

**COMPARISON OF TWO ANALGESIA TECHNIQUES FOR PAIN MANAGEMENT DURING CHEST TUBE REMOVAL AFTER CARDIAC SURGERY**Gaurav Goyal<sup>1</sup>, Varun Chhabra<sup>2</sup>, Premraj Nagarwal<sup>3</sup>, Ashish Jain<sup>4</sup>**HOW TO CITE THIS ARTICLE:**

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**ABSTRACT: BACKGROUND:** This study aims to compare of two analgesia techniques for pain management during chest tube removal (CTR) after cardiac surgery. Two groups were compared in terms of pain, sedation levels, and hemodynamic response removal of chest tube. **METHODS:** The study was designed as a prospective, randomized, double-blinded study. Forty patients who underwent coronary artery bypass graft (CABG) surgery were enrolled. In postoperative period intravenous fentanyl 1µg/kg was given five minutes prior to chest tube removal (CTR). Each patient was explained about CTR procedure and VAS scoring charts. The patients were randomized into two groups as study group (Group S) and control group (Group C). All patients received either adrenaline free xylocaine 2% infiltration (Group S), 6 ml around each of three chest tube (2 mediastinal + 1 pleural) or normal saline 0.9% (Group C) in double blind manner. Severity of pain was recorded by asking Visual analogue scale (VAS) from the patients. Faces rating scale (FRS), Behavioral rating scale (BRS) and Ramsay sedation score (RSS) along with hemodynamic data were also recorded, blinding to group at four time intervals; at baseline (T base) , 2min (T2m,) 5min (T5m) 10min (T10m) and 20 min (T20m.) after CTR. **RESULTS:** The demographic characteristics of the patients in both groups were similar. Before chest tubes removal (CTR), all the scores of pain intensity (VAS), pain distress (FRS, BRS) and sedation levels (RSS) were comparable, but they differ significantly at T2, T5, and T10. However, these scores were comparable at T20. Patients remained alert and comfortable after 20 CTR regardless of which group they were assigned. **CONCLUSION:** Intravenous fentanyl 1µg/kg along with local infiltration of 2% xylocaine can substantially reduce pain and better regime than Intravenous fentanyl 1µg/kg alone during chest tube removal in post-coronary artery bypass graft surgery patients. Both techniques are equally safe in terms of sedation and post procedural complications.

**KEYWORDS:** Analgesia, Chesttube removal, Cardiac Surgery.

**INTRODUCTION:** Removal of chest tubes causes intense pain and has been described as one of the worst experiences by cardiac surgery patients during their post cardiac surgery recovery period. Despite all measures chest drain removal has been always a frightening experience for both clinician and patient. It has a pronounced negative emotional impact on postoperative recovery of the patient.<sup>1</sup> Determining an optimal intervention to relieve pain during such a frequently performed procedure may help promote pain control in these patients. Several pharmacological agents like non-steroidal anti-inflammatory drugs (NSAIDs), opioids (Morphine, fentanyl sufentanyl ) and non-pharmacological measures (Deep breathing relaxation exercises, music, ice application) along with many other methods had been investigated to alleviate the pain caused by this procedure but definitive regimen has not been determined. There are no guidelines available in the literature and pain during this common procedure continues to haunt cardiac surgery patients. The use of short acting intravenous opioids like fentanyl and sufentanyl has been used for pain control for CTR with variable

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results<sup>2</sup>. Topical analgesia for chest tube removal in cardiac patients was studied by Singh M and co workers<sup>3</sup>, but effectiveness of analgesic approach combining both intravenous short acting opioid and topical lignocaine has not been described in literature.

We had designed a double blinded random control study with the aim of compare two analgesia techniques for pain management during chest tube removal after cardiac surgery.

**METHODS:** This clinical trial was done on forty post-cardiac surgery patients in the cardiac surgery department of super specialty medical college. The patients who underwent left internal mammary artery (L IMA) and two vein off pump cardiac bypass surgery through median sternotomy and had two mediastinal and one left pleural tube placed as chest drains by surgeons were included in this study. Patients who were expected prolonged post-operative ventilation, combined surgery and nonstandard surgery, surgery other than mid line sternal incision were not included.

