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Effect Of Spinal Needle Gauge Size on Post Dural Puncture Headachey

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ABSTRACT

Background: A typical side effect of spinal anesthesia is post-dural puncture headache (PDPH), which is brought on by cerebrospinal fluid (CSF) leaking from the site of the dural puncture. The brain and meninges sag as a result of this leaking, which lowers intracranial pressure and stretches pain-sensitive tissues. PDPH usually manifests as a postural headache 24 to 48 hours after the surgery, frequently accompanied by nausea, stiff neck, and photophobia. Objective(s): The study is to assess how the size of the spinal needle gauge affects the incidence of PDPH. In particular, it investigates the connection between 25G and 27G spinal needles in pregnant patients receiving spinal anesthesia who are between the ages of 20 and 35. Methodology: Participants' data was gathered at one particular moment using a descriptive crosssectional study method. The study evaluated the correlation between the size of the needle gauge used during spinal anesthesia and the occurrence and severity of PDPH. Results: Results show that, in comparison to a 25G spinal needle, a 27G spinal needle considerably lessens CSF leaking, which lowers the incidence and severity of PDPH. Nevertheless, there were technical issues with the finer 27G needle, like the requirement for several insertion attempts. Conclusion(s): Despite their technical difficulties, the study demonstrates that 27G spinal needles are more effective than 25G needles at reducing PDPH. The findings emphasize how crucial it is to choose the right needle gauge and guarantee skilled technique in order to achieve good spinal anesthesia.

INTRODUCTION

Postdural puncture headache (PDPH) is still a major side effect of labor epidural analgesia following an unintentional dural puncture (ADP), even with advancements in procedural techniques and equipment ([i]. PDPH is frequently regarded as a transient inconvenience, but in the short term, it can be incapacitating. Serious consequences and chronic symptoms may also be linked to it ([ii]). Long-held assumptions that dysregulation of cerebrospinal fluid (CSF) homeostasis results from CSF fluid loss are currently being contested, and the exact underlying processes of PDPH remain poorly understood ([iii]). The presence of orthostatic headaches that are not caused by CSF loss necessitates taking into account alternative processes, such as those involving the autonomic nervous system or the release of calcitonin gene-related peptide (CGRP) ([iv]).

Intracerebral anesthesia allows for the creation of a deep nerve block in a large area of the body with the relatively simple injection of a very tiny dosage of local anesthetic. In 1899, Dr.Augustier described the intrathecal administration of cocaine in his first report on the clinical use of spinal anesthesia ([v]). Significant knowledge and data about the physiology, pharmacology, and clinical application of spinal anesthetics have since been acquired ([vi]). Additionally, pharmaceutic research and technology have enhanced our clinical practice, and new techniques and specialized processes ([vii]). The gauge notion is wildly incorrect if it doesn't specify which standard is being utilized ([viii]). We have investigated dural puncture needles provided by Braun (German) and Becton & Dickinson (British) in order to illustrate this inaccuracy, Without mentioning the gauge standards in use, 26-gauge needles are brown and 25-gauge needles are orange from both businesses ([ix]).

One Major thoracic, abdominal, or leg surgeries require regional anesthesia ([x]). Which is based on neuraxial blocking achieved by injecting local anesthetic medications into the subarachnoid area (spinal anesthesia) or the epidural space around the spinal fluid sac (epidural anaesthesia) ([xi]).A significant portion of the extracellular fluid of the central nervous system (CNS) is cerebrospinal fluid (CSF), and the brain's health depends on the precise control of its composition ([xii]). The CSF serves several vital purposes as the brain floats in the CSF, it serves as a physiological medium and gives the brain mechanical support, lowering its effective weight ([xiii]).

Among studies that assessed both design types, pencil-point design was connected to a statistically significant drop in the frequency of PDPH when compared to cutting needles (risk ratio, 0.41; 95% CI, 0.31–0.54; P < 0.001; I 2 = 29%). Results from subgroup analysis comparing obstetric and non-obstetric surgeries were similar. Of the 57 randomized controlled trials (n = 16416) included in our analysis, 25 compared individual gauges of similar design and 32 compared pencil-point design with cutting-needle design. Among studies that assessed both design types, pencil-point design was connected to a statistically significant drop in the frequency of PDPH when compared to cutting needles (risk ratio, 0.41; 95% CI, 0.31–0.54; P < 0.001; I 2 = 29%).Results from subgroup analysis comparing obstetric and nonobstetric surgeries were comparable. Metaregression analysis of all 57 included trials after controlling for important factors revealed a notable relationship between needle gauge and rate of PDPH among cutting needles (slope = -2.65, P < 0.001), but not among pencil-point needles (slope = 0.01, P = 0.819) ([xiv]).

