



## Comparison of 25 gauge Quincke needle and 27 gauge Quincke spinal needle in caesarean section for the incidence of post Dural puncture headache: A comparative study

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### Abstract

**Introduction:** Post dural Puncture headache (PDPH) Particularly Following Caesarean Section is a well-known iatrogenic complication of spinal anaesthesia mostly occurs due to loss of cerebrospinal fluid (CSF) during the procedure.

**Aims and Objectives:** The study was planned to assess comparative superiority of 27 gauge spinal needle over 25 gauge spinal needle in caesarean section for reduction of PDPH.

**Material and Method:** The study was conducted in department of anaesthesia, H.N.B. Base teaching Hospital Srinagar Garhwal Uttarakhand, in which a total of hundred full term primi-parous women aged within 18-36 years undergoing elective Caesarean Section were selected. They were divided into two groups.

Group A (n=50) Receive spinal anaesthesia with 25 gauge spinal needle.

Group B (n=50) Receive spinal anaesthesia with 27 gauge spinal needle.

**Study Design:** A randomized study

**Exclusion criteria:** History of previous Caesarean Section or lumbar puncture due to any cause, multiparous, and need emergency Caesarean Section, patient with abnormalities of spine.

Data collection were done focusing incidence of PDPH, onset, site, duration and severity of the headache post operatively. Intraoperatively, difficulty in localizing the subarachnoid space and required time taken to administer spinal anesthesia were also recorded.

**Results:** The overall incidence of PDPH of 100 CS patients was 17% and significantly higher incidence is noticed in-group A than group B (26% vs 10%,  $p < 0.05$ ). Attempt required to attain CSF is higher in group B and finer needle takes significantly more time to collect CSF ( $P < .001$ ). Mean Duration for CSF Collection was  $35.08 \pm 13.43$  seconds (group A) and  $81.12 \pm 16.71$  seconds (groups B)

Conclusion Use of 27G spinal needle will be a good choice for reduction of PDPH.

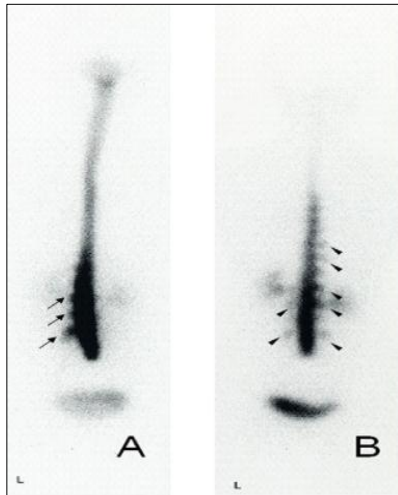
**Keywords:** PDPH, caesarean section, 25G and 27G spinal needle

### 1. Introduction

Dural puncture is a commonly performed invasive procedure for various indications like diagnostic lumbar puncture, spinal anaesthesia, and myelography and intrathecal chemotherapy. However, in anaesthesia practice apart from intentional dural puncture as in spinal anaesthesia, unintentional dural puncture can also occur while performing epidural anaesthesia or analgesia for various indications, including postoperative and labour pain relief. Carrie and Collins define post dural puncture headache (PDPH) as "a headache occurring after dural puncture and has a significant effect on the patient post-operative well-being i.e. headache which is not only postural but also continues for more than 24 hours at any level of intensity or so severe at any time that the patient is unable to maintain upright position [1]. When headache appears in the postoperative or postpartum period after regional anaesthesia it can be due to many reasons, rather as a complication of dural puncture during regional anaesthesia. However the most common cause of an anaesthesia induced headache is PDPH. Dr. Biers suggested that CSF loss caused the symptoms he experienced and his advise is to prevent the loss of CSF as much as possible, as he lost excessive CSF while receiving the experimental spinal block by his assistant who was unable to fit the syringe to the needle during the procedure. Dural response to trauma: It is

