

**ASSESSMENT OF DIFFICULT SPINAL ANAESTHESIA USING PRE PROCEDURAL ULTRASOUND COMPARED WITH CLINICAL METHODS IN YOUNG PATIENTS UNDERGOING ELECTIVE SURGERIES**A. C. Malarvizhi<sup>1</sup>, S. Sreeranjani<sup>2</sup>**HOW TO CITE THIS ARTICLE:**

A. C. Malarvizhi, S. Sreeranjani. "Assessment of Difficult Spinal Anaesthesia using Pre Procedural Ultrasound Compared with Clinical Methods in Young Patients undergoing Elective Surgeries". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 45, September 18; Page: 11051-11058, DOI: 10.14260/jemds/2014/3442

**ABSTRACT:** Spinal anesthesia can be challenging in young obese patients and in elderly age group (>65yrs). The surface landmarks observed by clinical palpation can be less helpful in these patients (1-7). The purpose of this study is to do pre procedural ultrasound and clinical examination of the lumbar spine in the same group of patients and comparing them to space finally in which the procedure was performed. The aim is to find out the usefulness of sonography in assessing the difficulty of spinal anesthesia in young patients (<55years). **METHODS:** Seventy five patients undergoing elective procedures under spinal anesthesia were included in the study. All these patients were assessed clinically and sonographically by different group of anesthesiologists and the best space was chosen in both. This was compared to the difficulty of performing the actual spinal procedure. Patients were then divided into three groups. Group A: In this group clinical and sonographic assessment correlated well with the final space in which spinal anesthesia was performed. Group B: In this group only the clinical assessment correlated with final space in which spinal anesthesia was performed. Group C: In this group only the sonographic assessment correlated with the final space in which spinal anesthesia was performed. The data was statistically computed using paired t test and results were obtained. **RESULTS:** Most of the patients in the study, were females 42/75 (56%), in the age group < 40 years (65.2%), the average weight of the patients <60 kg (69.2%) and height of 145-160 cm (69.3%). Majority of the patients had a BMI of < 30 kg/m<sup>2</sup> (97.3%). Statistical analysis of data from group A vs group B shows significant correlation (P value of 0.0001). Similarly comparing group C vs group A is statistically significant (P value = 0.0001). Comparing groups B and C was statistically insignificant (P value = 0.320). But there was significant difference in the time taken for clinical and sonographic examination (P value = 0.0001). **CONCLUSION:** From this study we interpret, that in patients less than 40 years of age, clinical as well as sonographic examination of lumbar spine were equally good in predicting the correct space. Whereas in patients of age group 41-55years, sonogram gives better correlation for identifying the correct space though it is more time consuming. Hence, we conclude that though ultrasound is more useful in patients aged > 40 years expertise is still needed in using this technique. This calls in for routine use of pre procedural sound screening for all anticipated difficult spinals.

**KEYWORDS:** Ultrasound, Difficult Spinal.

**INTRODUCTION:** The Clinical method of lumbar spine examination can be really challenging in many patients due to age related changes, obesity or spinal abnormalities.<sup>(1-7)</sup> Hence, there is growing evidence that sonogram can be a valuable tool in assessing the spinal column and hence can predict the difficulty of spinal anesthesia.

## ORIGINAL ARTICLE

---

So, preoperative assessment is important. In many controlled trials done earlier, sonogram not only predicts difficulty but also can be used as a guide to perform the procedure.<sup>(8,9)</sup>Hence, in this study we plan to predict the difficulty of performing of spinal anesthesia technique using pre procedural sonogram compared with clinical assessment methods.

### **MATERIALS AND METHODS:**

**INCLUSION CRITERIA:** All elective surgical procedures done under spinal anesthesia including orthopaedics, obstetrics and gynaecology, general surgery were enrolled in the study. Patients with no co morbidities or controlled systemic illness (ASA 1, 2 patients) (10) in 20 -55 yrs age group were included.

**EXCLUSION CRITERIA:** All relative and absolute contraindications for spinal anesthesia like coagulopathy, local Infection, neurologic disease, patient refusal, allergy to local anesthetics, valvular heart disease, previous spine surgery were excluded from the study.<sup>(11)</sup>

This prospective blinded, descriptive study was conducted in 75 patients undergoing elective procedures under spinal anesthesia during a period of three months. After obtaining Institutional Ethical committee approval and informed consent from all patients, clinical assessment and ultrasound assessment of lumbar spine were done by two blinded operators in the same patient.