The incidence of post-dural puncture headache and backache was compared in a prospective trial of 80 individuals under 40 who received spinal anesthesia using either a 0.52 mm (25-gauge) or a 0.33 mm (29-gauge) needle. The 0.52 mm needle group experienced a 25% incidence of headaches, whereas the 0.33 mm needle group experienced none. Both groups saw the similar prevalence of back pain. Based on the number of needle redirections required to retrieve cerebrospinal fluid, the technique of providing spinal anesthesia was examined and found to be slightly more challenging with a 0.33 mm needle. The two needles did not differ in their ability to disseminate the blockage or provide sufficient spinal anesthesia ([xv]).

A comprehensive analysis of 504 patients treated with epidural blood patches (EBPs) separated the results into three groups: failure, partial symptom alleviation, and complete symptom relief. These groups had respective frequency rates of 7% (n = 34), 18% (n = 93), and 75% (n = 377). Multivariate analysis revealed that the only two parameters that were independently significant risk factors for EBP failure were the dura mater puncture needle's diameter and the duration of the EBP treatment. Specifically, an odds ratio of 5.96 (95% CI 2.63-13.47; P < 0.001) indicated a significant association between failure and a larger needle diameter, and an odds ratio of 2.63 (95% CI 1.066.51; P = 0.037) indicated a significant increase in failure risk for an EBP delay of less than 4 days.These findings highlight the importance of technical precision in needle selection and intervention timing for optimizing EBP outcomes. The study highlights how crucial it is to carefully consider these factors in order to improve patient outcomes and lower the likelihood that therapy will fail.Further research would be required to examine additional factors that could impact the success rate of EBP operations ([xvi]). We included 70 studies in the review and 66 studies with 17,067 participants in the quantitative analysis. There are still twelve ongoing studies and eighteen more that need to be classified. 15 of the 18 studies that are still classified mainly deal with congress summaries published before 2010, for which the available data does not allow a comprehensive evaluation of all of their features and bias risks. Our main objective was to prevent PDPH, but we also assessed the onset of severe PDPH, headaches in general, and adverse events. Due primarily to bias risk concerns, the evidence quality was moderate for the majority of the results. For the analysis, three main comparisons were made: 1) Traumatic versus Atraumatic Needles; 2) Greater Gauge versus Smaller Gauge Traumatic Needles ([xvii]).

Overall, 20.2% of people had PDPH, according to the results of our study. Numerous attempts, needle sizes of 20 and 22 gauge, and previous spinal anesthesia were associated with the outcome variable PDPH. Therefore, it is better to perform spinal anesthesia with smaller gauge spinal needles and with fewer attempts. The study included 119 parturients who underwent cesarean sections assisted by spinal anesthesia. The age classification in this study was based on the mean age of the participants, and the distribution was almost equal above and below the mean value (51.3% and 48.7%, respectively). 70.6% of parturients had a BMI of less than 35 kg/m2, and the majority (62.2%) are from urban areas.([xviii]).

MATERIAL AND METHOD

Study Design: Study design selected for research is descriptive Cross-sectional study by collecting data from the sample of participants at the single point intime.

Settings: We collect data from private clinical settings of Sheikhupura 1=Khadija polyclinic and surgical hospital, 2=Al-Noor hospital

Study Duration: The duration of study will be four months after the approval of synopsis.

Sample Size: Sample size for this research is n=150 pregnant women age between 20-35 years population specificity.

Sampling Technique: We select non probability simple random sampling technique for our research data collection.

INCLUSION CRITERIA

- Patients
- Anesthesiologist

- Post-Op nurse
- Age 20year to 35years

EXCLUSION CRITERIA:

- Non paramedical staff
- Patient attendants
- Age less 20 year and greater then 35 years

DATA COLLECTION PROCEDURE

Target population of our study include cesarian section patient age between 20y to 35y

- **Independent variables:** spinal needle gauge size that is categorized by different needle size 22G, 25G, 27G,
- **Dependent variable:** incidence or severity of post dural puncture headache outcomes is depend on gauge size that is use in procedure.

