



## A STUDY OF POST DURAL PUNCTURE HEADACHE AFTER USING FINE GAUGE SPINAL NEEDLE IN SUBARACHNOID BLOCK

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### ABSTRACT

J. Leonard Corning<sup>1</sup> a neurologist of New York was the first one to give recorded but accidental spinal anesthesia in 1885 when he pierced the dura while experimenting with cocaine on spinal nerves of a dog. According to International headache society the criteria defined for Post Dural Puncture Headache (PDPH) includes a headache that develops in less than seven days after a spinal puncture, occurs or worsens in less than fifteen minutes after assuming upright position and improves in less than thirty minutes after assuming recumbent position with at least one of the following associate (neck stiffness, tinnitus, hypacusia, photophobia and nausea). The headache usually resolves within fourteen days after spinal puncture. In the present study we analyzed the incidence of post spinal headache after using narrow gauge atraumatic needles irrespective of administrator's status. We also analyzed to relate the skill of administration to the incidence of headache. Majority of the patients 1094 (88.58%) included in this study were between the ages of 20 to 60 years, while 63 (5.11%) were below 20 years and 78 (6.31%) were above 60 years of age. Of the 1235 patients included in the study 429(34.74%) patients were male and 806(65.26%) were females. Of the 1235 patients 515 females underwent surgery for obstetric reasons mostly L.S.C.S and rest underwent non obstetric surgeries. Overall PDPH rate observed in 1235 cases was 2.8% i.e. 35 patients had PDPH after using fine gauge spinal needle. Out of these 35 patients who reported having PDPH; in 21 patients (60%) was administered spinal anesthesia using 26G needle and 14 patients were given spinal block with 25G needle. The incidence of PDPH seems higher with 26G needle as most of the patients in our institution receives spinal anesthesia using 26G needle. . Of the 35 cases included reporting having PDPH, trauma occurred in only 6 cases i.e. 17.14% and in rest of the cases LP was atraumatic. 23 out of 35 (65.71%) patients lumbar puncture was done in first pass in single interspace only, in 5 patients (14.28%) more than one attempt was required but attempts were taken in single interspace with single skin puncture only, in 3 patients (8.57%) more than one attempt accompanied by one skin puncture in one interspace only and lastly in 4 patients (11.42%) multiple attempts in multiple spaces was done. Thus above observations clearly establishes that PDPH occurred more frequently in female in the age group of 20-40 years and majority of them underwent obstetric surgery.

**KEYWORDS :** Post dural puncture headache, PDPH, fine gauge needle, subarachnoid block.

### INTRODUCTION:-

"Innovation is the unrelenting drive to break the status quo and develop anew where few have dared to go"- by Steven Jeffes. Today the concept of "balanced anesthesia" and advancement by inclusion of newer potent fluorinated hydrocarbons and muscle relaxants have made anesthesia easy for anesthesiologist by providing adequate relaxation of muscle with lesser mortality and morbidity leading to better outcomes. The use of neuraxial and peripheral nerve blocks have further enhanced the armamentarium of an anesthesiologist, the most commonly used in earlier days were spinal and epidural blocks. In present days more peripheral blocks like brachial plexus, caudal blocks etc. are increasingly used successfully from pediatric to geriatric age group. **J. Leonard Corning**<sup>1</sup> a neurologist of New York was the first one to give recorded but accidental spinal anesthesia in 1885 when he pierced the dura while experimenting with cocaine on spinal nerves of a dog. His next patient was a man with seminal incontinence who had transient paralysis after injection and then he applied this technique to various neurological disorders and called resulting analgesia as "spinal anesthesia" mentioning it to be a "procedure in the therapy which possesses Merit of Novality". In 1891, **Heinrich Iraneus Quinke**<sup>2</sup> established a simple clinical method of lumbar puncture.