now claimed that the repair of a dural perforation is facilitated by the fibroblastic proliferation from surrounding tissues and promoted more by the damage to pia, arachnoid, the underlying neural structures and presence of blood clot [2]. So, a careful placement of spinal needle does not promote dural healing, as trauma to adjacent tissue is minimal in this instance. Indeed, it is now observed that bloody taps are less likely to lead to PDPH [3]. Consequences after cutting tip puncture compared to spreading bevel: Insertion of needle with cutting bevel parallel to the long axis of the spine decreases the likelihood of PDPH as fewer fibers are cut compared with perpendicular orientation. Tearing of the dura may occur upon removal of the needle if it is rotated to a perpendicular orientation after insertion. Bevel orientation is not an issue with a traumatic needle as they separate the dural fibers rather than cutting them allowing them to return to their original position with decreased CSF leakage [4]. Theories and mechanisms of PDPH: Puncture of dura has the potential to allow the excessive leakage of CSF which leads to intracranial hypotension due to reduction in CSF volume. After development of PDPH, a CSF leak has been confirmed with radionuclide cisternography (Figure-1), radionuclide myelography, manometric studies, epiduroscopy and direct visualization at laminectomy. There are two possible mechanisms of headache. First, the lowering of CSF pressure

causes traction on the intracranial structures in upright position.



**Fig 1:** Radioisotope cisternography images in two patients of PDPH. (A). Parathecal activity at lumbar level (arrows).

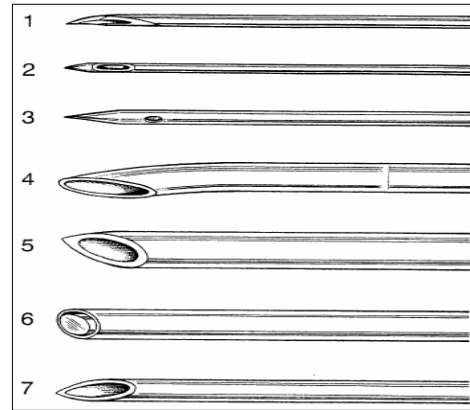
(B). Parathecal activity at both lumbar and thoracic levels (arrowheads). L: left side. (Reproduced from Takahashi K, Mima T. Cerebrospinal fluid leakage after radioisotope cisternography is not influenced by needle size at lumbar puncture in patients with intracranial hypotension. CSF Research 2009; 6:5)

These structures are pain sensitive, leading to the characteristic headache. Secondly, the loss of CSF produces a compensatory venodilatation as per the Monro-Kellie doctrine<sup>[8]</sup>. The consequence of a decrease in CSF volume is a compensatory increase in blood volume. The venodilatation is then responsible for headache.

**Table 1:** relationship between needle size and incidence of PDPH

Needle tip design	Needle gauge	Incidence of PDPH (%)
Quincke	22	36
Quincke	25	3-25
Quincke	26	0.3-20
Quincke	27	1.5-5.6
Quincke	29	0-2
Quincke	32	0.4
Sprotte	24	0-9.6
Whitacre	20	2-5
Whitacre	22	0.63-4
Whitacre	25	0-14.5
Whitacre	27	0
Atraucan	26	2.5-4
Tuohy	16	70

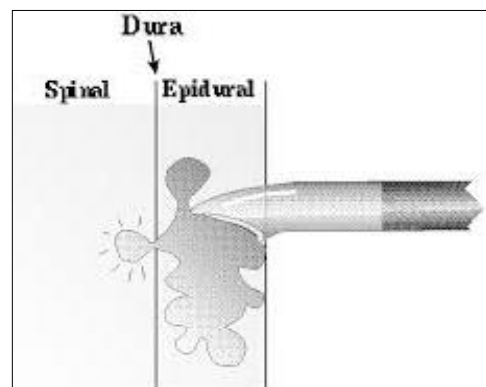
Reducing the size of spinal needle narrower to 31G has made a significant impact on incidence (Table-1)<sup>[6]</sup>. However, technical difficulties leading to failure of the spinal anaesthetic are common with needles of 29G or narrower. Today the use of fine gauge pencil-point needles has largely reduced the incidence of PDPH (Figure - 2). During applying epidurals, the incidence of accidental dural puncture (ADP) is in between 0.7 and 2.6%. The incidence of ADP with a Tuohy needle, unrecognized by CSF visualization, but subsequently diagnosed by onset of PDPH, is 1.8%. PDPH may also be even due to a scratch by the tip of a Tuohy needle on the dorsal dura<sup>[7]</sup>.