Clinical assessment of the lumbar spine was performed by qualified anesthesiologist. All patients were assessed in preoperative assessment clinic in sitting position. Any spinal anomaly clinically was noted. No radiological examination of lumbar spine was done. The difficulty scoring was done with anesthetist subjective opinion as (Easy/ moderate/ Difficult/ impossible).<sup>(12)</sup>

Calcification of spine clinically was noted. Similarly the intervertebral space distance at L2-L3, L3- L4, L4- L5 levels were measured with the help of calipers and the total time taken for clinical examination was noted. The best intervertebral space was then chosen clinically from the above data. Similarly, Ultrasound assessment of lumbar spine was carried out by a different group of anesthesiologist who had adequate training in the technique.

All patients were assessed sonographically in the sitting position. USG was performed in para median and transverse plane view using a 8 -13 MHz curved array transducer. The interlaminar space, calcification of ligamentum flavum (LF),<sup>(13)</sup> distance of skin to posterior complex, skin to anterior complex, skin to midpoint of intra thecal space (Skin to PC +1/2 (PC- AC)) was noted.

Any abnormal thickening of ligamentum flavum was noted which is defined as inability to visualize the structures posterior to LF.<sup>(14, 15)</sup> The time taken and the best space were chosen sonographically.

The patients were then divided into three groups according to the results.

**Group A:** In this group clinical and sonographic assessment correlated well with the final space in which spinal anesthesia was performed.

**Group B:** In this group only the clinical assessment correlated with final space in which spinal anesthesia was performed.

## ORIGINAL ARTICLE

**Group C:** In this group only the sonographic selection of space correlated with the final space in which spinal anesthesia was performed.

The patients were fasted as for any elective procedure and premedication of Tablet Lorazepam 1 mg was given the previous night. The patients were explained about the procedure, intravenous access and routine standard monitors were attached. The third operator performed the spinal anesthesia.

The final space chosen, number of skin punctures, redirections, attempts taken, any change of space, needle or operator, abandoning the procedure and the time taken for the technique was noted.

The depth of intrathecal space was measured from skin to the point at which CSF is obtained.

The data thus obtained was computed and the results were obtained.

**STATISTICAL ANALYSIS:** In this study, 75 patients were enrolled and clinical as well as sonographic assessment of lumbar spine was done as per study protocol.

From the statistical data arrived, 46 patients were in group A, 15 in group B and 14 in group C. Analyzing the demographic data in patients of group A (n=46), 33 (42.6%) patients were <40 years of age, 34(45.2%)< 60kg. So in most of the patients younger than 40 years and weight <60kg, had good correlation between clinical and sonographic assessment. Clinical as well as sonographic assessment correlated well with final space chosen in patients with weight <60kg, height of 145-160cm and BMI < 30kg/m<sup>2</sup>.

Similarly in group B (15 patients) were clinical assessment correlated well with the space chosen finally. Most of them were females, with 8% of patients in age group 31-40 years, with weight of 45-60kg (10.6%) and most had a height of 145-160cm (14.6%), with BMI 25-30kg/m<sup>2</sup> (12%).

In group C sonographic assessment predicted the final space in 14 patients. Majority was male patients, with a height of >160cm (9.3%), weight > 60kg (10.6%) and aged from 41-55years (9.3%).

Statistical analysis of group A/group B shows significant correlation with a P value of 0.0001. Similarly comparing group C/group A is statistically significant (P value =0.0001). Comparing groups B and C was statistically insignificant (P value = 0.320).

GROUP	MEAN	SD	SEM
GROUP A	0.61	0.49	0.06
GROUP B	0.2	0.4	0.05
GROUP C	0.19	0.39	0.05

(N=75)	P VALUE	SIGNIFICANCE
GROUP A/B	0.0001	SIGNIFICANT
GROUP B/C	0.320	INSIGNIFICANT
GROUP C/A	0.0001	SIGNIFICANT

# ORIGINAL ARTICLE

## DEMOGRAPHIC DATA:

N= (75)	GROUP		GROUP A	GROUP B	GROUP C	TOTAL
AGE	1	< 30YRS	11 (14.6%)	4 (5.3%)	2 (2.6%)	17 (22.6%)
	2	31- 40 YRS	21 (28%)	6 (8%)	5 (6.6%)	32 (42.6%)
	3	41- 55 YRS	14(18.6%)	5 (6.6%)	7 (9.3%)	26 (34.6%)
			46 (61.3%)	15 (20%)	14 (18.6%)	75 (100%)
<b>AGE (YEARS)</b>						

