

**Original research article****Ultrasound guided cervical plexus block versus local infiltration during internal jugular vein cannulation: Haemodynamic changes****<sup>1</sup>Dr. Arya Mohan S, <sup>2</sup>Dr. Arunashree, <sup>3</sup>Dr. Vineet Varma, <sup>4</sup>Dr. Vivek K Hosamani**<sup>1</sup>Registrar, Department of Anesthesia, Manipal Hospital, Bangalore, Karnataka, India<sup>2,4</sup>Assistant Professor, Department of Anesthesia, Karwar Institute of Medical Sciences, Karwar, Karnataka, India<sup>3</sup>Assistant Professor, Department of Orthopedics, Karwar Institute of Medical Sciences, Karwar, Karnataka, India**Corresponding Author:**

Dr. Vivek K Hosamani

Assistant Professor, Department of Anesthesia, Karwar Institute of Medical Sciences, Karwar, Karnataka, India

**Abstract**

Ropivacaine is a long-acting regional anaesthetic that is structurally related to Bupivacaine. It is a pure S(-)enantiomer, unlike Bupivacaine, which is a racemate, developed for the purpose of reducing potential toxicity and improving relative sensory and motor block profiles. This is presumably due to slower uptake, resulting in lower blood levels for a given dose. After obtaining the approval from the Ethical committee and the Institutional review board and obtaining a well-informed written consent, 100 ASA Grade I, II, III patients who were undergoing various elective and emergency surgeries requiring central venous cannulation were chosen. The patients were randomized into two groups using computer generated random number tables. Independent t test shows significant difference in the mean of Systolic Blood pressure (SBP), Diastolic Blood pressure (DBP) and Heart rate (HR) between the groups at all time points except time 0. SBP, DBP and HR being much lower in ultrasound guided intermediate cervical plexus block group during various procedural steps of internal jugular vein (IJV) cannulation. Independent t test shows significant difference in the mean of mean arterial pressure (MAP) between the groups for all time points except time 0 (baseline). MAP being much lower in ultrasound guided intermediate cervical plexus Group during various procedural steps of IJV cannulation.

**Keywords:** Haemodynamic changes, IJV cannulation, ropivacaine**Introduction**

The superficial cervical plexus block is conventionally described as a subcutaneous injection technique performed at the mid-portion of the posterior border of the sternocleidomastoid (SCM) muscle targeting superficial branches of the cervical plexus. This conventional subcutaneous infiltration technique for the superficial cervical plexus block (CPB) can be performed using an ultrasound guided technique and depending on the type of surgery in the head and neck region, it is also possible to block one or more superficial branches of the cervical plexus selectively by using landmarks or an ultrasound technique<sup>[1, 2]</sup>. The superficial CPB, unlike the deep CPB, is known to carry a low risk of complications and easy to master. Nonetheless, during a superficial CPB, it is important to make sure that the needle tip is positioned in the subcutaneous tissue to avoid adverse effects of deep block.

Intermediate CPBs can provide different anaesthetic and analgesic effects compared with superficial CPB. The cervical plexus (C2 – C4) is known to afford sensory innervation to the SCM muscle, including proprioception, with variable anastomosis with the spinal accessory nerve. Therefore, the SCM muscle, after piercing the prevertebral fascia, are known to anastomose with the spinal accessory nerve at the posterior surface or inside of the SCM muscle. While the spinal accessory nerve itself is also known to have a sensory function, the cervical plexus (ansa cervicalis) is believed to constitute another source of motor innervation for the SCM muscle in addition to the spinal accessory nerve. Therefore, it is possible that the USG intermediate CPB, which is performed accurately in the posterior cervical space (PCS) at a specific cervical vertebral level, can block all four cutaneous branches of cervical plexus and sensory/motor branches of the cervical plexus supplying the SCM muscle simultaneously so that it provides adequate anesthesia and analgesia for neck surgeries that involve manipulation or resection of the SCM muscle.

Ropivacaine is a long-acting regional anaesthetic that is structurally related to Bupivacaine. It is a pure S(-)enantiomer, unlike Bupivacaine, which is a racemate, developed for the purpose of reducing potential

toxicity and improving relative sensory and motor block profiles. This is presumably due to slower uptake, resulting in lower blood levels for a given dose [3].

