ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Comparative Study Between 5% Dextrose and Normal Saline in Brachial Plexus Block for Onset and Duration of Complete Sensory and Motor Block.

Bhavik Shah, Atul B Vyas, Nidhi Mandowara, Dhaval Chauhan, Anuja Thakker, and Karrupiah.

BJ Medical College, Ahmedabad, Gujarat, India.

ABSTRACT

Brachial plexus block through supraclavicular route is a widely practiced regional anaesthesia technique for upper limb surgeries. This study was designed to evaluate the effect of 5%dextrose (5d) as a diluent, in onset and duration of complete motor and sensory block as compared to normal saline (ns), when given through supraclavicular approach of brachial plexus block. Sixty patients ASA1 or ASA2 aged (21-60) years scheduled for elective arm and forearm surgery were randomly assigned to receive inj. bupivacaine (0.5%)+ inj. lignocaine(2%) with adrenaline (1:2,00,000) + (5% dextrose / n.saline) through supraclavicular approach of brachial plexus block by paresthesia technique. Two groups were compared with reference to onset and duration of motor and sensory block. 5%dextrose administered resulted in significant reduction in latency of onset of complete motor and sensory block with no significant increase in duration of blocks. Onset of complete sensory blockade for 5D and NS were 10.38±3.14 and 18.10±4.68 respectively (p value <0.0001). Onset of complete motor blockade with 5D and NS were 16.42±4.23 and 22.36±3.56 respectively (p value <0.0001).Duration of complete sensory block with 5D and NS were 193.12±18.54 and 185.26 ± 19.89 respectively (p value 0.1188). Duration of complete motor block with 5D and NS were 217.32±19.35 and 209.65±21.48 (p value 0.1516). It is concluded that 5%dextrose produces a definite reduction in the latency of complete sensory as well as motor blockade with no significant changes in duration of motor and sensory block

Keywords: 5% dextrose, brachial plexus, sensory and motor block.

Corresponding author

ISSN: 0975-8585

INTRODUCTION

Brachial plexus block is a versatile and reliable regional anaesthesia technique. It is a block of roots, divisions and cords first performed by Halsted in 1884. It provides a useful alternative to general anaesthesia for upper limb surgery by being safe, decreasing the cost of anaesthetic agents, decrease operation theatre pollution and with an advantage of prolonged post-operative pain relief [1]. The block achieves ideal operating conditions by producing complete muscular relaxation maintaining stable intraoperative haemodynamic parameters and the associated sympathetic block. The sympathetic block decreases post-operative pain, vasospasm and oedema. There are different ways to block the brachial plexus.

The supraclavicular approach to brachial plexus blockade was introduced in clinical practice in Germany by Kulenkampff in 1911. The supraclavicular route of brachial plexus blockade provides anaesthesia of the entire upper extremity in the most consistent, time efficient manner of many brachial plexus technique. It is performed at the trunk level where plexus is presented most compactly. This anatomic compactness is responsible for rapid onset and complete & reliable anaesthesia [2]. Another advantage of supraclavicular technique is that it can be performed with the patient's arm in any position to provide excellent anaesthesia for elbow, forearm and hand surgery.

High perineural sodium concentration may displace the LA (local anaesthetics) from the binding site and alter its analgesic effect. Therefore, it is possible that LA diluted with normal saline (NS) may influence onset/regression of blockade [3]. Five percent dextrose (D5) is painless on injection and is not known to cause any long-term sequel when injected around neural tissue [4-7].

The hypothesis of this study was that dilution of LA with 5D reduces the onset time of sensory peripheral nerve block. The primary objective was to prospectively compare and evaluate the onset of action of LA when diluted with 5D or NS in patients scheduled for upper limb surgery.

MATERIALS AND METHODS

This study was carried out after obtaining permission from institutional ethical committee and obtaining written informed consent of the patient's relative. We recruited total 60 patients for our prospective randomized controlled study.