N= 75	GROUP		A	B	C	TOTAL
WEIGHT	1	<45KG	8 (10.6%)	5 (6.6%)	2 (2.6%)	14 (18.6%)
	2	45-60KG	26 (34.6%)	8 (10.6%)	4 (5.3%)	38 (50.6%)
	3	>60KG	12 (16%)	2 (2.6%)	8 10.6%)	22 (29.3%)
			46 (61.3%)	15 (20%)	14 (18.6%)	75 (100%)
<b>WEIGHT(KG)</b>						

N=75	GROUP		A	B	C	TOTAL
HEIGHT	1	<145CM	4 (5.3%)	2 (2.6%)	1 (1.3%)	7 (9.3%)
	2	145-160CM	35 (46.6%)	11 (14.6%)	6 (8%)	52 (69.3%)
	3	>160CM	7 (9.3%)	2 (2.6%)	7 (9.3%)	16 (21.3%)
			46 (61.3%)	15 (20%)	14 (18.6%)	75 (100%)
<b>HEIGHT(CM)</b>						

N=75	GROUP		A	B	C	TOTAL
BMI	1	<25	20 (26.6%)	6 (8%)	5 (6.6%)	31 (41.3%)
	2	25-30	25 (33.3%)	9 (12%)	8 (10.6%)	42 (56%)
	3	30-35	1 (1.3%)	0 (0%)	1 (1.3%)	2 (2.6%)
			46 (61.3%)	15 (20%)	14 (18.6%)	75 (100%)
<b>BODY MASS INDEX (BMI KG/M2)</b>						

N=75	GROUP		A	B	C	TOTAL
GENDER	1	FEMALES	26 (34.6%)	9 (12%)	7 (9.3%)	42 (56%)
	2	MALES	20 (26.6%)	6 (8%)	7 (9.3%)	33 (44%)
			46 (61.3%)	15 (20%)	14 (18.6%)	75 (100%)
<b>GENDER</b>						

Data represented as frequency n (%).

## ORIGINAL ARTICLE

	L2-L3	L3-L4	L4-L5
INTER VERTEBRAL SPACE (CM)	2.88	3.24	2.94
CALCIFICATION	0	3	3
ABNORMALITY OF SPINE	0	0	0

### CLINICAL DATA

	L2-L3	L3-L4	L4-L5
INTERLAMINARSPACE(CM)	2.60	3.12	3.22
SKIN TO PC (CM)	3.22	4.12	4.04
DEPTH OF ITS (Skin to PC +1/2 (PC- AC)) CM	3.48	4.42	4.31
THICKENED LF	0	2	0
ABNORMALITY OF SPINE	0	0	0

### SONOGRAPHIC DATA

		CLINICAL	USG
SPACE CHOSEN	L2-L3	14 (18.6%)	9 (12%)
	L3-L4	58 (77.3%)	53 (70.6%)
	L4-L5	3 (4%)	13 (17.3%)
ABNORMALITIES OF LUMBAR SPINE		0	0
THICKENING OF LIGAMENTUM FLAVUM		6(8%)	2 (2.6%)
DIFFICULTY	EASY	52 (69.3%)	62 (82.6%)
	MODERATE	17 (22.6%)	11 (14.6%)
	DIFFICULT	6 (8%)	2 (2.6%)
	IMPOSSIBLE	0(0%)	0(0%)
TIME TAKEN		2.82 min	3.80 min
DEPTH OF INTRATHECAL IN FINAL SPACE CHOSEN		4.40 cm	4.432 cm

### COMPARITIVE DATA

Data represented as frequency n (%).

FINAL SPACE CHOSEN	L2- L3	2 (2.6%)
	L3- L4	69 (92%)
	L4- L5	4(5.3%)
NO OF ATTEMPTS	ONE	62 (82.6%)
	TWO	12 (16%),
	> THREE	1 (1.3%)
NO OF REDIRECTIONS	ONE	46 (61.3%)
	TWO	26(34.6%)
	>THREE	3 (4%)
CHANGE OF NEEDLE		0
CHANGE OF OPERATOR		0
CHANGE OF SPACE		0

### SPINAL TECHNIQUE

Data represented as frequency n (%).

## ORIGINAL ARTICLE

---

**DISCUSSION:** For many years anesthesiologist used clinical methods for assessing spinal anatomy. Sonography is a newer tool which aids in visualizing the spinal structures clearly and provides more information on same. By studying the sono anatomy of the spine we are able to have better idea to choose the best space for performing spinal.