**Fig 2:** Graphical representations of needle used for central neuraxial blocks 1. 26G Quincke® medium cutting bevel; 2. 26G Sprotte® pencil point; 3. 22G Whitacre pencil point; 4. 16G Tuohy needle; 5. 17G Barkers needle; 6. Large gauge spinal needle; 7. 18G Crawford needle. Needles 5, 6 and 7 are from the Sheffield Anaesthetic Museum and are an indication of the style of spinal needles used in the past. (Reproduced from Geurts JW, Haanschoten MC. Post-dural puncture headache in young patients. Acta Anaesthesiol Scand 1990; 34: 350-3).

**Table 2:** Estimated rate of spontaneous recovery from postdural puncture headache

Duration (days)	Percentage recovery
1 - 2	24
3 - 4	29
5 - 7	19
8 - 14	8
3 - 6 weeks	5
3 - 6 months	2
7 - 12 months	4



**Fig 3:** Unrecognised dural puncture by Tuohy needle. (Reproduced from Joseph Eldor, MD. Combined Spinal-Epidural Anesthesia. www.csen.com) Diagnosis of PDPH should only be made when other causes of headache are ruled out.

When a headache occurs after spinal or epidural anaesthesia it must be considered potentially serious and should be differentiated from other causes of headache. Awareness must be cultivated that dural puncture headache is only one of the many causes of headache in postoperative and postpartum period. Careful questioning and physical examination needs to be done for other causes of headache<sup>[8]</sup>. There are enough evidences that both needle size, and tip design impact the incidence of PDPH. The results of a meta-analysis of 450

articles showed reduction of PDPH when: (a) small spinal needle was used compared with a large needle of the same type and (b) non-cutting spinal needles rather than cutting needles were used, unless the discrepancy in needle size is very large<sup>[9]</sup>. With quincke needle the incidence of PDPH is directly related to the size of the needle used<sup>[10]</sup>. In general the relative risk of PDPH decreases with each successive reduction in needle diameter. Many clinical trials investigated the relation between size and design of spinal needle and incidence of PDPH. The literature regarding size and shapes of needle has already been reviewed.

## 2. Materials and Methods

All women aged 18-36 year, primi-para, in term, single uncompromised fetus and uncomplicated pregnancy, admitted in H.N.B Base Teaching Hospital Srinagar Garhwal uttarakhand at department of Obstetrics & Gynecology were included into the study. Two groups were selected and denoted Group A and Group B. The women in both group were scheduled to received spinal anesthesia for elective CS and 25 G Spinal needle were used for group A, whereas 27 G needle were used for group B. Women were selected randomly by lottery methods where all had equal chances to enter each group. All patients were blind for the size of the needle used for spinal anesthesia.

### Exclusion Criteria

Patients refusal, Patients with abnormalities of spine, soft tissue infection at the site of needle insertion, and/or coagulation disorders were excluded. Moreover, patient's factors like history of previous CS or lumbar puncture due to any cause, multiparous, pregnancy induced hypertension, required emergency CS (due to fetal distress or others), obesity (BMI>30), patients on anticoagulation therapy and concomitant respiratory tract infection or suffering from cardiovascular and neurological disorder. Before inclusion, it was assured that they did not suffer from any kind of headache disorder.

All the patients were visited a day before surgery and were described about the study, study procedure and potential benefits and risks. They were assured that procedure of this study will not enhance the chance of postdural headache other than usual headache. All patients were subjected to a thorough and detailed history of present & past medical illness, past history of any surgical as well as anesthetic procedure along with detailed physical examination. Preoperatively, routine investigations like Complete Blood Count (CBC), ECG, serum creatinine, random blood sugar (RBS), serum electrolytes, and chest x-ray were done in each patients.