Data will be collected by making:

- questionnaires or survey forms
- from patient's medical records
- clinical observational check list and
- patients follow-up interviews

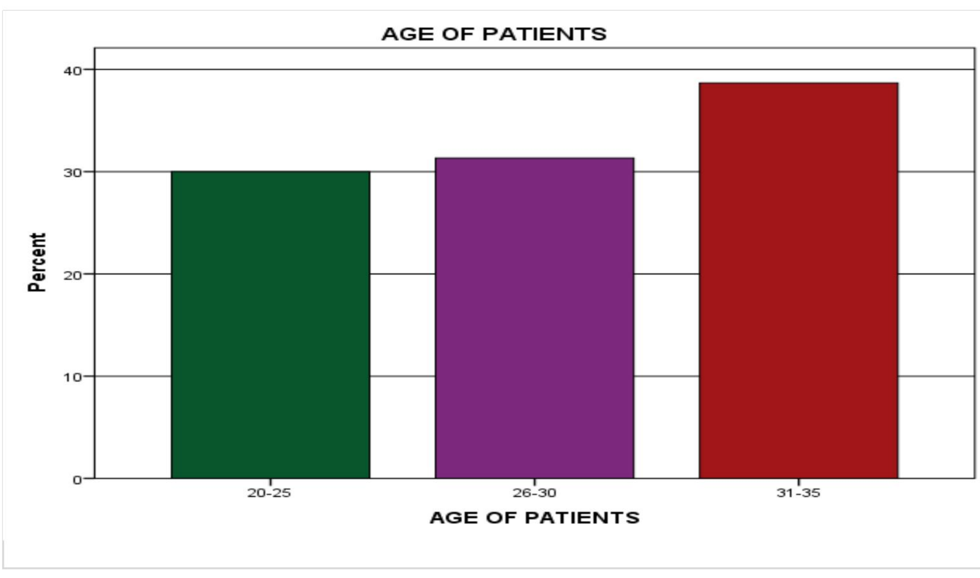
DATA ANALYSIS PROCEDURE

Descriptive statistics are used in data analysis to summarize participant characteristics and the incidence of post-dural puncture headache (PDPH) across various needle sizes in the research of the effect of spinal needle gauge size on PDPH. The chi-square test for categorical data are examples of comparative tests that evaluate group differences.

RESULTS

1-Age Distribution of Patients Showing the Highest Percentage in the 31-35 Age Group

The age distribution of patients is depicted in the bar chart, which is divided into three age groups: 20-25, 26-30, and 31-35 years. The age groups are shown on the x-axis, and the percentage of patients is shown on the y-axis. The age group 20-25 makes up 30%, followed by 26-30 with a little higher percentage at around 31.3%, and 31-35 with the largest percentage at about 38.7%. With the 31-35 age group having the highest representation, this pattern shows that the percentage of patients within this range rises with age. The data distribution is visually supported by the graph, which displays a somewhat balanced but rising trend in patient age.



CHI-SQUARE TESTS

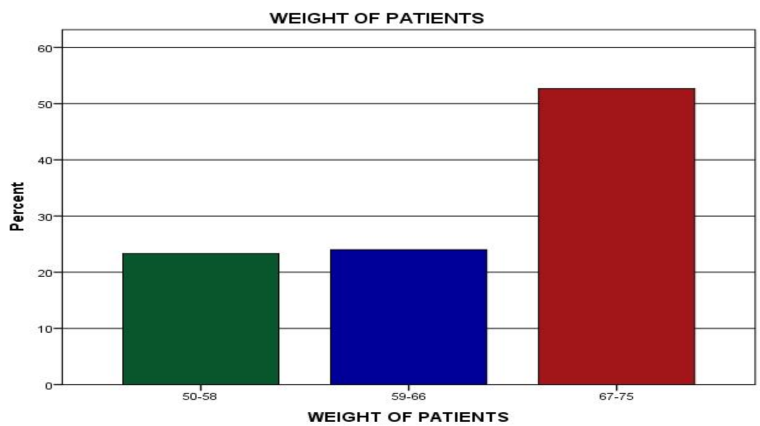
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.864[a]	15	.885
Likelihood Ratio	12.160	15	.667
Linear-by-Linear Association	4.465	1	.035
N of Valid Cases	75		

Interpretation: There is no statistically significant correlation between the two categorical variables, as indicated by the p-value, which is significantly higher than 0.05.

