ORIGINAL RESEARCH PAPER

Volume-7 | Issue-4 | April-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A COMPARATIVE STUDY OF DEXMEDETOMIDINE AND VERAPAMIL AS ADJUNCT TO LOCAL ANAESTHETIC SOLUTION ON THE ONSET, QUALITY AND DURATION OF BRACHIAL PLEXUS BLOCK

Anaesthesiology

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ABSTRACT

Background: Alpha 2 agonists , Calcium channel blockers and many other adjuvants potentiate the effects of local anaesthetics. We compared the effect of dexmedetomidine and verapamil as adjuvant to local anaesthetic solution on the onset, quality and duration of brachial plexus block in patients undergoing routine upper extremity surgery.

Aims: The study is aimed to perform and demonstrate the comparative effect of dexmedetomidine and verapamil as adjuvant added to 0.5% bupivacaine for supraclavicular brachial plexus block.

Methods and Material: The study was a prospective, randomized, controlled, double blinded study. 120 patients undergoing elective upper limb surgery were divided into three groups of 40 each. Group B received 30 ml of 0.5% bupivacaine, Group D received 30 ml of 0.5% bupivacaine with 100 µg dexmedetomidine added to it and Group V received 30 ml of 0.5% bupivacaine with 2.5 mg verapamil added to it.

Statistical analysis used: Microsoft Excel 2007 and statistical software plug-ins, Chi-square test and student t-test (Unpaired and One way ANOVA).Data are being represented as mean ± SD. A 'p' value of <0.05 was considered significant.

Results: Onset of sensory blockade time was fastest in Group D(11.3 ± 1.38 minutes),marginally faster in Group V(18.1 ± 1.24 minutes) as compared to Group B(18.55 ± 1.78 minutes)($p<0.05$).Onset of motor blockade time was fastest in Group D(14.2 ± 1.24 minutes),marginally faster in Group V(20.55 ± 1.54 minutes) as compared to Group B(21.05 ± 2.09 minutes)($p<0.05$).Quality of sensory blockade was better in Group D(max VAS score 1.52 ± 0.67) as compared to Group V(max VAS score 1.9 ± 0.8) and Group B(max VAS score 2.05 ± 0.77)($p<0.05$).Duration of motor blockade was longer in Group D(9.61 ± 1.51 hrs) as compared to Group V(5.58 ± 0.87 hrs) and Group B(5.42 ± 0.86 hrs)($p<0.05$).Duration of analgesia was much prolonged in Group D(14.42 ± 2.49 hrs.) as compared to Group V(8.61 ± 1.96 hrs.) and Group B(8.27 ± 1.82 hrs.)($p<0.05$).

Conclusions: Addition of dexmedetomidine to bupivacaine in supraclavicular brachial plexus block produces early onset, better quality of block, and prolonged pain free post – operative period without increasing the side effects or complications, while addition of verapamil to bupivacaine does not produce any significant difference in block characteristics.

KEYWORDS

Verapamil; Dexmedetomidine; Brachial plexus block

Introduction

Development of brachial plexus block was a significant landmark in the history of anaesthesia. Prior to it, general anaesthesia was to be administered for upper limb surgeries, compelling need for stringent post-operative monitoring and care, increased cost of medical services and associated greater morbidity and mortality. Peripheral nerve block is a commonly used technique for anaesthesia for different surgical procedures. Its role has expanded from operating suite into post-operative arena and chronic pain management. The recent emergence of pain management as a formal sub speciality, the advantage of regional over general anaesthesia in case of emergency surgeries and increasing importance of out-patient (ambulatory) surgery in anaesthetic practices have further bolstered interest in peripheral nerve blocks.

Techniques of peripheral nerve blockade were developed early in the history of anaesthesia. First brachial plexus block was performed by William Stewart Halsted in 1884, after Koller demonstrated the anaesthetic efficacy of cocaine. He exposed the roots surgically under direct vision. In 1911, G.Hirschel described the first percutaneous brachial plexus using axillary approach. D.Kulankampff first described classical supra-clavicular approach to brachial plexus in the same year(1911) by injecting procaine in his own brachial plexus at the mid clavicular point lateral to subclavian artery. In 1919, Mully developed the interscalene approach to brachial plexus in order to avoid pneumothorax.

