Effect of intrathecal catheterisation on incidence of postdural puncture headache after accidental dural puncture in non-obstetric patients

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Abstract

Background and Aims: After accidental dural puncture (ADP) with large bore epidural needles, postdural puncture headache (PDPH) develops in 16%–86% of patients, which is unpleasant and interferes with activities of daily life of the patient. Hence we aimed to assess the effect of intrathecal catheter insertion after ADP with 18G Tuohy needle on incidence of PDPH.

Material and Methods: In all, 173 patients after ADP were enrolled and divided into two groups according to the choice of treating anesthesiologist. Group IC included 74 patients who had intrathecal catheter placed in subarachnoid space. In group NIC, which included 99 patients, one of the following was done: epidural catheter was cited in a different intervertebral space, or the procedure was abandoned and general anesthesia was administered or single-shot spinal anesthesia was administered through the Tuohy needle itself. The catheters were left in situ for 36–48 h. Patients were monitored for the next 7 days after ADP for the incidence of PDPH, its severity and requirement of analgesics, and duration of catheter in situ from the time of ADP.

Results: The incidence of PDPH in group IC was 36% in comparison to 59% in group NIC (P = 0.001). The severity of PDPH and requirement of analgesics was significantly less in group IC.

Conclusion: Insertion of intrathecal catheter at the site of ADP significantly reduces the incidence and severity of PDPH.

Keywords: Accidental dural puncture, anesthesia, intrathecal catheterization, postdural puncture headache, wet tap

Introduction

Postdural puncture headache (PDPH) classically presents as a postural headache that occurs after puncture of the dura. The criteria for PDPH include a headache that develops within 5 days of dural puncture that is not accounted by any other cause. The reported incidence of accidental dural puncture (ADP) ranges from 0.4% to 6.0% in experienced hands. PDPH develops in 16%–86% of patients after ADP with large bore needles.

Although PDPH usually resolves spontaneously, it is an unpleasant and fearful experience, restricts ambulation, extends the hospital stay, may lead to complications, and in obstetric patients, it may interfere with a new mother’s ability to take care of new born. Many anesthesiologists still use traditional methods such as strict bed rest and aggressive hydration as the method of treatment despite lack of evidence. In the past two decades, there have been many new studies on the prevention and treatment of PDPH such as the use of intrathecal catheter insertion from the site of puncture, morphine administration into the epidural space, intravenous gabapentin before development of PDPH, and so on; there is still no consensus on a standard strategy for its management.
At our institution, ADP is managed according to the preference of the treating anesthesiologist with only a few opting for insertion of intrathecal catheter despite evidence available of its effectiveness. The aim of our study was to evaluate the incidence of PDPH after ADP in nonobstetric patients with insertion of an intrathecal catheter and compare it with patients without intrathecal catheters. We hope to establish evidence-based guidelines resulting in better patient management and improved patient outcomes.