Blood pressure, heart rate and saturation estimation were done non-invasively half an hour before anesthetic procedure. Moreover, preloading by standard fluid were also done before surgery. With maintaining all aseptic precautions, spinal anesthesia procedure was performed in sitting position by the same anesthesiologist at L3-4 or L4-5 intervertebral space. The patients were given a standard spinal anesthetic consisting of 10–12.5 mg (2.0–2.5 ml) of 0.5% hyper baric Bupivacaine and 25µg Fentanyl (total volume 2.5–3 ml) by either a 25Gx90 mm needle in group A, and 27Gx90 mm needle in group B. Spinal needles were introduced with the needle tip bevel directed laterally following standard sterilization and subcutaneous infiltration of skin by 2ml of 2% lidocaine, which was followed

according to the methodology of the study by Mohammed EL *et al.*<sup>[11]</sup>

Following operative procedure, the patients was turned to the supine position with left uterine displacement. All patients were resuscitated and followed up cautiously during pre-operative, per operative and post-operative period. Fall in systolic blood pressure below 100 mmHg or 20% of the baseline value was treated with rapid administration of i.v. fluids and 5–10 mg of Ephedrine given intravenously. Complications like nausea, vomiting, bradycardia, respiratory depression&/or skin reaction (i.e.; itching, erythema or pruritus) were managed symptomatically and injection metoclopramide, atropine, and pheniramine maleate was used respectively whenever required. The women were interviewed on days 1, 2, and 3 day postoperatively and were questioned about headache. Besides the information regarding incidence, onset of headache, severity, location, and duration, were assessed respectively. PDPH was defined as by the 'headache occurring within 5 days after lumbar puncture, and being aggravated when standing or sitting and relieved when lying flat' according to the definition of the International Classification of Headache Disorder, 3rd edition. Severity of headache was assessed on 1–4 scale<sup>[11]</sup>

(1) Mild headache which permitted long periods of sitting/erect position and no other symptoms. (2) Moderate headache, which made it difficult for the patient to stay upright for more than half an hour. It occasionally accompanied by nausea, vomiting, auditory and/or ocular symptoms. (3) Intense headache immediately upon getting up from bed, alleviated while lying horizontal in bed. Often accompanied by nausea, vomiting, ocular and auditory symptoms and (4) Headache that occurred even while lying horizontal in bed and greatly aggravated immediately upon standing up, eating is impossible because of nausea and vomiting. PDPH was treated with bed rest, Diclofenac 75mg/3ml, i.m., good hydration, paracetamol (1gm twice or thrice daily) and/or Epidural Blood Patch (EBP).

## 3. Result

Total 100 cases of Caesarian section were included in this study. Based on the needle used during spinal anesthesia they were divided into group A and group B. 25 G and 27 G needle was used for group A and group B respectively.

Age and weight distribution of pregnant mothers were almost similar in both groups and there was no statistical difference. Mean age of group A was 25.92±3.94 years and of group B was 26.56±3.83 years. Mean weight of the both groups were respectively 57.90±7.13 kg and 57.26±7.26 kg (Table 3).

Incidence of post-dural puncture headache (PDPH) was higher in Group A (25G) (26%) patients than Group B patients (27G) (10%) and incidence rate is significantly lower ( $p < 0.05$ ) in finer needle size. (Figure1 & Table 3)

Onset, site, severity and duration of headache were comparable across groups. In group a headache took mean 23.75±10.00 SD hours to develop and in group B it was 15.60±11.23 SD hours. The most commonly identified site of headache was occipitofrontal (50%) in group A and occipital (60%) in group B. Fifty percent subjects of group A had moderate headache in comparison of group B (40%) (More illustrated in table 4).

Mean headache duration in both groups were varied and,

majority subjects (41.7%) of Group A had headache duration between 49 to 72 hours. In addition, majority in-group B (60%) had headache duration between 49 to 72 hours (See table 4).

Of all, 22% subjects of group a needed more than one trial to administer spinal regional anesthesia. Whereas, in-group B, 40% subjects needed more than one trial (p 0.05). Significantly, more time was required to get CSF in group B than in group A. Time to get CSF in group A was 35.08±13.43 seconds and in group B 81.12±16.71 seconds. (See table 5).

