

ORIGINAL ARTICLE

Comparison of Mean Duration of PDPH (Post-Dural Puncture Headache) and Mean Length of Hospital Stay by Theophylline and Sumatriptan in the Treatment of Post-Dural Puncture Headache.

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ABSTRACT... Objective: To compare mean duration of PDPH and mean length of hospital stay by Theophylline and sumatriptan in the treatment of Post-Dural puncture Headache. **Study Design:** Quasi Experimental study. **Setting:** Department of Anesthesia, Allied Hospital Faisalabad. **Period:** January 2025 to July 2025. **Methods:** After taking written informed consent, 60 patients diagnosed with PDPH were enrolled. Participants were assigned into two groups of 30 each. Group A received oral theophylline anhydrous 150 mg, while Group B received oral sumatriptan succinate 25 mg; every 12 hours continued until NRS <3 or maximum of 48 hours. PDPH onset and duration were recorded in hours, and hospital stay in days. Data were analyzed using SPSS 26.0. **Results:** No significant difference was observed in hospital stay (Group A: 3.38 ± 0.87 days vs. Group B: 3.22 ± 0.75 days; $p=0.449$) or PDPH duration (Group A: 15.57 ± 4.57 hours vs. Group B: 14.45 ± 3.36 hours; $p=0.285$). Stratified analysis revealed significantly longer PDPH duration in Group A among patients with BMI ≤ 24 kg/m² (17.45 ± 2.71 vs. 14.17 ± 3.01 hours; $p=0.01$), male patients (16.52 ± 4.34 vs. 13.75 ± 3.47 hours; $p=0.03$), and those receiving 22G needles (16.35 ± 3.35 vs. 13.40 ± 3.64 hours; $p=0.039$). **Conclusion:** Both oral theophylline and sumatriptan were effective in managing PDPH. However, sumatriptan demonstrated slightly better outcomes, particularly in male patients, those with lower BMI, and those receiving 22G needles. These findings suggest that sumatriptan may be preferred in specific subgroups to reduce PDPH duration.

Key words: Post-Dural Puncture Headache, Sumatriptan, Theophylline.

Article Citation: Arooj S, Ahmad H, Saeed A, Askri MR, Yousaf A, Maqbool S. Comparison of Mean Duration of PDPH and Mean Length of Hospital Stay by Theophylline and Sumatriptan in the Treatment of Post-Dural Puncture Headache. Professional Med J 2026; 33(10):2008-2013. <https://doi.org/10.29309/TPMJ/2026.33.10.10416>

INTRODUCTION

Spinal anesthesia is simple, cost-effective, and efficient technique that produces complete sensory/motor block and also provides postoperative pain relief with high success rate.¹ One of the most frequent complications after lumbar puncture is PDPH.² It is often associated with nausea, neck stiffness, and photophobia. Reported incidence rates vary widely across studies, ranging from about 8% to 37%.³ PDPH usually starts within two days after the procedure, rarely can appear after two weeks. In most patients, symptoms resolve on their own within few days.³

Common management options include hydration, caffeine, corticotropin therapy, sumatriptan, and epidural blood patch application.⁴ Triptans are effective anti-migraine drugs that act as selective serotonin (5-HT_{1B}/5-HT_{1D}) receptor agonists.⁵

They relieve headache by causing vasoconstriction of dilated intracranial blood vessels, inhibiting the release of vasoactive neuropeptides from trigeminal nerve endings, and reducing pain signal transmission within trigeminal pathways.⁶ Sumatriptan has been used for PDPH treatment with good results and is generally well tolerated, especially when combined with analgesics. Zolmitriptan, a newer second-generation triptan, has also shown success in treating PDPH.⁷

Methylxanthines are purine alkaloids mainly known for their stimulant and bronchodilator properties. Theophylline, a methyl xanthine derivative, is believed to help treat PDPH by reducing intracranial blood flow and venous dilation while increasing CSF production.⁸ In some reports, theophylline is used as a treatment option before considering epidural blood patch or saline injection.⁹

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Article received on:

25/02/2026

Accepted for publication:

12/05/2026



A multidisciplinary panel developed 50 evidence-based recommendations for PDPH management using systematic literature review and modified Delphi consensus process. While high consensus was achieved, most recommendations were based on moderate-to-low certainty evidence, highlighting ongoing uncertainty and the need for further research.¹⁰

This study aimed to compare and evaluate the efficacy and safety of oral theophylline versus oral sumatriptan in the treatment of PDPH. The drug demonstrating better outcomes may be recommended in the future to help reduce the duration of PDPH and shorten hospital stay.

