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# Comparison of incidence of PDPH between two different gauges of whitacre spinal needles in patients undergoing caesarean section

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**Abstract**
**Background**: One of the complications of spinal anesthesia especially in pregnant women is post dural puncture headache (PDPH). Objectives of the study was to compare the incidence of PDPH between 25G and 27G Whitacre spinal needles and to compare the ease of lumbar puncture.
**Materials and Methods:** Two hundred elective caesarean section patients were allocated into two groups of 100 each. In Group 1, Spinal anesthesia was given with 25 G and in group 2 with 27 G Whitacre needle.
**Results:** Incidence of PDPH between two groups is not statistically significant with zero percent incidence. It was technically easier to perform lumbar puncture with 25 G Whitacre needle than 27 G needle which was statistically significant.
**Conclusion:** It is technically easier to perform lumber puncture with 25G whitacre needle with no difference in the incidence of PDPH between 25G and 27G Whitacre needle.

**Keywords:** Post-dural puncture headache; cesarean section; quincke spinal needle; whitacre spinal needle

## 1. Introduction
Pain is the most unpleasant sensation which is well understood by mankind. To quote Hippocrates - "divine is the task to relieve pain". The International Association for study of pain has defined pain as “A conscious sensation of distress, suffering or agony with actual or atleast potential tissue damage”. Anesthesiologist plays a pivotal role in the management of pain and providing totally pain free surgical experience. WHO recognizes pain as the fifth vital sign and alleviation of pain is regarded as basic human right [1].
Spinal anesthesia is one of the most commonly used anesthesia technique for lower extremity and lower abdominal surgeries. It acts by temporary interruption of transmission of nerve impulses when a local anesthetic agent is injected into subarachnoid space. It is economical, safe, easy technique and is preferred over general anesthesia (GA) [2].
In the late 1800s, spinal anesthesia was developed with the work of Wynter, Quincke and Corning [3]. However, Karl August Bier, a Germen surgeon was the first person to give spinal anesthesia deliberately using 3 ml of 0.5% cocaine [4]. Later Hildebrandt and Bier performed spinal anesthesia on each other and they experienced the clinical symptoms of Post Dural Puncture Headache (PDPH) [1]. He describes his personal experience as this.
*“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* [5]*. ’’*
He also explained that headache was due to excessive loss of cerebrospinal fluid [3].
After public demonstration of ether anesthesia by WTG Morton in 1846, it was introduced into obstetric practice. Until it was in 1901, a Swiss obstetrician used intrathecal cocaine for the relief of pain in the second stage of labour that regional anesthesia for obstetrics became popular. In 1930s, there was high incidence of vomiting and PDPH following caesarean section performed under spinal anesthesia that lead to reduction in this technique. Hence 1930 to 1950 is called ' Dark ages of Obstetrics Anesthesia'.
To decrease the incidence of PDPH various gauges (G) and tips of spinal needles were devised as PDPH is directly related to gauge and type of spinal needle [6, 7]. With the introduction of non-cutting and pencil point needle by Whitacre and Hart in 1951, incidence of PDPH has reduced dramatically over the years.[3] Since then spinal anesthesia has become the most commonly used anesthesia technique for caesarean section (CS) [8].

Post Dural Puncture Headache can occur as a result of diagnostic lumbar puncture, spinal anesthesia and un-intentional dural puncture during epidural anesthesia. It is one of the most common post-operative complications of spinal anesthesia, especially in pregnant women [6]. Though self-limiting, PDPH is unpleasant, may affect the neonatal care by the mother and may prolong hospital stay [9]. Rarely, it may be associated with serious complications like subdural hematoma, seizures and sagittal sinus thrombosis [5]. There are several studies comparing the non-cutting (Whitacre) and cutting (Quincke) needles to decrease PDPH, which supports the use of Whitacre needle in reducing the incidence of PDPH [4,5,8, 9].

There are very few studies evaluating the difference in the incidence of PDPH with different sizes of Whitacre needle. Hence the present study is an attempt to compare the incidence of PDPH with the use of 25G & 27G Whitacre needle in patients undergoing elective CS.

## 2. Objectives of the study

Primary objective was to compare the incidence of post dural puncture headache between patients receiving spinal anesthesia for caesarean section with 25G and 27G Whitacre spinal needles. Secondary objectives were to compare the ease of lumbar puncture and the incidence of failed spinal anesthesia between the two groups

## 3. Materials and methods

This prospective, randomized, observational study, approved from institution ethics committee of our hospital was done from December 2014 to May 2016. Written informed consent was taken from all the patients. Patients aged between 18-35 of ASA I & II undergoing elective caesarean section were included in the study. Patients who refused, infection at the site of injection, pregnancy with PIH, emergency Caesarean Section delivery, patients with spinal deformity/surgery, multiple pregnancy, patients with deranged coagulation profile were excluded.