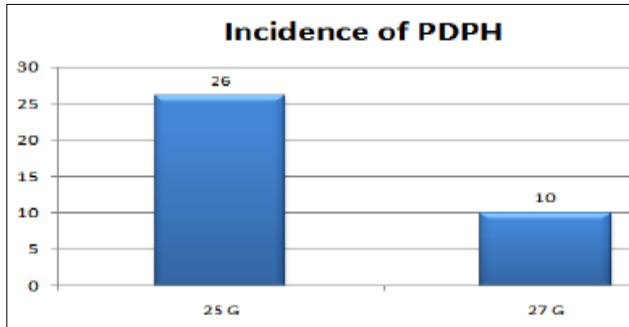


Fig 4

Table 3: Age and weight of patients

Variable	Group A (25G) (n=50)	Group B (27G) (n=50)	P value
Age (years) [Mean ±SD]	25.92 ±3.94	26.56 ±3.83	.41
Weight (kg) [Mean±SD]	57.90±7.13	57.26±7.26	.66

Table 4: Incidence and other information related to post-dural purchase headache (PDPH)

Variable	Group A (25G)	Group B (27G)	p value
Incidence, n (%)	12 (26)	5 (10)	0.04
Onset: (h), mean (SD)			
range	23.75 (10.00) 10 - 43	15.60 (11.33) 7 - 34	0.16
Site of headache, n (%)			
Occipital	4 (33.3)	3 (60.0)	0.49
Occipitofrontal	6 (50.0)	1 (20.0)	
Frontal	2 (16.7)	1 (20.0)	
Severity of headache, n (%)			
Mild	4 (33.3)	2 (40.0)	0.81
Moderate	6 (50.0)	2 (40.0)	
Intense	1 (8.3)	1 (20.0)	
Headache while lying in bed	1 (8.3%)	(0)	
Duration (hours): n (%)			
≤ 24 hours	2 (16.7)	0	0.64
25 - 48 hours	4 (33.3)	1 (20.0)	
49 - 72 hours	5 (41.7)	3 (60.0)	
>72 hours	1 (8.3)	2 (20.0)	

Table 5: Number of trials and time to get CSF during spinal anesthesia

Variable	Group A (25G) (n=50)	Group B (27G) (n=50)	p value
Number trials needed n (%)			
One	39(78)	30(60)	.05
More than one (>1)	11(22)	20(40)	
Time to get CSF (sec): mean (SD)	35.08 (13.43)	81.12 (16.71)	<0.001

4. Discussion

General anaesthesia for Caesarean Section is associated with an increased risk of maternal mortality [12]. It is therefore a popular practice to use regional anaesthesia wherever possible [13]. Headache after dural puncture is a complication of spinal anaesthesia and is believed to result from leakage of CSF both at the time of dural puncture and, probably more importantly, continuing leak afterwards [14].

Post dural puncture headache is a complication that should not be treated lightly. There is the potential for considerable morbidity due to postdural puncture headache [15] and there are reports of PDPH symptoms lasting for months or years [16], untreated PDPH leading to subdural hematomas [17], and even death from bilateral subdural hematoma [18]. Therefore anesthesiologist are advised to prevent PDPH by optimizing the controllable factors like spinal needle size as well as shape while conducting spinal anaesthesia [19]. Obstetric patients are at high risk of PDPH, being female and under 40 years of age [20]. Indeed, the highest incidence of PDPH is in the parturient and may partly explain the higher incidence of PDPH in females as a whole [21]. Diagnosis of dural puncture headache depends upon its association with body position; the pain is aggravated by sitting or standing and relieved or decreased by lying down flat [22]. Apart from other factors, post dural puncture headache is related to the size as well as type of the spinal needle used [23]. It is progressively reduced with the use of thinner Quincke type spinal needles [24].

This study was designed to find out the differences in incidence of PDPH after spinal anesthesia during Caesarian Section using 25 G (Group A) and 27 G (Group B) Quincke spinal needles.

