e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(7); 22-29

Original Research Article

To Study Comparison of 25 G Quincke and 25 G Whitacre Spinal Needles for Post-Dural Puncture Headache in the Subarachnoid Block

Shivrambhai D Prajapati[1], Bhargav R. Patel[2], Sachinkumar S. Patel[3], Ankit R Sorathiya[4], Dixitkumar B. Modh[5], Meetkumar Kansagra[6], Jaldeep Patel[7]

[1]Senior Resident, Anesthesia, GMERS Medical College, Dharpur Patan
[2]Assistant professor in Anesthesia, GMERS Medical College, Dharpur, Patan
[3]Consultant Anaesthetist, Mehsana, Gujarat,
[4]Senior Resident, Anesthesia, Smt. NHL Municipal Medical College, Ahmedabad, Gujarat
[5]Professor and Head, Anaesthesiology, GMERS medical college, Dharpur-Patan
[6]Consultant, Anaesthetist, Rajkot, Gujarat.
[7]Associate professor in anesthesiology, Gujarat Adani Institute of Medical Sciences Bhuj, Gujarat

Received: 20-04-2023 / Revised: 11-05-2023 / Accepted: 05-06-2023
Corresponding author: Dr. Ankit R Sorathiya
Conflict of interest: Nil

Abstract:

The incidence of PDPH with the use of two different spinal needles was studied in this randomized control trial. The study comprised two hundred patients belonging to ASA PS Grade I/II who were randomly allotted to two groups of hundred each. Group-I was using the 25G Quincke spinal needle and Group II was using the 25G Whitacre spinal needle in patients undergoing elective surgery. With the data obtained there was a statistically significant rate of decrease in the incidence of PDPH in patients belonging to Group-II compared to those of Group-I.

Keywords: Quincke needle, Whitacre needle, Subarachnoid block, Post Dural Puncture Headache, spinal anaesthesia.

Introduction

Spinal anesthesia, invented by August Bier in 1898, has been widely used for surgeries below the umbilicus [1]. The development of spinal needles, particularly the design of the needle tip, has evolved alongside the understanding of the anatomy and physiology of the central nervous system. Early advancements were often based on incomplete or incorrect information, but as knowledge improved, modifications were made to the equipment to enhance safety and reduce the severity and frequency of complications associated with spinal anesthesia.

During spinal anesthesia, a small amount of local anesthetic is injected into the cerebrospinal fluid (CSF). The chosen anesthetic should not only effectively block nerve pathways but also be non-toxic to prevent any interference with the vital metabolic processes or delay in the function of the brainstem centers. Typically, spinal anesthesia is performed below the level where the spinal cord ends (L2) and is commonly carried out in the L3-L4 region [2]. Postdural puncture headache (PDPH), a well-known complication of spinal anesthesia, can be particularly problematic in young patients [3]. It was first reported by Bier and Hildebrandt in 1898, with an incidence of 100%, as they performed spinal anesthesia on each other [4].

The primary risk factor that can be prevented and is associated with the occurrence of post-dural puncture headache (PDPH) is related to the choice of needle [5]. The incidence of PDPH can vary widely, ranging from 0.1% to 36%, depending on the type and size of the spinal needle used [6]. The gauge and shape of the needle tip have been identified as important factors in reducing the occurrence of PDPH. Several studies have provided evidence in support of using spinal needles with a pencil point tip, such as Whitacre or Sprotte spinal needles, to lower the incidence of PDPH [7,8].

However, there are also studies that have failed to confirm this lower incidence of PDPH when using spinal needles with a pencil point tip [9-11].

Given these conflicting findings, we aimed to compare the incidence and severity of post-dural puncture headache between the use of 25G Quincke and 25G Whitacre spinal needles during subarachnoid block.

Materials and Methodology:

This study was designed to Comparison of 25 G Quincke and 25 G Whitacre spinal needles for post-dural puncture headache in the subarachnoid block. After Ethical Committee clearance and getting written informed consent from patients, this randomized double-blind study was conducted in 200 patients of either gender, aged between 18 & 50 years, of ASA physical status I & II, and who required not more than 3 attempts to achieve SAB, at the department of anaesthesiology, GAIMS Bhuj, during 2020-2021. Exclusion Criteria include patient refusal, coagulopathy or other bleeding disorders, severe hypovolaemia (Shock), and increased intracranial pressure.

