

Comparison of post-dural puncture headache using three different types of needles on sub arachnoid block- a clinical study

Arathi BH^{1,*}, Namrata Ranganaath²

¹Assistant Professor, ²Associate Professor, Kidwai Memorial Institute of Oncology, Bangalore

***Corresponding Author:**

Email: arathibh@gmail.com

Abstract

Background: The study was undertaken to compare the effects on post dural puncture head ache /sequel two with two different types pencil point needles, and one conventional cutting type of needle in patients undergoing lower abdominal surgical and gynecological operative procedures.

Material: Following institutional ethical committee approval the study was undertaken 150 patients ASA I and II grades in the age group of 20 to 50 years and the height between 150 to 168cms, giving informed consent were included.

Patients with h/o chronic head ache, any contra indication to sub arachnoid block and who did not give consent to participate in the study were excluded.

Methods: Patient was randomly allocated in to three groups.

B.P., ECG, HR and SPO2 monitored non-invasively rate, of injection 1ml/15sec, volume 3ml of 0.5% bupivacaine heavy, lateral position and L3-4 interspace, were kept constant

Group I Quincke 27G needle n=50.

Group II -Sprotte 27G needle n=50.

Group III - Whitacre 27G needle n=50.

The following parameters were compared

Number of attempts, PDPH, Back ache, NPDPH, and Patient acceptability.

The results were compared statistically using Fischer exact test, Analysis of variance and Chi square test.

Results: Statistically analyzing, there was no significant difference in number of attempts in three types of needles with the use of introducer. PDPH 6% in Group 1, 2% in Group 2, and 0% in group 3 inferring that group1 is associated with higher incidence P.D.P.H.

Conclusion: PDPH with pencil point needle compare to Quincke needle in the study group. Sprotte needle is associated with significant failure rate which may limit the use of the same.

Keywords: Anaesthesia technique; Onset of sensory block; SAB; PDPH; NPDPH; Equipment; 27G Whitacre; 27GQuincke; 27G Sprotte

Introduction

Spinal anesthesia (sub arachnoid block) remains a technique of choice in lower abdominal surgeries as it is easy to perform, airway is maintained, patient remains conscious and cost effective, spinal anaesthesia is associated with few complications, post dural puncture head ache, is one of the complication which is distressing. There has been a trend towards the production of smaller gauge needle. The needle with pencil point tips has changed the practice of anesthesia to reduce the incidence of post dural puncture head ache.

Spinal anesthesia now regarded as the technique of choice for all lower abdominal surgeries as the well-known problems of general anesthesia are avoided. The advantage of spinal anesthesia over epidural anesthesia is more rapid onset and more consistent quality of anesthesia. Nevertheless problems with spinal anesthesia can occur with difficulty in needle placement, failed blocks and trauma

Materials and Methods

This is a randomized prospective study, Institutional ethical committee approval was obtained.

Informed written consent was obtained from patients who were included in the study.

150 ASA Gr I and Gr II patients below 50 years whose height was between 150 to 168 cms scheduled for elective lower abdominal procedures were included in the study.

Patients with chronic headache/ migraine, backache and any contraindication to SAB were excluded from the study.

Methods

Patients were randomly allocated into 3 groups.

Group I - Quincke 27G needle n=50.

Group II - Sprotte 27G needle n=50.

Group III - Whitacre 27G needle n=50.

A detail history of present and past medical illness, past h/o of anesthetic exposure, concomitant history of drug allergy and any medications in preoperative period was recorded.

General physical examination and systemic examination of the patients was done. Routine and relevant specific investigations were done. Height in cms and weight in kgs were recorded.

500ml of ringer lactate solution was pre-loaded before SAB patients were monitored non-invasively with NIBP ECG and pulse oximeter in the operating room. Procedure was done in right or left lateral decubitus position. Under Aseptic precaution back was cleaned with surgical spirit and draped with sterile drapes spinal anaesthesia was given in midline approach L-3-4 / L-4-5 space was selected. Adequate local anaesthesia was infiltrated needle was chosen randomly. Introducer was introduced in the selected space lumbar puncture was done. Identification of the free flow of CSF was identified and marked as the end point of needle placement.⁽⁴²⁾

If no CSF was identified the needle redirect the needle after withdrawing it till skin needle withdrawing was considered as an attempt. After ensuring free flow of CSF, Bupivacaine 0.5% heavy 3cc injected through the spinal needle at rate of 1ml/15sec. Following this patient was turned to supine position.

