume may activate adenosine receptors directly causing cerebral vasodilatation and stretching of pain sensitive cerebral structures.<sup>[8]</sup> In our study 62.3% of the cases had dural puncture with spinal-epidural needles larger than 22G. Multiple attempts, individual differences of dural thickness between patients may play a role in pathophysiology.

Cerebrospinal fluid density may also effect incidence of headache. CSF density is lower in pregnant.<sup>[7]</sup> Pregnants seems to be keen on PDPH because of facilitating factors like gender, young age, common use of regional anesthesia.<sup>[1,5,9]</sup> Anatomic changes in pregnancy and presacral edema creates a technical difficulty and its clinical presentation causes multiple attempts. 31 (40.2%) women in our evaluation had C/S and this seems to be consistant with the pathophysiology of headache.

The incidence of accidental dural puncture with Touhy epidural needle is 0.04-6%. PDPH is a complication of epidural analgesia with an incidence of 1-3%. In more than 80% of these patients develop PDPH.<sup>[10]</sup> Touhy epidural needle were used in 14.3% of patients who were performed EBP and this is significantly lower than ratio of patients who were applied dural puncture with 22 G Quincke spinal needle. We can explain this situation that accidental dural puncture with Touhy epidural needle is seldom in our study as published in literature.

Spinal dural thickness has large variations individually and also between patients. Perforation of thicker region of duramater lets CSF leakage lesser (therefore causes less PDPH), so thinner region lets PDPH more.<sup>[3,10,11]</sup> This may explain the mechanism in PDPH cases which dural puncture had performed at first attempt. However performing dural puncture by experienced practitioners would lessen the incidence of multiple attempts. Furthermore experienced practitioners would perform the procedures with small diameter needles without any technical difficulty.

PDPH is usually a self limited clinical situation. 72% of cases ceases in 7 days and 87% of cases in 6 months spontaneously.<sup>[12,13]</sup> In our study patients referred to our clinic ceased on average 3 days.

Patients typically suffer from positional headache worsens by upright position. In some cases tinnitus, vertigo, nausea-vomiting, photophobia, neck stiffness can be seen.<sup>[2,11]</sup> Differential diagnosis of PDPH includes other clinical manifestations like nonspecific headache, caffeine withdrawal syndrome, migraine, meningitis, sinusitis, pre-eclampsia, intracranial pathologies<sup>[1,13]</sup> and they are eliminated before EBP in our clinic.

Conservative therapy of PDPH consists of oral or intravenous hydration, caffeine and methylxantines. There is no clinical evidence that proves the effectiveness of intravenous hydration in PDPH but patients should not be left dehydrated.

Effectiveness of caffeine is 75-80% but it is reported that this effect lasts for only 48 hours.<sup>[14,15]</sup> Methylxantines provides a transient relief due to their cere-

bral vasospasm effect. Failure in conservative therapy is more than 80% especially in obstetric patients.<sup>[14]</sup> For all these reasons EBP application becomes to be a method that increasingly gaining popularity.

Effectiveness of EBP application for once is 70-98% in literature.<sup>[16]</sup> Amount of autologous blood transferred to epidural space is also important. In a multicenter study of Abouleish et al 524 cases in 11 centers were followed up for long term after EBP performed with amount of more than 15 ml and found that it is effective more than 95%.<sup>[15]</sup>

In some studies it is stated that injecting more than 20 ml of blood at sitting position spreads through approximately 9-10 spinal segment.<sup>[6,15,17]</sup> Abouleish et al explained there is no benefit of volumes more than 20 ml.<sup>[15]</sup> Most probably EBP has an acute effect in PDPH by a transient increase in CSF pressure and a permanent effect by clot formation in epidural space that forms an obstruction of dural defect and avoids CSF leakage.<sup>[18]</sup> Opioids can curb the symptoms of slight PDPH cases.<sup>[8]</sup> Most of the authors of case reports or controlled studies notified administration of epidural, intrathecal or parenteral opioids.<sup>[4]</sup> The advantage of administration of intrathecal fentanyl is analgesia with rapid onset without creating motor blockage. Peak effect can be achieved by 25 µg of fentanyl.<sup>[6]</sup> Before EBP we considered the probability of intrathecal transition of opioid and administered 25 µg of fentanyl to epidural space for increasing the effectiveness of therapy. We also used 15-20 ml of autologous blood for EBP as similar in literature. Only one case needed 2nd administration of EBP. Headache was completely relieved in this case.

The most common complications seen after EBP are backache (35%), neckache (0.9%), transient fever (5%).<sup>[19]</sup> Haemorrhage, infection, accidental dural puncture, arachnoiditis caused by blood transferred to subarachnoid region and in only two cases transient facial nerve palsy in only two cases are reported.<sup>[20,21]</sup> Also tinnitus, vertigo, ataxia, drowsiness, vasovagal syndrom are reported as the other complications.<sup>[22]</sup>

Inadequate amount of autologous blood transferred to epidural space may delay pain relief. However

EBP performed with excessive blood volumes may induce radicular pain.<sup>[19]</sup> Radiculopathy is reported at highly excessive blood volumes (>30 ml) and this clinical manifestation improves spontaneously in 3-4 months.<sup>[23]</sup>

We observed radicular pain in 17 cases (22.07%) lasting for 5-10 minutes after application of 15-20 ml autologous blood to epidural space and no medical treatment was required. This symptom has not been reported in literature. This present situation can be explained by following reasons. This clinical symptom has a nature with short duration and also recovers spontaneously without further medical treatment so radicular pain can be ignored as an adverse effect. And also injection of blood had been stopped when radicular pain observed. Because of all these reasons radicular pain might be ignored in literature.

Although PDPH cases who do not respond to conservative therapy symptoms regresses in months, pain relief is very important for improving life quality for all groups of patients. Because of this clinical situation deteriorates relationship between mother and baby at postpartum period, EBP is an effective and relatively safe method in obstetric patients. Also we consider that practitioners must be alert on avoiding this clinical situation by using small diameter needles less than 22 G and beware of multiple attempts.

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