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Original Research Article

To study the effect of fentanyl and tramadol as an adjuvant to ropivacaine in supraclavicular brachial plexus block

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ABSTRACT

Background: Brachial plexus block is used in our clinical practice as an alternative to general anaesthesia for upper limb surgeries. 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. To assess any side effects.

Methods: Seventy 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 35 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].

Results: Mean onset of motor block in Group RT was 11.3 minutes while as it was 15.4 minutes in Group RF. Mean onset of sensory block in Group RT was 10.6 minutes while as it was 11.1 minutes in Group RF. Mean interoperative VAS score of Group RT and Group RF at 5 minute was 5.09 and 6.14, at 10 minutes it was 2.49 and 4.06 in both the study groups. Mean duration of analgesia in hours in Group RT was 14.7 and in Group RF it was 8.6. Rescue analgesia of two doses was needed in 19 patients in Group RT, while as 3 doses were needed in 24 (68%) patients in Group RF. When postoperative complications were compared in two study groups it was observed that nausea was seen in 5 (14.3%) patients in Group RT and 2 (5.7%) patients in RF. Vomiting was seen in 3 (8.6%) patients in Group RT and 1 (2.9%) patients in Group RF, respectively.

Conclusion: In conclusion, tramadol when used as adjuvant with local anaesthetic in peripheral nerve block provides better surgical anaesthesia and analgesia. Therefore, its use should be promoted for routine addition to local anaesthetics in peripheral nerve blocks.

1. Introduction

Brachial plexus block is a regional anesthesia technique that is sometimes employed as an alternative or as an adjunct to general anesthesia for surgery of the upper extremity. This technique involves the injection of local anesthetic agents in close proximity to the brachial plexus, temporarily blocking the sensation and ability to move the upper extremity.[1] Brachial plexus block is used in our clinical practice as an alternative to general anaesthesia

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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.[2] Opioid drugs exert their analgesic activity directly in the central nervous system;[3] 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.[4–6] Stein and colleagues[7,8] 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.[9,10] Peripheral administration of an opioid agonist can theoretically inhibit the propagation of action potentials or the release of excitatory transmitters in primary afferent fibres,[7,11] but contrasting results have been reported in the clinical setting.[12,13]

Ropivacaine is widely used in clinical practice, but little is known about the effects on its nerve block characteristics by adding a small dose of fentanyl for brachial plexus anaesthesia. Peripheral administration of an opioid agonist can theoretically inhibit the propagation of action potentials or the release of excitatory transmitters in primary afferent fibres,[11,14] since opioid receptors have been demonstrated on primary afferent neurons.[9,10] This peripheral antinociceptive effect of exogenous opioids should be particularly enhanced under inflammatory conditions.[9,10]

2. Objectives

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

3. Materials and Methods

This prospective, randomized double-blind study was conducted in the Department of Anaesthesiology and Critical care Sher-i-Kashmir Institute of Medical Sciences, Soura, Srinagar, Kashmir during 2017-2019. After obtaining approval from the ethical committee of the Institute, an informed written consent was obtained from all the patients undergoing the study. 70 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 35 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 (UAAP) 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 C_4-C_5 dermatome. Sensory block was quantified as per visual analogue scale (VAS) every 5 minutes for 30 minutes after injection intraoperatively. Visual analogue scale (VAS) (0= No pain, 1-3= Mild pain, 4-6= Moderate pain, 7-10= Severe pain. Onset of Motor block was defined as reduction of muscle power to grade 3 or less. When surgical anaesthesia will not be achieved in a patient even after 30 min from the anaesthetic injection, the case was considered as failed block and the operation was then performed under general anaesthesia. Sedation score was evaluated every 5 minutes after injection till 30 minutes intraoperatively as per standard sedation scale (awake, alert=score 1, Sedated and responds to verbal stimulus = Score 2, Sedated and responding to mild physical stimulus= Score 3, Sedated and responding to moderate and strong physical stimulus= Score 4, Not aroused= Score 5.

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.

3.1. Statistical analysis

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Continuous variables were expressed as Mean±SD and categorical variables were summarized as frequencies and percentages. Student's independent t-test was employed for comparing continuous variables. Chi-square test or Fisher's exact test, whichever appropriate, was applied for comparing categorical variables. A P-value of less than 0.05 was considered statistically significant. All P-values were two tailed.

