COMPARISON OF 25 GAUGE WHITACRE NEEDLE VERSUS 27 GAUGE WHITACRE ON EASE OF INSERTION AND BLOCK EFFECT IN PATIENTS UNDERGOING CAESAREAN SECTION UNDER SPINAL ANAESTHESIA. – A RANDOMIZED CONTROL STUDY.

Dr Vennila [1], Dr Sushmitha Rishabh [2], Prof Dr Arun Kumar [3],

Dr Rishabh Bokadia [4], Sonia Suresh Daga [5]

[1] Postgraduate , Department of Anaesthesiology, Chettinad Hospital and Research Institute,Chettinad Academy of Research and Education,Kelambakkam

[2]Assistant professor ,Department of Anesthesiology,Annapoorana medical college and Hospitals

[3] Professor, Department of Anaesthesiology , Chettinad Hospital and Research Institute,Chettinad Academy of Research and Education,Kelambakkam

[4] Senior Resident ,Department of Pharmacology ,Annapoorana Medical College and Hospitals

[5] Deputy Medical Administrator.Kauvery Hospital, Vadapalani.

Corresponding author-Dr Arunkumar, Professor, Department of Anaesthesiology, Chettinad Hospital and Research Institute, Chettinad Academy of Research and Education, Kelambakkam

ABSTRACT

BACKGROUND
The rate of caesarean sections has increased in recent decades due to factors such as maternal and fetal health concerns and patient choice. This has increased the demand for safe, effective anaesthesia techniques. Spinal anaesthesia, particularly with the Whitacre needle, is preferred due to its advantages over general anaesthesia, including a lower risk of airway complications and quicker recovery. However, technical challenges arise with needle insertion, especially in pregnant patients, which may affect the efficacy and safety of the procedure.

AIM
To compare the ease of insertion and block effect between the 25G and 27G Whitacre needles in patients undergoing caesarean section under spinal anaesthesia.

METHODS
This double-blinded, randomized clinical trial was conducted at Chettinad Hospital and Research Institute.The study included 80 parturients undergoing elective or emergency caesarean sections under spinal anaesthesia. Participants were randomly allocated to receive spinal anaesthesia with either the 25G or 27G Whitacre needle. The outcomes assessed were the number of attempts for successful lumbar puncture, time to onset of sensory and motor block, incidence of spinal anaesthesia failure, occurrence of post-dural puncture headache

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(PDPH), and any other side effects. Hemodynamic parameters were also monitored during the procedure.

RESULTS
There were no significant differences in the number of attempts for successful lumbar puncture, time to sensory and motor block onset, or incidence of complications such as PDPH between the 25G and 27G needle groups. Both groups showed a 0% incidence of PDPH, and the side effects were minimal, with only "other headache" being reported in 7.5% of patients in both groups. Hemodynamic stability was similar across both groups.

FINDINGS
Both the 25G and 27G Whitacre needles demonstrated comparable performance regarding ease of insertion, block onset, and incidence of complications. The results suggest that both needle sizes are equally effective for spinal anaesthesia in caesarean section procedures, with no significant differences in clinical outcomes.

KEYWORD Anaesthesia, Block Onset, Caesarean Section, Post-Dural Puncture Headache, Spinal Anaesthesia, Whitacre Needle

INTRODUCTION

The rate of caesarean sections has progressively risen over the last decades, prompted by a range of factors including patient choice and medical indications like maternal and fetal issues.[1] Specifically, the increase in emergency caesarean deliveries has been made possible by improvements in fetal and maternal monitoring, which allow for early identification of complications and hence timely interventions.[2] This rising incidence of caesarean sections is posing an ever-increasing challenge of providing safe and efficient anaesthesia methods.[3,4] The task of anaesthetists is to keep both the mother and the baby healthy and happy throughout the procedure, and reduce the risk posed by anaesthesia to the barest minimum.[5]

In the past, general anaesthesia was a routine method employed for caesarean sections.[6] However, with time, regional anaesthesia, and especially spinal anaesthesia, has come to be preferred because of its many benefits.[7,8] One of the greatest advantages of spinal anaesthesia is that it can circumvent complications from general anaesthesia, e.g., difficult airway management, risk of aspiration, and the toxic effect of systemic sedation on the fetus.[9] Additionally, spinal anaesthesia has the additional benefit of keeping the mother awake, thus giving her the ability to actively be involved in the process of birth and interact with the baby right after delivery. This method has been found to enhance patient satisfaction and improve maternal recovery.[10]