With routine use of brachial plexus block it was soon realized that fast onset of sensory and motor block, adequate analgesia during entire operative period and post-operative analgesia is a challenge due to upper dose limit of local anaesthetics that can be injected along with variable onset, duration and perception. Bupivacaine is a long acting local anaesthetic used widely in modern anaesthetic practice however slow onset of block and duration of analgesia are limiting factors. In an attempt to overcome all these obstacles, get good and adequate analgesia it was observed that adjuvants can be added to local anaesthetics having pharmacodynamic and pharmacokinetic interactions with local anaesthetics, increasing their efficacy thereby increasing quality and duration of block without increasing dosage of local anaesthetics above safe limits.

A variety of adjuvants like morphine, pethidine, epinephrine, bicarbonate, clonidine, butorphanol, neostigmine, tramadol, have been used concomitantly with local anaesthetics for this purpose.

Clonidine has been routinely used as adjuvant to local anaesthetics administered via several routes viz. spinal anaesthesia, epidural anaesthesia, peripheral nerve block. Also, calcium ions have an important role in analgesia mediated by local anaesthetics. Local anaesthetics reduce calcium permeability and various studies have shown that verapamil can potentiate the analgesic effects of local anaesthetics.

The aim of this study is to compare the block characteristics derived from addition of verapamil and dexmedetomidine into local anaesthetics injected into brachial plexus sheath.

The objectives of this study were:

- To study the effect of 0.5% bupivacaine with normal saline as a local anesthetic in supraclavicular brachial plexus block.

- To study the effect of dexmedetomidine added to 0.5% bupivacaine, as an adjuvant in supraclavicular brachial plexus block.
- To study the effect of verapamil added to 0.5% bupivacaine, as an adjuvant in supraclavicular brachial plexus block.
- To compare the effects of 0.5% bupivacaine with normal saline, 0.5% bupivacaine with dexmedetomidine and 0.5% bupivacaine with verapamil in supraclavicular brachial plexus block.

Subjects and Methods

One hundred twenty patients of American Society of Anaesthesiologists (ASA) class I and II undergoing routine upper limb surgery at this hospital were included in the study. Exclusion criteria were age below 14 years, patient's refusal, patient having cardio-respiratory illness, patient having metabolic disorders, nervous system disorders, history of hypersensitivity reactions to any of the study medications, patient having bleeding diathesis and coagulopathy, patient receiving anticoagulant or calcium channel blockers, sepsis, valvular heart disease/pregnant patient, history of peripheral neuropathies.

Ethical clearance was obtained from hospital ethical committee. The anaesthetic procedure was explained to the patients and consent obtained. All patients received tablet alprazolam 0.5mg on the night before surgery.

The patients were randomly divided into three groups of 40 patients each. All patients were administered brachial plexus block by supra-clavicular approach using peripheral nerve stimulator. Local anaesthetic was injected only after eliciting motor response when current was reduced to 0.5 mA. Group B patients received 30 ml of 0.5% bupivacaine with 1 ml of normal saline. Group V patients received 30 ml of 0.5% bupivacaine with 1ml (2.5 mg) verapamil added. Group D patients received 30 ml of 0.5% bupivacaine with 1 ml (100µg) Dexmedetomidine added. The solution to be injected was prepared by an independent anaesthesiologist. The block was administered and observations made by anaesthesiologist blinded to the solution.

The following parameters were observed:

Onset of sensory block (time between injection and total abolition of pin prick response),

Onset of motor block (time from injection to loss of movement was noted),

Duration of motor block (return of complete muscle power),

Duration of analgesia (time between onset of action and onset of pain),
Quality of sensory block (Max. VAS score),

Max. Sedation score (Ramsay sedation scale).
Observations were made every 30 minutes and rescue analgesia was given with Inj. Tramadol 50 mg when visual analogue scale (VAS) score was more than 4. All observations were made in 4 major nerve distribution areas (Radial, Median, Ulnar and Musculo-cutaeneous).