The next major development in the history of spinal anesthesia was the work of **Augustus Karl Gustav Bier**<sup>3</sup>. 16<sup>th</sup> August, 1898 Bier used his technique for operation on lower extremity of a young laborer. He designed a larger bore needle that needed no introducer. The Bier spinal needle was 15G or 17G with a long, cutting bevel and a sharp point. After

the introduction of large bore Bier's needle the importance of size of needle and shape of its bevel were recognized. However, incidence of Post lumbar puncture headache was very high. It was **Sicard**<sup>4</sup> in 1902 who anticipated that the cause of headache was the loss of CSF through the dural tear. Later on the significance of size of needle, bevel type were recognized as causing tissue trauma and the needles with small non cutting bevel, needles with stylet were introduced for use in administering spinal anesthesia. In 1923 **Herbert Merton Greene**<sup>5</sup> stated that a smaller, less traumatic hole was made if cutting tip was replaced by smooth and round tip. He used ordinary 23G needle that sharpened to a rounded tip by removing the cutting edges of bevel helped in reducing the incidence of headache following lumbar puncture. Earlier experiments of **Labat**<sup>6</sup> who withdrew different volumes of CSF (5, 10, 15, 20 and 30 ml) and no patient complained of headache after this. Later on it was established that headache after spinal anesthesia occurs due to continued loss of CSF from the intervertebral foreman, larger than the rate of its formation. Headache usually occurs within 48 hours after the dural puncture the common site being frontal and occipital region.

According to International headache society the criteria defined for Post Dural Puncture Headache (PDPH) includes a headache that develops in less than seven days after a spinal puncture, occurs or worsens in less than fifteen minutes after assuming upright position and improves in less than thirty minutes after assuming recumbent position with at least one of the following associate (neck stiffness, tinnitus, hypacusia, photophobia and nausea). The headache usually resolves within fourteen days after spinal puncture. In the present study

we analysed the incidence of post spinal headache after using narrow gauge atraumatic needles irrespective of administrators status. We also analysed to relate the skill of administration to the incidence of headache.

**AIMS AND OBJECTIVES:-**

**Primary Objective:**

- To find out the incidence of post spinal headache in patients operated under subarachnoid block.

**Secondary Objective:**

- To find out whether skill of administering spinal subarachnoid block affects the incidence of post spinal headache.

**MATERIALS AND METHODS:-**

The present study has been carried out on the patients admitted in surgical, orthopedics, gynecological and obstetric wards of C.R. Gardi hospital, Ujjain undergoing surgery under spinal anesthesia.

**Inclusion criteria –**

All patients operated under spinal anesthesia and they were followed postoperatively till discharge from the hospital for occurrence of headache. Relevant details were noted in patients having post spinal headache.

**Exclusion Criteria:-**

- Pediatric patients.
- All patients not giving consent for the procedure or declined to get enrolled in the study.

**Pre-operative medication:-**

Tablet clonazepam 0.25mg given a night before surgery for anxiolysis and night sedation.

- Anesthetic Agents: Heavy xylocaine 5% 1 ampoule Or Heavy Bupivacain 0.5% 1 ampoule
- Vasoconstrictor agent: Mephentermine/ ephedrine multidose vial
- Vagolytic drugs: injection atropine/glycopyrrolate
- Local Anesthetic solution: for skin wheal 2% xylocaine with adrenaline 30ml vial Emergency drugs tray was always kept ready at hand for use if needed.

**Skill of administrating spinal anesthesia:-** Classified in four categories:

- Successful in first attempt
- More than one attempt but only in one interspace with single skin puncture
- More than one attempt accompanied by more than one skin puncture in one interspace only.
- Multiple attempts in multiple interspaces.

**Statistical Methods:**

- Study Design: Clinical observational study
- Source of Data: Patients anesthesia records and observation chart
- Sample size calculation: based on the prevalence rate of post spinal headache rate in earlier published studies; with 95% confidence level, we used the following formula

$$n = Z^2 * P * (100 - P) / d$$

1 proportion – Estimation	
Proportion (p)*	5.00%
Precision	1.00%
Significance level (α)	0.050
Drop-out	10%
Sample size	1825
Sample size (with drop-out)	2028

**Case Definition:**

Adult patients fulfilling the inclusion criteria and given anesthesia in R.D Gardi Medical College

**Study design:** clinical observational study

**Source of data:** patient's record and observational charts for individual study subject.

**Calculation parameters used:** Range, Mean, Mode, Median, Standard deviation were used.

**OBSERVATION & RESULTS:-**

Majority of the patients 1094 (88.58%) included in this study were between the ages of 20 to 60 years, while 63 (5.11%) were below 20 years and 78 (6.31%) were above 60 years of age. Of the 1235 patients included in the study 429(34.74%) patients were male and 806(65.26%) were females. Of the 1235 patients 515 females underwent surgery for obstetric reasons mostly L.S.C.S and rest underwent non obstetric surgeries.