Material and Methods

The study was carried out in a tertiary hospital after permission from the institute’s ethical committee and patients were included in the study after their written informed consent. Nonobstetric patients who underwent elective surgery and received either an epidural with general anesthesia (GA) or combined spinal–epidural (CSE) anesthesia, after accidental puncture of the dura, were managed as advised by the consultant anesthesiologist managing the case. Patients with a previous PDPH, history of migraine or any other headache, and American Society of Anesthesiologists grade III and IV were excluded from the study. Those included were placed in either of the two groups. Group IC included patients in whom intrathecal catheter was inserted at the site of ADP. Group NIC included patients in whom no intrathecal catheter was placed. The technique used to localize the epidural space was loss of resistance with air. All the catheters (epidural/intrathecal) were placed at either L2–L3 or L3–L4 level, taking into account patient and surgical factors. In group IC, after ADP, the epidural needle was left in situ and a 20G multiorifice epidural catheter (Espocan®) was threaded through the same 18G epidural needle up to a depth of 3–4 cm into the subarachnoid space. Continuous surgical anesthesia was maintained with bupivacaine along with additives (fentanyl/clonidine) through the catheter. In group NIC, one of the following was done: epidural catheter was citied in a different intervertebral space and threaded up to a depth of 3–4 cm and isobaric bupivacaine with additives (clonidine/morphine) were given to maintain surgical anesthesia, or the procedure was abandoned and GA was administered or single-shot spinal anesthesia with bupivacaine and additives (fentanyl/clonidine/morphine) was administered through the Tuohy needle itself. The catheters and filters were sealed aseptically and labeled “intrathecal/epidural catheter: do not inject” and the medical staff on duty were duly informed. Postoperative pain management was done with epidural top-ups in patients with epidural catheter in situ. The remaining patients were given injection diclofenac (75 mg i.m. every 8 h). These patients were followed for a period of 7 days to look for the development of PDPH. During this interval, the patients were visited and examined by anesthesiologist at fixed intervals (12, 24, 48, 72, 96, 120, 144, and 168 h after ADP) for the incidence of PDPH, its severity and requirement of analgesics, duration of catheter in situ from the time of ADP, and for development of any complications. The catheter in situ, intrathecal or epidural, was removed 36–48 h after the dural puncture. The patients were followed telephonically once a week from the time of discharge to up for 3 months to look for any neurological sequelae. The severity of PDPH was categorized using modified Lybecker classification as mild PDPH causing a slight restriction of patient’s physical activity, no confinement to bed, and no associated symptoms; moderate PDPH which forced the patient to stay in bed for part of the day and restricted physical activity with presence of associated symptoms; and severe PDPH in which the patient became bedridden for the entire day and made no attempt to raise their head or to stand with presence of associated symptoms. The patients who developed PDPH were treated according to the institute’s protocol (mild PDPH with fluids/nonsteroidal anti-inflammatory drugs (NSAIDS), while moderate to severe PDPH with fluids/NSAIDS, and if not responding then with gabapentin/theophylline/sumatriptan). Epidural blood patch was to be considered if PDPH persisted for more than 48 h. The result were analyzed using SPSS version with Chi-square/Fishers test, values were expressed as mean ± standard deviation and percentages, and \( P < 0.05 \) was considered significant.

Results

The study was conducted from October 2014 to February 2017. During this period, 2366 elective surgeries (general and orthopedic surgeries) were performed under epidural (with GA) or CSE anesthesia. ADP occurred in 173 (7.31%) of these patients. Of these, in 74 patients intrathecal catheter was inserted and in the remaining 99 intrathecal catheter was not inserted. Among 99 patients in group NIC, 81 patients had epidural catheter cited at a different level, 11 patients had received GA, whereas 7 patients received single-shot spinal anesthesia. Three patients were excluded (two from group IC and one from group NIC) from the study as one patient was diagnosed with migraine during postoperative period, and in two patients the intrathecal catheter was misplaced during shifting.

The mean age group, sex ratio, and body mass index were comparable in the two groups, although there was a predominance of females in both the groups [Table 1]. The incidence of PDPH was significantly higher (\( P=0.001 \)) in group IC (36%) in comparison to group NIC (59%).
severity of PDPH was less in group IC than in group NIC, and none of the patients in either group developed severe PDPH [Table 2]. The requirement of analgesia was much less in group IC than in group NIC [Table 3].

No complication of catheter knotting or infection at the site of catheter insertion was noted in either of the groups. None of our patients had complaints of cerebrospinal fluid (CSF) leak or meningitis, paraesthesia, or bowel bladder dysfunction. No neurological complication was noted after 3-month follow-up.

**Discussion**

The incidence of ADP in literature varies from 0.4% to 6.0%. The incidence in our study was 7.31% which is higher than that quoted in previous studies. This may be due to heterogeneous group of patients and difference in the experience of anesthesiologists as ours is a training institution where many epidurals or CSE are put by trainee anesthesiologists under the guidance of senior anesthesiologists. Age, sex, obesity, or pregnancy also affect the incidence of PDPH. Our study included nonobstetric patients, while other factors were similar in the study. Our data reveal that only 36% of the patients in whom intrathecal catheter was inserted developed PDPH, whereas in patients with no intrathecal catheter, a higher incidence of 59% was noted.

The mechanism by which subarachnoid catheter prevents PDPH is not well known. It is speculated that the large bore intrathecal catheter decreases the CSF efflux from the subarachnoid space to the epidural compartment by plugging the epidural puncture. Leaving the catheter in place for more than 24 h may lead to an inflammatory process that facilitates closure of the dural puncture.