Results

The age, sex and weight distribution is given in Table 1. Results were analysed statistically using student's t-test, chi square test. Onset of sensory and motor block in the three groups is given in Table 2 & 3 respectively. There is no statistically significant difference in the onset in group B in comparison to group V ($p>0.05$).Onset of both sensory & motor block was faster in group D in comparison to group B and this difference was statistically significant ($p<0.05$).Onset of sensory & motor block was faster in group D in comparison to group V and this difference was statistically significant ($p<0.05$).

Duration of motor block in the three groups is given in Table 4.There is no statistically significant difference in the duration of motor block in group B in comparison to group V ($p>0.05$).Duration of motor block was longer in group D in comparison to group B and this difference was statistically significant ($p<0.05$).Duration of motor block was longer in group D in comparison to group V and this difference was statistically significant ($p<0.05$).
Duration of analgesia in the three groups is given in Table 5. There is no statistically significant difference in the duration of analgesia in group B in comparison to group V ($p>0.05$).Duration of analgesia was longer in group D in comparison to group B and this difference was statistically significant ($p<0.05$).Duration of analgesia was longer in group D in comparison to group V and this difference was statistically significant ($p<0.05$).Quality of block in the three groups is given in Table 6. There is no statistically significant difference in the quality of block in group B in comparison to group V ($p>0.05$).Quality of block was better in group D in comparison to group B and this difference was statistically significant ($p<0.05$).Quality of block was better in group D in comparison to group V and this difference was statistically significant ($p<0.05$).

Discussion

Brachial plexus block is frequently used procedure for upper limb surgeries due to the ease of administration, few side effects and complications along with excellent operating conditions and freedom to take up case as day care surgery. However time taken for onset of analgesia and duration of anaesthesia are limiting factor along with quality of block.

Pain is a highly subjective phenomenon and a variety of receptors mediate pain perception. To extend analgesia beyond operation theatre along with minimal requirements of systemic analgesics in form of opioids and NSAIDs has always been a fascinating and challenging arena for health care providers since it directly adds to cost of medical care by virtue of longer stay in hospital and risk of side effects and complications of systemic medications.

Different modalities like indwelling catheters, adjuncts in form of sodium bi–carbonate, neostigmine, epinephrine, opioids have been tried to extend period of post-operative analgesia. The aim of this study was to systematically review evidence of benefit of addition of verapamil or dexmedetomidine to bupivacaine for supraclavicular brachial plexus block for upper limb surgeries in terms of improved onset and quality of block as well as prolonged duration of analgesia.
Esmaoglu et al1 concluded that addition of 100 µg Dexmedetomidine to 0.5 % levobupivacaine in axillary brachial plexus block produced faster onset of sensory and motor block, prolonged duration of motor block and analgesia without increased incidence of side effects.

A S Ammar, Khaled M Mahmoud et al2 concluded that addition of 0.75 µg / kg dexmedetomidine to 0.33 % bupivacaine in infraclavicular brachial plexus block produced significantly shorter onset of sensory and motor block, longer duration of sensory / motor block, and analgesia.

Dexmedetomidine3 is a highly selective, specific, and potent alpha2 – adrenergic agonist (α2:α1 activity is 1620:1). Alpha2 adrenergic agonists when administered via intrathecal, epidural route or in peripheral nerve block, improve the quality and duration of block. More recently, dexmedetomidine has been investigated as an adjunct to local anaesthetics in loco-regional anaesthesia and analgesia. Dexmedetomidine alone did not produce significant sensory blockade nor sustained motor blockade. There have been four proposed mechanisms for the action of clonidine in peripheral nerve blocks. These mechanisms include centrally mediated analgesia, α2B adrenoceptor mediated vasoconstrictive effects, attenuation of the inflammatory response, and direct action on the peripheral nerve.

