

## Spinal anaesthesia for caesarean section: Comparison of 25G Whitacre needles with 25G and 23G Quincke needles for technical problems and post-operative complications

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### Abstract

**Background:** The well-known complication of spinal anaesthesia, postdural puncture headache (PDPH), is especially troublesome in young obstetric patients. The needle gauge and configuration of needle tip appear to be the important factors in reducing the incidence of PDPH. We compared the type and size of spinal needles namely whitacre 25G and Quincke 25G and 23G needles in obstetric patients undergoing caesarean section.

**Methods:** Hundred women, age group 18-30 yrs., of ASA grade I and II undergoing spinal anaesthesia for elective caesarean sections were randomly allocated into three groups. In Group I and II, patients received spinal anaesthesia with 23G and 25G Quincke needles whereas in Group III, 25G Whitacre needles were used. The efficacy and usefulness of the needles were studied in preventing the complications like PDPH, backache, non-PDPH and the results obtained were compared statistically.

**Results:** Of the 100 patients, PDPH occurred in 11 patients (11%). The overall incidence of PDPH is 20.5% in 23G Quincke group, 9.09% in 25G Quincke group and 3.03% in 25G Whitacre group. In the present study the incidence of back ache was 23.52% in 23G Quincke group, 15.15% in 25G Quincke group, 9.09% in 25G group.

**Conclusion:** The pencil point 25G Whitacre needle was associated with a lower incidence of PDPH when compared with 25G and 23G Quincke needle and hence could be used routinely for spinal anaesthesia in caesarean section.

**Keywords:** Spinal anaesthesia; PDPH, Whitacre, Quincke spinal needles

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### Introduction

Spinal anaesthesia is now regarded by many as the technique of choice for caesarean section.<sup>(1)</sup> The well-known problems of general anaesthesia for obstetric operative delivery are avoided by the use of regional techniques. The advantage of the latter includes increased safety and maternal satisfaction. Increasing use of regional techniques may be a factor in the recent decline in anaesthesia related maternal mortality.<sup>(2)</sup> Spinal anaesthesia in obstetrics differs from that in non-pregnant patients in several ways;<sup>(3)</sup> smaller doses of local anaesthetic agent are required, increased incidence of post dural puncture headache (PDPH) and hypotension, technical difficulties due to increased lumbar lordosis and less cooperative patient in the emergency setting are more likely.

PDPH has been regarded as the most common complication of spinal anaesthesia.<sup>(4)</sup> It is severely debilitating for mother who, ideally should be able to mobilize and care for her new born baby. Needle gauge and the shape of the needle tip appear to be important in reducing the incidence of PDPH. Studies have revealed evidence in favour of a spinal needle with a pencil point tip such as Whitacre or Sprotte spinal needles.<sup>(5,6)</sup> However, some studies have failed to confirm this lower incidence of PDPH when using spinal needles with a pencil point tip.<sup>(7-9)</sup>

The aim of this prospective randomized comparative study was to evaluate the influence of available needle gauge (23G, 25G) and design (Whitacre and Quincke) on technical problems and incidence of postoperative complications like PDPH, Non PDPH and Backache in obstetric patients undergoing spinal anaesthesia for caesarean section.

### Material and Methods

The protocol was approved by the hospital ethical committee and the study was carried out on 100 women of ASA grade I and II undergoing spinal anaesthesia for elective caesarean sections. The women were between Age group 18-30 yrs., Weight range of 45-60 kgs and Height range of 145-160 cm. The patients excluded from the study were those having preeclampsia, eclampsia, vulvular heart disease, infection at the site of injection, systemic hypotension (Systolic arterial pressure less than 100 mm Hg) and vertebral anomaly. Written informed consent was obtained from all patients prior to the inclusion in the trial. Patients were randomly divided by computer-generated random numbers into three groups. Group I (23Q): Patients who received spinal anaesthesia with 23-gauge Quincke needle, Group II (25Q): Patients who received spinal anaesthesia with 25-gauge Quincke needle, Group III (25W): Patients who received spinal anaesthesia with 25-gauge Whitacre needle. A thorough and detailed history of present and past medical illness,

past history of anaesthetic exposure with concomitant history & drugs taking in preoperative period were also recorded. Routine investigations including coagulation profile was done. General and systemic examinations of all the patients were done.