Since the variables seem to be unrelated to one another, we are unable to reject the null hypothesis.

2- WEIGHT DISTRIBUTION OF INDIVIDUALS, SHOWING THE HIGHEST REPRESENTATION IN THE 67-75 WEIGHT GROUP

The weight distribution of patients is depicted in the bar chart, which is divided into three weight ranges: 50-58, 59-66, and 67-75 kilograms. The x-axis shows the weight groupings, and the y-axis shows the percentage of patients. The 50-58 kg group makes up about 23%, the 59-66 kg group makes up about 24%, and the 67-75 kg group makes up the largest percentage, more than 50%. According to this distribution, the lower weight groups have comparatively smaller representations, but the **majority of patients lie within the 67-75 kg range. More patients have higher body weights within the given range, according to the chart.



Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.275[a]	23	.989
Likelihood Ratio	14.059	23	.925
Linear-by-Linear Association	.153	1	.696
N of Valid Cases	75		

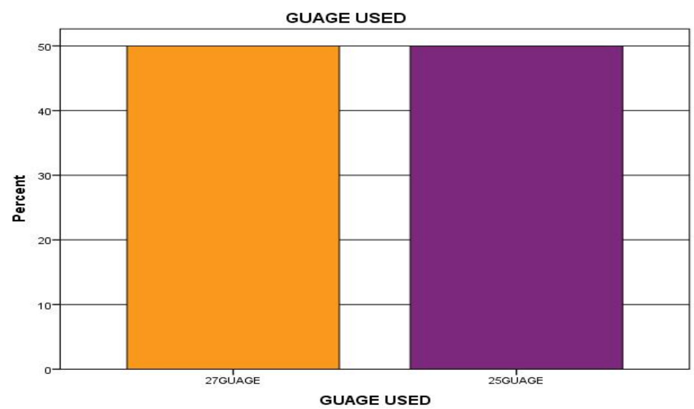
Interpretation: The two categorical variables do not significantly correlate, as indicated by the extremely high p-value.

Since the variables seem to be independent, we are unable to reject the null hypothesis.

3- EQUAL DISTRIBUTION OF INDIVIDUALS BETWEEN 27GUAGE AND

25GUAGE CATEGORIES

The distribution of gauge usage is depicted in the bar chart by contrasting 27GUAGE and 25GUAGE. The gauge types are shown on the x-axis, and the percentage of usage is shown on the y-axis. With each making up 50% of the total usage, 27GUAGE and 25GUAGE are used equally Given that both gauges are used in the same proportion, this suggests that there is no discernible preference for one over the other. A balanced distribution is graphically confirmed by the chart, indicating that depending on the situation, either gauge can be used interchangeably.



CHI-SQUARE TESTS

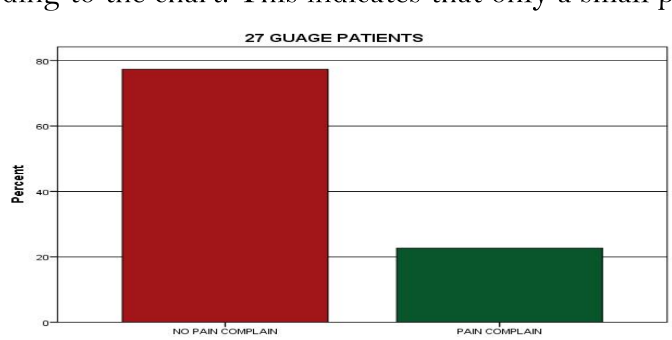
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	49.700[a]	1	.000		
Continuity Correction[b]	45.573	1	.000		
Likelihood Ratio	53.880	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	49.037	1	.000		
N of Valid Cases	75				

Interpretation: A highly significant association between the two categorical variables is indicated by a p-value < 0.001.

Since there is a substantial, statistically significant correlation between the variables, we reject the null hypothesis.