**Table 1 showing overall incidence of PDPH**

Table 1 shows overall PDPH rate observed in 1235 cases was 2.8% i.e. 35 patients had PDPH after using fine gauge spinal needle.

Total number of patients	Number of patients with no PDPH	Number of patient with PDPH	% of patients with PDPH
1235	1200	35	2.8%

Out of these 35 patients who reported having PDPH; in 21 patients (60%) was administered spinal anesthesia using 26G needle and 14 patients were given spinal block with 25G needle. The incidence of PDPH seems higher with 26G needle as most of the patients in our institution receives spinal anesthesia using 26G needle. In majority of patients headache was typically postural in nature and in most of the cases patient presented with frontal headache 20 (57.14%) and a few reported headache in occipital region 10 (28.57%) radiating to neck. Very few patients had no postural headache in frontal/occipital region but complained of neck stiffness and difficult neck movement and considered as case of PDPH arising from infratentorial cranial nerve stretching, they did not show any other sign of meningeal irritation i.e. meningitis. None of the patient included in the study showed association of any other symptoms like diplopia, vomiting etc.

**Table 2 shows the distribution of age group and sex of patients with PDPH**

Sex of patient with PDPH	Age group in years	Number of Patients	Percentage of patients
Male	Below 20	1	2.9%
	21-40	6	17.12%
	41-60	1	2.9%
	Above 61	0	0%
Female	Below 20	1	2.9%
	21-40	20	57.04%
	41-60	6	17.14%
	Above 61	0	0%

It shows that out of 35 patients who reported having PDPH 20 were female in age of 20-40years. Lesser and insignificant percentage of patients who were male belonged to the other age group had PDPH.

Both patients (below 20 years group) shown PDPH were 18 years of age. We did not observe PDPH in pediatric age group patients below 14 years of age.

**Table 3 shows the skill of administering the spinal anesthesia**

In 75% of cases LP was done in first pass; 20% required manipulation of spinal needle in same space to enter subarachnoid space. In 5% of cases blood appeared with CSF or frank blood was seen coming through needle. In these cases LP was done in one space above. Clear CSF was observed and drug given.

Skill of administering Spinal Block	Number of patients	Percentage of patients
A	889	71.98%
B	223	18.06%
C	89	7.21%
D	34	2.75%

- A. Successful in first attempt
- B. More than one attempt but only in one interspace with single skin puncture
- C. More than one attempt accompanied by more than one skin puncture in one interspace only.
- D. Multiple attempts in multiple interspaces

Majority of spinal anesthesia was administered by residents under supervision of senior resident/consultant. Only 2.6% was given by consultant for various reasons.

**Table 4 showing traumatic vs atraumatic lumbar puncture in patients with PDPH**

Table no 4 shows that in patients with PDPH, blood appeared with C.S.F, local anesthesia drug was administered only after clear CSF flow was seen. Of the 35 cases included reporting having PDPH, trauma occurred in only 6 cases i.e. 17.14% and in rest of the cases LP was atraumatic.

Type of Lumbar Puncture	Number of patients	Percentage of patients
Traumatic(Blood tinged C.S.F/Frank blood)	6	17.14%
Atraumatic	29	82.86%

**Table 5 showing severity of PDPH**

The grading of severity was done on the basis of restriction of physical activity and willingness to remain recumbent in bed for the fear of headache.

In table no 5 shows the severity of PDPH; majority of patient s headache was mild to moderate and relieved by recumbency. Oral/ intravenous hydration and/ or simple analgesic and caffeine containing drinks.

No patient had severe headache and associated symptoms like vomiting, diplopia etc. None of the patient with PDPH required aggressive treatment like epidural blood patch or saline.

Patients cannot be advised prolonged recumbency for the fear of occurrence of PDPH as other complications like Deep Vein Thrombosis may occur on prolong immobility. Patients were suggested to move out of bed early only were advised recumbency if headache was moderate to severe.