On top of these benefits, spinal anaesthesia provides fast onset and uniform block level, both of which are crucially necessary in cases of emergency when timing is crucial.[11] Spinal anaesthesia does, however, come with challenges. Technical difficulties are encountered with the insertion of the needle, especially in pregnant patients who show different anatomical and physiological characteristics, including a more pronounced lumbar lordosis and smaller subarachnoid space. These considerations may complicate the process of accurate needle placement, resulting in failed or incomplete blocks.[12]

The construction of the spinal needle is critical to the success of the procedure. Spinal needles are designed in several different ways, each with distinct characteristics that influence ease of insertion as well as risk of complications.[13] The Whitacre needle, a pencil-point needle, is commonly preferred because it tends to reduce dural trauma by splitting the dural fibers instead of cutting them, thus lowering the rate of post-dural puncture headaches (PDPH), a frequent complication of spinal anaesthesia. Smaller gauge needles, including the 25G and 27G Whitacre needles, have been reported to produce less cerebrospinal fluid (CSF) leak and are thought to decrease the risk of PDPH, although they can be associated with greater technical challenge because of their thinner size and flexibility.[14]

Although the 25G Whitacre needle is used routinely in clinical practice, the 27G one has attracted interest as being able to decrease the risk of PDPH further, although more attempts might be needed to make successful spinal placement.[15] Despite these hypothetical benefits, evidence supporting or refuting the use of the two needle sizes—especially during caesarean sections—is still weak. More stringent clinical studies are needed to evaluate not only the ease of insertion and quality of the block but also the rate of complications like PDPH and other side effects, which can greatly affect the post-operative recovery and overall experience of the patient.[16]

This research attempts to bridge this gap by comparing 25G Whitacre with the 27G Whitacre needles in caesarean-section patients given spinal anaesthesia.[17] Particularly, the research focuses on assessing crucial parameters like the number of attempts needed for successful lumbar puncture, time to onset of sensory and motor block, the rate of failure of spinal anaesthesia, occurrence of post-dural puncture headache (PDPH), and occurrence of any other untoward side effects.[18] By weighing these factors, this study endeavors to offer critical insight into the best needle size to provide optimum safety, effectiveness, and patient satisfaction.[19]

AIM AND OBJECTIVES

AIM

To compare 25G Whitacre needle and 27G Whitacre needle with respect to ease of insertion and block effect in patients undergoing caesarean section under spinal anesthesia.

OBJECTIVES

To compare 25 Gauge Whitacre needle and 27 Gauge Whitacre needle in terms of; Number of attempts required for successful lumbar puncture, Onset of sensory blockade, Onset of motor blockade, Incidence of failure of lumbar puncture, Incidence of Post Dural Puncture Headache, Side effects, if any

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MATERIALS AND METHODS

This double-blinded, randomized future clinical study was performed in the Department of Anaesthesiology & Critical Care, Chettinad Hospital and Research Institute, Kelambakkam. The purpose of the study was to compare the ease of insertion, technical performance, block efficacy, and post-operative complications of the 25 gauge Whitacre needle with that of the 27 gauge Whitacre needle in women undergoing caesarean section under spinal anaesthesia.

The sample size in this randomized controlled trial was calculated with OpenEpi software according to the rate of success for lumbar puncture on the first attempt in a pilot study, which was 93% for the 25G Whitacre needle (Group A) and 68% for the 27G Whitacre needle (Group B). With a Type I/II Error Rate (α) of 0.05 and Power of 80%, the sample size required for each group was determined to be 40 patients, with a ratio of enrolment being 1:1. Patients were randomly allocated to Group A (25G Whitacre needle) or Group B (27G Whitacre needle) by a computer-generated random number code, and the randomization code was hidden from the investigator and the patients to maintain blinding.