In the operating room patients were monitored non-invasively with NIBP, ECG and pulse oximeter. A preload of 500ml of ringer lactate solution was administered before induction of spinal anaesthesia. Spinal anaesthesia was given in left lateral decubitus position. Anaesthesiologists with more than 5 years of experience conducted all the lumbar punctures. The back of the patients was cleaned with spirit and draped with sterile towels, spinal anaesthesia was performed using a midline approach at L3-4 intervertebral space using one of the above spinal needles with needle bevel orifice pointing laterally. Identification of a free flow of CSF marked the end point of needle placement. If no CSF was identified the needle was withdrawn and a second attempt was made. Any backward movement of the needle followed by the redirection was classified as a further attempt. After identification of CSF, 0.5% bupivacaine (12 mg) was injected through the spinal needles. After withdrawal of the needle, the patient was turned to the left wedged supine position. Level of sensory blockade and changes in parameters like heart rate, blood pressure were recorded. Solutions of ringer lactate, dextrose, saline and colloids were infused as maintenance fluids according to blood loss, patient's condition, response of surgery, or according to hemodynamic stability. Complications like nausea, vomiting, bradycardia, respiratory depression, skin reaction were managed symptomatically. All patients were blinded to the needle utilized. The Anesthesiologist conducting the procedure was not blinded as the two needles have a different appearance making blinding impossible. Patients were assessed after operation by an investigator blinded to the needle and not involved in their perioperative care.

All the patients were questioned about headache with regards to its severity, location, onset, effect of posture, character and duration, associated symptoms like nausea, vomiting, auditory and ocular symptoms. Criteria of PDPH were:<sup>(10)</sup> whether the headache occurred typically after the patient became ambulatory, was aggravated in the erect or sitting position and was relieved by the patients lying flat, whether the localization was mostly frontal or occipital, whether headache was accompanied by dizziness, vomiting, rigidity of the neck and visual or auditory disturbances. Otherwise, the headache was recorded as non-post dural puncture headache (NPDPH). The headache was graded as:<sup>(11)</sup> **Mild** (not interfering with activity, facial makeup applied, able to care for child), **Moderate** (able to care for child, ambulation for short period, and little interest in appearance), **Severe** (unable to care for child, up only to toilet if at all, tinnitus or diplopia).

The study groups were compared for the number of attempts required to achieve dural puncture, and the incidence of headache and other post-operative complications. Power analysis based on a similar previous study<sup>(12)</sup> revealed that a sample size of 33 patients per group was sufficient to achieve a power of 80% and an alpha error of 0.05 to detect a 20% reduction in incidence of PDPH: Statistical analysis was performed using SPSS version 17. To analyze the data, ANOVA Scheffé's test made comparisons between the groups  $p < 0.05$  was considered as statistically significant,  $p > 0.05$  was considered non-significant, whereas  $p < 0.01$  was considered as statistically highly significant. Data are presented as mean  $\pm$  SD, median (range) values and numbers (percent).

