

Prospective Randomized, Double Blind Controlled Study to Evaluate the Effect of Fentanyl and Tramadol as an Adjuvant to Ropivacaine in Supraclavicular Brachial Plexus Block

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Conflict of interest: Nil

Abstract

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

Methods: This prospective randomized, double blind controlled study conducted in the, Department of Anaesthesiology and critical care, Era's Lucknow Medical college and Hospital, Lucknow, Uttar Pradesh, India, for 1 years. 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. 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 interoperative VAS score of Group RT and Group RF at 5 minute was 5.10 and 6.15, at 10 minutes it was 2.50 and 4.07 in both the study groups. Mean VAS score at 15 minutes was 0.84 and 1.92 in Group RT and RF, at 20 minutes mean VAS score of Group RT was 0.32 and that of Group RF was 0.88. 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 RT 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.

Conclusion: We concluded that the 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.

Keywords: fentanyl, tramadol, VAS, BPB

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Introduction

A brachial plexus block (BPB) provides anesthesia and analgesia during surgery involving the upper limb and for acutely painful conditions, and is the most frequent plexus block performed by anesthesiologists. It is worthwhile to explore the options for extending pain relief while minimizing the adverse effects of local anesthesia. Local anesthetics (LAs) have been used with various perineural adjuvants, including dexamethasone, clonidine, dexmedetomidine, opioids, and magnesium, to enhance the quality and duration of anesthesia and postoperative analgesia.[1-6]

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] 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]

Material and methods

This prospective randomized, double blind controlled study conducted in the, Department of Anaesthesiology and critical care, Era's Lucknow Medical college and Hospital, Lucknow, Uttar Pardesh, India, for 1 year, after taking the approval of the protocol review committee and institutional ethics committee. 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 C₆-C₇ 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.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS

Version 25.0 (SPSS Inc., Chicago, Illinois, USA).

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 5.10 and 6.15, at 10 minutes it was 2.50 and 4.07 in both the study groups. Mean VAS score at 15 minutes was 0.84 and 1.92 in Group RT and RF, at 20 minutes mean VAS score of Group RT was 0.32 and that of Group RF was 0.88. 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 RT 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.

Table 1: Mean interoperative VAS score

Mean interoperative VAS score	Group RT	Group RF
At 5 min	5.10	6.15
At 10 min	2.50	4.07
At 15 min	0.84	1.92
At 20 min	0.32	0.88

Discussion

In our study mean age in Group RT was 39.1 years where as mean age in Group RF patients were 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, alkalized 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 interoperative VAS score of Group RT and Group RF at 5 minute was 5.10 and 6.15, at 10 minutes it was 2.50 and 4.07 in both the study groups. Mean VAS score at 15 minutes was 0.84 and 1.92 in Group RT and RF, at 20 minutes mean VAS score of Group RT was 0.32 and that of Group RF was 0.88. 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 alkalized 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.

Conclusion

We concluded that the 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.

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