Preoperative Evaluation:

Patients were thoroughly assessed in pre-operative visits and explained about the nature and risks involved in the study. They were enrolled according to the above-mentioned inclusion and exclusion criteria. Patients were randomly divided into two groups using computer-generated random number sequences and concealed in opaque envelopes Group A, and Group B.

Preoperative investigations were done as all cases were posted for surgery. The patients were instructed to be nil by mouth for 6 hours before the surgery. The patient was shifted to the preoperative room. Monitoring with a Pulse oximeter, electrocardiogram (ECG), and non-invasive blood pressure (NIBP) was done before performing a subarachnoid block and monitored throughout the procedure. Intravenous access was established over the dorsum of the hand with the 18-gauge intravenous cannula.

Premedication with an injection of Ondansetron 0.8 mg/kg. Pre -loading with 10 ml/kg of iv fluids done for all patients. Block was performed by senior faculty of the department. Patient was placed in a sitting position.

The back of the patient was cleaned with Povidone iodine and spirit and draped with a sterile towel. A skin wheel was raised with 2% Lignocaine and a subarachnoid block was performed with 0.5% hyperbaric bupivacaine at L3-L4 space. Sensory and Motor block elicited with pinprick method. After giving a position and adequate level of anesthesia Mean blood pressure was monitored every five minutes intervals and any decrease of more than 20% from baseline was treated with a 100ml bolus of crystalloids and an incremental bolus of 6mgs intravenous Ephedrine. If bradycardia occurs pulse < 60/min inj.

Atropine 0.6 mg IV was given. In case of failure of subarachnoid block or inadequate analgesia, patients were administered General anaesthesia. Failure of the block is defined as either an inability to produce a free flow of CSF after three attempts or inadequate analgesia for surgery at 15 minutes after giving the local anesthetic agent. Postoperatively all the patients were enquired about the onset, characteristics, duration, severity, and associated symptoms of any headache for three days. PDPH is characterized by postural headache, aggravated by sitting or standing and relieved by lying supine. It may be dull aching or throbbing, mostly in the occipital or frontal region, accompanied by nausea, vomiting, neck stiffness, diplopia, and tinnitus. Complications like nausea, vomiting, bradycardia, and respiratory depression were managed symptomatically. Patients were interviewed day on 1,2,3,4 and 5 and were questioned regarding headache, its severity, location character, duration, and associated symptoms like nausea, vomiting, and auditory and ocular symptoms.

The headache was graded by Corbey MP, Berg P Quanar H.

Grade I = FG1 + VAS 1-3 (FG1 = Headache did not interfere with normal activity.)

Grade II = FG2 + VAS 4-7 (FG2 = Periodical bed rest was necessary to relieve headache.)

Grade III = FG3 + VAS 8-10 (FG3 = Headache was so intense that it was not possible to sit up.) Grade IIIA – symptoms relieved by bed rest and per oral analgesia.

Grade IIIB – Symptoms not relieved by bed rest and per oral analgesia.

PDPH when present was treated with bed rest, adequate hydration, IV fluids, and analgesics like aspirin, codeine, or caffeine. Severe headache requires treatment with an epidural blood patch in addition to the above measures.

Statistical Analysis: Data collected from 200 selected subjects were internally compared, tabulated, analyzed, and interpreted by using descriptive and inferential statistics based on the formulated objectives of the study. Descriptive statistics were done for all data and were reported in terms of mean values, SD, and percentages. Suitable statistical tests of comparison were done.

Continuous variables were analyzed with the unpaired t-test with the usage of graph pad software. Categorical variables were analyzed with the Chi-Square Test. Statistical significance was taken as $P < 0.05$.

Result: Table 1 showed that out of 200 patients, 100 were in group A and 100 in group B. The mean age was 37.55 ±10.388 in Group A and 36.92 ±9.987 in Group B. The p value is 0.6648. The difference was statistically non -significant.

Table 1: Age Distribution between Two Group

Group	Age	
	Mean	SD
Group A Quincke Needle	37.55	10.388
Group B Whitacre Needle	36.92	9.987
P Value	0.6648	

Table 2 showed that 100 patients each were in groups A and B. In group A - 53 were males and 47 were females. In group B- 51 were males and 49 were females. The percentage of age distribution in group A for males is 26.50% and for females is 23.50% and in group B for males is 25.50% and for females is 24.50%. The p-value is 0.7771. The difference is statistically non-significant.

