Comparison of Median and Paramedian Approaches in the Incidence of PDPH After Spinal Anesthesia for Cesarean Section

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Abstract

Background: There are two common techniques used in spinal anesthesia, median and paramedian, each of which has advantages and disadvantages. The median approach is the most common technique used, but it is technically difficult. The paramedian approach is sometimes preferred because of faster catheter insertion. The exact mechanisms leading to PDPH are still not completely understood, although several factors, particularly the patient's age and gender, modulate its incidence.

The aim of this work: to assess whichapproach is associated with less frequency of PDPH.

Setting: Department of Obstetrics and Gynecology, Al Azhar University.

Timing: from the period between July 2012 to May 2014.

Study Design: randomized clinical trial

Methodolgy:120 pregnant patients had the same characteristics and indicated for cesarean section wereselected to receive spinal anesthesia either by median approach (group1, no. = 60) or para median approach (group2, no =60).Comparison between both groups as regard the incidence of PDPHwithin 2 days after the cesarean section was done.

Results: there was a statistically significant difference between the both groups as regard the incidence of PDPH which was more frequent in group1 than group2 (11/56(19.6%) versus 3/58(5.2%) with p=0.018).there were no significant difference between the two groups in view of occurrences of backache, paraethesia or the need for additional analgesia.

Conclusion: Para median approach not only associated with significant reduction of PDPH but also with less frequent backache, paraethesia and post-operative need for additional analgesia.

Keywords:

Caesarean Section, Spinal, Median Approach, Para median Approach, PDPH, Paraethesia.

Introduction

Headache after lumbar puncture (PDPH) is of a common occurrence (32%) and carries a considerable morbidity, with symptoms lasting for several days, at times severe enough to immobilize the patient. If untreated, it can result in serious complications such as subdural hematoma and seizures, which could be fatal (Ahmed et al 2006).

According to the Headache Classification Committee of the International Headache Society, PDPH is defined as "bilateral headaches that develop within 7 days after a lumbar puncture and disappears within 14 days. The headache worsens within 15 min of resuming the upright position, disappears or improves within 30 min of resuming the recumbent position". This definition helps to avoid confusion with migraine or simple headache after lumbar puncture. (Olsen et al 2004).

The onset of PDPH is usually within 24–48 h after dural puncture,(Olsen et al 2004) but contrary to the above definition, it could be delayed by up to 12 days,(Fearon 1993) The postural nature of the headache is very characteristic and the symptoms are usually self-limited,(Fearon 1993) but sometimes it may be severe enough to immobilize the patient. Headache after lumbar puncture is usually dull or throbbing in nature, and can start in the frontal or occipital region, (Turnbull and Shepherd 2003) which can later become generalized. It is possible for the pain to radiate to the neck and shoulder area, and could be associated with neck stiffness. Head movements

exacerbate the pain and any maneuvers that increase intracerebral pressure, such as coughing, sneezing, straining or ocular compression, may also worsen the symptoms.(Vilming and Kluster 1998)
Headache usually resolves within a few days, but the longest reported headache after lumbar puncture lasted for 19 months (Niall et al 1986).

Although the loss of cerebrospinal fluid(CSF) and lowering of CSF pressure is not disputed, the actual mechanism producing the headache is unclear. There are two possible explanations.First, the lowering of CSF pressure causes traction on the intracranial structures in the upright position. These structures are pain sensitive, leading to the characteristic headache. Secondly, the loss of CSF produces a compensatory venodilatation vis-à-vis the Monro–Kellie doctrine (Grant et al 1991).

Certain factors contributeto the development of PDPH. If these factors are taken into consideration, the incidence of headache could be markedly reduced. It is therefore important that the doctors are aware of the methods available for reducing the incidence of headaches after lumbar puncture(Ahmed et al 2006).