### Observation and Results

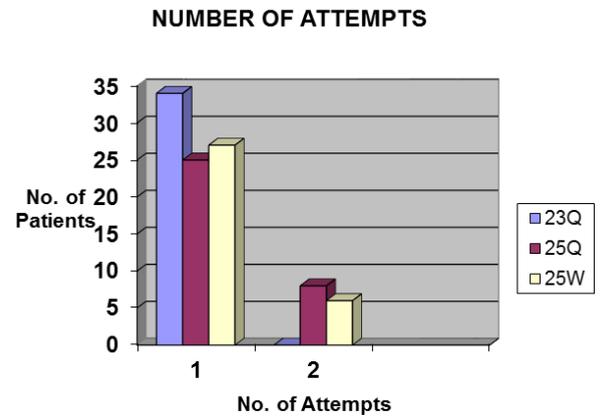
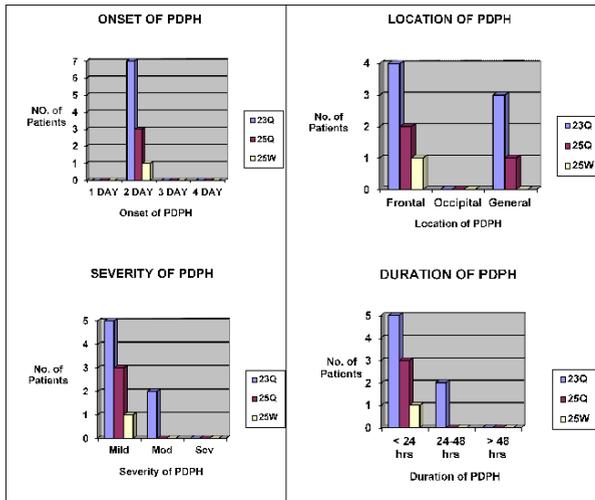
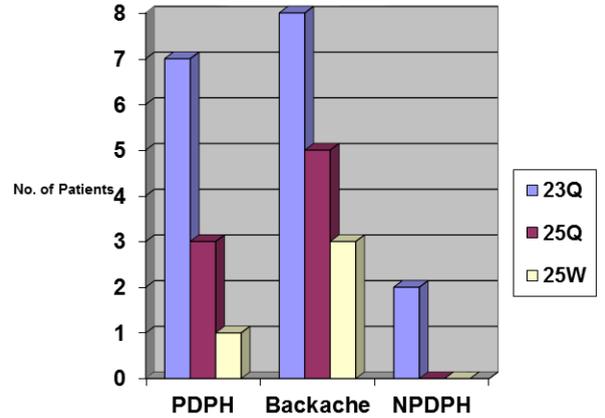
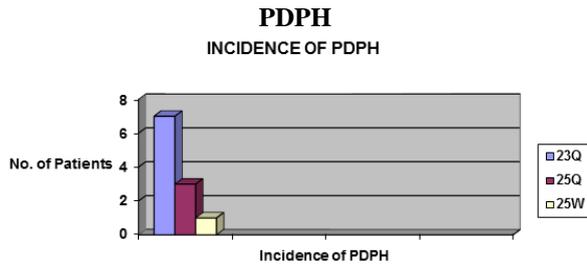
Of the 100 patients, PDPH occurred in 11 patients (11%) as shown in Table 1. The overall incidence of PDPH was 20.5% in group I (23Q), 9.09% in group II (25Q) and 3.03% in group III (25W). In 9 patients, out of 11 patients who developed headache, the duration of headache, lasted less than 24 hrs. In 2 patients, the duration of headache was up to 48 hrs. In 9 patients out of 11 patients who developed PDPH had mild headache and 2 patients had moderate headache. In 7 patients out of 11 patients who developed headache, the location was frontal region, 4 patients had generalized headache.

Once the symptoms and signs of PDPH were confirmed and diagnosed, the patients were first treated by conservative means like bed rest, encouraging them to take good intake of fluids. If patient is unable to take oral fluids then i.v fluids were given. Pharmacological measures were adopted to treat by either Tab. Aceclofenac 100mg BD or Tab caffeine or Inj. Diclofenac 75mg IM.

**Table 1: Post-spinal Headache**

	Group I (23Q)	Group II (25Q)	Group III (25W)
	No. (%)	No. (%)	No. (%)
Incidence	7 (20.5)	3 (9.09)	1 (3.03)
Onset			
1 <sup>st</sup> Day	-	-	-
2 <sup>nd</sup> Day	7 (63.6)	3 (27.3)	1 (9.1)
3 <sup>rd</sup> Day	-	-	-
4 <sup>th</sup> Day	-	-	-
Location			
Frontal	4 (36.38)	2 (18.12)	1 (9.10)
Occipital	-	-	-
Generalized	3 (27.3)	1 (9.10)	-
Severity			
Mild	5 (45.5)	3 (27.3)	1 (9.10)
Moderate	2 (18.2)	-	-
Severe	-	-	-
Duration			
< 24 hrs	5 (45.5)	3 (27.3)	1 (9.10)

24 – 48 hrs	2 (18.2)	-	-
> 48 hrs	-	-	-



Post Operative Complications

Post-operative backache was most prevalent in the group of women in whom a 23-gauge Quincke needle had been used, but the number of cases was not significantly different from that in the two other groups as shown in Table 2. There were two cases of non-PDPH in 23 G Quincke group and no incidence of dysuria in all three groups.