K.Kaygusuz et al4 concluded that when 1 µg / kg of Dexmedetomidine was added to 0.5 % levobupivacaine, onset time to sensory block was significantly shorter, duration of motor block and time to first analgesic use was longer.

Reuben SS et al5 demonstrated that calcium channel blockers potentiate the analgesic properties of both local anaesthetics and opioids. They concluded that the addition of verapamil (2.5 mg) to brachial plexus block with 1.5% lidocaine can prolong the duration of sensory anaesthesia, but it had no effect on analgesic duration of 24 h analgesic use.

Mosafa F. et al6 evaluated the analgesic effects of two doses(2.5 mg vs 5 mg) of verapamil added to 0.5 % bupivacaine compared with bupivacaine alone in interscalene block. They concluded that verapamil could be an effective adjuvant for bupivacaine in interscalene block compared with bupivacaine administered alone, as far as the decrease in onset time of analgesia and anaesthesia is concerned.

RK Lalla, S Anant et al7 evaluated that calcium channel blockers potentiate the effects of local anaesthetics. They concluded that addition of 2.5 mg of verapamil to 1% lignocaine with 0.25% bupivacaine produced marginally faster onset of sensory block but it was not significant statistically.

Verapamil, a L-type calcium channel blocker, is a synthetic derivative of papaverine. Chemically it belongs to phenylalkylamine group of drugs. Verapamil is supplied as a racemic mixture. The dextroisomer is devoid of activity at slow calcium channels and instead acts on fast sodium channels, accounting for local anaesthetic effects of verapamil (1.6 times as potent as procaine)[8].

Conclusion

Addition of verapamil to local anaesthetic solution for brachial plexus block can modify the action of the local anaesthetic. In our study addition of verapamil (2.5 mg) to 0.5 % bupivacaine marginally shortened the onset of sensory block, marginally prolonged the duration of analgesia but it was not significant statistically. But when Dexmedetomidine (100 µg) was added to 0.5 % bupivacaine in supraclavicular brachial plexus block it produced significantly faster onset of sensory block / motor block, significantly longer duration of motor block / analgesia, better quality of block without increasing the side effects or complications.

References

1. Esmaoglu A, Yegenoglu F, Akin A, Turk CY. Dexmedetomidine prolongs the effect of levobupivacaine for axillary brachial plexus blockade. Anaesth. Analg. 2010;111 (6):1548-51
2. A.S.Ammar, Khaled M.Mahmoud. Ultrasound guided single injection infraclavicular brachial plexus block using bupivacaine alone or combined with dexmedetomidine for pain control in upper limb surgery : A prospective randomized control trial. Saudi J Anaesthesiol.2012 April-Jun;6(2):109–114
3. Robert K. Stoelting. Pharmacology & Physiology in Anaesthetic Practice. 4th edition. Lippincott Williams & Wilkins, Philadelphia; 344 - 345
4. Kenan Kaygusuz, Iclal Ozdemir Kol, Cevdet Duger, Sinan Gursoy, Hayati Ozturk, Ulku Kayacan et al. Effects of adding dexmedetomidine to levobupivacaine in axillary brachial plexus block. Current Therapeutic Research. 2012 June;73(3):103–111
5. Reuben S.S, Reuben J.P.Brachial Plexus Anesthesia with verapamil and or morphine. Anesth – analg 2000; 91(2): 279 – 283
6. Mosafa F., Salimi A.R.,Rasti A. Evaluation of the analgesic effects of two doses of verapamil added to bupivacaine compared with bupivacaine alone in interscalene block.Iranian Journal of Anaesthesiology and Intensive Care. 2006; 27(51):22-28.
7. Gp Capt R K Lalla, Gp Capt S Anant, Air Cmde H S Nanda. Verapamil as an adjuvant to local anaesthetic for brachial plexus block. Medical J Armed Force India.2010 Jan;66(1):22–24
8. Robert K. Stoelting. Pharmacology & Physiology in Anaesthetic Practice. 4th edition. Lippincott Williams & Wilkins, Philadelphia; 344 - 345