

Original article

Non invasive Management of Post Dural Puncture Headache –A Comparison

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Abstract:

Aim: To evaluate the efficacy of oral Theophylline for the management of post dural puncture headache (PDPH). **Material and Method:** Forty patients with PDPH, whose surgeries were done under spinal anaesthesia, were selected randomly and divided into two groups of 20 each. One group to receive conservative treatment and the other group Theophylline (400 mg) only orally. Intensity of headache was analysed using a visual analogue scale (VAS) of pain. Assessment was done immediately before (0 h) and at 8, 16 and 24th hr of drug administration. **Result:** Significantly better relief of PDPH was found in Theophylline (9.3 ± 5.7) than the conservative group (56.7 ± 10.2) ($p < 0.001$). Recurrence of headache was found in 2 patients (10%) at 16th hr and 2 (10%) at 24th hr in the Theophylline group compared to 12 (60%) and 14 (70%) patients respectively in the other group. **Conclusion:** The study concludes that Theophylline in the management of post dural puncture headache may be considered the best choice over the conventional approach.

Key Words: Conservative measures, PDPH, Spinal anaesthesia, Theophylline, VAS

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Introduction:

Post-dural puncture headache (PDPH) is an iatrogenic and distressing headache which, as the name implies, occurs due to puncture of the dura mater.

“Toward the evening I was forced to take to bed and remained there for nine days, because all the Manifestations recurred as soon as I got up. At midnight a violent headache set in that quickly became insupportable.” August Bier 1898– a personal experience of post-dural puncture headache.

This was the first reported post-dural puncture headache by the German surgeon, Dr.Karl August Bier. Clinical Presentation of PDPH: The International Headache Society¹ has defined PDPH as a headache which develops within 48 hours to five days of dural puncture and is self-limiting. 70% of them tend to resolve within one week, 95% within six weeks and 96% within six months^{2,3}. A post dural puncture headache (PDPH) or "spinal

headache" is dull or throbbing in nature which is worsened on ambulation and improved by assuming the decubitus position⁴.

The headache starts in the occipital or frontal region and later becomes generalised. It may radiate to the neck or shoulders. It gets exacerbated by raised intracranial pressure caused by coughing or straining. It may or may not be accompanied by nausea, vomiting, dizziness, tinnitus, neck stiffness, photophobia⁵. Visual disturbance as diplopia due to stretching of the VIth cranial nerve over the petrous part of the temporal bone⁶; auditory disturbances as transient hearing loss⁷; tinnitus, because of the direct connection between Cerebrospinal fluid (CSF) and perilymph across the cochlear aqueduct; transient palsies of the IIIrd, IVth, VIIth and VIIIth cranial nerves⁸ due to the stretching of the nerves secondary to cerebrospinal fluid (CSF) redistribution, have been reported. Pathophysiology of Post Dural Puncture Headache: Cerebrospinal fluid(CSF) is

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secreted by the choroid plexus of the 3rd ventricle. About 500 mL of CSF per day or 21 mL per hour, at the rate of 0.3 mL/kg/hr is produced by an average adult. A total of about 150 mL of CSF circulates in the brain and spinal cord at any one time and is absorbed by the arachnoid villi. The incidence of PDPH is estimated to be between 30-50% following diagnostic or therapeutic Lumbar puncture, 0-5% following spinal anesthesia and up to 81% following accidental dural puncture during epidural technique. The incidence of dural puncture ranges from 0.16%–1.3% in experienced hands⁹.

Aim

To evaluate the efficacy of oral Theophylline as a sole agent over other conservative measures for the treatment of PDPH.

Material and Method

The study was conducted in Goldfield Institute of Medical Sciences and Research, Chhainsa, Faridabad, India, during the period of July 2012 to January 2013. Surgeries which could be done under spinal anaesthesia were timed in the afternoon so

that if PDPH occurred, treatment could be started at bed time at around 10P.M., Indian Standard Time (IST). 40 patients of ASA I and II suffering from post dural puncture headache were selected for the study. 20 patients in each group were selected randomly. Groups did not differ in age (20 to 40 years) height (150 to 167.5 cm), weight (40 to 70 kg) as well as the size and type of needle (23G Quincke-point needle). Patients were explained and informed about the visual analogue Scale (VAS). Patients under study were asked to mark a 0 to 100 mm VAS in sitting position to facilitate a maximal score at the onset of PDPH. This assessment was performed at baseline (T0) before, and at 8th, 16th 24th hour after the administration of treatment with Theophylline 400mg, a methylxanthine derivative, orally. Data obtained from the study were compared and analysed statistically. The statistical difference or associations were calculated either by ‘two sample students t’ or ‘Chi-squared’ test as applicable. The types of surgery, treatment given and male female grouping have been analysed in Table 1