The study population consisted of parturients who were undergoing elective or emergency caesarean sections under spinal anaesthesia and fulfilled the inclusion and exclusion criteria. Inclusion criteria consisted of parturients between the ages of 18 and 40 years, ASA grade II classification, and a BMI of ≤ 30. Exclusion criteria were refusal by the patient, patients refusing spinal anaesthesia, systemic hypotension during the procedure, infection at injection site, abnormalities in coagulation profiles, valvular heart disease, vertebral anomaly, and PDPH occurring in earlier gestations. Written informed consent was obtained from all participants after describing the study procedures and associated risks.

Patients were premedicated with 150mg of Ranitidine the night before and once at 6 a.m. on the day of the procedure. An 18G IV cannula was placed, and patients were preloaded with 500 mL of Ringer Lactate IV infusion. Heart rate (HR), non-invasive blood pressure (NIBP), oxygen saturation (SpO_2), and ECG were monitored at baseline and at later intervals during the procedure. The patients were placed in either the sitting or lateral position, as appropriate. The interspace L3-L4 was infiltrated with 2ml of 2% injection lignocaine under aseptic precautions to minimize discomfort during needle insertion. Spinal anaesthesia was done with either the 25G or 27G Whitacre needle (group allocation-dependent) by the midline technique. Free flow of cerebrospinal fluid (CSF) validated correct needle positioning, and a mixture of 1.8ml 0.5% Bupivacaine (Heavy) and 0.2ml (60 mcg) Buprenorphine was administered into the subarachnoid space via a 5 ml syringe.

After injection, the patients were positioned supine and tilted to the left to reduce the risk of aorto-caval compression, according to usual practice. The procedure was measured by recording the number of attempts taken for successful lumbar puncture, onset time of sensory blockade (assessed by loss of temperature sensation at the T6 dermatome), and onset time of motor blockade (assessed by Modified Bromage Scale). The rate of failure of lumbar puncture, post-dural puncture headache (PDPH), and other side effects like nausea, vomiting, tinnitus, shivering, or blurred vision were also recorded.

After the surgery, patients were kept in the Post-Anaesthesia Care Unit (PACU) and were still observed for 24 hours after the operation. The incidence, severity, and duration of PDPH were evaluated, as well as any other complications. Hemodynamic measurements such as heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure (MAP), and SpO_2 were noted every interval in the operative course (0, 3, 6, 9, 12, 15, 20, 30, 40, 50, 60, 70, 80, and 90 minutes).

Data were analyzed with SPSS version 26. Descriptive statistics were applied to continuous and categorical variables. Independent samples t-tests were utilized to compare continuous variables between groups, and chi-square tests were applied to categorical variables. Repeated measures analysis of variance (RMANOVA) was utilized to evaluate changes over time. A p-value of <0.05 was used as statistically significant.

RESULTS

80 patients were enrolled in the study, and 40 patients in each group were admitted: Group A (25G Whitacre needle) and Group B (27G Whitacre needle). All the patients satisfied the inclusion and exclusion criteria and finished the study without any dropouts. Demographic features of the study population, age, weight, height, body mass index (BMI), and American Society of Anaesthesiologists (ASA) physical status were equivalent between the two groups.

Table 1: Age Distribution Among Study Participants

Age Category	Group A (n=40)	Group B (n=40)	Total (n=80)	p-value
18 to 25 Years	13 (32.5%)	11 (30.0%)	24 (30.0%)	0.708
>25 to 40 Years	27 (67.5%)	29 (70.0%)	54 (70.0%)	
Mean Age (±SD)	26.75 ± 3.49	26.50 ± 2.34		

The age distribution between the two groups (Group A and Group B) was similar, with no significant difference (p = 0.708). The majority of patients in both groups were between the ages of 25 and 40 years, accounting for 67.5% in Group A and 70% in Group B. The mean age of participants in both groups was approximately 26.5 years, suggesting that both groups were comparable in terms of age.

Table 2: Weight Distribution Among Study Participants

Group	Mean Weight (kg) ± SD	p-value
Group A (n=40)	68.52 ± 5.86	0.565
Group B (n=40)	69.22 ± 4.94	

The average weight of participants in both groups was also comparable, with Group A having a mean weight of 68.52 kg and Group B having a mean weight of 69.22 kg. The p-value of 0.565 indicates that the difference in weight between the two groups is statistically insignificant, meaning that weight was not a confounding factor in the results.