Most of the patients in the study were in the age group <40 years (65.2%), the weight of <60KG (69.2%) and height of 145-160cm (69.3%). Majority of the patients had a BMI of <30 kg/m<sup>2</sup> (97.3%). Majority of them were females 42/75 (56%). So, the study included mainly young (<40years) and non-obese population (BMI < 30kg/m<sup>2</sup>).

In study conducted by de Filho et al, in 1481 patients, the quality of landmarks was an independent predictor of difficulty of the technique. So clinical assessment of spine is very valuable in areas where ultrasound is not available. In study mentioned that age, gender, height, weight, body habitus, palpability of spinous process, patient positioning were all studied. They found that, independent predictors (Odds ratio, 95% confidence limits) were the quality of anatomical landmarks (1.92 (1.57; 2.35)), the provider's level of experience (1.24 (1.15; 1.33)) and the adequacy of patient positioning (3.84 (2.84; 5.19)).<sup>(1)</sup>

All clinical assessment in this study was done in sitting position. The average intervertebral space at L3-L4 level was 3.24cm which was space chose best clinically in 64/75 (85%) of patients. Only 6 patients had clinical difficulty in assessing the spine subjectively, 3 each in L3-L4 and L4-L5 levels respectively. This is accordance with study mentioned earlier that quality of landmarks predicts difficulty.

For sonographic examination of lumbar spine, we have chosen the paramedian and transverse view. The para median sagittal view provides information on interlaminar spaces which can be visualized as a "saw tooth 'pattern and described as "trident sign".

The transverse plane view was used to visualize the deeper structures, the posterior complex (PC) (ligamentum flavum and posterior dura) and anterior complex (AC) which includes the (anterior dura, posterior longitudinal ligament and posterior aspect of the vertebral body or the intervertebral disc) which are collectively visible as a single linear hyper echoic structure called anterior complex. Any calcification of LF is seen as single hyperechoic shadow and structures deeper to it is not visible.<sup>(16,17)</sup> But thickened LF allows visualization of structures deeper to it.

In the sonographic arm of assessment, the average inter laminar space at L3-L4 level was 3.12cm which was the best space chosen in 60/75 (80%) of patients. The average distance of skin to ITS ((Skin to PC +1/2 (PC- AC)) was 4.42cm at L3-L4 level which correlated well with clinical depth of 4.40cm at the same level clinically.

Karmarkar et al, studied the sonoanatomy of the spine and uses a four point rating scale in viewing the structures.<sup>(16,17)</sup> Identifying the lamina or any one of deeper structures was considered successful. In this study out of 6 patients who had clinical difficulty only 2 out of the 6 had sonographically thickened LF.

The final space in which successful spinal anesthesia was performed L2-L3: 2 (2.6%), L3-L4: 69(92%), L4-L5: 4(5.3%). The number of attempts taken for successful spinal anesthesia were one attempt: 62(82.6%), two attempts: 12(16%), >than three attempts: 1(1.3%). The number of redirections of needle needed one redirection c nx:46 (61.3%), One to two redirections: 26 (34.6%), more than three redirections: 3(4%). None of the patient required change of needle, operator, or abandoning the procedure.

## ORIGINAL ARTICLE

---

The time taken clinically and sonographically was 2.82 min and 3.80 min which was statistically significant (P value 0.0001).

**LIMITATIONS:** The study has many limitations. The study included a very small sized sample (N=75). Though bias due to demographic data was ruled out, there were some technical difficulties in assessing sono anatomy of the spine. This dictates the need for more training for anesthesiologist in this field. Third, there was no real time imaging of spine which could have been compared easily with the clinical method. The study didn't include morbidly obese patients; where in the role of sonogram would be of significance.

**CONCLUSION:** From this study we interpret, that in patients less than 40 years of age, clinical as well as sonographic examination of lumbar spine was equally good in predicting the correct space. Whereas, in patients of age group 41-55 years, sonogram gives better correlation of the space though it is more time consuming.

Hence, we conclude that though ultrasound is more useful in patients aged >40 years, expertise is still needed in using this technique. This calls in for routine use of pre procedural sonographic screening in all anticipated difficult spinals.