Onset of sensory block was assessed at 5 mins by pin prick method achieved. Maximum height achieved was considered as the height of the block.

Parameters like HR, Blood Pressure were recorded ringer lactate solution and colloids were infused as maintenance fluids. Intra-operative side effects like nausea, vomiting and bradycardia were managed symptomatically. Post-operatively all the patients were assessed regarding regression of block using Bromage Scale.

Patients were assessed regarding head ache its onset, location, severity, effect of position, character, duration, associated symptoms like nausea, vomiting, auditory and ocular symptoms.

The headache was graded by Corbey MP, Berg P Quanar H.⁽⁸⁾

Grade I = FG1 + VAS 1-3 (FG1 = Headache did not interfere with normal activity.)

Grade II = FG2 + VAS 4-7 (FG2 = Periodical bed rest was necessary to relieve headache.)

Grade III = FG3 + VAS 8-10 (FG3 = Headache was so intense that it was not possible to sit up.)

Grade IIIA – symptoms relieved by bed rest and per oral analgesia.

Grade IIIB – Symptoms not relieved by bed rest and per oral analgesia.

PDPH when present was treated with bed rest. Pharmacological measures were adopted to treat by either tab. Aceclofenac 100mg b.d or Inj. Diclofenac 75mg IM.

The following parameters in the study group were compared

1. Number of attempts
2. PDPH
3. NPDPH
4. Patient acceptability

At the end of the study statistical analysis of the data were done using

1. Chi-Square test

2. Fisher exact test
3. Analysis of variance

Results

Study design: A Comparative study with 150 patients randomized in to three groups with 50 in Group I (QUINCKE NEEDLE 27 GAUGE), 50 patients Group II (SPROTTE 27 GAUGE NEEDLE) and 50 patients in Group III (WHITACRE 27 GAUGE NEEDLE) is undertaken to study the effects on three different needles on subarchanoid block.

Statistical Methods: statistical analysis was done by descriptive method been carried out in the present study. Results on continuous measurements are presented on Mean±SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients, Chi-square/2x3, 3x4 Fisher Exact test has been used to find the significance of study parameters on categorical scale between two groups. ANOVA has been used to test the homogeneity samples based on of age (or continuous parameters) and Chi-square test to test the homogeneity of samples based on parameters on categorical scale between two groups.

1. **Fisher Exact test:** Let there exist two such variables X and Y , with m and n observed states, respectively. Now form an $m \times n$ matrix in which the entries a_{ij} represent the number of observations in which $x = i$ and $y = j$. Calculate the row and column sums R_i and C_j , respectively, and the total sum

$$N = \sum_i R_i = \sum_j C_j$$

of the matrix. Then calculate the conditional probability of getting the actual matrix given the particular row and column sums, given by

$$P_{\text{cutoff}} = \frac{(R_1! R_2! \dots R_m!)(C_1! C_2! \dots C_n!)}{N! \prod_{i,j} a_{ij}!},$$

which is a multivariate generalization of the hypergeometric probability function

The sum of the probabilities of "unusual" tables gives the Fisher Exact test probability

2. **Analysis of Variance:** F test for K Population means

Objective: To test the hypothesis that K samples from K Populations with the same mean.

Limitations: It is assumed that populations are normally distributed and have equal variance. It is also assumed that samples are independent of each other.

