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Effectiveness of Atraumatic Needle to Avoid Post-Dural Puncture Headache

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ABSTRACT

Objective: To determine occurrence of headache after a dural puncture using an atraumatic needle.
Study Design: Quasi-experimental study.
Place and Duration of Study: Department of Anesthesia, Combined Military Hospital, Rawalpindi Pakistan, from Apr to Sep 2021.
Methodology: A total of 336 patients were divided into two groups of 168 patients each, after obtaining institutional approval and informed consent from patients. Female patients, of reproductive age group, who were scheduled to receive subarachnoid block before c-section, were included in the study. We compared the usage of a traumatic needle (25 gauge) compared to atraumatic (25 gauge) in causing post-lumbar puncture (LP) headache.
Results: Post-LP headache occurred in 7.1% of the patients assigned to the atraumatic needle and 32% of the patients assigned to the traumatic needle, which was found to be significant (p=0.001).
Conclusion: We found that usage of atraumatic needles led to a reduction in the occurrence of headaches during lumbar puncture.

Keywords: Atraumatic needle, Post-dural puncture headache, Traumatic needle.

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INTRODUCTION

A lumbar puncture is a common example of an invasive medical procedure performed for treatments such as chemotherapy, analgesia, and reducing intracranial pressure following diagnosis by sampling or imaging.[1,2] Although the lumbar puncture has come a long way in terms of patient safety since it was first performed in the 1800s, it is still associated with serious adverse effects, the most common of which is a headache.[3,4] Postural and fronto-occipital in origin, headaches after a lumbar puncture are typically associated with sitting or standing for long periods of time but patients suffering from these headaches may need to be hospitalized,[5] as cerebrospinal fluid (CSF) seepage via the puncture site in the dura mater is hypothesized to be the cause.[6,7] LP-related headaches have been connected to needle gauge, needle tip design, patient position, and operator skill, among other factors,[8,9] with the shape of the needle tip being used to classify it as either atraumatic or traumatic with 'Traumatic' or 'conventional' needles being the norm as they have an aperture at the tip for CSF collection or drug injection, and a beveled tip for puncturing tissue but 'Atraumatic' needles, on the other hand, have a rounded tip like a pencil with a port on the side to inject or collect, which dilates the dural fibers, splaying them throughout the procedure and allowing them to slowly return to their original position once the needle is removed,[10] Thus, we planned this project with the aim to determine if using an atraumatic needle can reduce the risk of experiencing a headache after a dural puncture.

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METHODOLOGY

The quasi-experimental study was conducted from April 2021 to September 2021, after receiving the approval of the Institutional Ethics Review Committee via letter No. 365. Our sample size was determined by using the World Health Organization (WHO) calculator, keeping level of significance 1%, power of test 80%, anticipated population proportion to be 54% and population proportion two to be 29%10, resulting in 77 patients to be included in each group but to increase the strength of our study, we collected a sample of 336, with 168 patients in each group, by using a non-probability consecutive sampling method.

Inclusion Criteria: Female patients of reproductive age group (20-45 years) scheduled to receive lumbar puncture (LP) for subarachnoid block before Caesarean section (C-section) were included.

Exclusion Criteria: Patients with neuropsychiatric disorders or history of headaches were excluded.

Prior to the lumbar puncture, each patient was randomly assigned to either Group-AT (atraumatic needle) or Group-TT (traumatic needle). Patients were not informed of the needle type used, and only two anesthetists performed the procedure. In Group-AT patients, 25-gauge (Atraumatic, pencil point, Braun) needle was used and in Group-TT, 25-gauge (Traumatic, Quinke, Braun) needle was used. Standard spinal anesthesia was given to all patients in sitting position with 1.5ml of local anesthetic (0.5% bupivacaine). The patients was interviewed after one week following LP, to learn more about the patient's experience with any post-puncture symptoms, including the severity of those symptoms, how long it took for those symptoms to appear, and how they were handled. Needle used was unknown to the interviewer, who then decided on whether or not there was a headache or other side effect after LP. An LP headache was defined as upright headache or neck pain within five days of LP with symptoms abating on lying down or the presence of nausea, vomiting, dizziness, and tinnitus.[11] Statistical Package of Social Science (SPSS) version 26 was used to analyze and interpret data with Mean±SD calculated for quantitative variables and frequency computed for qualitative variables. Chi-square analysis was used for comparison of the frequency of LP-headache between both groups with *p*-value ≤0.05 considered to be significant.