PDPH occurs more often in young adults, especially in the 18–30-year age group (Ahmed et al 2006) .Young women with a lower body mass index and those who are pregnant have the highest risk of developing the headache(Kuntz et al 1992). A less stretchable duramater due to either atherosclerosis or age-related mechanical changes in the epidural space might explain why the incidence is low in elderly patients (Dripps and Vandam 1954).
Subarachnoid space can be approached from the posterior aspect of the vertebral body either through the midline or paramedian approach (PMA). Accurate identification of the subarachnoid space is paramount, as multiple attempts at needle insertion may cause patient discomfort, higher incidence of spinal hematoma, trauma to the neural structures and PDPH (Conroy et al 2013).

The most commonly practiced technique is the midline approach (Wantman et al 2006). This approach is technically difficult in the geriatric patients because of degenerative changes in the spine(Boon et al 2003). Calcification of supraspinous and interspinous ligaments in the geriatric age group makes midline approach difficult.

Paramedian approach is not routinely practiced and is used only when midline approach has failed or is not possible due to anatomical variations like ankylosing spondylitis (Mitra and Sharma 1998). PMA is also a very easy and effective technique that can be practiced routinely as well as for some clearly indicated cases.

Aim of the work: to assess which approach is associated with less frequency of PDPH.

Methodology

120 patients scheduled to undergo elective caesarean section (CS) under spinal anesthesia admitted to Obstetrics and Gynecology Department,Al AzharUniversity, from the period of April 2012 to July 2014, were included in the study. Inclusion criteria were patients with ages between 30 and 40 years old,BMI ≤34 ,willing for spinal anesthesia ,no medical diseases as diabetes mellitus ,hypertension ,no coagulopathies,no neurological or psychological disorders ,no infection at the site of puncture and no skeletal anomalies in the vertebral columnand no more than one attempt failure of the spinal anesthesiain addition to no history of PDPH after previous spinal anesthesia. Uncomplicated singleton term pregnancy and normal fetal heart rate at the time of surgery were mandatory inclusion criteria. In the operation theatre, patients were positioned supine with left lateral displacement of 15-20 degree by putting a wedge under the right hip. Selected patients were randomly allocated to 2 groups. Group1 (no.=60 patients) underwent median spinal approach and group2 (no.=60 patients) underwent Para median spinal approach.Preoperative evaluation and routine investigations were done. All the patients were pre-loaded with 1000 ml Ringer's lactate and monitoring was done with ECG, heart rate, noninvasive blood pressure and arterial oxygen saturation. Under all aseptic conditions, spinal anesthesia was given with 25 gauge spinal needle with either the midline or para median approach in sitting position at L5-S1 interspace. Around 2.2 ML to2.5of 0.5% heavy bupivacaine was used for each patient. An attempt was considered unsuccessful if the operator removed the stylet and there was no CSF. In case of failure or insufficient block, general anesthesia was given.The patients were followed for 48 hours forPDPH,backache,praeathesia,the first attempt success rate and the need for additional analgesia.Presence of PDPH was assessed by Visual Numerical Analogue Scale (VAS), **figure1,2**. Score of "0"was considered as absence of PDPH while score of "1 – 10"was considered as presence of PDPH.

Figure (1):The Faces Pain Scale for Assessment of the Severity of Pain (Wong et al., 2001)

No pain ----------The most
01 2 3 4 5 6 7 8 9 10
Figure (2):VAS chart *(Warden et al., 2003)*.

Statistical analysis
Descriptive statistics and inferential methods were used to analyze data using the test of hypothesis with the significance level set at 5%.Comparison of quantitative data was done using the independent T test .Qualitative data were compared using the Chi-square test .P-value was significant if ≤ 0.05. Randomization was done using computerized randomization programs.