Table 2: Sex Distribution in Both Group

Group	Male(N)	Female (N)	Male (%)	Female (%)	Total
Group A Quincke Needle	53	47	26.50%	23.50%	100
Group B Whitacre Needle	51	49	25.50%	24.50%	100
P Value	0.7771				

Table 3: Asa Grading between Two Groups.

ASA	ASA 1 (N)	ASA 2(N)	ASA 1(%)	ASA 2(%)
Group A Quincke Needle	73	27	36.50%	13.50%
Group B Whitacre Needle	71	29	35.50%	14.50%
P Value	0.7528			

Table 3 shows that out of 200 patients, 100 were in group A and 100 in group B. The number of patients with ASA grade 1 was 73 in Group A and 71 in Group B while ASA grade 2 was 27 in Group A and 29 in Group B. The percentage of ASA grade 1 was 36.50% and 35.50% in group A and group B respectively while the percentage of ASA grade 2 was 13.50% and 14.50% in group A and group B respectively. The p-value is 0. 7528. The difference was statistically non-significant.

Table 4: Comparison of Heart Rate In Both Groups

Heart Rate	Group AQuincke Needle	Group B Whitacre Needle	P Value
Baseline	92.32±3.52	92.86±3.-01	0.2473
Just After Block	91.92±2.65	89.87±2.32	0.7644
5 Min	79.69±2.45	79.57±4.45	0.8149
10 Min	81.79±2.72	81.21±3.71	0.2108
15 Min	90.26±4.10	89.82±4.03	0.4469
30 Min	93.04±2.11	92.57±2.18	0.1244
1 Hr	85.09±1.97	84.59±3.14	0.1808
4 Hr	86.96±1.9	86.65±2.78	0.3659
8 Hr	89.22±1.90	88.88±3.08	0.3543
12 Hr	94.16±2.41	93.72±2.05	0.1723
24 Hr	86.63±4.38	86.53±3.25	0.8555
48 Hr	91.45±2.67	91.17±4.47	0.5922

Table 4 shows the heart rate in both groups. There are no significant changes in heart rate.

Table 5: Comparison of Systolic Blood Pressure in Both Groups

SBP	Group A QuinckeNeedle	Group B WhitacreNeedle	P Value
Baseline	129.38±3.11	128.67±2.66	0.0863
Just After Block	120.17±2.61	119.7±4.69	0.3853
5 Min	104.99±3.23	104.71±5.45	0.6608
10 Min	110.52±5.82	110.16±5.97	0.6683
15 Min	120.27±3.81	119.74±4.59	0.3783
30 Min	120±6.12	119.06±5.94	0.2745
1 Hr	127.69±3.56	126.66±3.91	0.0543
4 Hr	132.35±3.64	131.34±3.92	0.0618
8 Hr	127.39±5.20	126.48±4.89	0.2067
12 Hr	123.41±3.22	122.38±4.52	0.0672
24 Hr	133.78±2.53	133.47±3.29	0.4571
48 Hr	133.16±4.52	132.06±4.13	0.0761

Table 5 showed systolic blood pressure in both groups. There were no significant changes in systolic blood pressure.

Table 6: Comparison of Diastolic Blood Pressure In Both Groups

DBP	Group A Quincke Needle	Group B Whitacre Needle	P Value
Baseline	88.81±4.75	88.94±4.34	0.8416
Just After Block	83.29±2.07	82.58±2.97	0.0544
5 Min	80.16±2.57	79.49±3.20	0.1075
10 Min	84.9±2.99	85.43±2.98	0.2153
15 Min	88.03±3.68	87.39±3.63	0.2209
30 Min	86.64±2.01	86.03±2.72	0.0748
1 Hr	83.85±2.61	83.3±2.14	0.1075
4 Hr	84.9±2.02	84.46±2.49	0.1745
8 Hr	82.06±1.34	81.67±2.60	0.1882
12 Hr	85.56±2.61	85.98±2.81	0.2765
24 Hr	89.13±3.46	88.5±3.14	0.1808
48 Hr	88.98±3.18	88.05±3.77	0.0624

Table 6 showed diastolic blood pressure in both groups. There were no significant changes in diastolic blood pressure.