At the time of CTR, each patient's nurse was asked to prepare the patient for chest tube removal according to standard procedure. Any patient who had received confounding analgesic agent was excluded from study. Patients were told CTR procedure in detail. They were also explained about VAS score and how to do grading of pain when asked. All patients remained in past cardiac recovery unit and had advanced hemodynamic monitoring in form of electrocardiogram, invasive blood pressure, central venous pressure, and pulse oxymeter. Each patient received fentanyl injection 1µg/ kg intravenously 5 minutes before the removal of chest tubes. In addition, all patient received either adrenaline free xylocaine 2% infiltration (Group S), 6 ml around each of three chest tube (2 mediastinal + 1 pleural) or normal saline 0.9% (Group C). Total 18 ml of infiltration was given by 20 ml-22G, 3.5 cm needle syringe around all three drain tubes. This 18 ml infiltration injection was prepared according to computer generated randomized table by one independent colleague and given to the duty doctor. Patient, doctor and observer, all three were blinded to the composition of infiltration injection.

Severity of pain was recorded by asking Visual analogue scale (VAS) from the patient. Facial rating scale (FRS), Behavioral rating scale (BRS) and Ramsay sedation score (RSS) along with hemodynamic data were also recorded at four time intervals; T base: baseline data, before stating the procedure, T2m: 2 min. after CTR, T5m: 5 min. after CTR, T10m: 10 min. after CTR and T 20m: 20 min. after CTR by the observer. Any VAS score of more than 5, after T5 was given rescue analgesia in form of additional fentanyl injection 1µg/ kg intravenously.

After data collection from all the 40 patients, infiltration drug composition was de-coded the and at this time patients were divided into their respective groups. Data was analyzed with the use of t-test for continued and ordinal variables.

**RESULTS:** Both the groups were comparable in terms of age, weight, sex ratio, surgical technique, number of chest tube, co-existing diabetes and postoperative period. Before chest tubes removal (CTR), all the scores of pain intensity (visual analog scale), pain distress (Wang-Baker facial rating score, behavioral rating score) and sedation levels (Ramsay sedation score) were comparable, but they differ significantly during first ten minutes after CTR. Table 2 showed that VAS, FRS, BRS and RSS values at T2m, T5m and T10m were significantly lower in group S than group C but at T20 all these scores were comparable. These results indicate that pain relief was better in group S than group C for first ten minutes and this advantage lost after 20 minutes of CTR.

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Patients remained alert and comfortable after study period regardless of assigned. Overall incidence of significant hemodynamic changes and post CTR complications were not different but two patients in group C needed rescue analgesic dose of fentanyl while in group S none of the patient required rescue analgesia. (Table 3)

**DISCUSSION:** The pain relief strategies during CTR described in literature suggest that pain was managed better when local anesthetics were injected into pleural chest tubes<sup>4</sup>. Patient experience less pain if intravenous morphine was administered in combination with subfascial lidocaine injections during CTR.<sup>5</sup> Intravenous morphine has many limitations in spontaneously breathing post cardiac surgery patient. Morphine in small doses is known to cause moderate to severe pain chest tube removal.<sup>6</sup> A Nonsteroidal anti-inflammatory drug (NSAID) is not preferred choice in post-cardiac surgery patient, who is already on anti-platelet agents because of risk of coagulopathies, peptic ulcer disease and risk of renal impairment. Researchers tested the effects of nonpharmacological interventions on decreasing patients' pain during chest tube removal.

Neither ice applied around the chest tube,<sup>7</sup> nor use of a quick relaxation technique,<sup>8</sup> nor white noise or music.<sup>9</sup> was effective in decreasing pain intensity below moderate levels of pain. Mimnaugh et al.,<sup>10</sup> found significant correlations between patients' anxiety and their perception of sensations during chest tube removal. Preparing patients by providing information about the CTR procedure had helped in minimize pain intensity and distress during CTR procedure. Short acting opioid have been advocated for CTR procedure in literature.

Joshi et al.<sup>11</sup> used bolus fentanyl and sufentanil 10 min before chest tube removal and demonstrated a low mean pain intensity score compared with the control group at 5 and 20 min in the postprocedural period. VAS scores in Joshi et al.<sup>11</sup> were relatively lower and possible explanation is in their study investigators used high dose of opioids which was used in view of anxious and restlessness of patients prior to the procedure reflected in deference in pre and post procedural sedation scores.

Findings of our double blinded randomized control study suggest that if it is used in combination with local xylocaine infiltration, both pain intensity and distress can substantially reduce pain during chest tube removal as reflected by favorable VAS, FRS and BRS scores. The most important finding in this study was the achievement of good analgesia levels without compromising hemodynamic parameters. Better analgesia was achieved only in the study group, as more favorable outcomes is seen in this group of patients. Stable hemodynamic variables and sedation score (RSS) which remained within physiological range during study period and acceptable post procedure recovery explained safety of this strategy.

