The Postdural Puncture Headache and Back Pain: The Comparison of 26-gauge Atraucan and 26-gauge Quincke Spinal Needles in Obstetric Patients

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Abstract

Background: The postdural puncture headache (PDPH) and postdural puncture backache (PDPB) are well-known complications of spinal anesthesia. There are some attempts to reduce the frequency of complication such as different design of the spinal needles. Aims: The primary outcome of this study is to compare the incidence of PDPH between 26-gauge Atraucan and 26-gauge Quincke spinal needles in elective cesarean operations. The severity of symptoms, the incidence of backache, technical issues, and comparison of cost of needles are secondary outcomes. Materials and Methods: After Investigational Review Board approval, a randomized, prospective, double-blinded study was designed in 682 American Society of Anesthesiologists I–II women having elective cesarean operations under spinal anesthesia. Patients were divided into two groups as 26-gauge Atraucan Group A (n = 323) and 26-gauge Quincke spinal needles Group Q (n = 342). All patients were questioned about backache 1 week later. Differences between categorical variables were evaluated with Chi-square test. Continuous variables were compared by Student’s t-test for two independent groups. A two-sided P < 0.05 was considered statistically significant for all analyses. Results: There were no significant differences between groups in all demographic data. The one attempt success rate of the dural puncture in Group A (70.58%) and in Group Q (69.3%) was similar (P > 0.05). The incidence of PDPH was 6.5% in Group A and 4.9% in Group Q (P > 0.05). The epidural blood patch was performed to the three patients in Group A and five patients in Group Q who had severe headache (P > 0.05). The incidence of PDPB was 4.33% versus 2.04% in Group A and Group Q (P > 0.05). Conclusions: The incidence of complication rates and technical handling characteristics did not differ between two groups. Quincke needle is cheaper than Atraucan needle, so it can be a cost-effective choice in obstetric patients.

Keywords: Atraucan needle, cesarean section, postdural puncture back pain, postdural puncture headache, Quincke needle, spinal anesthesia

Background

Spinal block is a reliable and easy technique frequently used in the anesthetic practice. The postdural puncture headache (PDPH) is a well-known complication of spinal block. There are many factors affecting the frequency of PDPH. These factors may include age, female sex, needle size and type, pregnancy, previous history of PDPH, median-paramedian difference in approach, puncture level. The PDPH, which cause significant morbidity in obstetric patients, has higher incidence because of the increased cerebrospinal fluid (CSF) pressure related to pregnancy, dehydration, blood loss, postpartum diuresis, hormonal imbalance, high serum estrogen levels, and increased peridural pressure.

The cutting point (Quincke) needles are widely used in spinal anesthesia and diagnostic lumbar puncture. They provide ease of use and economically cheaper than other needles. Despite these benefits of Quincke needle, this needle design creates larger dural holes and it may cause more CSF leakage. The pencil-pointed Atraucan needle, which creates smaller hole on dura, come into use after better understanding of the structure of dura.

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It has a narrow cutting tip and atraumatic bevel.

Postdural puncture backache (PDPB) which is characterized by continuous pain around the site of spinal puncture without any irradiation is also a common complaint after spinal anesthesia. The paraspinal muscular relaxation with stretching of spinal ligaments and/or localized tissue trauma are accepted as the pathophysiology of PDPB. Acute postspinal backache usually resolves within 7 days without any treatment. The effect of needle type, size, design, and use of introducer in spinal needles on postdural back pain for neuraxial block has been studied. Some studies showed no difference in PDPB related to needle size and shape. The previous studies about the effect of the introducer needle on back pain showed no significant difference.

The primary outcome of this study is to compare the incidence of PDPH between 26-gauge Atraucan and 26-gauge Quincke spinal needles in elective cesarean operations. The severity of symptoms, the incidence of backache, comparison of price of needles, and technical handling characteristics in obstetric patients are secondary outcomes of this study.

**Materials and Methods**

After approval from Investigational Review Board, the study period extended between January 2009 and January 2010 at Obstetrics and Gynecology Clinic, in Dicle University Medical Faculty. A randomized, prospective, double-blinded study was designed in 682 American Society of Anesthesiologists (ASA) I–II, 18-45 ages women having elective cesarean operations under spinal anesthesia. The informed consent was obtained from each patient. The patients who have chronic headache and migraines, emergency cesarean indications, history of antepartum hemorrhage, preclampsia and eclampsia, allergic reaction history to any drug used in study, hemostatic disorders, denial of the patient for spinal anesthesia, and the patients with the cardiovascular system problems were excluded from the study.

The patients fasted for at least 8 hours from midnight. The patients did not receive any pharmacological premedication. Before spinal anesthesia, 10–15 ml/kg isotonic fluid was preloaded in 20 min through 18-gauge intravenous cannula. The electrocardiogram, peripheral oxygen saturation, noninvasive blood pressure monitorization were performed to all patients. The weight, height, ASA status and age of the patients were recorded.