Table 7: Comparison of Mean Arterial Pressure in Both Groups

MAP	Group A QuinckeNeedle	Group B Whitacre Needle	P Value
Baseline	102.33±3.37	102.18±3.20	0.7465
Just After Block	95.58±1.66	94.95±3.207	0.0843
5 Min	88.43±2.07	87.89±2.82	0.1263
10 Min	93.44±2.73	93.67±2.67	0.5475
15 Min	98.77±2.93	98.17±3.09	0.1612
30 Min	97.76±2.45	97.35±2.32	0.2274
1 Hr	98.46±2.03	98.03±1.91	0.1247
4 Hr	100.71±1.92	100.30±2.09	0.1469
8 Hr	97.17±2.00	96.60±2.43	0.0779
12 Hr	98.176±1.95	98.11±2.45	0.836
24 Hr	104.01±2.27	103.49±2.48	0.1217
48 Hr	103.70±2.68	102.95±3.19	0.0766

Table 7 showed the mean arterial pressure in both groups. There were nosignificant changes in mean arterial pressure.

Table 8: Comparison of Spo_2 between Two Group

SPO2	Group A Quincke Needle	Group B Whitacre Needle	P Value
Baseline	98.05±1.49	98.14±1.50	0.673
Just After Block	98.06±1.39	97.94±1.32	0.5351
5 Min	98±1.40	97.97±1.45	0.8831
10 Min	98.18±1.32	98.11±1.50	0.7295
15 Min	98.04±1.51	97.94±1.45	0.6356
30 Min	97.88±1.43	98.02±1.41	0.4904
1 Hr	97.65±1.46	97.85±1.39	0.3254
4 Hr	97.88±1.37	97.96±1.50	0.6962
8 Hr	98.15±1.38	98.09±1.38	0.7606
12 Hr	98.27±1.50	98.14±1.387	0.5295
24 Hr	98.21±1.27	98.11±1.32	0.5892
48 Hr	97.99±1.43	97.87±1.324	0.5432

Table 8 showed SpO_2 in both groups. There were no significant changes in SpO_2.

Table 9: Comparison of Number of Attempt for Sab

Number of Attempts	Group A Quincke Needle (N)		Group B Whitacre Needle (N)	
	Number	%	Number	%
1	90	45%	87	43.50%
2	10	5%	13	6.50%
3	0		0	
Total	100	50%	100	50%
P Value	>0.9999			

Table 9 showed the number of attempts for a successful subarachnoid blockin both groups. There is no significant difference in both groups.

Table 10: Frequency of Headache Depending on Type of Needle

Groups	Headache					
	Present		Absent		Total	
	Number	%	Number	%	Number	%
Group A Quincke Needle	10	5%	90	45%	100	50%
Group B Whitacre Needle	3	1.50%	97	48.50%	100	50.00%
Total	13	6.50%	187	93.50%	200	100.00%
P Value	0.0032					

Table 10 showed the frequency of headaches depending on the type of needle. The number of patients with PDPH present was 10 in group A and 3 in group B while PDPH absent was 90 in group A and 97 in group B. The percentage of PDPH present was 5% and 1.5% in group A and group B respectively while the percentage of PDPH absent was 45% and 48.50% in group A and group B respectively. The p-value is 0.0032. The difference was statistically significant.