Results

Table(1): shows the basal characteristics of both groups

Parameter	Median Group (N0= 60) Mean ±SD	Para median Group (N0= 60) Mean ±SD	p-value
Age	34.6±2.3	33.9±2.2	0.105
BMI	27.8± 1.7	28.3±1.4	0.104
Gestational age	38.4±1.14	38.6±1.2	0.378
Parity	2.3±1.7	2±1.5	0.302

Differences were estimated using Student's t-test

- From the above table there is no significant difference between both groups as regard the basal characteristics.

Table (2):comparison between both groups as regard the frequency of PDPH, backache, parethesia and the need for additional analgesia

Parameter	Median Group (N0= 56[1]) Frequency (%)	Para median Group (N0= 58) Frequency (%)	p-value
Headache	11/56 (19.6%)	3/58 (5.2%)	0.018 *
Backache	4/56 (7.1%)	1/58 (1.7%)	0.171
Parethesia	2/56 (3.6%)	2/58 (3.4%)	0.677
Need for additional analgesia	5/56 (8.9%)	1/58 (1.7%)	0.302

*Significant if p < 0.05
Differences were estimated using Chi-square test.
[1] four cases were dropped out from group1 and 2 cases were dropped from group2.

- From the above table, there is a statistically significant difference between both groups as regard the frequency of PDPH (19.6% vs.5.2% with p=0.018).Also the table shows increased frequency of backache, paraethesia and the need for additional analgesia in group1 than group2,although these differences are not statistically significant.

Discussion

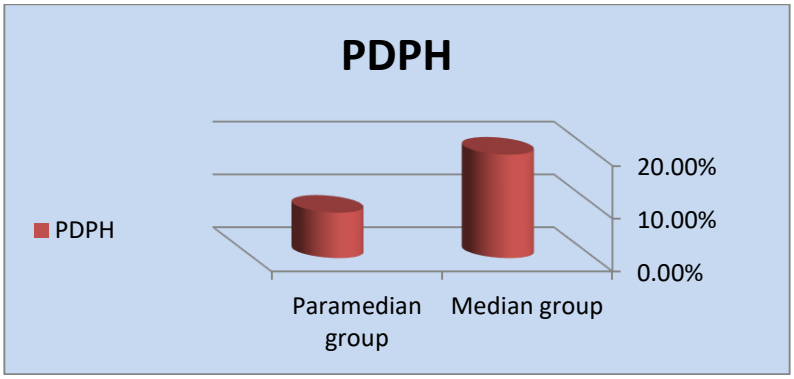
In the current study,there were no statistically significant difference between both groups as regard mean age,BMI,parity and gestational ages.

The age group was selected to be between 30 and 40 years because of many studies which reported that PDPH is more frequent in patient age group 18 -30 (Ahmed et al 2006and Kuntz et al 1992) and less frequent in old ages due to atherosclerosis or age-related mechanical changes in the epidural space (Dripps and Vandam 1954).

Six cases were dropped out from the study due to failed first attempt (three cases in group1 and two cases in group2) and failed spinal which switched to general anesthesia (one case in group1 and no cases in group2).Therefore the first attempt success rates were95 % and 96.7 % for both groups respectively without any significant difference (p= 0.192).So the total number of patients whocompleted the study was 114 cases,56 in group1 and 58 in group2.

According to many studies there is no correlation between the weight of the patient and the incidence of PDPH, the averages of BMI in the current study were (27.8 and 28.3, p=.104) for both groups respectively.
Since female gender & pregnancy are already well known risk factors for PDPH, we specifically conducted our study only on obstetric (pregnant) female patients undergoing cesarean section under spinal anesthesia to exclude any confounding element between the two study groups.

