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Effect of Fentanyl and Tramadol as an adjuvant to Ropivacaine in Supraclavicular Brachial Plexus Block: Prospective Study

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Abstract

Background: Axillary brachial plexus block is widely used technique for perioperative anesthesia and analgesia for elbow, forearm, and hand surgery and also provides reliable cutaneous anesthesia of the inner upper arm including the medial cutaneous nerve of arm and intercostobrachial nerve, areas often missed with other approaches. Peripheral administration of an opioid agonist can theoretically inhibit the propagation of action potentials or the release of excitatory transmitters in primary afferent fibres, but contrasting results have been reported in the clinical setting.

Objectives: To compare the time of onset of supraclavicular block between the two groups, to compare duration and quality of analgesia between the two groups, Time to achieve complete block between the two groups, Frequency of rescue analgesia doses required in the two groups and to assess any side effects.

Material and Methods: One Hundred patients of either sex aged 20-60 years, belonging to ASA physical status I or II undergoing upper-arm surgery were recruited for this study. The patients were randomly allocated into 2 groups of 50 patients each. Group RT: Patients were given 0.5% Ropivacaine 30ml + tramadol 50mg [1ml]. Group RF: Patients were given 0.5% Ropivacaine 30ml + fentanyl 50mcg [1ml]. Post-operatively an observer unaware of patient groups assessed the following variables. (i) Pain score (VAS) every 3 hourly till 24 hours, (ii) Duration of analgesia, defined as time elapsed from performance of block to appearance of pain in operated limb. (iii) Requirement of rescue analgesia doses in first 24 hours.

Results: Mean onset of motor block in Group RT was 11.6 minutes while as it was 15.1 minutes in Group RF and difference was significant statistically. ($p \leq 0.05$) Mean onset of sensory block in Group RT was 11.2 minutes while as it was 11.8 minutes in Group RF and difference was

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significant statistically. ($p \leq 0.05$). Mean postoperative VAS score of Group RT and Group RF was significant at various intervals.

Conclusion: The ropivacaine – tramadol group showed significant prolonged sensory and motor block and better pain relief.

Key Words: Axillary brachial plexus block, Fentanyl, Ropivacaine, Tramadol

Introduction

Brachial plexus block has evolved as an important tool in anesthesiologist's armamentarium as a safe alternative to general anesthesia for upper limb because of its increased effectiveness, the margin of safety, reduced total cost, reduced hospital stay, avoidance of undesirable side effects of general anesthesia, and good postoperative analgesia. Supraclavicular brachial plexus block is a popular and widely used technique for perioperative anesthesia and analgesia for surgery of the upper extremity except shoulder surgery.[1] A variety of local anesthetics (LAs) have been studied for brachial plexus blockade. Levobupivacaine is S-enantiomer of bupivacaine belonging to an amino-amide group, having favorable clinical profile and margin of safety with respect to both cardiovascular system (CVS) and central nervous system effects compared with racemic bupivacaine.[2] Brachial plexus block have evolved as a safe alternative to general anesthesia (GA) for upper limb procedures.[3] Axillary brachial plexus block is widely used technique for perioperative anesthesia and analgesia for elbow, forearm, and hand surgery and also provides reliable cutaneous anesthesia of the inner upper arm including the medial cutaneous nerve of arm and intercostobrachial nerve, areas often missed with other approaches.[4]

Brachial plexus block is used in our clinical practice as an alternative to general anaesthesia for upper limb surgeries. The axillary approach first demonstrated by William Halsted in 1884, later became popular among anaesthetists in 1959 after the publication by Burnham.[5] Opioid drugs exert their analgesic activity directly in the central nervous system;[6] however, peripheral co-administration of narcotic drugs and local anaesthetic solutions has been reported to improve the onset time, quality, and duration of peripheral nerve.[7–8] Stein and colleagues[9,10] suggested that peripheral antinociceptive effects of exogenous opioids can be particularly enhanced under inflammatory conditions by the peripheral expression of opioid receptors, which has been actually demonstrated on primary afferent neurons. [11,12]