Table 3: Height Distribution Among Study Participants

Group	Mean Height (cm) ± SD	p-value
Group A (n=40)	158.70 ± 5.68	0.067
Group B (n=40)	160.82 ± 4.47	

There was no significant difference in the mean height between the two groups (Group A: 158.70 cm, Group B: 160.82 cm), as indicated by the p-value of 0.067. This suggests that the height of participants in both groups was similar and did not affect the study outcomes.

Table 4: Body Mass Index (BMI) Distribution Among Study Participants

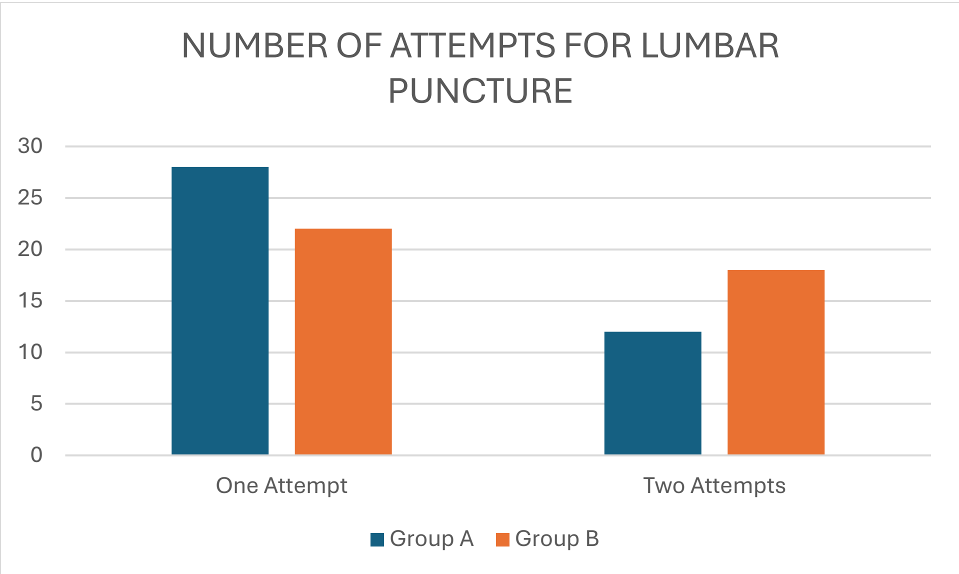
Group	Mean BMI (kg/m^2) ± SD	p-value
Group A (n=40)	27.18 ± 1.40	0.183
Group B (n=40)	26.76 ± 1.42	

The mean BMI in Group A was 27.18 kg/m^2, while Group B had a mean BMI of 26.76 kg/m^2. The p-value of 0.183 suggests thayt the BMI difference between the two groups was not statistically significant, implying that BMI did not influence the results of the study.

Table 5: Number of Attempts for Lumbar Puncture

Group	One Attempt (n,%)	Two Attempts (n,%)	p-value
Group A (n=40)	28 (70%)	12 (30%)	0.166
Group B (n=40)	22 (55%)	18 (45%)	