Inclusion criteria

- Age of patient-18 to 65yrs
- Either sex
- ASA(American society of anaesthesiologist) grade I or II
- Weight 50 - 80 kg
- Admitted for any kind of Orthopaedic or Plastic surgeries on upper limb, lasting more than 30 minutes.

Exclusion criteria

- Patient's refusal
- Allergy to amide group of local anaesthetic agent
- Contraindication to brachial plexus block
- Significant neurological disease in upper limb
- Renal disease and psychiatric history
- Inability to comply with study assessment
- Pregnancy and lactation
- Patient on anticoagulants or bleeding disorder
- Underlying other significant systemic disease

All the patients underwent a pre anaesthetic checkup before surgery and all the routine and specific investigations were noted. The patients were kept electively nil per oral for 6 hours before surgery and prior to operation patients were explained about the procedure. Standard monitors like ECG, NIBP, and pulse oximeters were applied and patient's baseline parameters like pulse, blood pressure, respiratory rate, SpO_2 were recorded. Intravenous line secured in all the patients and intravenous fluid started.

TECHNIQUE

For performing brachial plexus blockade through supraclavicular approach we used Classical technique (Kulenkampff's). After placing the patient in dorsal recumbent position with head turned away from site of injection with strict aseptic and antiseptic precautions midclavicular point, external jugular vein and subclavian artery pulsation were identified. About 2 cm above the mid clavicular point just lateral to subclavian artery pulsation, a 22 gauge 1.5 inch hypodermic needle attached with 2 ml saline filled syringe was introduced and directed caudal and medially until paraesthesia or motor response was elicited or the first rib was encountered.

After brachial plexus was located the drug was injected and before every incremental dose negative aspiration for blood was performed to avoid any intravascular placement.

According to the drug administered the patients were randomly allocated to 2 groups-

Group N: Normal saline
Group D: Dextrose (5%)

Heart rate, blood pressure, oxygen saturation were recorded before the procedure and at 5, 10, 15, 30, 45, 60, 90, 120 min and then every two hourly postoperatively till the complete wearing off of effect.

Onset of Sensory block was assessed every 2 min by atraumatic pin prick test in the areas innervated by radial, ulnar, and median nerves and compared with the same stimulation on contralateral hand. Sensory blockade was graded as

Grade 0: No sensation felt
Grade 1: Dull sensation felt
Grade 2: Sharp pain felt

Onset time was defined as time from injection of drug to a dull sensation on any of the nerve distribution.

Sensory Peak effect time is defined as time from injection of drug to complete loss of sensation along all the nerve distribution.

Duration of sensory block was defined as time between the peak effect time and feeling of dull sensation in any of the nerve distribution.

Onset of wearing off of sensory block starts from feeling of dull sensation in any of the nerve distribution.

Complete wearing off of sensory block is defined as sharp pain felt in all the nerve distribution.

Similarly, onset of motor block was evaluated by asking the patient to move the forearm against resistance and to flex the forearm. Motor blockade was graded by four point scale.

Grade 0: No movement
Grade 1: Only elbow movement
Grade 2: Reduced movement of fingers and wrist
Grade 3: Complete movement of fingers and wrist

Onset time was considered from injection of drug to patient felt heaviness on abduction of arm at shoulder.

Motor Peak effect time was from injection of drug to absence of any voluntary movement at the level of arm and forearm.

Duration of motor blockade was defined as between the onset of peak motor effect and the onset of weaning of motor effect in any of the nerve distribution.

Onset of wearing off of motor blockade is the time when reduced movement of fingers and wrist is present.

ISSN: 0975-8585

Complete wearing off of motor blockade is the time when complete movement of wrist and fingers return.

Patients were observed for any systemic side effects like bradycardia, hypotension etc. Intra operative data were recorded at every 15-30 minute interval. Tourniquet inflation and deflation time and duration of surgery were noted.