4. Results

There were a total of 35 patients each in group RT and group RF with mean age in Group RT 39.1 years where as mean age in Group RF patients was 41.5 years. There were 21 (60%) and 18 (51.4%) male patients in Group RT and Group RF while as females constituted 14 (40%) and 17 (48.6%) patients. Mean onset of motor block in Group RT was 11.3 minutes while as it was 15.4 minutes in Group RF with a p value of < 0.001. Mean onset of sensory block in Group RT was 10.6 minutes while as it was 11.1 minutes in Group RF with a p value of 0.155. Mean interoperative VAS score of Group RT and Group RF at 5 minute was 5.09 and 6.14, at 10 minutes it was 2.49 and 4.06 in both the study groups. Mean VAS score at 15 minutes was 0.83 and 1.91 in Group RT and RF, at 20 minutes mean VAS score of Group RT was 0.31 and that of Group RF was 0.87. Mean interoperative sedation score of Group RT and Group RF at 5 minute was 2.97 and 3.11, at 10 minutes it was 1.97 and 2.11 in both the study groups. Mean sedation score at 15 minutes was 1.06 and 1.20 in Group RT and RF, at 20 minutes mean sedation score of Group RT was 1.09 and that of Group RF was 1.14. Mean sedation score at 25 minutes in Group RF and RF was 1.03 and 1.09, while as it was 1.03 and 1.06 at 30 minutes in both the study groups. Mean time (min) to achieve complete block in Group RT was 20.6 and in Group RF it was 26.1 minutes. Mean time (hours) of sensory block in Group RT was 13.7 and in Group RF it was 7.8 hours. Mean duration (hours) of motor block in Group RT was 13.1 and in Group RF it was 7.2 hours.

Mean postoperative VAS score of Group RT and Group RF at 3 hours was 0.43 and 1.31, at 6 hours it was 0.57 and 2.77 in both the study groups. Mean VAS score at 9 hours was 1.40 and 3.97 in Group RT and RF, at 12 hours mean VAS score of Group RT was 2.60 and that of Group RF was 2.46. Mean postoperative VAS score at 15 hours was 3.43 and 2.97 in Group RT and RF, at 18 hours mean VAS score was 1.26 in RT group and 2.89 in RF group. At 21 hours mean postoperative VAS score was 1.94 and 2.71 in both the study groups, while as at 24 hours mean VAS score was 2.14 in Group RT and 2.94 in Group RF.

Mean duration of analgesia in hours in Group RT was 14.7 and in Group RF it was 8.6. Rescue analgesia of two doses was needed in 19 patients in Group RT, while as 3 doses were needed in 24 (68%) patients in Group RF.

When postoperative complications were compared in two study groups it was observed that nausea was seen in 5 (14.3%) patients in Group RT and 2 (5.7%) patients in RF. Vomiting was seen in 3 (8.6%) patients in Group RT and 1 (2.9%) patients in Group RF, respectively.

5. Discussion

In our study mean age in Group RT was 39.1 years where as mean age in Group RF patients was 41.5 years. Geze S et al. (2012)[15] 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)[16] 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 21 (60%) and 18 (51.4%) male patients in Group RT and Group RF while as females constituted 14 (40%) and 17 (48.6%) 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. Rajkhowa T et al (2016)[16] studied 66 ASA I and II patients aged 18-65 years and with a male to female ratio of 24:11 (Group R) and 23:08 (Group RF). Mean onset of sensory block in Group RT was 10.6 minutes while as it was 11.1 minutes in Group RF. Mean onset of motor block in Group RT was 11.3 minutes while as it was 15.4 minutes in Group RF. Rajkhowa T et al (2016)[16] studied 66 ASA I and II patients aged 18-65 in their study. The duration of onset of sensory and motor block were comparable in between the two groups, while the duration of analgesia (sensory block) was 4.5 (4.11-4.89) hours in group R and 7.75 (7.28-8.22) hours in group RF, whereas the duration of motor block was 3.66 (3.2-4.12) hours in group R and 6.56 (6.13-6.99) hours in group RF respectively. Khosa AH et al (2015)[18] evaluated the efficacy of tramadol when combined with bupivacaine in axillary brachial plexus block for upper limb surgery. The onset of motor block also showed significant difference between the two groups. In group I motor block occurred earlier than group II (22.83±8.1min vs 28.5±8.6min). Sensory block duration was prolonged in group I (6.9±0.76 hours) as compared to group II (4.7±1.07 hours).

Mean intraoperative VAS score of Group RT and Group RF at 5 minute was 5.09 and 6.14, at 10 minutes it was 2.49 and 4.06 in both the study groups. Mean VAS score at 15 minutes was 0.83 and 1.91 in Group RT and RF, at 20 minutes mean VAS score of Group RT was 0.31 and that of Group RF was 0.87. 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 patients each. In their study, mean VAS score at 30 min in group I, group II and group III were 2.70± 0.47, 2.35±0.49 and 2.15±0.37 respectively. The mean VAS score at 30 min was lowest in group III and the difference was statistically significant compared to both groups I and group II. They observed a

significant difference in VAS between group I and II.