Two hundred patients were randomized into two groups containing one hundred patients in each, using computer generated random numbers and sealed envelope method.

- **Group 1:** Patients received spinal anesthesia with 25G Whitacre needle
- **Group 2:** Patients received spinal anesthesia with 27G Whitacre needle

In both the groups 0.5% hyperbaric bupivacaine was used for giving spinal anesthesia. All patients included in the study underwent a thorough pre-operative assessment including detailed history, clinical examination and necessary investigations. Age, height, weight and ASA grade of the patients were recorded. Premedicated Tab. Ranitidine 150 mg and Tab. Metoclopramide 10 mg orally, 2 hours before surgery. After securing the IV line using 18G cannula, patients were pre-loaded with 20 ml/kg of isotonic saline. Routine monitors like electrocardiograms (ECG), noninvasive blood pressure (NIBP), oxygen saturation (SpO2) were applied.

Patients were allocated into either group 1 or group 2 by computer generated randomization table. Group 1 patients received spinal anesthesia with 25 G Whitacre spinal needle and Group 2 patients received spinal anesthesia with 27G Whitacre spinal needle. Anesthesiologists of all grades with prior experience of spinal anesthesia performed the blocks. Patients were put in sitting position. Patient's back was cleaned under complete aseptic precautions, with povidone iodine and draped. After administering local anesthesia with 2% lignocaine, lumbar puncture was done with the Whitacre needle in the midline either between L2-3 or L3-4 inter-laminar space with the help of an introducer. Successful entry of subarachnoid space was evidenced by clear, free flow of CSF. The degree of difficulty of lumbar puncture was assessed by the anesthesiologist on a four-point scale.

1 = Easy (one attempt)
2 = Moderate (2-3 attempts)
3 = Difficult (>3attempts)
4 = Impossible.

Bupivacaine heavy 0.5%, 2.4ml, was injected into the subarachnoid space. No additives were used. After the block, the patient was placed in supine position with a wedge under right buttock. Level of sensory and motor blockade and changes in parameters like heart rate, BP were recorded. Solution of Ringer's lactate, NS or colloid was infused as a maintenance fluid based on haemodynamic status of the patient. Blood was transfused according to the blood loss. Hypotension was treated with ephedrine in titrated doses intravenously. Complications like nausea, vomiting, bradycardia, respiratory depression if occurred, were managed symptomatically.

Patients were followed-up for 96 hours for the incidence of PDPH. The person assessing the PDPH was blinded as to the gauge of the spinal needle used.

Failure of spinal anesthesia was defined as either the inability to elicit free flow of CSF after three attempts or clearly inadequate analgesia for surgery at 15 min after injection of local anesthetic. In such circumstances general anesthesia was administered with all standard care.

No limitations was placed on patient's ambulation after complete sensory and motor function had returned.

### 3.1 Criteria for PDPH

1. Mostly localized in occipital, frontal or generalized.
2. Aggravated by erect or sitting position, coughing and straining.
3. Relieved by lying supine.

### 3.2 Severity of headache was assessed on 1-4 scale. (Crocker 1976) (6)

- **Grade 1:** Mild headache which permitted long periods of sitting/erect position and no other symptoms.
- **Grade 2:** Moderate headache, which made it difficult for the patient to stay upright formore than half an hour. Occasionally accompanied by nausea, vomiting, auditory and ocular symptoms.
- **Grade 3:** Intense headache immediately upon getting up from bed, alleviated while lying horizontal in bed. Often accompanied by nausea, vomiting, ocular and auditory symptoms.
- **Grade 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.

Treatment of headache was individualized and ranged from non-opioid analgesics and increased oral or intravenous fluids with bed rest, to oral caffeine and epidural blood patch when necessary.

### 4. Statistical analysis
Student's t-test was used in comparing independent variables like age, height, weight. Fisher's exact test was used to assess technical difficulty. The Chi Square ($\chi 2$) test was used to compare the incidence of PDPH, non-spinal headache and failed spinal anesthesia. A P value < 0.05 was considered statistically significant.

### 5. Results
Following the data collection, statistical analysis was done as described above. The results were as follows;

The study participants of two study groups were comparable in terms of age, height and weight. Majority of the study participants were in young adults in each group, whose mean age from Group 1 & Group 2 were 27.91±4.62 years and 27.38±3.98 years, respectively (p= 0.39).