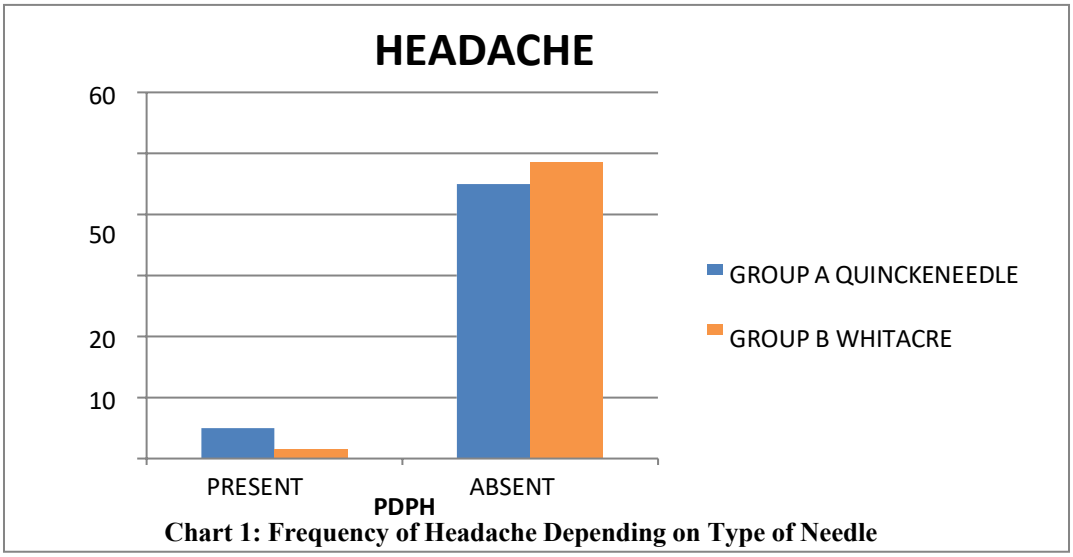

Chart 1: Frequency of Headache Depending on Type of Needle

Table 11 showed comparison of post-dural puncture of headache according to time. PDPH occur within 24 hours was 6 in group A and 2 in group B while PDPH occur 2nd days was 4 in group A and 1 in group B patients. The percentage of PDPH occur within 24 hours was 3% and 1% in group A and group B respectively while the percentage of PDPH occur 2nd days was 2% and 0.05% in group A and group B respectively. PDPH is more common occur within 24 hrs.

Table 11: Comparison of Post-Dural Puncture of HeadacheAccording to Time

PDPH	Group A Quincke Needle		Group B Whitacre Needle	
	Number	%	Number	%
Within 24 Hrs	**6**	**3%**	**2**	**1%**
2nd Days	**4**	**2%**	**1**	**0.05%**
3rd Days	**0**	**0**	**0**	**0**
4th To 7 Days	**0**	**0**	**0**	**0**
Total	**10**	**5%**	**3**	**1.50%**

Table12: Severity of Pdph

Severity of PDPH	Group A Quincke Needle		Group B Whitacre Needle	
Grade I	8	4%	3	1.50%
Grade II	2	1%	0	0
Grade III	0	0	0	0

Table 12 showed the severity of post-dural puncture headache. Grade I PDPH occur within 8 patients in group A and 3 patients in group B while Grade II PDPH occur within 2 patients in group A and 0 patient in group B. The percentage of Grade I PDPH was 4% and 3% in group A and group B respectively while the percentage of Grade II PDPH was 1% and 0% in group A and group B respectively. Grade I

PDPH is more common.

Discussion:

Regional anaesthesia, specifically spinal anaesthesia, has undergone significant advancements since its introduction in the late 1800s. Currently, spinal anaesthesia is regarded as a preferred option for regional anaesthesia due to its safety, reliability, and cost-effectiveness. Like other techniques, spinal anaesthesia has both advantages and complications. One important complication is post-dural spinal headache (PDPH), the occurrence of which depends on various factors including the patient's age, gender, needle size, type, orientation, and the type of surgery performed. The frequency of PDPH can range from 0% to 36%.When comparing two groups, the demographic parameters such as age, gender distribution, and ASA physical status are similar and not statistically significant. Similarly, the hemodynamic parameters including heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and SpO2 are also comparable between the two groups and statistically insignificant.

In our study, out of a total of 200 patients, 13 individuals (6.5%) experienced headaches. Among these patients, 10 belonged to group A, while 3 were from group B. The remaining patients without post-dural spinal headache (PDPH) were 90 in group A and 97 in group B. The percentage of patients with PDPH was 5% in group A and 1.5% in group B, whereas the percentage of patients without PDPH was 45% in group A and 48.50% in group B. The calculated p-value was 0.0032, indicating a statistically significant difference between the two groups. Our findings revealed that the incidence of PDPH was lower when using the 25G Whitacre needle compared to the 25G Quincke needle.

Another study conducted by Anirban Pal et al. came to a similar conclusion, stating that the use of a pencil point 25G Whitacre spinal needle resulted in a reduced frequency of PDPH compared to the 25G Quincke spinal needle. Therefore, they recommended the use of the 25G Whitacre needle for patients at a high risk of developing PDPH [12]. Similarly, Shaikh et al. conducted a study involving 480 post-Caesarean section patients, utilizing 25G and 27G Quincke needles, as well as 27G Whitacre spinal needles. They found that the 27G Whitacre spinal needle produced better outcomes [13].