OBSERVATION AND RESULTS

Demographic data

Table-1: Demographic data

Variables	Group A	Group B
1) Age in yrs		
Mean	41.72	38.84
Standard deviation	12.95	11.49
2) Wt. in kg		
Mean	65.94	65.22
Standard deviation	4.40	4.68
3) Sex ratio		
M:F	18:12	16:14

Table shows distribution of patients according to mean age and mean weight with standard deviation and sex incidence of patients in both groups with no significant difference

Table 2: Type of Surgery

	Arm	Forearm	Hand
Group A	6	22	2
Group B	5	19	6

This table shows distribution of different type of surgery is almost similar between both groups.

Time for onset of sensory and motor block

	Sensory block onset time (min)		Motor block onset time (min)	
	MEAN	SD	MEAN	SD
5%DEXTROSE	10.38	3.14	16.42	4.23
N.SALINE	18.10	4.68	22.36	3.56
p-value	<0.0001		<0.0001	

	DURATION OF SENSORY BLOCK	DURATION OF MOTOR BLOCK	DURATION OF ANALGESIA
5%DEXTROSE	193 min	217 min	288 min
NORMAL SALINE	185 min *ns	209 min *ns	279 min *ns

DISCUSSION

Regional anaesthesia provides improved satisfaction and cause less cognitive impairment and immunosuppression compared to general anesthesia (particularly in elderly patients). Peripheral nerve blocks offer an excellent alternative for patients in whom postoperative nausea and vomiting are a problem, who are at risk for development of malignant hyperthermia, or who are hemodynamically compromised or too ill to tolerate general anesthesia. Regional anesthesia accords other advantages over general anesthesia, including early ambulation, the reduction of blood loss of 20–50% in many procedures, attenuation of the hypercoagulable state associated with surgery.

Brachial plexus block is a versatile and reliable regional anaesthetic technique and a suitable alternative to general anaesthesia for upper limb surgery. The supraclavicular approach provides the most complete and reliable anaesthesia as it provides anaesthesia of the entire upper extremity in the most consistent, time efficient manner of many brachial plexus technique. It is performed at the trunk level where plexus is presented most compactly. This anatomic compactness is responsible for rapid onset, complete and reliable anaesthesia. Another advantage is that it can be performed with the patient's arm in any position to provide excellent anaesthesia for elbow, forearm and hand surgery.

Lidocaine (diethylamoinoacetyl-2-6-xylidine) is a tertiary amide derivative of diethylamino-acetic acid. It has become one of the most widely used local anaesthetics across the world. In concentrations of 0.5-2% it produces a rapid onset of intense motor and sensory nerve blockade. Protein binding is relatively low so the duration of action is intermediate, and repeated injection may reveal tachyphylaxis. It is also used intravenously as a class 1b anti-arrhythmic agent.

Bupivacaine [1-butyl-2-(2,6-xylylcarbamoyl)- piperidine] was introduced in 1963. It is the butyl derivative of N-alkyl pipecoloxylidine and is structurally related to mepivacaine and

ropivacaine. It is a potent agent (commercial preparation concentrations 0.1-0.75%) with a slow onset, but despite this, is a popular choice due to its prolonged duration of action. Normalsaline is an isotonic fluid which is most commonly used as a diluent to dilute local anaesthetic agents to increase the volume of the solution. One litre of 0.9% NaCl (Normal saline) contains 154 mEq of both sodium and chloride ions. Each 100 ml contains 0.90 gm of sodium chloride. When used as a diluent it increases the concentration of sodium ions in local anesthetic solutions.

5% dextrose is a hypotonic fluid which contains 50 gram of glucose in 1litre of fluid. Using 5% dextrose as a diluent does not increase the sodium ion concentration of the solution. Present randomized control study was done to evaluate the effect of 5% dextrose as a local anaesthetic diluent and compared it to most commonly used local anaesthetic diluents – Normal saline in brachial plexus block through supraclavicular route posted for upper limb surgeries. The effects were evaluated in terms onset of sensory and motor block, duration of sensory and motor block and duration of analgesia in 60 patients of ASA physical status I/II.