Peripheral administration of an opioid agonist can theoretically inhibit the propagation of action potentials or the release of excitatory transmitters in primary afferent fibres,[13,14] since opioid receptors have been demonstrated on primary afferent neurons.[11,12] This peripheral antinociceptive effect of exogenous opioids should be particularly enhanced under inflammatory conditions. [11,12]

Objectives

To compare the time of onset of supraclavicular block between the two groups, to compare duration and quality of analgesia between the two groups, Time to achieve complete block between the two groups, Frequency of rescue analgesia doses required in the two groups and to assess any side effects.

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Material and Methods

This prospective, randomized double-blind study was conducted in the Department of Anesthesiology, tertiary care institute of India for the duration of one and half years. After obtaining approval from the ethical committee of the Institute, an informed written consent was obtained from all the patients undergoing the study. One Hundred patients of either sex aged 20-60 years, belonging to ASA physical status I or II undergoing upper-arm surgery were recruited for this study. Pre-operative visit were performed one day prior to surgery. All the patients were clinically assessed, evaluated and investigated as per proforma. All patients were kept NPO for 8 hrs. On arrival to the operation theatre, i/v line was established with 20 Gauge cannula. All patients received Midazolam 1 mg iv as premedication before performance of block. Standard anaesthesia monitoring was done (ECG, blood pressure, pulse oximetry). Drug solution was prepared by an anaesthetist not involved in the performance of the block. The patients were randomly allocated into 2 groups of 50 patients each. Group RT: Patients were given 0.5% Ropivacaine 30ml + tramadol 50mg [1ml]. Group RF: Patients were given 0.5% Ropivacaine 30ml + fentanyl 50mcg [1ml]. Under all aseptic precautions supraclavicular was performed by 100mm locoplex needle under USG guidance. Intraoperatively onset of block was assessed by the time between drug injection and complete loss of pin-prick sensation in C4-C5 dermatome. Sensory block was quantified as per visual analogue scale (VAS) every 5 minutes for 30 minutes after injection intraoperatively. Onset of Motor block was defined as reduction of muscle power to grade 3 or less. Sedation score was evaluated every 5 minutes after injection till 30 minutes intraoperatively as per standard sedation scale. Post-operatively an observer unaware of patient groups assessed the following variables. (i) Pain score (VAS) every 3 hourly till 24 hours, (ii) Duration of analgesia, defined as time elapsed from performance of block to appearance of pain in operated limb. (iii) Requirement of rescue analgesia doses in first 24 hours. Rescue analgesia will be given by injection paracetamol 15mg/kg when VAS is >4m, and, (iv) Incidence of nausea, vomiting, pruritus or any other complication.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

There were a total of 50 patients each in group RT and group RF with mean age in Group RT 40.2 years where as mean age in Group RF patients was 41.2 years. (Table 1) There were 30 (60%) and 26 (52%) male patients in Group RT and Group RF while as females constituted 20 (40%) and 24 (48%) patients. (Table 2) Mean onset of motor block in Group RT was 11.6 minutes while as it was 15.1 minutes in Group RF and difference was significant statistically. ($p \leq 0.05$) Mean onset of sensory block in Group RT was 11.2 minutes while as it was 11.8 minutes in Group RF and difference was significant statistically. ($p \leq 0.05$). Mean interoperative VAS score of Group RT and Group RF at 5 minute was 5.24 and 6.30, at 10 minutes it was 2.54