Table 2: Post-Operative Complications

Complications	Group I (23Q) (n=34)	%	Group II (25Q) (n=33)	%	Group III (25W) (n=33)	%
Headache						
PDPH	7	20.5	3	9.09	1	3.03
NPDPH	2	5.9	-	0	-	0
Backache	8	23.5	5	15.2	3	9.09
Dysuria	-	0	-	0	-	0

PDPH = Post Dural Puncture Headache

NPDPH = Non Post Dural Puncture Headache

In the present study, the CSF appeared in first attempt in all 34 cases (100%) in-group I (23Q) as shown in Table 3. The CSF appeared in first attempt in 25 (75.60%) cases and in second attempt in 8 (24.40%) cases in-group II (25Q). The CSF appeared in first attempt in 27 (81.9%) cases and in second attempt in 6 (18.1%) in-group III (25W).

**Table 3: Number of attempts for successful Dural puncture**

No. of Attempts	Group I (23Q) (n=34)		Group II (25Q) (n=33)		Group III (25W) (n=33)	
	No. of Cases	%	No. of Cases	%	No. of Cases	%
1	34	100	25	75.60	27	81.90
2	0	-	8	24.40	6	18.10
Total	34	100	33	100	33	100

P < 0.05 between Group I and Group II (Significant)

P > 0.05 between Group II and Group III (Not Significant)

P < 0.05 between Group III and Group I (Significant)

## Discussion

The primary outcome of our study was that, the pencil point 25G Whitacre needles were associated with a lower incidence of PDPH (3.03%) when compared with 25G Quincke (9.09%) and 23G Quincke (20.5%) needles and secondary outcome was that the efficacy of pencil point 25G Whitacre needles like ease of insertion, number of attempts for successful dural puncture were satisfactory. The relative high incidence of PDPH in obstetric patients is considered to be a major disadvantage of the technique. The high incidence of PDPH may be explained by extreme changes in intra-abdominal pressure during labor, which could influence CSF pressure, the rapid changes in blood volume following delivery, the dehydration during labor and changing hormonal levels.<sup>(13)</sup> The majority of research related to spinal anaesthesia is therefore directed towards improvement of prophylaxis of PDPH. From the time August Bier<sup>(14)</sup> performed the first spinal anaesthesia, different modification of spinal needle tip have been made to suit various conditions. Greene H.M<sup>(15)</sup> proposed that a change of the point of spinal needle to a rounded shape would cause less damage to the dural fibers. Hart and Whitacre<sup>(16)</sup> suggested that similar needle which would separate or penetrate in a way a cambric needle penetrates fabric, would be less traumatizing than a needle which cuts or tears the fibers of the dura. On withdrawal of the needle the fibers should 'quickly return to a state of close opposition' and thereby reduce leakage. The result of their work was the introduction of the whitacre pencil point needle.

The occurrence of headache will depend on the balance between the rate of fluid loss and the rate of CSF production. If CSF production cannot compensate for the rate of loss then the reduction in subarachnoid fluid volume allows the brain to descend (Brain - Sag) within the cranium when the patient adopts the sitting or standing position. This leads to traction on pain-sensitive supporting structures of the brain and on the venous sinuses and cerebral vessels. Moreover, a compensatory mechanism to restore the intracranial volume (munroe and kelly's theory) results in dilatation of intracranial blood vessels.<sup>(17)</sup> Pain is referred from above the tentorium via the trigeminal nerve (V) to the frontal region and from below the tentorium via the glossopharyngeal (IX) and vagus (X) to the occiput and

via the upper cervical nerves(1,2,3) to the neck and shoulders.<sup>(18)</sup>

In the present study the incidence of PDPH was 20.5% (7 cases) in 23 G Quincke group, 9.09% (3 cases) in 25G Quincke group and 3.03% (1 case) in 25G Whitacre group. The present study was comparable to the similar studies done by Vallejo MC et al<sup>(12)</sup> and Buettner J et al.<sup>(19)</sup> Vallejo MC et al<sup>(12)</sup> in their study, the incidence of PDPH was 8.7% in 25G Quincke group and it was 3.1% in 25G Whitacre group. Buettner J et al<sup>(19)</sup> in their study the incidence of PDPH was 8.5% in 25 gauge Quincke group and it was 3% in 25G Whitacre group. As regards the 23G Quincke group the incidence of PDPH is 20.5% which is much lower to the study done by Prager et al,<sup>(20)</sup> in his study the incidence was 25% in 23G Quincke group. In all the 11 patients, the headache developed 24hrs after the dural puncture. In 7 patients out of 11 patients (63.6%) who developed headache, the location was frontal region and 4 patients (36.4%) had generalized headache. In 9 patients out of 11 patients who developed headache, had mild headache and 2 patients had moderate headache. In 9 patients out of 11 patients who developed headache, the duration of headache lasted less than 24 hrs and in 2 patients the duration of headache was up to 48 hrs. As regards the onset of headache the present study was comparable to the study of Shutt LE et al,<sup>(21)</sup> in their study, onset of headache was from 18 to 57 hrs after dural puncture.