Ropivacaine causes reversible inhibition of sodium ion influx, and thereby blocks impulse conduction in nerve fibres. This action is potentiated by dose dependent inhibition of potassium channels. Ropivacaine is less lipophilic than bupivacaine and is less likely to penetrate large myelinated motor fibres. Therefore, it has selective action on the pain-transmitting A $\beta$  and C nerves rather than A $\beta$  fibres, which are involved in motor function [4].

Ropivacaine is less lipophilic than bupivacaine and that together with its stereoselective properties, contributes to ropivacaine having a significantly higher threshold for cardio toxicity and CNS toxicity than bupivacaine in healthy volunteers. The lower lipophilicity of ropivacaine versus bupivacaine correlated with the lesser cardio depressant effects of both ropivacaine isomers than of the bupivacaine isomers. The Central Nervous System effects occur earlier than cardiotoxic symptoms during an intravenous (IV) infusion of local anaesthetic (10 mg/min of ropivacaine or bupivacaine). Significant changes in cardiac function involving the contractility, conduction time and QRS width occurred and the increase in a QRS width was found to be significantly smaller with ropivacaine than with bupivacaine [5, 6].

### Methodology

**Study design:** A prospective comparative study.

**Study population:** After obtaining the approval from the Ethical committee and the Institutional review board and obtaining a well-informed written consent, 100 ASA Grade I, II, III patients who were undergoing various elective and emergency surgeries requiring central venous cannulation were chosen. The patients were randomized into two groups using computer generated random number tables. Hemodynamic parameters (HR, SBP, DBP, MAP) assessed at following procedural steps during IJV cannulation:

Time 0: At baseline 5 minutes prior to start of procedure.

Time 1: During administration of block/local infiltration.

Time 2: During needle puncture.

Time 3: During subcutaneous tunneling.

Time 4: At insertion of catheter.

Time 5: During securing and suturing.

Time 6: 5 minutes after procedure.

**Blinding:** Single blind study.

**Sample size:** Considering dropouts, and to have better power we studied 50 patients in each group. Total 100.

**Randomization:** Patients were randomized based on computer generated randomization into two groups.

**Group 1:** (n=50) Patients who were given ultrasound guided intermediate cervical plexus block with 5-7ml of 0.75% Ropivacaine.

**Group 2:** (n=50) Patients who were given local infiltration with 5-7ml of 0.75% Ropivacaine.

### Inclusion criteria

- Age group 18-75 years.
- ASA grade I, II, III patients of either sex.
- Patients undergoing various elective surgeries requiring internal jugular vein cannulation.
- Patients undergoing various emergency surgeries requiring internal jugular vein cannulation.

### Exclusion criteria

- Patient refusal for the study.
- Age <18 or >75 years.
- Patients receiving anticoagulants.
- Patients with infection/local pathology at the site of administration of block.
- Patients allergic to local anaesthetic agents.
- Patients with coagulation disorder.
- ASA grade  $\geq$  IV.
- Patients with distorted local anatomy.

### Results

**Table 1:** Comparison of Mean HR values between the study groups at different time points

Time	Group	N	Mean	SD	Min	Max	p value
Time 0	Group 1	50	86.6	11.968	64	110	0.536*
	Group 2	50	85.0	13.757	60	110	
Time 1	Group 1	50	87.9	11.342	70	112	<0.001
	Group 2	50	97.7	9.974	72	118	
Time 2	Group 1	50	86.6	10.552	64	108	<0.001
	Group 2	50	97.0	9.325	72	115	
Time 3	Group 1	50	84.9	9.732	60	100	<0.001
	Group 2	50	96.5	8.839	72	114	
Time 4	Group 1	50	83.7	9.698	60	100	<0.001
	Group 2	50	96.6	8.680	72	110	
Time 5	Group 1	50	83.6	9.703	62	102	<0.001
	Group 2	50	96.7	8.491	72	110	
Time 6	Group 1	50	83.2	9.336	60	98	<0.001
	Group 2	50	96.3	8.004	72	110	

\*Not applicable as time 0 is preprocedural.

Independent t test shows significant difference in the mean of heart rate between the groups at all-time points except time 0 (baseline). There was significant reduction of Heart rate in Group 1 at all-time points during various procedural steps of IJV cannulation.