The patients were divided into two groups by random computer system support: Group A (Atraucan® B. Braun Melsunger, Germany, 26-gauge) and Group Q (Spinocan®, B. Braun Melsunger, Germany, 26-gauge). Patients were blinded to study. Anesthesiologists were blinded to the study needle used until a patient randomized on the study. The study coordinator that collected data were blinded to groups throughout the study. On the day of surgery, the anesthesiologist opened the envelopes that stored randomized sequence numbers in the operating room to not change patients’ allocation. Spinal anesthesia was performed in midline approach between the L2–L3, L3–L4, and L4–L5 intervertebral space with the patients in the sitting position. 10 mg heavy bupivacaine 0.5% was injected to the patients between 150 and 159 cm length, 12.5 mg heavy bupivacaine 0.5% to the patients between 160 and 169 cm length and 15 mg heavy bupivacaine 0.5% to the patients over 170 cm length intrathecally. The spinal anesthesia was performed to all patients by two experienced anesthesiologists. Quincke needles were inserted with the bevels directed in parallel direction to dural fibers in order not to cut dural fibers. After establishing free flow of CSF through the needle, the terminal orifice of the needle was directed cephalad to the patient. Twenty-six-gauge Atraucan needle was inserted through 20-gauge introducer needle. The bevel of the Atraucan needles turned parallel to the longitudinal axis of spinal cord.

After injection of local anesthetic over 15 s, patients were laid in supine with 15–20° of the left lateral tilt position. The sensory block level was evaluated every 3 min by the loss of pinprick sensation with 20-gauge hypodermic needle. Bromage scale (0 - free movement of legs and feet; 1 - just able to flex knees with free movement of feet; 2 - unable to flex knees, but with free movement of feet; 3 - unable to move legs or feet) was used to evaluate motor block of lower extremities. The operations were allowed as soon as the motor and sensory block level obtained at the T4–T6 level. Hypotension was defined as a 30% or more decrease in systolic blood pressure from baseline. Hypotension was treated first with iv volume expansion then if needed by 5–10 mg iv ephedrine. Bradycardia was defined as a heart rate of <45 beats/min and was treated with 0.01 mg/kg of iv atropine. A number of puncture attempts were recorded as 1, 2, or more. Midazolam (0.01–0.03 mg/kg) and fentanyl (0.5–1 mcg/kg) were administered intravenously to parturients with inadequate or supplemental analgesia after delivery of baby. General anesthesia was applied to patients after inadequate spinal anesthesia or failed spinal blockade for the completion of surgery. The needle type, number of puncture attempts were recorded.

In the postoperative period, patients were observed in the postanesthetic care room for 1–2 h. The patients were kept on bed rest for 6 h. All patients were mobilized after total return of motor block assessed by anesthesiologist. A combination of iv paracetamol 1 g three times in 24 h and diclofenac 50 mg intramuscularly 12-hourly to a maximum of 100 mg in 24 h was given for postoperative analgesia.

The patients were given 3 L fluid in a day, and they were discharged from the hospital on the 3rd day, patients were interviewed by anesthesiologist about headache, back pain, and any other complaints. All patients were questioned about headache, back pain 1 week later by telephone call.

The PDPH was defined according to the International Headache Society Classifications, as an bifrontal or occipital region headache that worse in the upright position and relieved with supine posture and headache develops within 5 days after dural puncture. Other types of headaches were considered nonspecific headaches and were excluded from the study.
The intensity of PDPH was classified as mild, moderate, and severe headache postoperatively by a numeric rating scale (11) on the 1st and 2nd postoperative day. On the scale, 0 is the absence of headache, 1–3 is mild pain, 4–6 is moderate pain, and 7–10 is severe pain (disabling; unable to perform daily activities). Mild PDPH was defined as nagging, annoying pain and the absence of restrictions in daily activities; the bed rest and fluid intake were recommended. Moderate PDPH was defined as the headache that restricts daily activities. The bed rest, liquid, and analgesic intake hourly to a maximum 2 g a day (acetaminophen 250 mg + propyphenazone 150 mg + caffeine 50 mg – Minoset Plus® 500 mg tablet) were recommended. Severe PDPH was defined as not able to feed her child, confining to bed, and being anorexic despite adequate medical treatment. The patients who had severe PDPH first advised the bed rest, fluid intake, coffee; then, given analgesic tablets (Minoset Plus® 500 mg) one tablet every 6 h. If severe headache persisted after these treatments for more than 3 or 4 days, epidural blood patch (EBP) was applied to patients by giving their own blood (15–20 ml) after informed consent obtained. EBP was conducted by experienced staff anesthesiologists under aseptic conditions. When the epidural space had been localized with 17-gauge or 18-gauge Tuohy needle by the loss of resistance technique, the second operator draws autologous venous blood sample from an antecubital vein into a plastic syringe. Then, 15–20 ml blood was slowly injected into the epidural space through the Tuohy needle at a speed of approximately 0.3 ml/s. After removing the cannula, the patient was asked to stay lying for 1 h in dorsal decubitus. The effectiveness of EBP was evaluated by asking the patient to stand up and walk 1 h later. PDPF was evaluated on the 1st postoperative day and on the 7th day by phone call.