Method: Let the j^{th} sample contain n_j elements ($j=1,2,\dots,K$). Then the total number of elements is

$$N = \sum nj \quad x.j = \sum \frac{xij}{nj}$$

$$S_1^2 = \frac{\sum_{i=1}^{n1} \sum (x1 - \bar{x}.j)^2}{N - K}$$

$$S_2^2 = \frac{\sum_{i=1}^{n1} nj(\bar{x}.j - \bar{x}..)^2}{K - 1}$$

F=S₂²/S₁² which follows F distribution (K-1, N-K)

3. Chi-Square Test

$$\chi^2 = \frac{\sum (O_i - E_i)^2}{E_i}$$

Where O_i is Observed frequency and E_i is Expected frequency

4. Significant figures

+ Suggestive significance (P value: 0.05<P<0.10)

* Significant (P value: 0.01<P ≤ 0.05)

** Strongly significant (P value: P≤0.01)

Statistical software: The Statistical software namely SPSS 15.0, Stata 8.0, MedCalc 9.0.1 and Systat 11.0 were used for the analysis of the data.

Table 1: Age, weight and Height distribution of patients studied

Demographic variables	Group I	Group II	Group III	All patients	P value
Age in years	36.21± 9.96	38.64± 10.91	37.90± 9.80	37.59± 0.22	0.489
Weight in Kg	58.78± 5.01	58.28± 5.15	56.02± 5.28	57.69± 5.26	0.019 *
Height in cm	158.48± 2.99	159.12 ±4.15	159.68± 4.12	159.09± 3.80	0.289

Weight (mean) is significantly less in Group II, but not clinically significant

Table 2: Interspace

Inter space	Group I		Group II		Group III		All patients	
	No	%	No	%	No	%	No	%
L3-4	45	90.0	41	82.0	38	76.0	124	82.7
L4-5	5	10.0	9	18.0	12	24.0	26	17.3
Total	50	100.0	50	100.0	50	100.0	150	100.0

Inter space is statistically similar between three groups of patients with P=0.201

Picture 1: Number of attempts

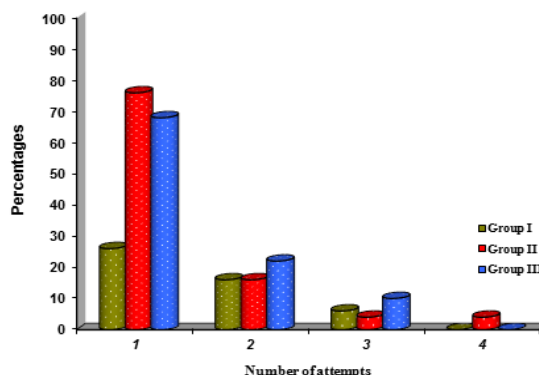


Table 3: Comparison of Post dural puncture headache (PDPH)

PDPH	Group I (n=50)	Group II (n=50)	Group III (n=50)
D1	2 (4.0%)	0	0
D2	1(2.0%)	0	0
D3	0	1(2.0%)	0
D4	0	0	0
Inference	Incidence of PDPH more in Group I (6.0% vs 2.0% vs 0%) when compared to Group II and Group III with P=0.324		

Picture 2: Incidence of P.D.P.H

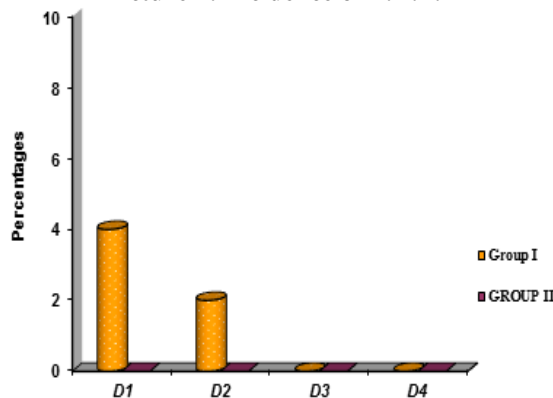


Table 4: Complications

Complications	Group I (n=50)	Group II (n=50)	Group III (n=50)
Back ache	0	0	0
NPDPH	3(6.0%)	1(2.0%)	2(4.0%)
Inference	Complications are statistically similar in all three groups with P=0.871		