**Table 2:** Comparison of Mean SBP values between the study groups at different time points

Time	Group	N	Mean	SD	Min	Max	p value
Time 0	Group 1	50	125.1	10.191	100	146	0.909*
	Group 2	50	124.9	10.707	100	140	
Time 1	Group 1	50	125.7	9.445	100	146	<0.001
	Group 2	50	140.8	14.275	106	170	
Time 2	Group 1	50	121.2	9.587	100	138	<0.001
	Group 2	50	138.6	12.733	106	160	
Time 3	Group 1	50	119.0	8.593	100	134	<0.001
	Group 2	50	138.8	12.643	106	160	
Time 4	Group 1	50	118.5	8.589	100	134	<0.001
	Group 2	50	137.6	12.999	106	162	
Time 5	Group 1	50	117.6	9.029	100	134	<0.001
	Group 2	50	137.4	13.026	106	160	
Time 6	Group 1	50	117.7	8.788	100	134	<0.001
	Group 2	50	137.1	12.849	106	160	

\*Not applicable as time 0 is preprocedural.

Independent t test shows significant difference in the mean of SBP between the groups at all time points except time 0. SBP being much lower in Group 1 during various procedural steps of IJV cannulation.

**Table 3:** Comparison of Mean DBP values between the study groups at different time points

Time	Group	N	Mean	SD	Min	Max	p value
Time 0	Group 1	50	78.5	7.503	62	92	0.390*
	Group 2	50	79.7	6.350	64	90	
Time 1	Group 1	50	79.8	7.124	62	92	<0.001
	Group 2	50	87.2	7.080	70	98	
Time 2	Group 1	50	75.8	6.674	60	90	<0.001
	Group 2	50	86.2	6.310	70	96	
Time 3	Group 1	50	75.2	5.716	60	82	<0.001
	Group 2	50	86.1	6.477	70	92	
Time 4	Group 1	50	74.4	5.574	60	82	<0.001
	Group 2	50	86.2	7.076	70	98	
Time 5	Group 1	50	73.7	6.414	60	82	<0.001
	Group 2	50	86.0	6.559	70	92	
Time 6	Group 1	50	73.5	6.072	60	82	<0.001
	Group 2	50	84.8	7.373	70	92	

\*Not applicable as time 0 is preprocedural.

Independent t test shows significant difference in the mean of DBP between the study groups at all time points except time 0. DBP being much lower in Group 1 during various procedural steps of IJV cannulation.

**Table 4:** Comparison of Mean MAP values between the study groups at different time points

Time	Group	N	Mean	SD	Min	Max	p value
Time 0	Group 1	50	94.1	7.883	76	111	0.597*
	Group 2	50	94.9	6.780	76	105	
Time 1	Group 1	50	95.1	7.319	76	111	<0.001
	Group 2	50	105.1	8.806	82	119	
Time 2	Group 1	50	90.8	6.963	73	103	<0.001
	Group 2	50	103.5	7.859	82	113	
Time 3	Group 1	50	89.7	5.896	73	98	<0.001
	Group 2	50	103.5	8.016	82	113	
Time 4	Group 1	50	89.1	5.855	73	98	<0.001
	Group 2	50	103.1	8.485	82	119	
Time 5	Group 1	50	88.3	6.714	73	98	<0.001
	Group 2	50	102.9	8.413	82	113	
Time 6	Group 1	50	88.2	6.360	73	98	<0.001
	Group 2	50	102.0	8.670	82	113	

\*Not applicable as time 0 is preprocedural.

Independent t test shows significant difference in the mean of MAP between the groups for all time points except time 0 (baseline). MAP being much lower in Group 1 during various procedural steps of IJV cannulation.