The PDPB was defined as continuous pain and tenderness over the lumbar area around the spinal needle insertion and recorded as the number of PDPB by asking phone call.

**Statistical analysis**

Data analysis was performed using SPSS 15 (Statistical Package for the Social Sciences, Chicago, Illinois, USA). Continuous variables were presented as mean ± standard deviation, whereas categorical variables as frequencies and percentages. Differences between categorical variables were evaluated with Chi-square test. Continuous variables were compared by Student’s t-test for two independent groups. The power analysis was calculated by PASS software (Power Analysis of Sample Size, http://www.ncss.com/software/pass/) (NCSS, LLC, Kaysville, Utah, USA). The sample size of 100 patients per group was necessary with the alpha error level set at 0.05 and 80%. A two-sided P < 0.05 was considered statistically significant for all analyses.

**RESULTS**

The 682 pregnant women were recruited in the study. Ten patients in atraumatic group and seven patients in Quincke group were excluded from the study because of inadequate spinal anesthesia that general anesthesia was applied. The spinal anesthesia was performed to 323 patients with 26-gauge Atracana type needle and 342 patients with 26G Quincke type needle. Demographic data are shown in Table 1. There were no differences between the two groups with regard to age, height, weight, and ASA physical status (P > 0.05).

PDPH was observed in 21 patients (6.5%) in Group A and in 17 patients (4.98%) in Group Q (Table 2). The PDPH was analyzed according to the incidence and severity; there were no significant differences between groups (P > 0.05).

Table 3 shows the spinal puncture attempts. The spinal anesthesia was performed to 228 patients (70.58%) in Group A and to the 237 patients (69.30%) in Group Q in single attempt. The second or more attempts were performed to 95 patients (29.42%) in Group A and 105 patients (30.70%) in Group Q. No difference between groups in terms of the number of attempts was observed (P > 0.05).

| Table 1: Demographic data of the patients |
|------------------------------------------|
| Characteristic                          | Group A     | Group Q     | P      |
| Age (years), mean±SD                    | 31.18±6.67  | 30.64±6.54  | >0.05  |
| Height (cm), mean±SD                    | 161.50±5.19 | 161.90±4.82 | >0.05  |
| Weight (kg), mean±SD                    | 7625±645    | 77.91±6.80  | >0.05  |
| ASA, n (%)                              |             |             |        |
| I                                        | 285 (8824)  | 315 (92.11) | >0.05  |
| II                                       | 38 (1176)   | 27 (7.89)   | >0.05  |
| Total                                    | 323 (100)   | 342 (100)   |        |

Differences between groups in all variables are not statistically significant. SD = Standard deviation, ASA = American Society of Anesthesiologists, n = Patient number, A=Atracana, Q=Quincke

| Table 2: Incidence and severity of postdural puncture headache |
|---------------------------------------------------------------|
| Groups                                                        | Group A, n (%) | Group Q, n (%) | P     |
| Intensity                                                     |               |               |       |
| Mild                                                         | 11 (3.4)      | 6 (1.8)       | >0.05 |
| Moderate                                                     | 7 (2.2)       | 6 (1.8)       | >0.05 |
| Severe                                                       | 3 (0.9)       | 5 (1.4)       | >0.05 |
| PDPH                                                         |               |               |       |
| Present                                                      | 21 (6.5)      | 17 (4.98)     | >0.05 |
| Absent                                                       | 302 (93.49)   | 325 (95.02)   | >0.05 |
| Total                                                        | 323 (100)     | 342 (100)     |       |

Differences between groups are not statistically significant. PDPH=Postdural puncture headache, n=Patient number, A=Atracana, Q=Quincke

| Table 3: Number of the dural puncture attempts |
|-----------------------------------------------|
| Number of attempts                           | Group A, n (%) | Group Q, n (%) | P     |
| 1                                            | 228 (70.58)    | 237 (69.30)    | >0.05 |
| ≥2                                           | 95 (29.42)     | 105 (30.70)    | >0.05 |
| Total                                        | 323 (100)      | 342 (100)      |       |

Differences between groups are not statistically significant. n=Patient number, A=Atracana, Q=Quincke
The EBP was performed to the three patients in Group A and five patients in Group Q who had severe headache ($P > 0.05$). PDPB was seen in 14 patients (4.33%) in Group A, and seven patients (2.04%) was seen in Group Q ($P > 0.05$) [Table 4].