Santanen U et al. conducted a prospective randomized study comparing the use of 27G Whitacre and 27G Quincke spinal needles in relation to post-dural spinal headache (PDPH) and non-post-dural spinal headache (NPDPH). They found that the incidence of PDPH in the Quincke group was 2.7%, whereas in the Whitacre group it was 0.37%. They concluded that the occurrence of PDPH is rare when using a 27G spinal needle, and utilizing a 27G Whitacre needle further reduces the incidence of PDPH [14]. Similarly, Vallejo studied 1002 women undergoing elective caesarean section with different types of needles for spinal anesthesia. The frequency of headaches was 8.7% for 25G Quincke needles and 3.1% for Whitacre needles of the same size [15].

In our study, we observed that PDPH occurred in 6 patients in group A and 2 patients in group B within 24 hours, while on the second day, PDPH occurred in 4 patients in group A and 1 patient in group B. The percentage of PDPH occurring within 24 hours was 3% in group A and 1% in group B, while the percentage of PDPH occurring on the second day was 2% in group A and 0.05% in group B. Based on these findings, it can be concluded that PDPH more commonly occurs within 24 hours. Tanveer Baig conducted a study on the frequency and severity of PDPH, comparing 25G cutting and non-cutting needles in patients undergoing elective cesarean section under spinal anesthesia. The severity of post-dural puncture headache was significantly higher in the cutting needle group compared to the non-cutting needle group on the second and third day (Chi-square test=8.56, df=3, P=0.036). They concluded that the frequency and severity of PDPH were higher in the 25G cutting spinal needle group compared to the non-cutting needle group, suggesting that 25-gauge non-cutting needles should be used for spinal anesthesia [16].

In our study, Grade I PDPH occurred in 8 patients in group A and 3 patients in group B, while Grade II PDPH occurred in 2 patients in group A and no patients in group B. The percentage of Grade I PDPH was 4% in group A and 3% in group B, whereas the percentage of Grade II PDPH was 1% in group A and 0% in group B. It was observed that Grade I PDPH was more common.

In a study conducted by Zhang, D., Chen, L. et al., they analyzed randomized controlled trials that compared spinal anesthesia using Whitacre spinal needles or Quincke spinal needles for post-dural puncture headaches [17]. Their meta-analysis revealed that spinal anesthesia with Whitacre spinal needles resulted in a lower incidence of post-dural puncture headache (RR 0.34; 95% CI [0.22, 0.52]; P < .00001). Additionally, the severity of post-dural puncture headache was lower in the Whitacre spinal needle group (RR 0.32; 95% CI [0.16, 0.66]; P = .002). Moreover, the frequency of requiring an epidural blood patch was lower in the Whitacre spinal needle group compared to the Quincke spinal needle group (RR 0.15; 95% CI [0.04, 0.51]; P = .002). They concluded that Whitacre spinal needles are a superior choice for spinal anesthesia compared to Quincke spinal needles [17].

In our study, we found that simple measures such as hydration, adequate rest, and analgesics were

effective in relieving headaches in all patients. The treatment options for Post dural puncture headache (PDPH) range from simple measures like hydration and nonsteroidal anti-inflammatory drugs (NSAIDs) to more complex procedures like epidural blood patch. Simple measures are highly effective in managing the majority of PDPH cases [12,15,18]. The number of attempts required for a successful subarachnoid block can be reduced by the experience of the anesthetist. An experienced anesthetist is more likely to achieve subarachnoid block in fewer attempts. In our study, all patients received spinal anesthesia from the same anesthetist, who successfully performed the procedure in a single puncture attempt. In group A, using the 25G Quincke needle, out of 100 patients, 90 patients achieved successful subarachnoid block on the first attempt, and 10 patients required a second attempt. In group B, using the Whitacre needle, out of 100 patients, 87 patients achieved successful subarachnoid block on the first attempt, and 13 patients required a second attempt. The calculated p-value was greater than 0.9999, indicating no significant difference between the two groups.

Shutt. LE and colleagues conducted a study comparing 22G and 25G Whitacre needles with 26G Quincke needles for cesarean sections. The groups were assessed for ease of insertion, number of attempts for needle insertion before identification of cerebrospinal fluid (CSF), quality of subsequent analgesia, and the incidence of post-operative complications. They concluded that the use of 22G and 25G needles in elective cesarean sections is associated with a low incidence of PDPH, while post-operative backache is more likely when more than two attempts are made [19].

Conclusion

In our study we conclude that frequency and severity of PDPH is lower in 25G Whitacre needle compared to 25 G Quincke needle. Hydration, adequate rest and analgesic relieved headache in all patients. There is no significant difference between number of attempts for successfully subarachnoid block.

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