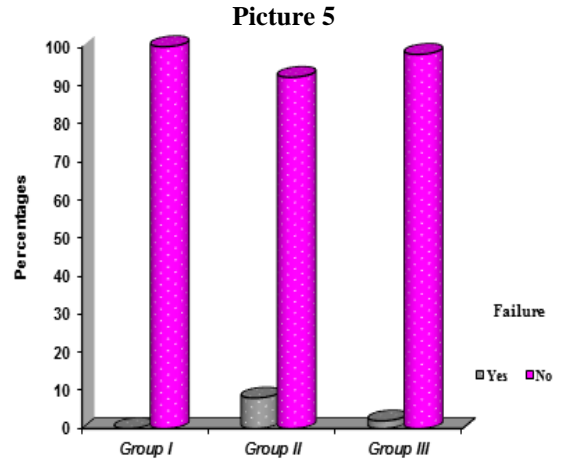
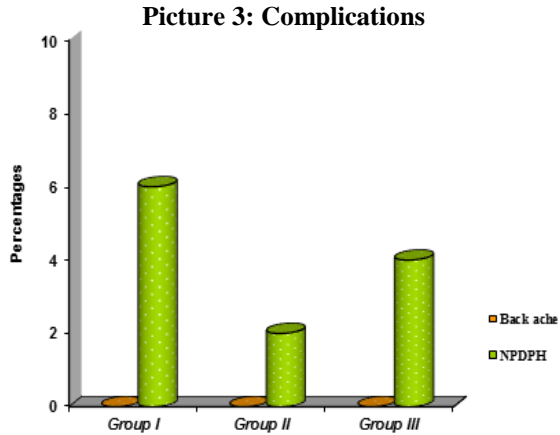


Table 5: Acceptability

Acceptability	Group I (n=50)	Group II (n=50)	Group III (n=50)
Good	47(94.0%)	47(94.0%)	47(94.0%)
Not good	3(6.0%)	3(6.0%)	3(6.0%)
Inference	Acceptability is statistically similar between all three groups (94.0%) with P=1.000		

Table 7: Onset of PDPH

Onset of PDPH	Group I (n=50)	Group II (n=50)	Group III (n=50)
D1	2 (4.0%)	0	0
D2	1(2.0%)	0	0
D3	0	1(2.0%)	0
D4	0	0	0

P=0.324

Picture 4: Acceptability

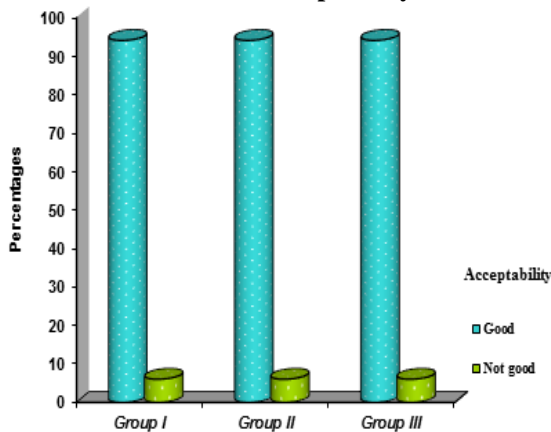


Table 8: Location of PDPH

Location of PDPH	Group I (n=50)	Group II (n=50)	Group III (n=50)
Frontal	2 (4.0%)	0	0
Occipital	1(2.0%)	1(2.0%)	0
Generalized	0	0	0

P=0.324

Table 6: Failure rate

Failure	Group I (n=50)	Group II (n=50)	Group III (n=50)
Yes	0	4 (8.0%)	1 (2.0%)
No	50 (100.0%)	46 (92.0%)	49 (98.0%)
Inference	Failure rate is more in Group II (4.0%) and 2.0%) in Group III with P=0.128		

Table 9: Severity of PDPH

Severity of PDPH	Group I (n=50)	Group II (n=50)	Group III (n=50)
Grade I	3(6.0%)	1(2.0%)	0
Grade II	0	0	0
Grade III	0	0	0

P=0.324

Table 10: Duration of PDPH

Duration of PDPH	Group I (n=50)	Group II (n=50)	Group III (n=50)
<24 hours	3(6.0%)	1(2.0%)	0
24-48 hours	0	0	0
>48 hours	0	0	0

P=0.324

Discussion

Number of attempts: There are few studies which examined the technical difficulties involved with the use of different spinal needles.