METHODS

This quasi experimental study, was conducted at the Department of Anesthesia, Allied Hospital, Faisalabad, over a period of six months [January 2025 to July 2025] following approval of the study synopsis by Institutional Ethical Review Committee [No. 48.ERC/FMU/2023-2024; Dated: 2/09/2024] and CPSP. Informed consent was obtained from all participants after briefing them about study objectives and ensuring confidentiality of their information. The sample size was calculated using confidence level of 95% and a power of 90%, with anticipated mean PDPH duration of 18.40 ± 1.52 hours in Group A and 33.20 ± 5.52 hours in Group B, calculated sample size was 60 patients (30 in each group).¹¹

Patients aged 21–50 years of both genders, classified as ASA I–II, and diagnosed with PDPH according to International Headache Society criteria¹², with Numerical Pain Rating Scale score >5 , were included. Patients were excluded if they were pregnant, had history of chronic headache, neurological diseases, prior stroke, hypertension, cardiac disease, hyperthyroidism, peripheral vascular disease, liver or renal impairment, or if they had taken methyl xanthine/ergotamine derivatives, SSRIs, or MOI inhibitors within 2 weeks.

Demographic and clinical data, including age, gender, BMI, ASA classification, type of surgery, and spinal needle size, were recorded. Patients were allocated into two groups of 30 each. Group A received oral

theophylline anhydrous 150 mg every 12 hours, and Group B received oral sumatriptan succinate 25 mg every 12 hours. The intervention continued until achieving NRS score <3 or for a maximum of 48 hours. Patients with NRS scores >7 received additional conservative management according to hospital protocol. PDPH onset was measured in hours from the time of lumbar puncture, while PDPH duration was recorded in hours from onset until resolution (NPRS <3). Length of hospital stay was measured in days from the day of lumbar puncture until discharge. Pain severity was assessed using NRS, where 0 represented no pain and 10 indicated worst imaginable pain.¹³

Data were analyzed using SPSS version 25.0. Quantitative variables such as age, weight, height, BMI, PDPH onset, PDPH duration, and hospital stay were presented as mean $\pm$ standard deviation, while categorical variables such as gender, ASA type, type of surgery, and spinal needle size were expressed as frequencies and percentages. Independent sample t-tests were applied to compare mean PDPH duration and hospital stay between the two groups. Effect modifiers including age, gender, BMI, ASA type, type of surgery, and spinal needle size were controlled by stratification, and post-stratification independent t-tests were performed to evaluate their influence. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 60 patients were enrolled in the study, with 30 patients in each group. The baseline demographic and clinical characteristics of both groups are presented in Table-I. There were no statistically significant differences between Groups A and B in terms of age (34.27 ± 5.59 vs. 33.88 ± 5.40 years, $p=0.783$), weight (73.78 ± 7.87 vs. 72.97 ± 8.02 kg, $p=0.694$), height (1.60 ± 0.06 vs. 1.60 ± 0.06 m, $p=0.947$), BMI (26.53 ± 2.99 vs. 27.09 ± 3.52 kg/m², $p=0.515$), or PDPH onset (6.39 ± 2.02 vs. 6.81 ± 2.17 hours, $p=0.437$). Gender distribution, type of surgery, needle type and size, and ASA class were also comparable between groups (all $p>0.05$).

Outcome measures are summarized in Table-II. No significant difference was found between the two groups in terms of hospital stay (Group A: $3.38 \pm$

0.87 days vs. Group B: 3.22 ± 0.75 days; $p=0.449$) or PDPH duration (Group A: 15.57 ± 4.57 hours vs. Group B: 14.45 ± 3.36 hours; $p=0.285$), with a slight improvement observed in Group B (sumatriptan) compared to Group A (theophylline).