Figure 1 : Number of Attempts for Lumbar Puncture

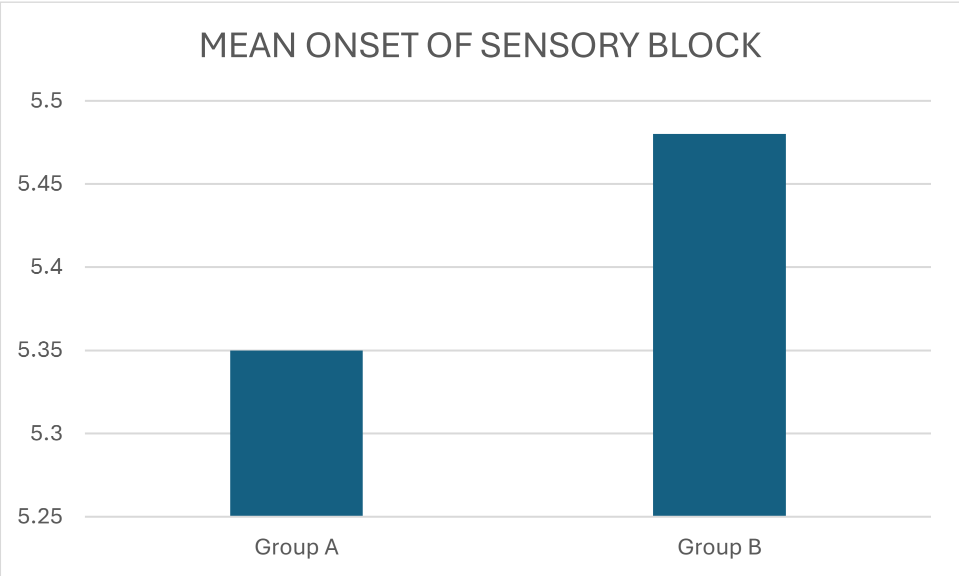


The number of attempts required for successful lumbar puncture was similar between the two groups. In Group A, 70% of participants had a successful first attempt, while 55% of participants in Group B achieved the same on their first attempt. The p-value of 0.166 indicates that the difference between the groups was not statistically significant, meaning that both needle sizes were similarly effective in terms of needle insertion success.

Table 6: Onset of Sensory Block

Group	Mean Time (minutes) ± SD	p-value
Group A (n=40)	5.35 ± 1.05	0.590
Group B (n=40)	5.48 ± 1.01	

Figure 2 : Onset of Sensory Block

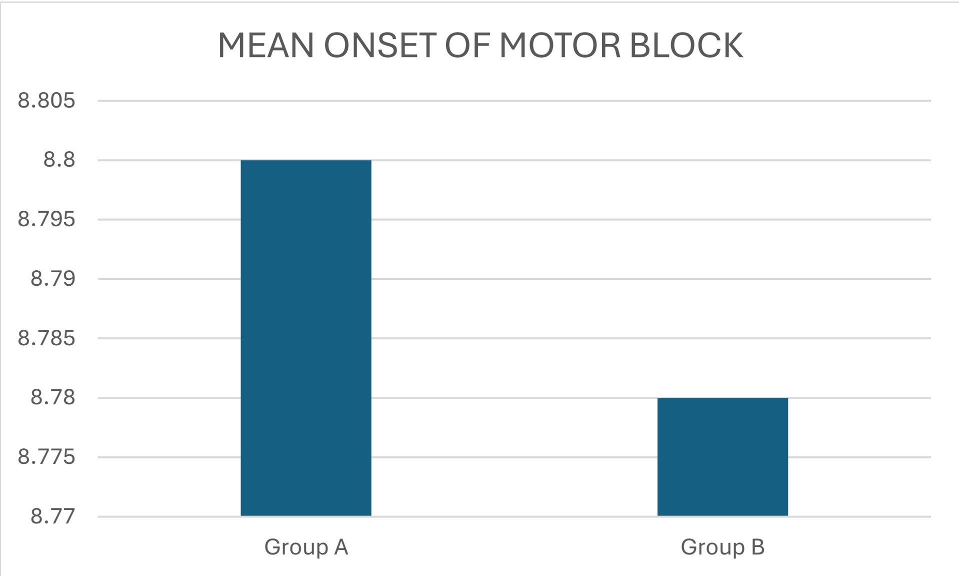


The onset time of sensory block was nearly identical between the two groups, with Group A showing a mean of 5.35 minutes and Group B showing a mean of 5.48 minutes. The p-value of 0.590 indicates no significant difference, suggesting that both needle sizes achieved sensory block in nearly the same amount of time.

Table 7: Onset of Motor Block

Group	Mean Time (minutes) ± SD	p-value
Group A (n=40)	8.80 ± 1.09	0.917
Group B (n=40)	8.78 ± 1.05	

Figure 3 : Onset of Motor Block



Similarly, the onset of motor block was almost identical between both groups, with Group A taking 8.80 minutes and Group B taking 8.78 minutes on average. The p-value of 0.917 indicates that the difference was not significant, implying that the motor block was achieved in a similar time frame for both groups.

Table 8: Incidence of Post-Dural Puncture Headache (PDPH)

Group	PDPH (Yes)	PDPH (No)	p-value
Group A (n=40)	0 (0%)	40 (100%)	---
Group B (n=40)	0 (0%)	40 (100%)	

None of the patients in either group experienced PDPH, with a 0% incidence rate for both Group A and Group B. This suggests that both 25G and 27G Whitacre needles were equally effective in minimizing this common complication of spinal anaesthesia.