Various studies in the literature support this difference in the incidence of PDPH observed. Verstraete S et al. found that intrathecal catheter placement in obstetric patients significantly reduced the incidence of PDPH after ADP to 42% when compared with 62% in those who had the catheter resited epidurally. Parthasarathy S et al. administered continuous spinal anesthesia with epidural catheter for intraoperative and early postoperative analgesia in nonobstetric patients. The catheters were removed immediately after the surgery, and only 3% of the patients developed PDPH. Heesen M et al. in their meta-analysis found that the risk ratio (RR) for PDPH with intrathecal catheter was 0.82 ($P = 0.06$), and the need for epidural blood patch was 0.64 ($P = 0.001$). They concluded that insertion of intrathecal catheter reduces the requirement of epidural blood patch but has no significant effect on the incidence of PDPH and that intrathecal catheterization is a promising approach to prevent PDPH which needs to be evaluated further. However, few authors are against the use of intrathecal catheter as they did not find any beneficial effect of intrathecal catheterization in their studies.

The duration of intrathecal catheterization also probably has an influence on the incidence of PDPH with the majority of the studies favoring 24 h of catheter placement. Ayad S et al. in their study on obstetric patients, observed that the incidence of PDPH was 91.1% in patients in whom intrathecal catheterization was done. This was significantly reduced to 51.4% in patients in whom intrathecal catheter was put and removed after surgery, while it was further reduced to 6.2% when the catheter was left in situ for more than 24 h ($P < 0.001$). Cohen S et al. in their study on obstetric patients, found that the incidence of PDPH was reduced significantly with the use of intrathecal catheter for more than 24 h while no difference was found in patients where epidural catheter was resited in epidural space or intrathecal catheter was removed immediately after the surgery. Apfel et al. failed to find a difference in the incidence of PDPH with short-term intrathecal catheterization ($RR = 0.88$) while the incidence was decreased when catheter was left in situ for more than 24 h ($RR = 0.21$).

### Table 1: Demographic profile of the patients

|                  | Group IC | Group NIC | $P$   |
|------------------|----------|-----------|-------|
| Number of patients with ADP | 72       | 98        |       |
| Age (years) (mean±SD) | 49.3±13.1 | 47.0±13.0 | 0.253 |
| Sex (male:female) | 20:52    | 36:62     | 0.110 |
| BMI              | 24.3±3.7 | 24.2±3.5  | 0.946 |

ADP=Accidental dural puncture; SD=Standard deviation; BMI=Body mass index

### Table 2: Severity of PDPH

|                  | Group IC | Group NIC | $P$   |
|------------------|----------|-----------|-------|
| Mild PDPH        | 17 (65%) | 24 (41%)  | <0.001|
| Moderate PDPH    | 9 (35%)  | 34 (59%)  |       |
| Severe PDPH      | 0 (0%)   | 0 (0%)    |       |

PDPH=Postdural puncture headache

### Table 3: Analgesic requirements

|                  | Group IC | Group NIC | $P$   |
|------------------|----------|-----------|-------|
| Total patients with PDPH | 26       | 58        |       |
| Patients requiring analgesics (%) | 5 (19%)  | 24 (41%)  | 0.024 |
| NSAIDs           | 5        | 20        |       |
| Gabapentin       | 0        | 2         |       |
| Theophylline     | 0        | 1         |       |
| Sumatriptan      | 0        | 1         |       |
| Epidural blood patch | 0      | 0         |       |

PDPH=Postdural puncture headache; NSAID=Nonsteroidal anti-inflammatory drug
In our study, the severity of PDPH observed was much less ($P = 0.021$) and the requirement of analgesics was also significantly lower ($P = 0.024$) in patients with intrathecal catheter in situ when compared with the other group. These findings are similar to those of Cohen S et al.\textsuperscript{[5]} ($P < 0.009$) and Apfel et al.\textsuperscript{[7]} Patients with mild PDPH were treated with NSAIDS, whereas of those patients who developed moderate PDPH, two patients required gabapentin and one patient required sumatriptan and theophylline in addition to NSAIDS. None of our patients required epidural blood patch as PDPH subsided with mentioned medications. No complication with indwelling catheter was seen in our study.

Our study had a few limitations. Being an observational study, randomization of the patients was not done. As the intrathecal catheter was labeled for safety purposes, the observers were not blinded and there was a potential for bias.

Thus to conclude, the incidence of PDPH decreases by keeping an intrathecal catheter in situ for more than 24 h.

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**Conflicts of interest**

There are no conflicts of interest.

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