4- DISTRIBUTION OF PAIN COMPLAINTS, SHOWING MAJORITY REPORTING NO PAIN

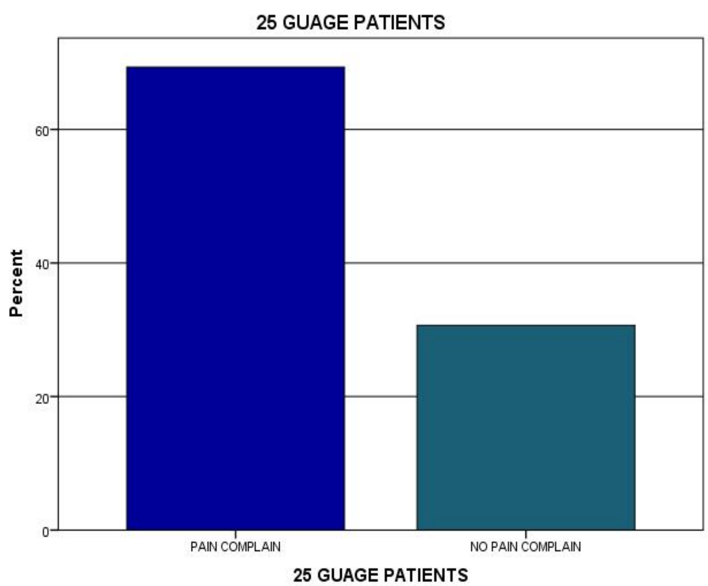
The bar chart displays the pain complaints made by patients who used a 27-gauge needle. The y-axis displays the percentage of patients who fall into the "No Pain Complain" and "Pain Complain" categories on the x-axis. About 80% of patients reported no pain, while 22% reported pain, according to the chart. This indicates that only a small portion of patients report discomfort, indicating that most patients tolerate the 27-gauge needle well. A 27-gauge needle would be a better option to lessen pain complaints



given the significant difference between the two groups.

5- DISTRIBUTION OF PAIN COMPLAINTS, SHOWING MAJORITY EXPERIENCING PAIN

The distribution of pain complaints among patients who received treatment with a 25-gauge instrument is depicted in the bar chart. Patients who reported pain complaints,make up a far larger percentage, surpassing 60%, represented by the blue bar. The teal-colored bar, on the other hand, is noticeably lower, at about 30%, and represents those who reported no pain complaints. This suggests that the 25-gauge instrument may be linked to a higher level of discomfort because it shows that most patients felt pain when using it.



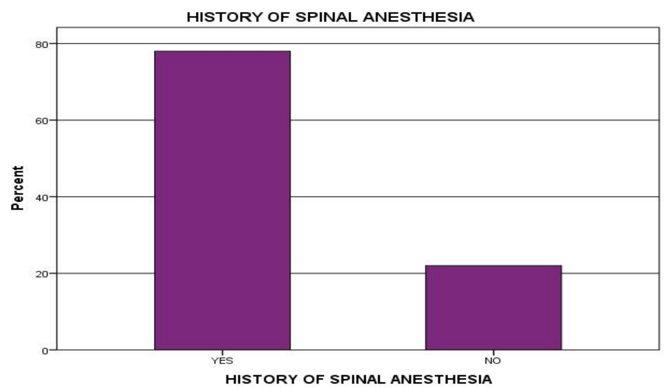
CHI-SQUARE TESTS

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	49.700[a]	1	.000		
Continuity Correction[b]	45.573	1	.000		
Likelihood Ratio	53.880	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	49.037	1	.000		
N of Valid Cases	75				

Interpretation: A highly significant association between the two categorical variables is indicated by a p-value of less than 0.001.
Since there is a substantial, statistically significant correlation between the variables, we reject the null hypothesis.

6-SURVEY RESPONSES BREAKDOWN, MAJORITY "YES" AT 78%, MINORITY "NO" AT 22%

The percentage distribution of answers to the question of whether a person has ever experienced spinal anesthesia is shown in the bar chart "History of Spinal Anesthesia". The percentage of respondents is shown on the y-axis, and the response categories ("YES" and "NO") are shown on the x-axis. The bar in the "YES"group is noticeably higher, suggesting that roughly 78% of respondents had experienced spinal anesthesia in the past. The bar for the "NO" category, which represents about 22% of responders, is significantly shorter. The majority of those surveyed have had spinal anesthesia, as the chart graphically highlights.