Severity of PDPH	Number of patients	Percentage of patients
Mild	22	62.86%
Moderate	10	28.57%
Severe	3	8.57%

**Table 6 showing skill of administration of spinal anesthesia in patients with PDPH**

Table no 6 shows the skill of administration of lumbar puncture, it shows that in 23 out of 35 (65.71%)patients lumbar puncture was done in first pass in single interspace only, in 5 patients (14.28%) more than one attempt was required but attempts were taken in single interspace with single skin puncture only, in 3 patients (8.57%)more than one attempt accompanied by one skin puncture in one interspace only and lastly in 4 patients (11.42%) multiple attempts in multiple spaces was done.

Skill of administration	Number of patients	Percentage of Patients
A	23	65.71%
B	5	14.28%
C	3	8.57%
D	4	11.42%

Thus above observations clearly establishes that PDPH occurred more frequently in female in the age group of 20-40 years and majority of them underwent obstetric surgery.

**DISCUSSION:-**

Post dural Puncture Headache is an iatrogenic problem caused by breach in the continuity of thecal sac resulting in continued loss of C.S.F; if the hole made in the thecal sac fails to close spontaneously. The C.S.F initially collects in the extradural space then leaks into the peritoneal and pleural cavity. This continued loss of C.S.F results in hypotension in the cranium and sagging of pain sensitive structures of cranium when patient assumes sitting or standing posture, imparting PDPH to be typical postural character. PDPH is known to exist ever since spinal anesthesia was introduced in Clinical Anesthesia. As a fact of matter, the inventor of spinal anesthesia himself experienced severe headache and vomiting for 9 days; when he got himself injected cocaine intrathecally by one of his assistant. PDPH is known to occur whether Lumbar puncture is done for diagnostic or therapeutic reasons. It was soon recognized that Lumbar puncture done with large bore, cutting type of needle or unintentional dural puncture during epidural anesthesia results in higher incidence of PDPH and thereafter attention was paid by the anesthesiologist on the design and size of LP needle that resulted in the reduced incidence of occurrence of headache. In the present study we studied the influence of factors such as size of needle, age and gender of patient, type of surgery, skill of administration and rank of administrator on the incidence of PDPH. We used 25G and 26G Quincke type of spinal needle for administering spinal subarachnoid block.

**Patient related factors resulting in PDPH**

Age, Gender and Pregnancy increases the incidence of headache. In the present study also we observed that a higher incidence of PDPH was present in the middle aged women undergoing obstetric surgeries. The incidence recorded was 793 (64.21%) in 20-40 years age group patients and 515 (41.7%) females undergoing C-section. The incidence of headache reduced with increasing age and was only 6.31%.i.e. in 68 patients above 60 years of age, this is possible due to increased fibrosis around intervertebral foramen making the leakage slow in the peritoneal and pleural spaces. Numerous studies reviewed in literature establishes this fact clearly. Studies by **Owen, C.K and Owen, J.J'** and associates in 1953 have also supported this statement that in young people spinal headache is more apt to develop. Later on **Vandom, L.D and Dripps, R.D**<sup>8</sup>. have also confirmed the above statement.

**Procedure related factors resulting in PDPH**

Needle size is directly linked to the incidence and severity of PDPH. It is generally accepted that bigger is the needle greater is the incidence of PDPH. Literature revealed that large bore, cutting needle with a long bevel had greater impact on incidence of PDPH than non -cutting atraumatic pencil point needle. In a recent study using electron microscope revealed an irregular tear in dural sac that healed easily due to local inflammatory response closing the dural tear. In the present study we observed an incidence of 2.8% incidence of PDPH using 25G/26G Quincke type cutting needles. In a study by **D.K. Turnbull and D.B. Shepherdand**<sup>9</sup> noticed similar findings. Other studies reviewed in the literature establishes this fact. The orientation of the bevel insertion parallel to dural fibers reduces the incidence of PDPH because it separates the dural fiber and do not make a flap in the dural sac. The **Balwinderjit Singh et.al**<sup>10</sup> mentions that the PDPH rate is lower in para- median approach than midline. In the present studies we used midline approach only therefore we cannot compare our findings. Similarly a few studies mentions a lower incidence of PDPH when stylet is replaced before removing the needle after depositing the

local anesthetic. In present study we did not replace the stylet before removing the spinal needle hence our findings cannot be compared. The general recommendation for reducing the incidence of PDPH includes use of smaller bore, non-cutting 24G-27G needles as ideal.