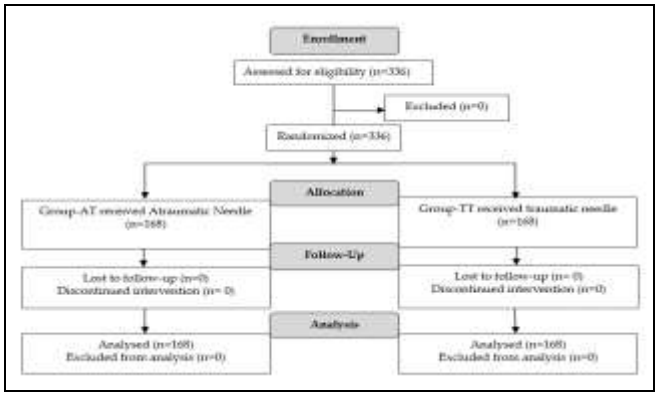

Figure: Patient Flow Diagram (n= 336)

RESULTS

A total of 336 female patients were enrolled in the study with mean age being 34.41±7.05 years, ranging from 19 to 41 years, mean weight being 58.06±4.23 kg and BMI being 27.33±3.41kg/m². The average c-section time was recorded to be 41.46±5.10 minutes. Further demographic details of the patients are presented in Table-I. As shown in Table-II, the frequency of spinal headache was 7.1% in Group-AT and 54% in Group-TT (*p*-value<0.001). Different side effects reported by patients are shown in Table-III. Nausea occurred more among traumatic needle patients as compared to atraumatic needle (*p*-value=0. 010).

Table-I: Demographic Characteristics of all the Patients (n=336)

Variable	Mean±SD
Age (Years)	36.53±5.38
Weight (kg)	58.06±4.23
BMI (kg/m²)	27.33±3.41
C-Section time (minutes)	41.46±5.10

**BMI: Body Mass Index*

Table-II: Frequency of Lumbar Puncture Headache in Both Groups (n=336)

Study Parameter	Group-AT (n=168) n (%)	Group-TT (n=168) n (%)	*p*-value (≤0.05)
Headache	12(7.1)	54(32.0)	<0.001

Table-III: Comparison of Post-Lumbar Puncture Complaints with Traumatic versus Atraumatic Needle (n=336)

Post-lumbar Puncture Headache	Group		*p*-value (≤0.05)
	Group-TT (n=168)	Group-AT (n=168)	
Nausea	16(9.5%)	4(2.4%)	0.010
Vomiting	9(5.3%)	2(1.2%)	0.257
Dizziness	6(3.6%)	3(1.8%)	0.502
Combination of all	4(2.4%)	2(1.2%)	0.685

DISCUSSION

In this study, a 25G atraumatic needle was associated with a significantly lower risk of Post Dural Puncture Headache (PDPH) than a larger traumatic needle. As per literature, diagnostic LP is best performed using a small-bore atraumatic needle rather than a larger needle.[12] In spite of the fact that only a few studies have investigated the topic, current recommendations from the American Academy of Neurology LP state that the stylet should be reinserted prior to needle removal when traumatic needles are being used,[13] as the risk of PDPH was shown to be lower with stylet reinsertion (5.0%) than without it (16.3%).[14] However, in our study, we removed the stylet and injected the drug and took the needle out without stylet re-insertion, with no comparison made of this fact in both groups. The paradoxical effect of lower spinal headaches is mentioned in one study, where spinal headaches were lower in patients with traumatic puncture versus atraumatic puncture, as there was greater inflammation induced by atraumatic needle due to blunt dissection of fibers,[15] however, the result of our study favored use of atraumatic needle

for prevention of spinal headache. It is worth noting that needle size and design had varying effects across different age groups, with the greatest impact being seen in the oldest participants,[16] however, we included younger patients of same gender to prevent bias. This is something that has not been discussed before, and it provides support for the use of small-bore traumatic needles for diagnostic LPs, even if the a-priori risk of PDPH is considered to be minimal. We believe that the unique needle point shape, which is associated with reduced stress to the dura and thus less CSF leaking, is responsible for the remarkably low incidence of post-LP symptoms, as also reported by other studies.[17,18] While the 22-gauge needle is thicker than the atraumatic 20-gauge needle, however, literature suggests that this size of needle is not recommended for everyday clinical use.[19]

LIMITATIONS OF STUDY

Our study was constrained by its relatively small sample size and being a single-center study with only young, female patients enrolled in the study. It is a possibility that we might have underestimated frequency of spinal headaches in patients because follow-up assessments were done on Day 5 after LP. This limits the generalizability of our findings to the rest of the population of our region.

CONCLUSION

We concluded that the 25-bore atraumatic needle is associated with a lower incidence of PDPH when compared to traumatic needle.

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Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

TY & SAMR: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

UEM & AK: Conception, data analysis, drafting the manuscript, approval of the final version to be published.

KM & HMT: Data acquisition, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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