Table 1: Treatment given, age and gender of the study subjects on the basis of type of surgery

Surgery	Treatment for PDPH		Age				Male				Female			
	Con-serv n=20	Theophy n=20	Conserv		Theophy		Conserv		Theophy		Conserv		Theophy	
			Mean	SD ±	Mean	SD ±	n	%	n	%	n	%	n	%
Inguinal Hernia	6	6	29	6.4	29.2	6	6	0.72	6	0.72	0	0	0	0
Appendectomy	5	5	26	8	28.4	6.2	3	0.15	1	0.05	2	0.10	4	0.2
Abd.Hysterectomy	3	3	37.6	1.8	38	0.81	0	0	0	0	3	0.18	3	0.18
ORIF Tibia	2	2	39	1	38	1	1	0.02	1	0.02	1	0.02	1	0.02
Haemorrhoidectomy	2	2	33	1	35	5	1	0.02	1	0.02	1	0.02	1	0.02
Fistulectomy	2	2	34	4	31	4	1	0.02	1	0.02	1	0.02	1	0.02

Conserv-Conservative; Theophy-Theophylline; Abd-Abdominal; ORIF-Open reduction and Internal fixation

Result

Forty patients of PDPH were studied. Group I patients received conservative treatment comprising of bed rest in supine position without a head pillow, Caffeine containing beverages, injectable Opioid and/or Non steroid anti inflammatory drug (NSAID). Group II patients selectively received oral Theophylline 400mg. Once a patient complained of pain, the drug was given at the 8th hr of dural puncture, which incidentally coincided with the bed time

in India as the surgeries under spinal to be conducted by the author, were posted in the afternoon. Once asleep the patients who had taken the drug would have least discomfort of the methylxanthine derivatives’ unpleasant side effects^{10,11} viz central nervous system stimulation, cardiac dysrhythmias, or gastric irritation if there was any. Visual analogue scale scores did not differ much between the groups at 0 hr. Improvement in VAS at 8th hr (T0 – T8) occurred in all 20 patients (100%) in group II versus 10 patients (50%) in group I. At 16th hr 2 patients and at 24th hr 2 patients in group II versus 12 patients and 14 patients in group I respectively showed higher VAS score than at the 8th hr (Table-2). Visual analogue scale scores at 24th hr also had difference between the two groups. Overall, the combined VAS scores at 8 hr,16hr and 24hr were lower in the Theophylline (9.3±5.7) than in the conservative (56.7±10.2) group (p<0.001).

Table 2: VAS score at different point of time in the two groups

Time point	Group I (n=20)		Group II (n=20)		P value
	Mean	SD	Mean	SD	
0 hour	94.6	4.4	93.5	5.9	0.496
8 hour	46.0	40.3	2.7	1.9	2.6
16 hour	57.7	41.9	13.4	28.3	0.0003
24 hour	66.5	39.1	11.8	30.0	1.5

Group I received conservative treatment; Group II received Theophylline

Discussion:

Following dural puncture there is a possibility of leakage of CSF from the puncture site. Intracranial CSF, the cushion of the brain thus gets depleted. This exerts traction on the pain sensitive intracranial nerves during upright posture. Thus a frontal headache is caused by traction on the fifth cranial nerve, traction of the ninth and tenth cranial nerve

causes pain in the occipital region. Pain in the neck and shoulders are caused by traction on the upper cervical nerves including C1, C2, and C3¹². Traction on the C6 nerve causes visual symptoms¹³.

There is also change in cerebrovascular mechanism which is mediated via adenosine receptors¹⁴. And as per Monro-Kellie-Burrows doctrine, compensatory cerebral venous vasodilatation occurs secondary to loss of CSF leading to intracranial hypotension¹⁵ which is considered to be responsible for PDPH¹⁶.

Clark et al in a clinical trial postulated that patients with a low level of substance P (<1.3 pg/ml), a neuropeptide in CSF, which is associated with neurogenic inflammation, have a higher risk of PDPH¹⁷.