As regards onset, location, severity & duration of headache the present study was comparable to the study of Shah A et al.<sup>(22)</sup> In their study the location of headache was frontal region in 7 cases (75.7%) and it was generalized in 2 cases (22.3%). In their study all the patients who developed PDPH had mild headache, the duration of headache lasted less than 24 hrs. and in 1 patient the duration of headache was up to 48 hrs.

In the present study the incidence of back ache was 23.52% (8 cases) in 23G Quincke group, 15.15% (5 cases) in 25G Quincke group, 9.09% (3 cases) in 25G whitacre group which was comparable to a similar study of Shutt LE et al.<sup>(21)</sup> In their study the incidence of backache was 22.4% in 22G whitacre group. 8.5% in 25G whitacre group and 8.3% in 26G Quincke group. In the present study 2 cases had NPDPH, which was comparable to the study of Shutt LE et al.<sup>(21)</sup> In their study the NPDPH developed in 2 cases which was mild,

began less than 24 hrs after dural puncture and subsided without treatment.

In the present study, the CSF appeared in first attempt in all 34 cases (100%) in-group I (23Q). The CSF appeared in first attempt in 25 cases (75.60%) and in second attempt in 8 cases (24.40%) in-group II (25Q). The CSF appeared in first attempt in 27 cases (81.9%) and in second attempt in 6 cases (18.1%) in-group III (25W). Shutt LE et al<sup>(21)</sup> in their study, the successful dural puncture in first attempt in 25G whitacre group 32 cases (64%) and in second attempt in 12 cases (24%), the successful dural puncture in first attempt in 26G Quincke group is 24 cases (48%) and in second attempt in 8 cases (16%) & the successful dural puncture in first attempt in 22 G whitacre group is 39 cases (78%) and in second attempt in 4 cases (8%). The present study was comparable to Shutt LE et al<sup>(21)</sup> who also got similar results like the present study where the difference between group II and group III were not statistically significant i.e. to say the type of needle namely 25G Quincke and 25G Whitacre needles are not different as regards the no. of attempts and ease of insertion. In the present study, the difference between Group I and Group II and also between Group III and Group I conclude that the size of the needle is the determining factor as regards the ease of insertion.

Strength of our prospective randomized comparative study was that we kept number of factors constant to study the effect of needle design and needle size like nature of surgery, study population, age group, approach of lumbar puncture, experience of anaesthesiologist, type of local anesthetic solution and volume of local anaesthetic injected.

Our study has a number of limitations. First, the limitations of our study include a relatively small sample size in proportion to the burden of this postoperative morbidity. Second, the anaesthesiologist who performed anaesthesia was not blinded to the type of needle. Postoperative outcome assessors were blinded to the group assignment in order to mitigate that limitation. Third, we followed our patients only for 5 days, because most of patients discharged on 5<sup>th</sup> postoperative day. However, we knew the fact that the symptoms of PDPH could develop in 15 days after the lumbar puncture.<sup>(23)</sup> Fourth, Whitacre needles used in our study are more expensive than Quincke needles. As our hospital is a public sector hospital and patient belongs to low socio economic status the Quincke needle reduces the economical burden as compared to Whitacre needle. Although, the choice of spinal needle must include other cost consideration, such as cost and side effects of medications used to treat PDPH, cost of epidural blood patch, a possible extended hospital stay, added discomfort to patient and increased staff requirement, there is a need for further multicentric RCT to compare cost factor versus cost effectiveness between finer gauge Whitacre and Quincke spinal needles. Future trails could investigate these aspects so that routine use of pencil

point spinal needles could be recommended in obstetric patients even in public sector hospitals.

## Conclusion

The pencil point 25G Whitacre needles are associated with a lower incidence of PDPH when compared with 25G and 23G Quincke needles and their efficacy like ease of insertion, number of attempts for successful dural puncture are satisfactory. Thus pencil point Whitacre needles are quite useful for spinal anaesthesia in caesarean section in the population that was studied and they could be used routinely, but for the cost factor which again should be weighed against the complications.

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