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and 4.11 in both the study groups. Mean VAS score at 15 minutes was 0.86 and 1.94 in Group RT and RF, at 20 minutes mean VAS score of Group RT was 0.35 and that of Group RF was 0.84. Mean interoperative sedation score of Group RT and Group RF at 5 minute was 2.93 and 3.15, at 10 minutes it was 1.94 and 2.12 in both the study groups. Mean sedation score at 15 minutes was 1.08 and 1.22 in Group RT and RF, at 20 minutes mean sedation score of Group RT was 1.07 and that of Group RF was 1.16. Mean sedation score at 25 minutes in Group RF and RF was 1.01 and 1.06, while as it was 1.02 and 1.05 at 30 minutes in both the study groups. Mean time (min) to achieve complete block in Group RT was 20.1 and in Group RF it was 25.9 minutes. Mean time (hours) of sensory block in Group RT was 13.2 and in Group RF it was 7.3 hours. Mean duration (hours) of motor block in Group RT was 12.8 and in Group RF it was 7.1 hours. Mean postoperative VAS score of Group RT and Group RF at 3 hours was 0.40 and 1.35, at 6 hours it was 0.53 and 2.72 in both the study groups. Mean VAS score at 9 hours was 1.36 and 3.92 in Group RT and RF, at 12 hours mean VAS score of Group RT was 2.55 and that of Group RF was 2.40. Mean postoperative VAS score at 15 hours was 3.40 and 2.94 in Group RT and RF, at 18 hours mean VAS score was 1.22 in RT group and 2.84 in RF group. At 21 hours mean postoperative VAS score was 1.90 and 2.65 in both the study groups, while as at 24 hours mean VAS score was 2.08 in Group RT and 2.84 in Group RF. Mean duration of analgesia in hours in Group RT was 13.9 and in Group RF it was 8.1. Rescue analgesia of two doses was needed in 24 patients in Group RT, while as 3 doses were needed in 34 patients in Group RF. When postoperative complications were compared in two study groups it was observed that nausea was seen in 7 (14%) patients in Group RT and 3 (6%) patients in RF. Vomiting was seen in 4 (8%) patients in Group RT and 2 (4%) patients in Group RF, respectively.

Table 1: Age wise distribution of study participants

Age Group	Mean	Standard deviation
Group RT	40.2	2.56
Group RF	41.2	1.98

Table 2: Gender wise Distribution of study participants

Gender	Group RT N (%)	Group RF N (%)
Male	30 (60)	26 (52)
female	20 (40)	24 (48)

Discussion

Brachial plexus block is the preferred choice for upper limb surgeries, and it is the most commonly used technique for this purpose.[1] Providing adequate and timely sensory and motor block, safety of use and augmentation the postoperative analgesic efficacy of the drug should be considered while selecting a pharmacological option during regional anesthesia.[15] It also lessens postoperative spasm, pain, and edema due to sympathetic blockade of blood vessels. It reduces

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surgical stress response and gives better postoperative analgesia and earlier discharge of patients.[16]

There were a total of 50 patients each in group RT and group RF with mean age in Group RT 40.2 years where as mean age in Group RF patients was 41.2 years. Geze S et al. (2012)[17] compared the effect of tramadol and fentanyl as adjuvant agents to local anesthetic mixtures in axillary plexus block for orthopedic upper extremity surgery. The mean age in Group T (tramadol) was 42.1 while as mean age in patients of group F (fentanyl) was 38.0 years. Rajkhowa T et al (2016)[18] studied 66 ASA I and II patients aged 18-65 years and found mean age of patients of group R (Ropivacaine) and group RF (Ropivacaine + Fentanyl) was 44.0 years respectively. There were 30 (60%) and 26 (52%) male patients in Group RT and Group RF while as females constituted 20 (40%) and 24 (48%) patients. Naaz S et al (2017)[17] studied 60 otherwise healthy patients with physical status ASA I and II were randomly allocated to 3 groups of 20 each to receive either plain bupivacaine 30ml, alkalinized bupivacaine 30ml (sodium bicarbonate 8.4%, 0.1ml/10 ml of bupivacaine) and fentanyl-bupivacaine (75µg fentanyl) 30ml.

In group I, there were 16 males and 4 females, in group II there were 15 males and 5 females, whereas in group III there were 14 males and 6 females respectively.