TABLE-I

Summary of study variables

Variable	Group B N=30	Group A N=30	P-Value
Age (years)	33.88 ± 5.40	34.27 ± 5.59	0.783
Weight (kg)	72.97 ± 8.02	73.78 ± 7.87	0.694
Height (m)	1.60 ± 0.06	1.60 ± 0.06	0.947
BMI (Kg/m2)	27.09 ± 3.52	26.53 ± 2.99	0.515
PDPH Onset	6.81 ± 2.17	6.39 ± 2.02	0.437
Gender			
Male	20 / 66.7%	18 / 60.0%	0.592
Female	10 / 33.3%	12 / 40.0%	
Surgery Type			
Elective	20 / 66.7%	14 / 46.7%	0.118
Emergency	10 / 33.3%	16 / 53.3%	
Needle Type			
Quincke	17 / 56.7%	17 / 56.7%	1
Pencan	13 / 43.3%	13 / 43.3%	
Needle Size			
22.00	14 / 46.7%	13 / 43.3%	0.285
25.00	10 / 33.3%	6 / 20.0%	
27.00	6 / 20.0%	11 / 36.7%	
ASA Class			
I	14 / 46.7%	18 / 60.0%	0.301
II	16 / 53.3%	12 / 40.0%	

TABLE-II

Outcome variables

Variable	Group B N=30	Group A N=30	P-Value
Hospital Stay (days)	3.22 ± 0.75	3.38 ± 0.87	0.449
PDPH Duration (hours)	14.45 ± 3.36	15.57 ± 4.57	0.285

Stratified analysis for hospital stay is shown in Table-III. There were no significant differences between groups when stratified by age, BMI, gender, ASA class, surgery type, or needle size $p>0.05$).

Stratified analysis for PDPH duration is presented

in Table-IV. Group A had significantly longer PDPH duration than Group B in patients with BMI ≤ 24 kg/m² (17.45 ± 2.71 vs. 14.17 ± 3.01 hours, $p=0.01$) and in male patients (16.52 ± 4.34 vs. 13.75 ± 3.47 hours, $p=0.03$). No statistically significant differences were observed in patients with BMI >24 kg/m², females, ASA I or II, different surgery types, or most needle sizes, except for 22G needles where PDPH duration was longer in Group A (16.35 ± 3.35 vs. 13.40 ± 3.64 hours, $p=0.039$).

DISCUSSION

In current study no significant difference was observed in hospital stay ($p=0.449$) or PDPH duration ($p=0.285$) among both oral theophylline and sumatriptan group. Stratified analysis revealed significantly longer PDPH duration in Group A among patients with BMI ≤ 24 kg/m² ($p=0.01$), male patients ($p=0.03$), and those receiving 22G needles ($p=0.039$). Review by Amini et al, supports current findings that both theophylline and sumatriptan are effective in preventing PDPH and reducing its severity.¹⁴ In contrast, Shaat et al, concluded that theophylline is superior to sumatriptan, leading to reduced pain scores, shorter PDPH duration, decreased hospital stay, and minimal adverse effects.¹¹

A review of multiple trials evaluating several pharmacological agents including theophylline demonstrated comparable effectiveness in the prevention and treatment of PDPH. However, triptans were not directly compared in these analyses, limiting conclusions regarding their relative efficacy against other drug classes.^{15,16} Manouchehrian et al, in their trial also found that oral administration of theophylline shows comparable effectiveness to other oral drugs in decreasing PDPH rate.¹⁷ van Dongen et al, found that 22G needles are associated with lower risk of PDPH.¹⁸ However, in present study, majority of patients in both groups who developed PDPH had procedures performed using 22G needle. demonstrated that needle gauge and shape are important risk factors for PDPH incidence, with smaller needles associated with lower PDPH rates.¹⁹ Girma et al, supporting our results found that PDPH was greater among obese and those in which lower gauge spinal needles were used.²⁰