In the present study number of attempts were analyzed by successful dural puncture in

First Attempt.	Second attempt
Group I – 76%	Group I – 16%
Group II – 76%	Group II – 16%
Group III – 68%	Group III – 22%
P value is 0.526	

Inferring that number of attempts is similar in all three groups, with the use of introducer. The present study is comparable to the results of the study by Shutt LE et al⁽¹⁷⁾ who studied the ease of insertion of 22Gauge Whitacre needle and 25Gauge Whitacre. 22Gauge Whitacre needle insertion was associated with more successful dural puncture in first attempt (72%) with a smaller failure rate. 25Gauge Whitacre needle for which the success rate was 64% on first attempt and 6% was failure rate. The most frequently recorded comment by the author was that there was no feeling as to what depth the needle had reached until CSF began to flow. In the present study, it was studied that ease of insertion was better with use of introducer with smaller Gauge failure rate is similar between pencil point and cutting type of needle.

Number of attempts comparison between present and comparing study

Present study	27G Quincke	76%
	27G Sprotte	76%
	27G Whitacre	68%
Shut lee et al ⁽¹⁷⁾	22G Whitacre	72%
	25G Whitacre	64%

PDPH is a distressing complication to the patient, because it is common and disabling to the patient. In

the present study the incidence of PDPH in group I, 6% in Group II 2% and 0% in Group III.

There is considerable evidence that PDPH is due to low pressure in C.S.F due to seepage of CSF through the dural puncture hole. Choroid plexus is unable to secrete sufficient fluid to maintain the CSF pressure. The negative pressure in the epidural space may draw CSF from sub arachnoid space. PDPH is related to the size of the dural puncture made by the needle.

The present study is comparable to study done by Wiesel .S they had compared 24G sprotte and 27G Quincke needle in young patients. The incidence of PDPH with the 27G Quincke needle is 12.8%⁽²⁰⁾ whereas in the present study it is 6%.

The present study is compared to a study done by **Santanen U** et al. They compared 27Gauge Whitacre with 27Gauge Quincke needle with respect to PDPH and NPDPH. The incidence of PDPH in the Quincke group is 2.7% while with the Whitacre needle it is 0.3%.⁽¹⁴⁾

The present study is comparable to a prospective randomized study and a meta-analysis, done by **Flatten H. et al.** They compared the incidence of PDPH, in 27Gauge Quincke with 27Gauge Pencan needle (modified Sprotte). 27Gauge Quincke needle had 8% PDPH and 27G Pencan needle had 1.9%.⁽²⁸⁾

It is comparable to study done by **Corbey M.P.** et al. The team compared the incidence of PDPH in 27Gauge Quincke with 26Gauge Quincke needle and systemic grading of severity of head ache and standardized criteria of PDPH was proposed. The same classification is adopted in the present study. In their study, 27Gauge Quincke had 8% PDPH which is comparable to the present study.⁽⁸⁾

	Present study	Wiesel et al ⁽²⁰⁾	Santanen et al ⁽¹⁴⁾	Flatten H. et al ⁽²⁸⁾	Corbey M.P. et al ⁽⁸⁾
27g quincke	6%	12.8%	2.7%	8%	8%
27g sprotte	2%			1,9%	
27G whitacre	0%		0.37%		

Regarding the onset location, severity and duration of the headache, the present study is comparable to study by **Shah A.** et al. In their study location was frontal in 7 cases generalized in 2 cases, mild in all cases and duration less than 24 hours in all cases except 1 patients who had headache for 48 hours. In the present study, PDPH location was frontal 2 cases, occipital 2 cases duration lasted less than 24 hours severity was Grade 1, could be treated with NSAID orally.⁽³⁰⁾

Gender distribution was equal with regard to PDPH in the study group.