### REFERENCES:

1. De Filho GR1, Gomes HP, da Fonseca MH, Hoffman JC, Pederneiras SG, Garcia JH; Predictors of successful neuraxial block: a prospective study; *Eur J Anaesthesiol.* 2002 Jun; 19(6):447-51.
2. Sprung J1, Bourke DL, Grass J, Hammel J, Mascha E, Thomas P, Tubin I; Predicting the difficult neuraxial block: a prospective study; *Anesth Analg.* 1999 Aug; 89(2):384-9.
3. Kawaguchi R, Yamauchi M, Sugino S, Yamakage M. Ultrasound aided ipsilateral dominant epidural block for total hip arthroplasty: a randomised controlled single blind study. *Eur J Anaesthesiol* 2011; 28; 137-140.
4. Watson MJ, Evans S, Thorp JM. Could ultrasonography be used by an anesthetist to identify a specified lumbar interspace before spinal anaesthesia? *Br J Anesth* 2003; 90: 509-511.
5. Furness G, Reilly MP, Kuchi S. An evaluation of ultrasound imaging for identification of lumbar intervertebral level. *Anesthesia* 2002; 57:277-280.
6. Weed JT, Taenzer AH, Finkel KJ, Sites BD. Evaluation of pre procedural ultrasound examination as a screening tool for difficult spinal anesthesia. *Anesthesia* 2011; 66:925-930.
7. Ellinas EH1, Eastwood DC, Patel SN, Maitra-D'Cruze AM, Ebert TJ; The effect of obesity on neuraxial technique difficulty in pregnant patients: a prospective, observational study; *Anesth Analg.* 2009 Oct; 109(4):1225-31.
8. Atallah MM, Demian AD, Shorrab AA. Development of a difficulty score for spinal anaesthesia. *Br J Anaesth* 2004; 92: 354-60.
9. Chin KJ1, Perlas A, Chan V, Brown-Shreves D, Koshkin A, Vaishnav V; Ultrasound imaging facilitates spinal anesthesia in adults with difficult surface anatomic landmarks; *Anesthesiology.* 2011 Jul; 115(1):94-101.
10. ASA Relative Value Guide 2002, American Society of Anesthesiologists.
11. www.nysora.com; Spinal anaesthesia; By admin.; 04/ 10/2013.

## ORIGINAL ARTICLE

12. Broadbent CR1, Maxwell WB, Ferrie R, Wilson DJ, Gawne-Cain M, Russell R; Ability of anaesthetists to identify a marked lumbar interspace; *Anaesthesia*. 2000 Nov; 55(11):1122-6.
13. Carney A and Hunt V, "The use of neuraxial scanning can facilitate spinal anaesthesia for lower limb joint arthroplasty," in Proceedings of the 15th Annual Scientific congress of the British Society of Orthopaedic Anaesthetists, Nottingham, UK, November 2010, vol. 66, pp. 407-408.
14. Chin K J, V. W. S. Chan, R. Ramlogan, and A. Perlas, "Real-time ultrasound-guided spinal anesthesia in patients with a challenging spinal anatomy: two case reports," *Acta Anaesthesiologica Scandinavica*, 2010, vol. 54, no. 2, pp. 252-255.
15. Grau T, Leipold RW, Fatehi S, Martin E, Motsch J. Real-time ultrasonic observation of combined spinal-epidural anaesthesia. *Eur J Anaesthesiol* 2004; 21:25-31.
16. Karmakar MK, Li X, Ho AM, Kwok WH, Chui PT. Real-time ultrasound-guided paramedian epidural access: evaluation of a novel in-plane technique. *Br J Anaesth* 2009; 102:845-54
17. Karmakar M K, MD, X Li, PhD, W H Kwok; Sonoanatomy relevant for ultrasound-guided central neuraxial blocks via the paramedian approach in the lumbar region; *British Journal of Radiology*, 2012, Jul:85 (1015).

### AUTHORS:

1. A. C. Malarvizhi
2. S. Sreeranjani

### PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Anaesthesiology, Tagore Medical College and Hospital, Rathinamangalam, Vandalur, Chennai.
2. Assistant Professor, Department of Anaesthesiology, Tagore Medical College and Hospital, Rathinamangalam, Vandalur, Chennai.

### NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. A. C. Malarvizhi,  
Assistant Professor,  
Department of Anesthesiology,  
Tagore Medical College and Hospital,  
Rathinamangalam, Vandalur,  
Chennai-600127.  
Email: malarvizhiac@gmail.com

Date of Submission: 25/08/2014.  
Date of Peer Review: 26/08/2014.  
Date of Acceptance: 05/09/2014.  
Date of Publishing: 17/09/2014.