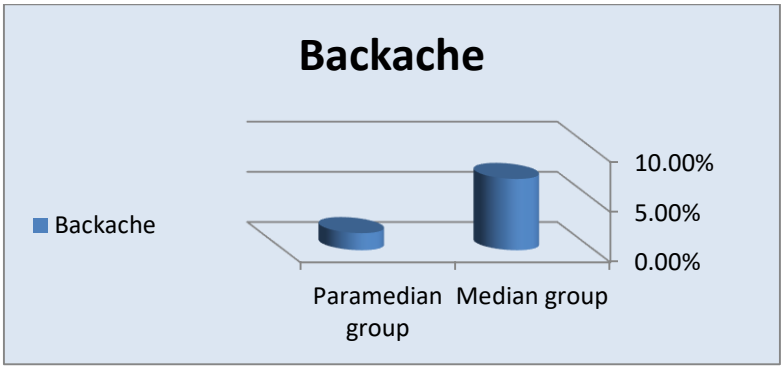
As regard PDPH there is a significant difference between both groups as regard the frequency where 11 cases (19.6%) in group1 and 5 cases (5.2%) in group2 showed this type of headache (p=0.018)table(2) Figure3.



Figure(3):bar chart shows the frequency of PHDH among both groups.

From the eleven cases in group1, six cases had presented with mild headache while five cases presented with severe headache.

In group2, four cases were presented with mild headache while one case was presented by severe headache.
Four patients in group 1 (7.1%) and one patient in group2 (1.7%) were presented with backache,however this difference is not statistically significant(p=.171)table (2),figure (4).



Figure(4):bar chart shows the frequency of backache among both groups.

Parasthesia was noted when the patient complained of a sharp pain in hips or legs while inserting the needle.

In the current study, twopatients in each group (3.6% vs. 3.4% in group1 and group2 respectively) showed paraethesia withoutany statistically significant difference (p=0.677).

Blomberg et al 1989 showed a statistically significant difference between the two techniques with regard to repeated number of attempts and paraesthesia. It was different from the current study in that we used the first attempt as a perquisite to be enrolled in the study ,so the comparison between the results of **Blomberg et al** and the results of the current study as regard the incidence of paraethesia is not fair.

Five cases in group1 needed additional analgesia (caffeine plus opiates) for the headache relieve (from them two cases had needed epidural blood patches). One case in group2 had needed additional analgesia as above. Although this difference in number of patients needing additional analgesia, it is not statistically significant (8.9% vs.1.7% with p=0.302)

Post-dural puncture headache (PDPH) is an iatrogenic complication of spinal anesthesia. Causes reported to influence the incidence of PDPH are sex, age, pregnancy, previous history of PDPH **(Lybecker et al 1990)**, needle tip shape **(Halpern and Preston 1994, Ross et al 1992)**, needle size **(Lybecker et al 1990, Halpern and Preston 1994)**, bevel orientation **(Lybecker et al 1990, Tarkkila et al 1992)**, number of lumbar puncture (LP) attempts **(Lybecker et al 1990),** median versus paramedian approach **(Janik and Dick 1992)**, type of local anesthetic solution (**Naulty et al 1990**), and clinical experience of the person operating the procedure **(Shnider and Levinson 1987).**

With the introduction of small sizes needles (22,24-gauges),the incidence of PDPH is dramatically decreased as evidenced by the study of **(Vandam and Dripps 1956)**. Now days there is more smaller sizes needles (25-gauge),which was used in the current study to abolish the effect of needle size on the incidence of PDPH.

PDPH is significantly more common in young females, with the highest incidence occurring in obstetric patients **(Vandamand Dripps 1956).**

We used 25-guage pencil-point needle because pencil-point needles are known to cause less trauma than sharp-point needles and in turn less PDPH.