Our observations are in congruence with those of Parikh RK et al (1995).[19] 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. Kardash K et al[12] observed a significant decrease in VAS score in the patients who received fentanyl and bupivacaine in brachial plexus block at 1 hour after surgery. This is consistent with our results. Mean intraoperative sedation score of Group RT and Group RF at 5 minutes was 2.97 and 3.11, at 10 minutes it was 1.97 and 2.11 in both the study groups. Mean sedation score at 15 minutes was 1.06 and 1.20 in Group RT and RF, at 20 minutes mean sedation score of Group RT was 1.09 and that of Group RF was 1.14. Mean sedation score at 25 minutes in Group RF and RF was 1.03 and 1.09, while as it was 1.03 and 1.06 at 30 minutes in both the study groups. Mean time (min) to achieve complete block in Group RT was 20.6 and in Group RF it was 26.1 minutes. Mean time (hours) of sensory block in Group RT was 13.7 and in Group RF it was 7.8 hours. Mean duration (hours) of motor block in Group RT was 13.1 and in Group RF it was 7.2 hours. Naaz S et al (2017)[17] studied the difference in time to achieve complete block was statistically significant with mean of 26.3±1.94 minutes in group I, 17.0±1.23 minutes in group II and 21.0±2.05 minutes in group III. Barsagade W et al (2016)[20] compared the clinical characteristics of ropivacaine 0.5% and bupivacaine 0.5% with fentanyl when used for interscalene brachial plexus block. In their study, mean time to achieve complete sensory block in group BF was 13.8 minutes and in group RF was 16.6 minutes. In their study mean time to achieve complete motor block was 20.1 minutes and 23.9 in both group BF and group RF. Duration of sensory block in minutes in their study was 10.73 hours 9.55 hours in both the groups, while as duration of motor block was 9.98 hours in group BF and 8.55 hours in group RF, respectively. Mean postoperative VAS score of Group RT and Group RF at 3 hours was 0.43 and 1.31, at 6 hours it was 0.57 and 2.77 in both the study groups. Mean VAS score at 9 hours was 1.40 and 3.97 in Group RT and RF, at 12 hours mean VAS score of Group RT was 2.60 and that of Group RF was 2.46. Mean postoperative VAS score at 15 hours was 3.43 and 2.97 in Group RT and RF, at 18 hours mean VAS score was 1.26 in RT group and 2.89 in RF group. At 21 hours mean postoperative VAS score was 1.94 and 2.71 in both the study groups, while as at 24 hours mean VAS score was 2.14 in Group RT and 2.94 in Group RF.

In a study conducted by Naaz S et al (2017)[17] 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 ($p<0.001$). A mean VAS score of 3.12±0.29 was found in group I, 2.96±0.34 in group II and 2.61±0.23 in group III. The VAS score in group III was lower than group II and group I. Patients in group III had a longer period of subjective comfort as compared to group II and group I. These observations are in congruence with those of Parikh R K et al. (1995).[19] 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. Kardash K et al.[12] observed a significant decrease in VAS score in the patients who received fentanyl and bupivacaine in brachial plexus block at 1 hour after surgery. This is consistent with our results. Mean duration of analgesia in hours in Group RT was 14.7 and in Group RF it was 8.6. Rescue analgesia of two doses was needed in 19 patients in Group RT, while as 3 doses were needed in 24 (68%) patients in Group RF. The duration of analgesia was maximum with the addition of fentanyl (464.8±38.98 mins) as compared to bupivacaine (238.5±12.12 mins) and alkalinized bupivacaine (316.0±11.88mins) and the difference was statistically significant among all the three groups ($p<0.001$) [Naaz S et al (2017).[17] When postoperative complications were compared in two study groups it was observed that nausea was seen in 5 (14.3%) patients in Group RT and 2 (5.7%) patients in RF. Vomiting was seen in 3 (8.6%) patients in Group RT and 1 (2.9%) patients in Group RF, respectively. Rajkhowa T et al (2016)[16] conducted a study in which no complication was found same findings were also observed by Geze S et al (2012)[15] in their study.

6. 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. High satisfaction scores were reported by patients in both groups of our study. All were contended with the brachial plexus block/anaesthesia and overall level of analgesia. 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. Further studies can be done to observe the efficacy of different doses of tramadol in various combinations of local anaesthetics in our population.

In conclusion, tramadol when used as adjuvant with local anaesthetic in peripheral nerve block provides better surgical anaesthesia and analgesia. Therefore, its use should be promoted for routine addition to local anaesthetics in peripheral nerve blocks.

7. Source of Funding

None.

8. Conflict of Interest

The author declares no conflict of interest.

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