**Table 1:** Demographic Data

| | Group | N | Mean | SD | Mean difference (95%CI) | t | df | p-value |
|---|---|---|---|---|---|---|---|---|
| Age | Group 1 | 100 | 27.91 | 4.62 | 0.53 (-0.67, 1.73) | 0.87 | 198 | 0.39 |
| | Group 2 | 100 | 27.38 | 3.98 | | | | |
| Height | Group 1 | 100 | 154.15 | 3.17 | 0.11 (-0.84, 1.06) | 0.23 | 198 | 0.82 |
| | Group 2 | 100 | 154.04 | 3.64 | | | | |
| Weight | Group 1 | 100 | 65.92 | 5.21 | -0.75 (-2.23, 0.72) | -1.00 | 198 | 0.32 |
| | Group 2 | 100 | 66.67 | 5.39 | | | | |

Independent sample t test;*$p$< 0.05 Statistically Significant; $p$>0.05 Non-significant, NS

The mean age, height & weight are represented in the Figure 1, 2 & 3 respectively. The p value for age, height & weight is 0.39, 0. 82 & 0.32 respectively. A total of 75 subjects from Group 1 and 81 subjects from group 2 were fitting in ASA Grade-I, while 25 and 19 subjects from group 1& 2 respectively, were fitting in ASA Grade.

**Table 2:** ASA

| | Group | | Total |
|---|---|---|---|
| | Group 1 | Group 2 | |
| ASA Grade 1 | 75(75.0%) | 81(81.0%) | 156(78.0%) |
| ASA Grade 2 | 25(25.0%) | 19(19.0%) | 44(22.0%) |
| Total | 100(50.0%) | 100(50.0%) | 200(100.0%) |

Chi square value (df) = 1.05(1), p= 0.31

We assessed ease of lumbar puncture, which was measured by the number of attempts being taken in each patient. With 25 G Whitacre needle in group 1, single attempt was enough in 93 and only 07 patients needed an additional attempt to access the subarachnoid space. Whlie in group 2 using 27 G Whittacre needle, required single attempt in 79 patients, second attempt in 20 patients and one patient required 4 attempts. It is important to note that while there was one case which required >3 attempts from group 2, none of the patients required 3 attempts. Significant association with regards to number of attempts was established by Fisher's exact test (p=0.007).

**Table 3:** Technical difficulty

| | Group 1 | Group 2 |
|---|---|---|
| Easy | 93 | 79 |
| Moderate | 7 | 20 |
| Difficult | 0 | 1 |
| Total | 100 | 100 |

*p<0.05 Statistically Significant; p>0.05 Non significant, NS; Fisher's exact test, p=0.007, None of the subjects across the two groups had Post Dural Puncture Headache.

### 6. Discussion
Spinal anesthesia is the most commonly used regional technique in caesarean sections. It is rapid in onset, produces dense motor block, profound analgesia and adequate muscle relaxation. It is safe, economical, doesn't need any sophisticated equipment to administer anesthesia.

When loss of CSF is greater than production as might occur after dural puncture leads to fall in the CSF pressure which inturn leads to intracranial venous dilatation resulting in increase in brain volume in upright position. It will also exert traction and stimulate pain sensitive structures like dural vessels, basal dura and tentorium cerebelli resulting in post spinal headache. The larger the hole in the dura, the more will be the leakage of CSF and increased incidence of PDPH. Number of dural punctures is also important, as it can lead to seepage of CSF resulting in low CSF pressure. It takes two weeks or more for the holes to seal [6].

After the experience of PDPH by August Bier in 1898, extensive studies have been done regarding incidence, risk factors, methods of prevention and treatment of PDPH. Many studies have been done previously to compare the incidence of PDPH and they have documented that needle tip configuration and needle size greatly influence the incidence of PDPH [6, 8, 9, 10].

After the dural puncture excessive loss of cerebrospinal fluid results in reduction in intracranial pressure. Larger the needle size, particularly larger than 25G, the rate of CSF loss through the dural perforation is generally greater than the rate of CSF production [11].

Many studies have been done previously to compare the incidence of PDPH between different gauges of Quincke and Whitacre spinal needle. They have documented that incidence of PDPH is less with the Whitacre needle when compared to Quincke needle [6, 8, 9, 10]. There were very few studies comparing two different gauges of whitacre spinal needles.