Mean onset of motor block in Group RT was 11.6 minutes while as it was 15.1 minutes in Group RF and difference was significant statistically. ($p \leq 0.05$) Mean onset of sensory block in Group RT was 11.2 minutes while as it was 11.8 minutes in Group RF and difference was significant statistically. ($p \leq 0.05$). Rajkhowa T et al (2016)[18] studied 66 ASA I and II patients aged 18-65 in their study. Khosa AH et al (2015)[20] evaluated the efficacy of tramadol when combined with bupivacaine in axillary brachial plexus block for upper limb surgery. Another study done similarly agreed that tramadol can prolong the analgesic duration of axillary brachial plexus block when added to ropivacaine with mean duration of 24.90 ± 0.33hr ($p < 0.05$). This finding was also supported by other studies.[21] The findings of this study is similar with study conducted in USA comparing addition 2.5 mcgm/ml fentanyl to 40 ml of 0.25% of bupivacaine for axillary block that resulted in significantly longer time to first analgesia request.[22]

Mean interoperative VAS score of Group RT and Group RF at 5 minute was 5.24 and 6.30, at 10 minutes it was 2.54 and 4.11 in both the study groups. Mean VAS score at 15 minutes was 0.86 and 1.94 in Group RT and RF, at 20 minutes mean VAS score of Group RT was 0.35 and that of Group RF was 0.84. Our observations are in congruence with those of Parikh RK et al (1995)[23] They observed that addition of fentanyl 0.2µg/ml to the solution increased the degree of analgesia. This has been attributed to the antinociceptive effects of fentanyl due to activation of opiate (µ) receptors present peripherally on primary afferent nerves. Secondly, fentanyl may also provide analgesia through central opioid receptormediated analgesia by peripheral uptake of fentanyl to systemic circulation. Barsagade W et al (2016)[24] compared the clinical characteristics of ropivacaine 0.5% and bupivacaine 0.5% with fentanyl when used for interscalene brachial plexus block.

Mean VAS score at 9 hours was 1.36 and 3.92 in Group RT and RF, at 12 hours mean VAS score of Group RT was 2.55 and that of Group RF was 2.40. Mean postoperative VAS score at

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15 hours was 3.40 and 2.94 in Group RT and RF, at 18 hours mean VAS score was 1.22 in RT group and 2.84 in RF group. At 21 hours mean postoperative VAS score was 1.90 and 2.65 in both the study groups, while as at 24 hours mean VAS score was 2.08 in Group RT and 2.84 in Group RF. In a study conducted by Naaz S et al (2017)[19] on comparing the Visual Analogue Scale (VAS) score between the three groups at various intervals i.e. 30 minutes, 1 hr, 2 hr, 4 hr, 6 hr, a statistically significant difference was found ($p<0.001$) These observations are in congruence with those of Parikh R K et al. (1995).[23] They observed that addition of fentanyl 0.2µg/ml to the solution increased the degree of analgesia. This has been attributed to the antinociceptive effects of fentanyl due to activation of opiate (µ) receptors present peripherally on primary afferent nerves. Secondly, fentanyl may also provide analgesia through central opioid receptor-mediated analgesia by peripheral uptake of fentanyl to systemic circulation. When postoperative complications were compared in two study groups it was observed that nausea was seen in 7 (14%) patients in Group RT and 3 (6%) patients in RF. Vomiting was seen in 4 (8%) patients in Group RT and 2 (4%) patients in Group RF, respectively. Rajkhowa T et al (2016)[18] conducted a study in which no complication was found same findings were also observed by Geze S et al (2012)[17] in their study.

Conclusion

Skillful administration of brachial plexus block is essential for effective surgical anaesthesia and analgesia. It not only eliminates stress response to surgery but also helps in smooth transition of patient from surgery to routine preoperative state. The ropivacaine – tramadol group showed significant prolonged sensory and motor block and better pain relief. While the first request analgesia time measured was prolonged in ropivacaine – tramadol group, we did not measure the total amount of supplemental analgesics taken post-operatively

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