TABLE-III

Data stratification with respect to hospital stay

Subgroups	N (Group A)	Group A (Mean $\pm$ SD)	N (Group B)	Group B (Mean $\pm$ SD)	P-Value
Age					
Upto 35 years	16	3.37 $\pm$ 0.92	18	3.33 $\pm$ 0.77	0.904
>35 years	14	3.40 $\pm$ 0.86	12	3.06 $\pm$ 0.70	0.284
BMI					
Upto 24 kg/m ²	13	3.28 $\pm$ 0.89	11	2.98 $\pm$ 0.85	0.406
>24 kg/m ²	17	3.46 $\pm$ 0.88	19	3.36 $\pm$ 0.67	0.714
Gender					
Male	18	3.42 $\pm$ 0.86	20	3.22 $\pm$ 0.87	0.476
Female	12	3.33 $\pm$ 0.93	10	3.23 $\pm$ 0.46	0.772
ASA					
I	18	3.59 $\pm$ 0.85	14	3.09 $\pm$ 0.47	0.056
II	12	3.08 $\pm$ 0.85	16	3.34 $\pm$ 0.93	0.439
Surgery Type					
Elective	14	3.51 $\pm$ 0.89	20	3.30 $\pm$ 0.71	0.446
Emergency	16	3.28 $\pm$ 0.87	10	3.08 $\pm$ 0.84	0.579
Needle Size					
22.00	13	3.65 $\pm$ 0.87	14	3.04 $\pm$ 0.78	0.066
25.00	6	3.17 $\pm$ 0.94	10	3.49 $\pm$ 0.63	0.422
27.00	11	3.18 $\pm$ 0.84	6	3.20 $\pm$ 0.83	0.966

TABLE-IV

Data stratification with respect to PDPH Duration

Subgroups	N (Group A)	Group A (Mean $\pm$ SD)	N (Group B)	Group B (Mean $\pm$ SD)	Notes / P-value
Age					
Upto 35 years	16	15.15 $\pm$ 4.36	18	14.00 $\pm$ 3.40	0.395
>35 years	14	16.06 $\pm$ 4.93	12	15.13 $\pm$ 3.34	0.588
BMI					
Upto 24 kg/m ²	13	17.45 $\pm$ 2.71	11	14.17 $\pm$ 3.01	0.01*
>24 kg/m ²	17	14.14 $\pm$ 5.24	19	14.62 $\pm$ 3.62	0.752
Gender					
Male	18	16.52 $\pm$ 4.34	20	13.75 $\pm$ 3.47	0.03*
Female	12	14.15 $\pm$ 4.74	10	15.87 $\pm$ 2.79	0.325
ASA					
I	18	14.81 $\pm$ 4.75	14	13.79 $\pm$ 3.76	0.513
II	12	16.72 $\pm$ 4.24	16	15.04 $\pm$ 2.98	0.229
Surgery Type					
Elective	14	15.65 $\pm$ 4.20	20	14.47 $\pm$ 3.58	0.385
Emergency	16	15.51 $\pm$ 5.02	10	14.42 $\pm$ 3.07	0.545
Needle Size					
22.00	13	16.35 $\pm$ 3.35	14	13.40 $\pm$ 3.64	0.039*
25.00	6	16.33 $\pm$ 5.78	10	15.36 $\pm$ 2.99	0.661
27.00	11	14.25 $\pm$ 5.25	6	15.40 $\pm$ 3.06	0.631

*statistically significant at $p \leq 0.05$

The current study did not assess side effects of oral theophylline and sumatriptan, which limits understanding of their overall safety profile. Additionally, the sample size was relatively small and drawn from a single center, which may affect the generalizability of the findings. The study also did not include long-term follow-up to evaluate recurrent or delayed PDPH, and patient-reported outcomes such as quality of life and functional recovery were not assessed.

CONCLUSION

The current study suggest that, oral both theophylline and sumatriptan were effective in managing PDPH, with no significant differences in overall hospital stay or PDPH duration. However, sumatriptan demonstrated slightly better outcomes, particularly in male patients, those with lower BMI, and those receiving 22G needles. These findings suggest that sumatriptan may be preferred in specific subgroups to reduce PDPH duration.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

SOURCE OF FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Humaira Ahmad: Literature review, study design, literature search.
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