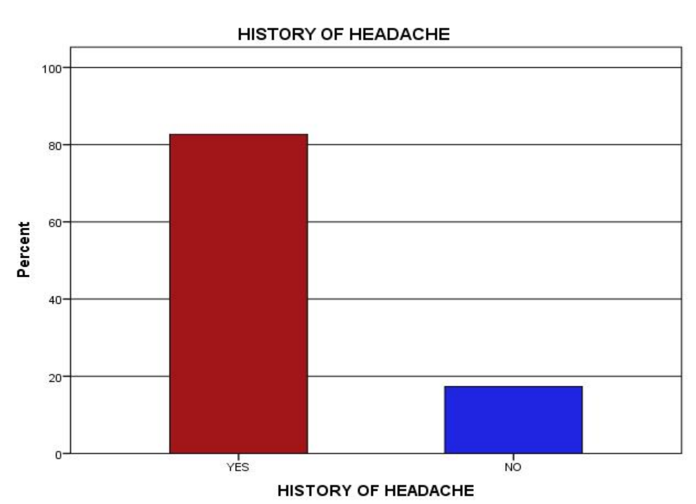
CHI-SQUARE TESTS

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.521[a]	2	.000
Likelihood Ratio	26.620	2	.000
Linear-by-Linear Association	18.986	1	.000
N of Valid Cases	75		

Interpretation: The two categorical variables have a statistically significant relationship ($p < .001$).
Since the variables are not independent, we reject the null hypothesis.

7-SURVEY RESULTS: 82.7% REPORT "YES" AND 17.3% REPORT "NO"

The bar chart titled **"History of Headache"** illustrates the percentage distribution of responses regarding whether individuals have experienced headaches. The x-axis represents the response categories ("YES" and "NO"), while the y-axis represents the percentage of respondents.The **"YES"** category is represented by a tall red bar, indicating that approximately **82.7%** of respondents reported a history of headaches. In contrast, the **"NO"** category is shown by a much shorter blue bar, representing about **17.3%** of respondents. This chart highlights that the majority of surveyed individuals have experienced headaches, while a smaller percentage has not.



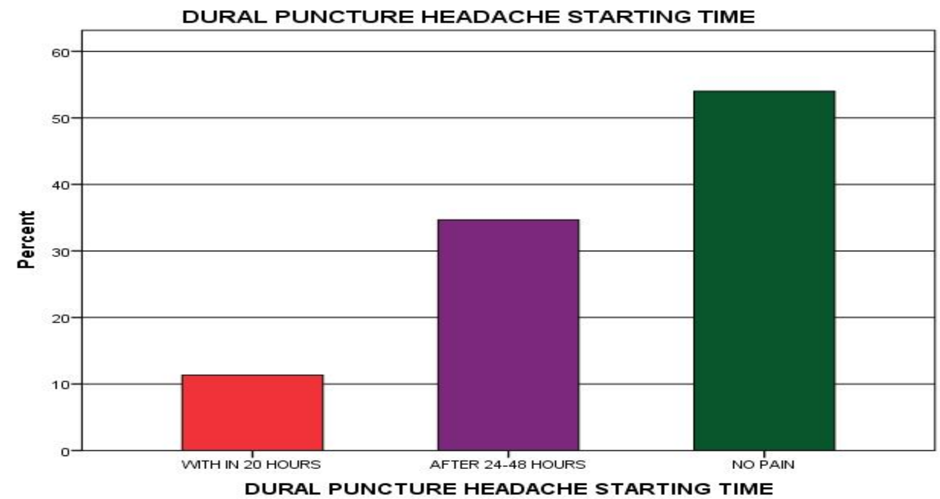
CHI SQUARE TEST

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.521[a]	2	.000
Likelihood Ratio	26.620	2	.000
Linear-by-Linear Association	18.986	1	.000
N of Valid Cases	75		

Interpretation: The p-value is significantly below the typical significance level of 0.05, at less than 0.0001. This suggests that there is a highly statistically significant difference between the "YES" (82.7%) and "NO" (17.3%) responses.

8-PAIN DISTRIBUTION: 54% NO PAIN, 34.7% AFTER 24-48 HOURS, 11.3% WITHIN 20 HOURS

In this study 11.3% (17 people) of the 150 respondents reported discomfort within 20 hours, whereas 34.7% (52 people) reported pain after 24 to 48 hours. Most participants, 54% (81 people), said they didn't feel any pain at all. According to the cumulative percentage, more than half of the participants reported no discomfort following the incident, with 46% of respondents reporting some degree of pain and the remainder 54% not.