Demographic Data

All patients in our study were demographically similar in both groups. There were no statistically significant intergroup variations regarding age, body weight, and gender distribution.

Surgical Procedure and Duration of Surgery

Majority of patients had surgical procedures like K-wire, platting, nailing implant removal and external fixator in upper limb and comparable in between the groups. Duration of surgery was also similar in both groups and statistically not significant

Onset of Sensory and Motor Block

In our study, the mean time for onset of sensory block in 5% dextrose (5D) group was 10.38 ± 3.14 min whereas in Normal saline (NS) group it was 18.10 ± 4.68 min. The difference was statistically significant (p value- <0.0001) .

Also, the mean time for onset of motor block in 5D group was 16.42 ± 4.23 min whereas in NS group it was 22.36 ± 3.56 min. The difference was statistically significant (p value- <0.0001)
Our results were similar to that of shalini dhir et al who used ropivacaine as an anaesthetic agent and diluted it with 5D and NS and found that onset of sensory and motor block was reduced significantly when 5D was used as a diluent in comparison to NS

Duration of Anaesthesia and Analgesia

The mean duration of sensory block in 5D group was 193.12 ±18.54 min and in NS group it was 185.26 ± 19.89 min. The difference was not found to be statistically significant (p value –

0.1188) The mean duration of motor block in 5D group was 217.32 ±19.35 min and in NS group it was 209.65± 21.48 min. The difference was not found to be statistically significant (p value - 0.1516) The mean duration of analgesia in 5D group was 288.56 ± 20.35 min and in NS group it was 279.47± 21.95 min. The difference was not found to be statistically significant (p value - 0.1016) Our results were similar to that of shalini dhir et al who used ropivacaine as an anaesthetic agent and diluted it with 5D and NS and found that duration of sensory , motor block and duration of analgesia was increased when 5D was used as a diluent in comparision to NS, however the result observed was not significant statistically[8]

Intra Operative Pulse Rate and Blood Pressure

In present study, the intra operative pulse rate and systolic blood pressure remained stable without any significant fluctuation in both groups. VAS (Visual Analogue Scale) SCORE Rescue analgesic was given when patient develop VAS score ≥ 4. In majority of patients, it was achieved at around 8 hr in both the groups. Results were clinically comparable and difference between two group was statistically not significant (p>0.05).

COMPLICATIONS

No significant intra-operative and post-operative complications like pneumothorax, intra-arterial or intravascular placement of drug, nausea, vomiting, neurotoxicity or cardiotoxicity were found in either group.

REFRENCES

[1] Bruce BG, Green A, Blaine TA, Wesner LV. J Am Acad Orthop Surg 2012;20(1):38-47
[2] Brown DL, Cahill DR, Bridenbaugh LD. Analg 1993;76;530-4
[3] Kanai A, Hoka S. Anesth Analg 2006;102:1851-5
[4] Sakura S, Chan VWS, Ciriales R, Drasner K. Anesthesiol 1995;82:236-40
[5] Hashimoto K, SakuraS, Bollen AW, Ciriales R, Drasner K. Reg Anesth Pain Med 1998;23;444-50
[6] Whiteside JB, Burke D, Wildsmith JAW. Br J Anesth 2003;90:304-8
[7] Tsui BCH, Kropelin B, GanapathyS, Finucane B. Acta Anaesthesiol Scand 2005;49:1562-5
[8] Shalini Dhir, Luminita Tureanu, Amir bouzari, Amna Masood, Mario Francispragasam, Sugantha Ganapathy. Anesth Analg 2012;114:1359
[9] Cuvillon P, Nouvellon E, Ripart J, Boyer JC, Dehour L,Mahamat A et al. Anesth Analg 2009; 108: 641–9.
[10] Chin KJ, Niazi A, Chan V. Anesth Analg 2008; 107: 729-31
[11] Pedro JR, Mathias LA, Gozzani JL, Pedro FS, Rittes JC. Rev Bras Anestesiol 2009; 59: 665–73.