**DISCUSSION**

In this study, we found that the rate of PDPH, PDPB after spinal anesthesia, and the success rate of needle insertion were similar between 26-gauge Atraucan and 26 Quincke needles in obstetric patients. There was no difference between the severity of PDPH.

The mechanism of PDPH is not fully understood. However, it is thought that the loss of CSF after dural puncture causes vasodilatation of the meningeal vessels and loss of CSF pressure can be a reason for traction of intracranial structures on erect position. These two mechanisms assume to cause PDPH. The type and size of the spinal needles determine the amount of the CSF loss through the hole on dura. The Quincke type cutting needles cause larger defect on fibers of dura and produce dural flap. The Atraucan type spinal needles, which introduced in 1993, conically separate the fibers of dura and thus cannot produce dural flap. The dural hole that Atraucan needles make is smaller than the external diameter of incision needle. Holst et al. found a positive correlation between the amount of CSF loss and the needle types. They determined the amount of CSF loss with the Quincke type 22-, 25-, 27-, and 29-gauge needles, respectively as 116, 54.6, 31.2, and 16.2 ml, the minimal loss was found as 9.4 ml in 26-gauge Atraucan needle.[3]

Despite the fact that Quincke needles cause more CSF leakage than Atraucan needles, the incidence of PDPH is contradictory. We found no statistically difference between two groups regarding PDPH in obstetric patients. In our study, we found 4.9% incidence of PDPH in 26-gauge Quincke needle group which was lower than the 20% reported by Ross et al.,[21] 10.3% reported by Abdullayev et al.,[15] 5% reported by Nafiu et al.,[22] in obstetric patients with the same 26-gauge Quincke needles. 6.5% incidence of PDPH in 26-gauge Atraucan group in our study was higher than 2.08% reported by Hwang et al.,[23] 5% reported by Vallejo et al.,[4] lower than 9.2% reported by Abdullayev et al.[15] in obstetric patients with same diameter spinal needle. The reason of different incidence of our results regarding PDPH from the other studies can be explained by different follow-up period, confounding diagnosis PDPH with non-PDPH, population size, their ages, study methodology, and genetic factors.

In this study, one attempt success rate of the dural puncture in Group A (70.58%) and in Group Q (69.3%) was similar. Pan et al.[10] (62%) and De Andrés et al.[11] (70.2%), Sharma et al.[14] found the similar success rate with 26-gauge Atraucan needles. Abdullayev et al.[15] achieved high success rates of 92.7% in Atraucan group, 85% in Quincke group, respectively. This may be attributed to the experience of anesthesiologist. The cutting tip and bevel of the Quincke needles and the introducer used in 26-gauge Atraucan needle are factors, which results in ease to use and high rate of achievement of one attempt dural punctures. The ease of using these needles and smooth insertion without repeated puncture can help in reducing painful complications.

PDPB is a common complaint after dural puncture. The type and duration of surgery, position of the patient during the puncture, and the immobilization time on the operating table affect the pathogenesis of postdural puncture back pain. In our study, the proportion of back pain of the patients was found as 4.3% of Group A and 2.04% of Group Q. We found the incidence of PDPB was lower in both groups (Group A and Group Q) according to other studies. The incidence of PDPB was recorded 9.6% by Pan et al.,[10] 22% by Sharma et al.,[14] after tubal ligation operations with 26-gauge Atraucan needle. The incidence of PDPB with 26-gauge Quincke needle was noted 24.3% by Kang et al.,[23] among ambulatory surgery and 5.9% by Schultz et al.[26] after subumbilical surgery except obstetric operations. De Andres et al. reported an incidence of 22.8% of PDPB after spinal anesthesia for lower limb orthopedic surgery. Backache with Atraucan needle that they suggested the reasons of the incidence of PDPB as young age of patients and use of 20-gauge introducer with the spinal needle. The reasons of low incidence of PDPB in our study may be because of the type and duration of surgery, immobilization time in operation, and genetic factors.

In our study, we investigated the incidence of PDPH and PDPB with Atraucan and Quincke spinal needles that we found no difference between them. We believe that the results of 682 patients evaluated in this study are important that the high incidence of PDPH seen in obstetric and young women. On the other hand, it is today gaining importance in anesthesia costs. The cost of a Quincke type needle is 1 euro and an Atraucan type needle nearly 4 euro in our country. Hence, the use of Quincke needles can be a cost-effective choice.

**Conclusions**

There is no statistically difference regarding the incidence of PDPH, PDPB, and technical ease of use between Atraucan and Quincke needles in obstetric patients. Both spinal needles (Quincke or Atraucan needles) are suitable according to the preference and the need of physician. The cost-effectiveness may be an advantage for Quincke type needles.

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Conflicts of interest
There are no conflicts of interest.

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