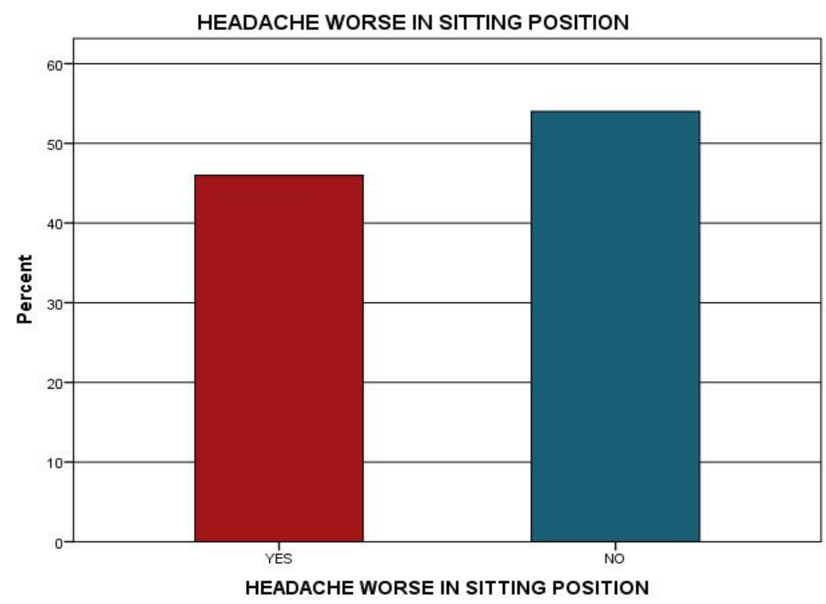
CHI-SQUARE TESTS

	Value	df	Asymp. Sig. (2sided)
Pearson Chi-Square		2	.000
Likelihood Ratio	21.185[a] 26.735	2	.000
Linear-by-Linear Association	19.064 75	1	.000
N of Valid Cases			

Interpretation: A statistically significant correlation between the two categorical variables is indicated by a p-value < 0.05. Since the variables are not independent of one another, we reject the null hypothesis.

9- HEADACHE WORSENING IN SITTING POSITION: 46% YES, 54% NO

The percentage of respondents who said whether their headaches were worse while they were sitting is shown in the bar chart "Headache Worse in Sitting Position". "YES" and "NO," are the two response categories shown on the x-axis, and the percentage of responders is shown on the y-axis. The higher bar in the "NO" category shows that 54% of respondents did not report that their headaches got worse while they were seated. The shorter bar in the "YES" category indicates that 46% of respondents said that sitting made their headache worse. This implies that most people did not have worsening headaches when sitting, but a sizable percentage did.