Table 9: Other Side Effects Reported

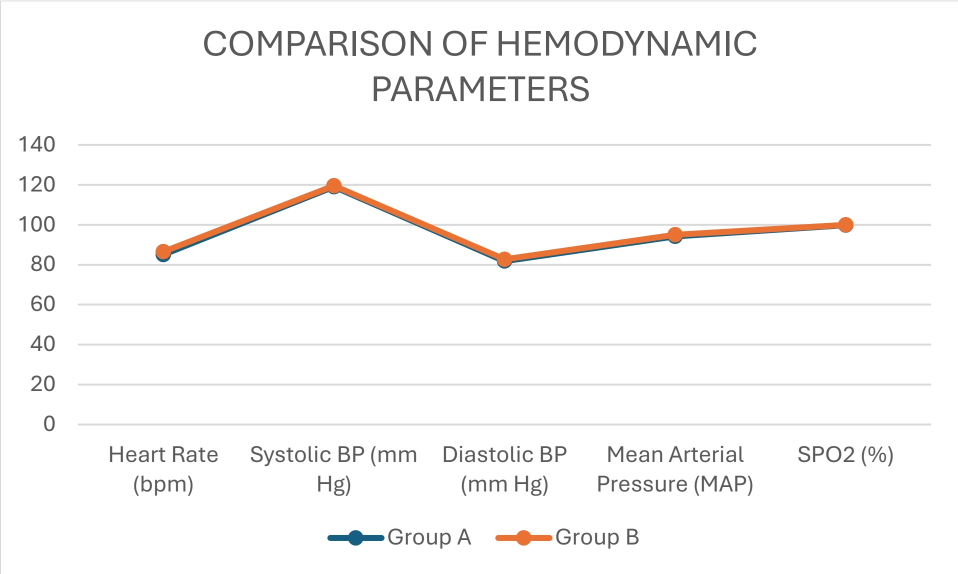
Side Effect	Group A (n=40)	Group B (n=40)	Total (n=80)	p-value
Other Headache	3 (7.5%)	3 (7.5%)	6 (7.5%)	1.000
Nausea	0 (0%)	0 (0%)	0 (0%)	
Vomiting	0 (0%)	0 (0%)	0 (0%)	
Tinnitus	0 (0%)	0 (0%)	0 (0%)	
Shivering	0 (0%)	0 (0%)	0 (0%)	
Blurring of Vision	0 (0%)	0 (0%)	0 (0%)	

The only side effect reported in both groups was "other headache," which was experienced by 7.5% of patients in each group. No other side effects, including nausea, vomiting, tinnitus, shivering, or blurred vision, were observed in any of the participants. This indicates that both needles had a low incidence of side effects, with no significant differences between the two groups (p = 1.000).

Table 10: Hemodynamic Parameters

Parameter	Group A (n=40)	Group B (n=40)	p-value
Heart Rate (bpm)	85.05 ± 6.05	86.55 ± 5.02	0.236
Systolic BP (mm Hg)	119.05 ± 3.27	119.53 ± 6.89	0.993
Diastolic BP (mm Hg)	81.80 ± 7.38	82.70 ± 6.70	0.883
Mean Arterial Pressure (MAP)	94.22 ± 5.15	94.98 ± 4.81	0.953
SpO2 (%)	99.73 ± 0.68	99.88 ± 0.46	0.726

Figure 4 : Hemodynamic Parameters



The hemodynamic parameters (heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and SpO2) showed a similar trend over time in both groups. There were no significant differences in these parameters between the two groups (p-values for all parameters were greater than 0.05), indicating that both needle sizes did not impact the patients' hemodynamic stability during the procedure.

DISCUSSION

The findings of the current study reveal that both 25 gauge (G) and 27G Whitacre needles of spinal anaesthesia in caesarean section have similar results regarding ease of insertion, onset of sensory and motor block, hemodynamic stability, and occurrence of complications such as post-dural puncture headache (PDPH). These results agree with various previous studies which have investigated the efficacy and safety of these sizes of needles and inferred that outcomes in spinal anaesthesia are comparable using different gauge sizes.