	Present study	Shah A et al ⁽³⁰⁾
Location	Frontal 2, occipital 2	Frontal 7, generalised 2.
Duration	Less than 24hrs in all cases	Less than 24 hrs 1 case up to 48 hrs

In the present NPDPH was Group I – 3%, Group II – 2% and Group -4%, which was mild patient was getting relief in sitting position and relieved without any treatment. This is comparable to study done by **Shutt LE** et al where NPDPH developed in 2 cases, which was mild, lasted less than 24 hours.⁽¹⁷⁾

In the present study, backache was not experienced by any of the patients in all three groups and patient acceptability was good in all three groups. It is comparable to a study by **Kang S.B.** et al where they studied post-operative back pain. There was no difference in the development of post-operative back pain by needle size. Patient acceptance was good with smaller gauge needle.⁽¹¹⁾

Post-operative back pain is common complication after spinal anesthesia. The reported incidence has been about 20%. However, it should be noted that back pain occurs as frequently after general anesthesia as after spinal anesthesia. The mechanism for the production of post-operative back pain seems to be the relaxation of the paraspinal muscle under anesthesia and result in flatter of the normal lumbar convexity and stretching of the inter lumbar lumbo sacral ligaments and joint capsules, particularly in lithotomy position.

In the present study failure rate is Group I -0%, Group II -8% and Group III -2% inferring that failure rate is more with Group II that is the Sprotte needle p value being 0.128% suggestive of statistical significance. This can be explained in a study by Crone. They compared Quincke and Sprotte needle with respect to failure as a complication of needle design.

Conclusion

In conclusion pencil point needle, 27Gauge Whitacre, 27Gauge Sprotte are and incidence of PDPH was low when compared to cutting type of Quincke needle. All three types of needles were easy to insert when used with an introducer. Thus pencil point Whitacre needle is better choice in view of low incidence of PDPH. However, cost factor which again should be weighed against the complication.

Bibliography

- Hart JR and Whitacre RJ. Pencil point needle in prevention of post spinal headache. *JAMA* 1951;47(7):657.
- Calthorpe N. The history of spinal needle getting to the point. *Anesthesia* 2004; 59:1231-1241.
- Hinnerk FW, Wulf. The centennial of spinal anesthesia. *Anesthesiology* 1998; 89(2):500-6.
- Greene H M Lumbar puncture and the prevention of post puncture headache *JAMA* 1926; 86(6):391-2.
- Krommendijk E, Verheijen R., Van Dijk B, Spoelder E, Gielen M. The pencan 25G needle a new pencil point needle for spinal anesthesia tested in 1193 patients. *Reg anest pain Med* 1999;24 (1):43-50.
- Turnbull D K, shepherd D B. Post dural puncture headache pathogenesis prevention and treatment. *Br. J. Anaesth* 2003;91(5):718-729.
- Dittmann M, Schafer HG, Ulrich J and Bond T W. Anatomical re-evaluation of the lumbar duramater with regard to post spinal headache. *Anaesthesia* 1988;43:635-37.
- Corbey MP, Berg P, Quaynar H. Classification and severity of post dural puncture headache. *Anesthesia* 1993;48:776-81.
- Lybecker H, Jacob T, Moller, May O, Hans K, Nielsen. Incidence and prediction of post dural puncture headache. A prospective study of 1021 spinal anesthetics. *Anesth Analg* 1990;70:389-94.
- Flaatten H, Rodt SA, Vamnes J, Rosland J, Wisborg T. Post dural puncture headache. A comparison between 26 and 29G needles in young patients. *Anesthesia* 1989;44:147-49.
- Kang SB, Goodnough DE, Lee Y K, Olson RA, Boroshoff JA, Farlano MM. Comparison of 26 and 27G needles for spinal anesthesia for ambulatory surgery patients. *Anesthesiology* 1992;76:734-738.
- Dahl JB, Schutz P, Anklr ME. Spinal anesthesia in young patients using 29G needle technical consideration and on evaluation of post-operative complaints compared with general anesthesia. *Br. J. Anaesth* 1990;64:178-82.
- Santanen U, Rautoma P, Luurila H, Erkola O, Pere P. Comparison of 27G Whitacre and Quincke needle with respect to post dural puncture head ache and non-dural puncture headache. *Acta Aneesthesiol Scand* 2004;48:474-79.
- Cesarini M, Torrielli R, Lahaye J, Mene M, Cabiro. Sprotte needle for intrathecal anesthesia for caesarian section incidence of post dural puncture headache. *Anaesthesia* 1990;45:656-58.
- Lynch J, Krings IE, Strick K, Topalidis K, Schaaf, Fiebig M. Use of 25G Whitacre needle to reduce the incidence of post dural puncture headache. *Br. J. Anaesth* 1991;67:690-93.
- Shutt LE, Valentine J, Wee MYK, Page RJ, Prosser A Thomas TA. Spinal anaesthesia for caesarian section; comparison of 22Gauge and 25Gauge Whitacre needle with 26 Gauge quincke needle *Br. J. Anaesth* 1992;69:589-94.
- Flanagan JF., Kumatta D. and Blue D. Comparison of 24G sprotte and 27G quincke needle on the incidence of post dural puncture headache. *Anesth Analg* 1991;72: S75-S76.
- Tarkkila PJ, Heine H Tervo RR. Comparison of sprotte and quincke needle with respect to post dural puncture headache and backache. *Reg Anesth* 1992;17(5):283-7.
- Wiesel S, Michael JT, and Jame EL Post dural puncture headache; a randomized prospective comparison of 24G Sprotte needle and the 27G Quincke needle in young patients. *Can J Anesth* 1993;40(7):607-11.
- Buettner J, Wresch KP, Klose R. Post dural puncture headache comparison of 27G whitacre and quincke needle. *Reg Anesth* 1993;18:166-9.
- Halpern S and Preston R. Post dural puncture headache and spinal needle design. *Metaanalyses Anesthesiology* 1994;81:1376-1383.
- Ross BK, Chadwick HS., Mancuso JJ, and Benedetti. C. Sprotte needle for obstetric anesthesia; decreased incidence of post dural puncture headache. *Reg Anesth* 1992;17(1):29-33.
- Mayer DC., Quance D, Sally KW. Headache after spinal anesthesia for caesarian section. A comparison of 27G quincke and 24G sprotte needle. *Anesth Analg* 1992;75:377-80.
- Campbell DC, Doudlas JM., Timothy JG, Merrick P, Mary LF McMOrland GH. Comparison of the 25G whitacre with 24G sprotte needle for elective caesarian section; Cost implication *Can J Anesth* 1993;40(12):1131-5.
- Lambert DH, Harley RJ, Hertwig L, Datta S. Role of needle G and tip configuration in the production of lumbar puncture headache *Reg Anesth* 1997;22(1):66-72.
- Thomas SR., Jamieson DR Muir KW. Randomized controlled trail of atraumatic versus standard needle for diagnostic lumbar puncture. *BMJ* 2000;321(21):986-990.