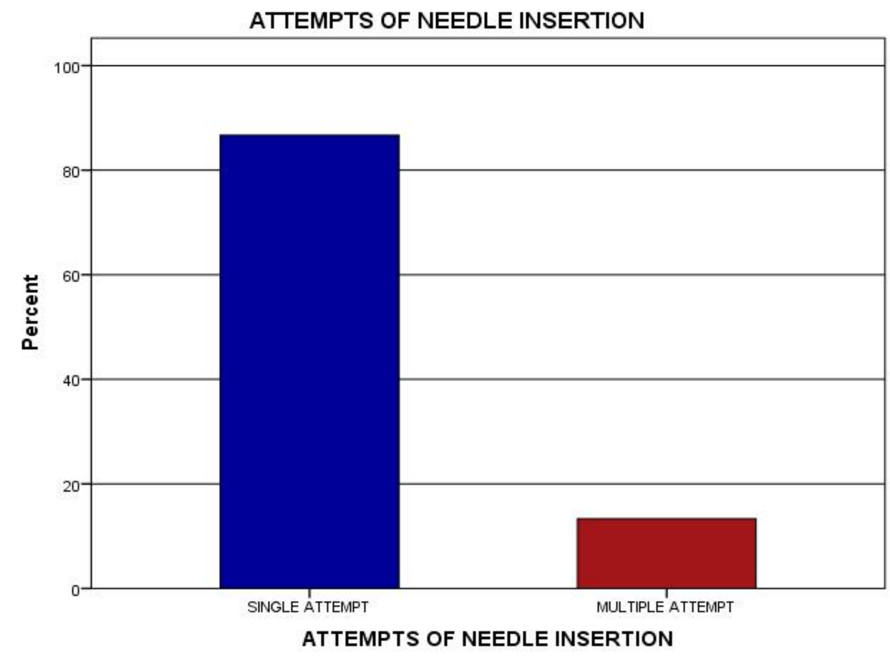
CHI SQUARE TEST

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	21.185[a]	2	.327
Likelihood Ratio	26.735	2	.423
Linear-by-Linear Association	19.064	1	.143
N of Valid Cases	75		

Interpretation: The observed and expected distribution of responses ("YES" vs. "NO") do not differ significantly because the p-value is higher than 0.05. The null hypothesis is not rejected, indicating that there is no discernible difference between a 50/50 distribution and the percentage of respondents who stated that their headaches got worse while they were seated.

10- DISTRIBUTION OF NEEDLE INSERTION ATTEMPTS

The number of efforts needed to insert the needle is shown in the bar chart. The tall blue bar indicates that the majority of cases (86.7%) were successfully finished in a single attempt. The shorter red bar indicates a smaller percentage (13.3%) that needed multiple attempts. According to this statistics, the majority of procedures were completed quickly and with no need for repeated tries.



CHI-SQUARE TESTS

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	21.185[a]	2	.000
Likelihood Ratio	26.735	2	.000
Linear-by-Linear Association	19.064	1	.000
N of Valid Cases	75		

Interpretation: The observed distribution of responses ("SINGLE ATTEMPT" vs. "MULTIPLE ATTEMPT") is highly statistically significant, as indicated by the extremely low p-value (< 0.0001). According to the results, a significantly greater percentage of respondents needed only one try to insert the needle than those who needed several.This indicates that we reject the null hypothesis and draw the conclusion that most needle insertions were successfully performed on a single try, with only a very tiny percentage requiring several tries.

DISCUSSION

This research examines the correlation between spinal needle gauge size and postdural puncture headache (PDPH) incidence. It specifically compares results among patients undergoing spinal anesthesia with 25-gauge versus 27-gauge Quincke needles. The results indicate that the 27-gauge group had a significantly lower PDPH incidence than the 25-gauge group, consistent with other studies, such as those by Johanson et al. (2008) and a meta-analysis showing lower PDPH rates with smaller needles. Though technically more difficult to insert, smaller gauge needles such as 27G may take several attempts and cause greater trauma—nevertheless, this study had an excellent first-attempt success rate, underlining enhanced clinical expertise. Smaller gauge needles such as 27G and 29G were also found to have a lower rate of PDPH than large needles (25G and 22G), which is also according to the hypothesis that thinner needles induce less trauma to the dura and curtail cerebrospinal fluid leak.

The research also recognizes the contribution of the design of the needle tip. Although it only considered Quincke needles, earlier research indicates that pencil-point needles (e.g., Whitacre, Sprotte) also decrease PDPH incidence to an even greater extent. Meta-regression analyses established a significant negative correlation between needle gauge and rate of PDPH in cutting needles but not in pencil-point needles. Statistical computation proved that neither age nor weight was found to correlate significantly with needle gauge selection or development of PDPH. The 25G group experienced greater pain and earlier headache emergence than did the 27G group ($p < 0.0001$). The results further support the clinical advantage of employing finer-gauge spinal needles, especially 27G, to minimize pain and avoid PDPH. In summary, this research corroborates previous evidence that smaller gauge needles, particularly 27G, are more efficient in reducing PDPH and related pain without affecting procedural success, as long as they are employed with proper technical proficiency. Future research should investigate the combined impact of needle gauge and tip design to further refine spinal anesthesia methods.

CONCLUSION

By comparing the incidence and severity of postdural puncture headache (PDPH) between 25G and 27G spinal needles, this study demonstrates that the 27G spinal needle reduces PDPH incidence. Consistent with previous studies, the results demonstrate that finer needles reduce CSF leakage and the severity of PDPH. Despite the high success rate reported in our study, some literature suggests that 27G needles may have technical problems, such as requiring more insertion attempts. Overall, the study supports the use of 27G needles to reduce PDPH while emphasizing the need for skilled technique and further research on needle design.

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