#### Recumbency as a treatment of PDPH

Prolonged recumbency to all patients undergoing various surgeries under spinal anesthesia is not advisable as prophylactic measures, however those patients who develops PDPH should remain recumbent and adequately hydrated either by oral or intravenous means. Early mobilization improves surgical outcome and prevents the occurrence of post-surgical complications like deep vein thrombosis, subsequent pulmonary embolism and sudden death which is more likely in obstetric patients who are in hypercoagulable state and in orthopedic patients who maybe immobile for surgical reasons.

#### Skill of administration on incidence of PDPH

The skill of administration of spinal subarachnoid block had little impact on the incidence of PDPH. Majority of patients having PDPH had lumbar puncture done in first pass in single space. The findings of our study in contrast to findings of Ghaleb et al<sup>11</sup> who found a higher incidence of PDPH after multiple dural puncture i.e. 4.2% vs 1.6%. Churchill H.C. and Davidson<sup>12</sup> also suggested that multiple dural puncture increases the incidence of PDPH.

#### Pharmacotherapy for treatment of PDPH

In the present study we used non-narcotic analgesics like Paracetamol for controlling mild to moderately severe PDPH. The role of caffeine in treatment and prevention of PDPH is debatable and definite role as cerebral venodilator to raise the intracranial pressure has not been clearly established however caffeine containing oral drink like coffee may have psychological/ a very small pharmacological place which we did in the present study. The other suggested measure like use of ADH and its synthetic analogues remains disputed. The use of Epidural blood patch has been established as a treatment modality for severe and persistent post spinal headache because of its tamponade effect and thus leading to decrease in C.S.F leakage. Since no Patients in the present study had severe and persistent PDPH epidural blood patch was not required. Thus the findings of present study clearly establishes that use of small bore needle reduces the incidence of PDPH to less than 5% which is statically insignificant. The only legal and moral issue remains to be settled or generally accepted whether a separate preoperative consent for occurrence of this insignificant yet unavoidable and well documented complication of spinal block should be obtained from the patients or not. Despite of the fact that observer is expected to observe the precautions to prevent PDPH.

#### Limitations:-

As calculated we could not perform the observations on the stipulated number of cases as calculated due to halt of regular surgeries in Covid 19 epidemic first and second wave, hence we presented observations on lesser number of cases.

#### SUMMARY AND CONCLUSIONS:-

The present study entitled "A study of Post Dural Puncture Headache after using fine Gauge Spinal needle in subarachnoid block" was undertaken in the department of Anesthesiology at R.D Gardi Medical College, Ujjain. In the present study we observed post spinal patients for the occurrence of PDPH on 1235 patients who received spinal subarachnoid block by persons of different rank in the department. We noted the relevant details of spinal subarachnoid block administration in patients who reported having PDPH. Of the 1235 patients interviewed postoperatively till their time to discharge from hospital. 35

(2.8%) patients reported PDPH and were advised to remain recumbent in bed and if intensity of PDPH is more they were advised to ask for tablet of Paracetamol 500 mg from the nursing staff and take adequate oral fluids. Location of PDPH was either frontal 20 patients, occipital or exhibited as neck stiffness with no associated symptoms in 10 and only neck stiffness without headache in 5 patients. Postural character was observed in all 30 cases. Of the 1235 patients interviewed 429 (34.74 %) were male and remaining 806 (65.26 %) were females. Of them 515 (41.7 %) underwent obstetric surgeries mostly LSCS. The PDPH reported by 2 (5.7%) patients, under 20 years of age had higher incidence than overall PDPH rate of 2.8%. Thus patients below 20 years had a higher rate of PDPH. In the age group 21 to 40 years the PDPH occurred in 26 female patients of them 20 underwent LSCS. In majority of patients who reported PDPH, in 65.71 % cases lumbar puncture could be performed in first pass. In remaining 34.3 % needle manipulation and trauma occurred during lumbar puncture. The aforesaid observation clearly establishes that with the use of fine gauge spinal needle PDPH occurred in statistically insignificant number of cases i.e. in less than 5% cases. Skill of administering spinal block had no effect on occurrence of PDPH.

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