Lynch *et al* conducted a study on the incidence of successful spinal anesthesia and post dural puncture headache using 27G Quincke and Whitacre's spinal needles in 398 ASA grade I or II patients undergoing elective orthopaedic procedures. It was concluded that, both the needles are associated with very low incidence of both PDPH and failed anesthesia [12].

The present clinical trial was an attempt to compare role of two needles that is 25 G Whitacre and 27 G Whitacre needles with respect to the incidence of PDPH as well as the number of attempts required to administer successful subarachnoid block (SAB).

In our study we evaluated 200 patients undergoing elective caesarean section under spinal anesthesia to compare the incidence of post dural puncture headache between two different gauges of Whitacre spinal needle. Out of these 100

patients received spinal anesthesia with 25G Whitacre needle and the remaining 100 patients received with 27G Whitacre needle. Two groups were comparable in terms of age, height and weight.

The International Headache Society classified it as one "that occurs or worsens less than 15 minutes after assuming the upright position and disappears or improves less than 30 minutes after resuming the recumbent position" [13].

In this study none of the patients developed post dural puncture headache which were followed up till fifth post-operative day. Two patients in Group 1 and one patient in Group 2 had non spinal headache with no postural variations which got relieved with analgesics like paracetamol.

Srivastava *et al* [8] conducted a study on 120 patients of ASA I & II obstetric & non-obstetric groups undergoing elective/emergency surgery to assess the incidence of PDPH using 27G Quincke & 27G Whitacre Needles. They found that there was no incidence of PDPH in non-obstetric group. While in obstetric cases the incidence of PDPH is 2% with 27G Whitacre needle and 4% with Quincke spinal needle.

In a study by Kang S B and associates, Seven hundred thirty ambulatory surgery patients, randomly assigned to receive spinal anesthesia with a 26 - or 27 G needle, were studied for the incidence of post-dural puncture headache (PDPH), post-operative back pain, and patient acceptance. The incidence of PDPH following the use of 26- and 27-G needles was 9.6% and 1.5%, respectively. They concluded that for ambulatory surgery, the use of 27-G needles resulted in a significantly lower incidence of PDPH and greater patient acceptance compared with the use of 26-G needles [14].

Santanen and associates compared spinal anesthetia using 27-G Quincke and 27-G Whitacre spinal needle. They reported that the incidence of PDPH was less in Whitacre group (0.37%) than the Quincke group (2.70%) which was clinically significant [15].

Shah *et al*, compared the incidence of PDPH after 25 G and 27 G Quincke needles, and 27 G Whitacre's needle during spinal anesthesia for Caesarean section and found that PDPH was minimum with 27 G Whitacre's needle (although statistically insignificant), but had a higher failure rate with regards to the single needle insertion [6].

Lambert *et al*, studied 4125 parturient patients undergoing spinal anesthesia compared between 26 G and 27 G Quincke and 25G Whitacre spinal needle, and concluded that use of smallest Gauge needle and the one that has non cutting Whitacre needle produced lowest incidence of PDPH [16].

V.R Shah concluded that the pencil point needles are associated with low incidence of PDPH than Quincke needles, the 25 G Whitacre needle was preferred choice as it has better success rate than compared to other needle [17].

The secondary outcome of our study was to assess technical difficulty in administering successful subarachnoid block. In this study, 93 subjects required one attempt and 25 subjects required 2-3 attempts in Group 1. None of the subjects required >3 attempts. In Group 2, 79, 20 subjects and only one patient required one, 2-3 and > 3 attempts respectively. It was statistically significant with the p value of 0.007. It was easier to perform lumbar puncture with 25 G Whitacre than27 G Whitacre needle as evidenced in this study where 93 subjects out of 100 in Group 1 required one attempt. Whereas 79 subjects in group 2 required single attempt. Only one patient in Group 2 required >3 attempts. In this study we could successfully perform subarachnoid block in all the patients.

There are few studies which compare technical difficulties in the use of different spinal needle. In a study by Shutt *et al*, the failure rate was 2 % and 6 % with 22 G and 25 G Whitacre needle. In another study by shah *et al* 25 G Quincke needle was associated with the greatest incidence of successful dural puncture following a single needle insertion (100 %). The 27 G Quincke needle was associated with 4 % failure rate. The 27 G Whitacre needle was associated with the greatest failure rate (12%) because of more needle flexibility.

## 7. Conclusion

Incidence of PDPH in patients undergoing elective caesarean section under spinal anesthesia using 25G and 27G Whitacre needle is not significant with zero incidence in both the groups. Number of attempts required for successful subarachnoid block is better with 25G than 27G Whitacre needle.

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