Table 3: Differential diagnosis of headache after dural puncture^{16,18}

Primary	Migraine; Tension headache ;Sinus headache;Orgasmic headache
Secondary	Spinal anaesthesia / epidural analgesia /combined spinal-epidural anaesthesia; Diagnostic lumbar puncture; Myelography / intrathecal chemotherapy; Subarachnoid or intracranial haemorrhage; Ischaemic or haemorrhagic Stroke; Hypertensive encephalopathy; Postpartum cerebral angiopathy; Cerebral arterial or venous sinus thrombosis; Pituitary apoplexy; Intracranial tumour; Meningitis; Uncal herniation; Caffeine withdrawal headache

toms. Different options are in practice which are not without side effects. There are reports, trying different options, in the treatment of PDPH.

Chau-in et al²⁶ and ErgunU et al²⁷ had shown Epidural blood patch for PDPH with a success rate of 80-97%. But this is an

Table4: Factors influencing PDPH

Non-modifiable	Modifiable
1. Age: 20–30 years of age, rare after 60 yrs ¹⁹ 2. Sex: female ¹⁹ 3. Parturients ²⁵ 4. Previous history of PDPH ¹⁹ 5. Low body mass index ¹⁹ 6. Obesity ²⁰ 7. Low concentration of substance P in cerebrospinal fluid ¹⁷	1. Size and type of needle: 30% -36% are with 22G Quincke needle ²¹ 2. Needle orientation: angle of puncture of the duramater not significant ²²

invasive treatment having complication such as backache or infection as a part of the procedure. Carp et al³² tried Sumatriptan in subcutaneous injection route and found complete relief of PDPH in 6hrs. Collier³³ reported effective

Table 5: Treatment options for PDPH

Conservative Measures	Bed rest & Hydration, Analgesics: NSAIDS, Opioids, Caffeine ²³
Non invasive agent	OralTheophylline ²⁴
Invasive Measures	Epidural patch of blood /saline / colloid / fibrin glue, Sphenopalentine ganglion block , Bilateral greater occipital nerve block
Prophylactic Measures	Epidural opioids, ACTH Analogue, Epidural blood patch

relief in 2 cases of PDPH on administration of long acting ACTH as single intravenous infusion. Both the drugs are expensive,

PDPH is usually a self-limiting process^{2,3}, however, treatment is required often to relieve symp-

used invasively and their controlled trial is needed. Camann et al³⁴ found significant pain relief from

PDPH with oral tablet of Caffeine 300mg. Relief of PDPH at VAS 4h was significantly better than in the placebo group ($p=0.014$). Frank et al²⁸ in their study administered Aminophylline infusion and Akdere et al²⁹ tried Theophylline intravenously making the procedures invasive. Ergun et al³⁰ demonstrated that average pain relief in PDPH obtained was 59.1% and mean VAS decrease was 4.17 ± 2.03 with Theophylline IV infusion. In case of the trial by Hungs et al³¹, the average VAS result was (2.2 ± 2.04) after Theophylline infusion. Feuerstein et al³⁵ showed significantly less pain (mean pain score: 16 ± 3.91) with Theophylline 282.7mg than the placebo group. Our study concentrates on a noninvasive method of treatment of PDPH, Theophylline which is a Methylxanthine derivative^{24,25,36}. Methylxanthine derivatives block adenosine receptors, which in turn leads to vasoconstriction of cerebral blood vessels and reduces venous engorgement resulting in decreased intracranial blood flow and thus relieves

PDPH^{24,36-37}. Methylxanthines may also stimulate sodium-potassium pumps to increase CSF production, leading to relief of headache³⁸. Methylxanthine derivatives do not treat the CSF leak, only provide symptomatic relief by counteracting the compensatory cerebral vasodilation that occurs in response to loss of CSF volume^{36,38}. So, now in comparison to all the above mentioned studies, it is evident that we used a patient friendly way to administer the drug, we found least side-effects and above all our result on the visual analogue score of pain with oral 400mg of Theophylline was (9.3 ± 5.7) , which is low than a similar study³⁵.

Conclusion:

We conclude that oral Theophylline in the management of post dural puncture headache may be considered the best choice over conventional approach. The benefits of oral Theophylline lie in the route of administration, minimal side effects having a rapid and long duration of action.

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