The exact mechanisms leading to PDPH are still not completely understood, although several factors, particularly the patient's age and gender, modulate its incidence. PDPH is believed to be caused by dural leakage of CSF from the iatrogenic dural puncture following diagnostic lumbar puncture or spinal anesthesia **(Reid and Thorburn 1991, Dittmann et al 1994).**
The results of the current study were similar to the results of study by **Li JY et al**. who compared the technical difficulty and the incidence of PDPH between two approaches of spinal anesthesia i.e. median and paramedian approaches. Cesarean section was performed in 700 women under spinal anesthesia with either median or paramedian approach. It revealed that the incidences of PDPH between median and paramedian approaches after single dural puncture is 4.33% (10 of 231 patients) and 0.97% (2 of 205 patients), respectively. According to these results, they concluded that paramedian approach might significantly reduce the incidence of PDPH but it would need a more skillful hand to increase the successful rate**.(Li et al 1995)**

The current study was consistent with the results of study by **Haider et al. 2005** on 50 patients undergoing different elective surgeries under spinal anesthesia found a statistically significant difference in the incidence of PDPH with median and paramedian approaches andthey concluded that the paramedian approach using the Quincke level needle(25- gauge needle) reduces the incidence of PDPH significantly.

In a randomized double blind clinical trial 125 patients scheduled for elective CS received spinal anesthesia with median &paramedian approach. Headache was evaluated for three days following surgery. The incidence of headache was 9.8% in paramedian group as compared to 9.4% in median group (p>0.05). The authors concluded that the use of paramedian approach in pregnant women who have difficulty in positioning is acceptable and without increasing risk of headache and hemodynamic changes **(Mosaffa et al 2011 and, Sadeghi et al 2009).** In another randomized control trial there were controversial results. The study reported that only 4% in paramedian group had

PDPH as compared to 28% in Median Group. The difference is not only clinically significant but also statistically significant**. (Sadeghi et al 2009)**.
In contrast, another study by **Janick et al. 1992** on 250 patients undergoing transurethral prostate surgery under spinal anesthesia reported a significantly higher rate of PDPH with the paramedian approach than with the median approach in relatively older patients, while no significant difference was observed in younger patients.

Midline approach involves passage of needle through supraspinous, interspinous and ligamentumflavum. Calcification of supraspinous and interspinous ligaments in older patients causes difficulty in passing thin gauge spinal needles.Also using large bore needles can cause patient discomfort, pain and increase incidence of PDPH. PMA is associated with less technical problems as compared to midline approach (**Ahsan et al 2005**) . The PMA avoids the supraspinous and interspinous ligaments and hits the ligamentumflavum directly after passing through the para-spinal muscles.

In PMA, there is less chance of bending or kinking of needle as bony ligaments are avoidedandit does not require flexed position as in midline approach **(Muranaka et al 2001).**

Podder et-al concluded that with a patient sitting in an unflexed position it is usually possible to insert needle in PMA than in median approach **(Podder et al 2004).** Rabinowitz A et-al conducted a study of 40 patients and compared the two approaches demonstrating success rate of 85% in PMA as compared to 45% in median approach **(Rabinowitz et al 2007).**

Mericq O et al concluded that in patients who are elderly and with spinal deformity, PMA is a safe alternative with success rate of 100% **(Mericq et al 1985)**.

Ahsan –ul-haq et al 2005,demonstrated that success rate with paramedian approach was 100% with the first attempt success rate of 60%.
Behzad et al compared the median and paramedian approaches and demonstrated that the distance from skin to subarachnoid space was more in the paramedian group **(Behzad et al 2011).**

PDPH is the commonest complication of spinal anesthesia. It results due to excessive loss of cerebrospinal fluid (CSF) through the dural puncture resulting in lowering of CSF pressure and traction on intracranial structures. PDPH depends on patient's age, number of punctures, needle size and bevel. The incidence is reduced when smaller size is used. With the paramedian approach there is less leakage of CSF and less chances of PDPH **(Silverman and Connelly 1997).**

The limitation of this study is that the comparison between the mentioned approaches had performed in pregnant females, which is a known risk factor for PDPH, and in turn may be considered as a confounder.So the comparison may be more appropriate if done on a non-pregnant population indicated for spinal anesthesia.

Conclusion

The para median approach in spinal anesthesia for caesarean section is associated with less frequency of PDPH than the median approach.

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