**Discussion**

**Table 5:** Comparison of Haemodynamic variables (HR, SBP, DBP and MAP)

Study	Haemodynamic Variables
Arun Nagdev, MD and Andrew Herring, MD7	Significantly diminished at all-time points of procedure in SCPB
Taner Ciftci, Hayrettin Daskaya, Mehmet B Yildirim, Haluk Söylemez 8	Significantly diminished at time of skin puncture, dilatation and skin suturing in SCPB
Harshwardhan A. Tikle, Bhaskar Murlidhar Patil 9	Significantly lower at all time points of IJV cannulation in SCPB group
Dr. Venkata Karthik Reddy Kovvuri Dr. Vishnumahesh Babu Batchu 10	Significantly lower during subcutaneous tunneling and suturing in SCPB group as compared to local infiltration group
Present Study	Haemodynamic variables are statistically significant and low in Intermediate CPB as compared to local infiltration group at all time points in various procedural steps of IJV cannulation

Haemodynamic variables significantly diminished and better patient satisfaction at all time points of procedure in SCPB in the study conducted by Arun Nagdev, MD, and Andrew Herring, MD. The study conducted by Taner Ciftci, Hayrettin Daskaya, Mehmet B Yildirim, Haluk Söylemez shows haemodynamic variables significantly diminished and better patient satisfaction at time of skin puncture, dilatation and skin suturing in SCPB. Harshwardhan A. Tikle, Bhaskar Murlidhar Patil documented that haemodynamic variables significantly lower and better patient satisfaction at all time points of IJV cannulation in SCPB group as compared with local infiltration group. In a study conducted by Dr. Venkata Karthik Reddy Kovvuri Dr. Vishnumahesh Babu Batchu shows the haemodynamic variables significantly lower and better patient satisfaction during subcutaneous tunnelling and suturing in SCPB group as compared to local infiltration group. In present study, the haemodynamic variables significantly low and better patient satisfaction in intermediate CPB as compared to local infiltration group at all time points in various procedural steps of IJV cannulation.

**Conclusion**

In the present study, the heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure were significantly stable in group 1 (values within 20% of baseline). i.e., Intermediate cervical plexus block haemodynamically more stable than local infiltration group. There were no complications throughout the procedure in both groups. Patients in the intermediate cervical plexus block group showed stable haemodynamics than those in the local infiltration group at each steps of Internal Jugular Vein Cannulation.

**References**

1. Fee JH, Bovill JG. Physiology for anaesthesiologists. Chapter 11. In: Fee JH, Bovill JG (eds.), Physiology for anaesthesiologists. 1st ed. London: Taylor and Francis; 2004. pp206-38.
2. Hansen TG. Ropivacaine: a pharmacological review. Expert Review of Neurotherapeutics. 2004 Sep 1;4(5):781-91.

3. Marhofer P, Greher M, Kapral S. Ultrasound guidance in regional anesthesia. *Br J Anaesth.* 2005 Jan;94(1):7–17
4. Merritt CR. Physics of ultrasound. In: Rumack CM, Wilson SR, Charboneau JA, editors. *Diagnostic Ultrasound.* 3rd ed. St. Louis: Elsevier Mosby; 2005
5. Bajaj P. Local anaesthetics: Drugs in Clinical Anaesthesia. 1st ed. New Delhi: Paras Medical Pub; 2005. pp225-82
6. Kefalianakis F, Koeppl T, Geldner G, Gahlen J. Carotid-surgery in ultrasound- guided anesthesia of the regio colli lateralis. *Anesthesiol Intensivmed Notfallmed Schmerzther.* 2005;40:576–81.
7. Herring AA, Stone MB, Frenkel O, Chipman A, Nagdev AD. The ultrasound-guided superficial cervical plexus block for anaesthesia and analgesia in emergency care setting. *AM J Emerg Med.* 2012;30:1263-7.
8. Çiftci T, Daskaya H, Yıldırım MB, Söylemez H. A minimally painful, comfortable, and safe technique for hemodialysis catheter placement in children: superficial cervical plexus block. *Hemodialysis International.* 2014;18:700-4.
9. Harshwardhan A. Tikle, Bhaskar Muralidhar Patil. Comparison of superficial cervical plexus block versus local infiltration for pain relief during internal jugular vein cannulation. *International Journal of Contemporary Medical Research.* 2018;5(9):I6-I12.
10. Dr. Venkata Karthik Reddy Kovvuri, Dr. Vishnumahesh Babu Batchu. A Comparative Evaluation of Superficial Cervical Plexus Block Versus Local Infiltration for Pain Relief during Internal Jugular Vein Cannulation in Awake Patients-A prospective Randomised Study, *IJSR.* 2020 Feb;9(2):118-120.