Within this research, there were similar numbers of attempts necessary for successful lumbar puncture in the two groups. Group A (25G needle) had a marginally higher rate of successful first attempts (70%) than Group B (55%), but the difference was not statistically significant (p = 0.166). This outcome is in accordance with Fama et al. (2015), who did a study on the comparison between 25G and 27G Whitacre needles for caesarean section and identified no significant variation in the number of attempts needed for successful lumbar puncture between the two sizes of needles

Likewise, research by **Smith et al. (1994)**[20] and **Pal et al. (2011)**[23] did not identify significant difference in the difficulty of insertion between 25G and 27G Whitacre needles for spinal anaesthesia. These studies corroborate the fact that both needle gauges are effective equally for spinal needle insertion in obstetric women.

In as far as the onset of sensory and motor blockade is concerned, the current study identified that both groups attained the onset of block in comparable times. Group A (25G needle) reached sensory block in 5.35 minutes and motor block in 8.80 minutes, whereas Group B (27G needle) reached sensory block in 5.48 minutes and motor block in 8.78 minutes. The p-values (0.590 and 0.917) suggested that there was no statistically significant difference between groups. These findings are in keeping with those of Smith et al. (1994), who described comparable onset times for sensory and motor blocks with both 25G and 27G Whitacre needles. Also, Arathi BH et al. (2010) comparing 27G Whitacre, Sprotte, and Quincke needles for spinal anaesthesia did not note any significant differences in the onset of sensory or motor blockade. This further reinforces the evidence that both 25G and 27G Whitacre needles produce similar anaesthesia in terms of block onset.

One of the most significant results of spinal anaesthesia is the development of PDPH, a frequent complication that can greatly influence patient recovery. The occurrence of PDPH in the current study was 0% for both groups, which aligns with results of various studies that have contrasted 25G and 27G Whitacre needles. For example, **Fama et al. (2015)**[21] concluded that the incidence of PDPH caused by 27G Whitacre needles was lower than that of 25G Quincke needles, albeit both were low occurrences. Likewise, **Bano et al. (2004)**[22] and **Pal et al. (2011)**[23] also found a reduced incidence of PDPH with 27G Whitacre needles when compared to other needle types. The 0% incidence of PDPH in both groups of the current study indicates that both the 25G and 27G Whitacre needles are equally effective in reducing this frequent complication of spinal anaesthesia.

The only negative effect noted in both groups was "other headache," which occurred in 7.5% of patients in each group. None of the patients in either group experienced nausea, vomiting, tinnitus, shivering, or blurred vision. This result is congruent with earlier research by **Arathi BH et al. (2010)**[24] and **Bhat et al. (2017)**[25]**,** which described analogous side effect profiles among patients who received spinal anaesthesia with 25G and 27G Whitacre needles. These findings indicate both needles have a low rate of side effects and are patient tolerated.

The hemodynamic parameters such as heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation were all stable during the surgical procedure in both groups. The parameters did not show any difference between the two groups, meaning that neither needle size affected hemodynamic stability significantly. These results agree with the outcome of **Smith et al.'s (1994)**[20] and **Fama et al.'s (2015)**[21] studies, which revealed comparable hemodynamic results with both 25G and 27G Whitacre needles for caesarean section spinal anaesthesia.

In general, the results of this study indicate that both 25G and 27G Whitacre needles are equally suitable for spinal anaesthesia in caesarean section, with similar results regarding technical ease, block onset, rate of PDPH, and other complications. These findings lend support to either needle size being a safe and effective choice for spinal anaesthesia in obstetric patients.

CONCLUSION

The current research illustrates that both 25G and 27G Whitacre needles offer similar results regarding ease of insertion, time to onset of sensory and motor block, hemodynamic stability, and the frequency of complications like post-dural puncture headache (PDPH) and other side effects. Since there are no significant differences between the two needle gauges, both are equally safe and effective for spinal anaesthesia in caesarean section. The findings favor the utilization of either needle size for performing consistent and secure spinal anaesthesia, providing anesthesiologists with flexibility when selecting the appropriate needle size in relation to patient characteristics and clinical conditions.

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