27. Flaatten H, Fethaus J, Kuwelker, Wisborg T. Post dural puncture headache. A prospective randomized study and meta-analysis comparing two different 0.4(27) spinal needle Acta Anaesthesiol Scand 2000;44(6):643-647.
28. Vallejo MC, Gordon L, Mandell, Daniel P, Sabo, Ramanathan. Post dural puncture headache. A randomized comparison of five spinal needles in obstetric patients. Anesth Analg 2000;91:916-20.
29. Shah A, Bhatia BK, Tulsiani KL. Post dural puncture headache in caesarian section. -A comparative Study using 25G Quincke 27G Quincke and 27G Whitacre needle. Indian J. Anaesth 2002;46(5):373-377.
30. Standl T, Stanek A, Burmeister MA., Gruscow S., Walhen B., Muller K et al. Spinal Anesthesia performance condition and side effects are comparable between the newly designed ball pen and sprotte needle. Results of a prospective comparative randomized multicenter study. Anaesth Analg 2004;98:512-7.
31. Oconnor. G, Gingrich R Moffat M. The effects of spinal needle design size and penetration angle on dural puncture cerebral spinal fluid loss. AANA J. 2007; April 75(2):111-6.
32. Lowery S, Oliverly A. Incidence of post-dural puncture headache and backache following diagnostic/ therapeutic lumbar puncture using 22G cutting spinal needle and after introduction 25G pencil point needle. Pediatric Anesthesia 2008;18:230-34.
33. Kotur F. Evidence based management of post dural puncture headache. Indian J Anaesth 2006;50(4):307-308.
34. Hogan QH, anatomy of neuraxis in Cousins and Bridenbaugh's neural blockade in clinical anesthesia and pain. Medicine Philidelphia Lippencott Williams and Wilkins. 2009; 4th ed. 181-209.