Age distribution of pregnant mothers was similar across groups. The mean age of subjects in group A and group B was 25.92±3.94 years and 26.56±3.83 years respectively. Mohammed E L and El Shal S M in a comparable study used 22G, 25G and 29G needles in three groups of parturient mothers. They reported a mean age of 27.8±5.7 years, 27.3±4.9 years and 27.6±5.0 years respectively in the former mentioned needle groups [11].

The average weight in group A and B was found 57.90±7.13 kg and 57.26±7.26 kg respectively.

Incidence of PDPH was significantly high in cases where the 25G needle (26%) was used compared to cases where 27G needle (10%) was used (p <0.05). This is consistent with findings of other similar studies. Wadood *et al.* [25] reported an incidence of 30.0% in 25G needle group compared to 14.0% in 27G needle group.

Onset, site, severity and duration of headache varied across studies involving comparison of different size needles [11, 25]. Most of them reported minor and statistically non-significant differences across comparisons groups. This implies that these variable did not differ much with use of different needles.

Number of trials for a successful needle prick was found high in 27G spinal needle groups. Forty percent patients in this group required more than one trial. Whereas, patients in 25G group required multiple trials in 22% cases. Time to get CSF fluid was also found to be statistically significantly higher in group B (27G) compared to group A (25G). These findings, supported by other studies [11], indicate that small bore needles, although lowers the incidence of PDPH, have high failure rate, takes longer time to get CSF and prolongs anesthetic injection times. These could be attributed to decreased internal diameter of the more fine needles which

provide increased resistance to CSF fluid as well as local anesthetic agents.

Pencil point needles are considered to produce less damage to the dural fibers and allow the hole to close more readily.

Thus they have a lower incidence of post dural puncture headache than cutting needle tip designs [26]. The overall incidence of postdural puncture headache ranges from 0% to 37% as reported by various authors [27]. Reported frequency of PDPH ranges from 4% 24 to 40% 25 when 25G Quincke spinal needle is used in young females. Ross *et al.* Reported PDPH in 9% of patients. In the study by Roheena and colleagues [28], severity of PDPH was from mild to moderate. None of the patients complained of severe PDPH. It was more on the 1<sup>st</sup> postoperative day and gradually decreased on the subsequent days. Incidence of PDPH with 27 gauge Quincke needle ranges from 1.1% to 12.8% [29]. However, in a recent study by Muhammad, *et al.* [30], frequency of PDPH was 0% with 27G Quincke spinal needle when spinal anaesthesia was administered for Caesarean section. In a study by Viitanen, *al.* [31], PDPH incidence was 8.5%. It was mild in 4%, moderate in 3% and severe in 1% of patients. Symptoms started on first or second day after spinal injection and lasted for 3 days. Our study, therefore, clearly demonstrated a significant reduction in frequency of PDPH when 27G Quincke spinal needle was used as compared to 25G Quincke spinal needles. However, a study by Shah and colleagues [32], which closely resembles our study, demonstrated PDPH incidence of 20%, and 12.5% patients with 25G Quincke, and 27G Quincke needles respectively. Although frequency of PDPH was relatively higher in all the three groups in that study, it was again clearly observed that 27G Whitacre needle reduced the frequency of PDPH in patients undergoing Caesarean section. There also not taken into account whether the patient had any other medical problem causing headache.

## 5. Conclusion

Although PDPH is a self-limiting and nonfatal condition, its postural nature prevents the patient from performing routine activity and many make them anxious and depressed. Therefore these patients require psychological support and a lot of reassurance in addition to therapeutic measures. Preventive measures like smaller needle size, shape of needles and direction of needle bevel in relation to dural fibers, should always be considered with the hope to decrease the incidence of PDPH. Overall, we concluded that when performing spinal anaesthesia for Caesarean section, 27G Quincke spinal needle has definite advantage over 25G Quincke spinal needles as far as frequency and severity of PDPH is concerned. Therefore we recommend routine use of the 27G Quincke spinal needle when performing spinal anaesthesia for Caesarean section.

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