**LIMITATIONS:** Study population was highly selective with relatively large numbers of exclusion criteria, but these criteria were essential in order to avoid complications and to assess the analgesia and sedation effectively.

**CONCLUSIONS:** If used correctly, fentanyl 1µg/kg along with local infiltration of 2% xylocaine can substantially reduce pain during chest tube removal without causing adverse sedative effects. Thus, clinicians may choose this strategy as one of several safe and effective analgesic interventions during chest tube removal in post-cardiac surgery patients.

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	Group C (n=20)	Group S (n=20)	p value
Mean age	50.7±7.2	52.3±6.9	0.33
M: f	14/6	12/8	
Weight	63.4±6.8	68.1±7.9	0.051
Surgical grafting details of cabg	LIMA+2V	LIMA+2V	
Mean EF%	42.7±11.9	45.5±9.8	0.422
Diabetic patients	9/20	7/20	
Post-op. (hrs.) at time of CT removal	26.4±3.8	28.6±5.4	0.144

Table 1: Demographical data

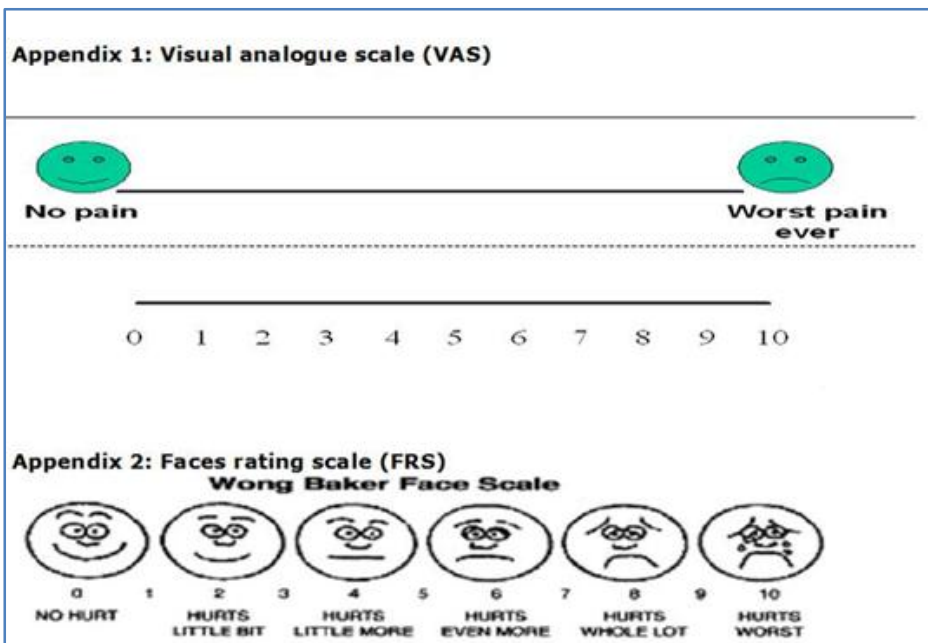
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	t base	t2m	t5m	t10m	t20m
VAS Gr. C	2.2±0.7	7.2±0.8	6.2±0.3	5.8±0.4	3.1±0.5
VAS Gr.S	2.5±0.5	5.2±0.3	4.5±0.9	4.2±0.5	2.7±0.9
P Value	0.127 ns	0.00 s	0.00 s	0.00 s	0.09 ns
FRS Gr. C	2.6±0.6	6.8±0.8	6.1±0.3	5.4±0.4	3.9±0.3
FRS Gr. S	2.7±0.3	5.4±0.4	4.2±0.7	4.1±0.2	2.9±0.7
PValue	0.509 ns	0.00 s	0.00 s	0.00 s	0.08 ns
BRS Gr. C	3.2±0.5	7.9±0.3	5.8±0.6	5.1±0.7	4.6±0.9
BRS Gr. S	3.4±0.2	7.1±0.1	5.2±0.7	4.6±0.3	4.1±0.8
P value	0.105 ns	0.00 s	0.006 s	0.006 s	0.07 ns
RSS Gr. C	2.0±0.0	1.0±0.0	1.3±0.3	1.4±0.1	1.8±0.5
RSS Gr. S	2.0±0.0	1.4±0.4	1.7±0.4	1.9±0.1	2.0±0.1
p value	1.0 ns	0.00 s	0.001 s	0.003 s	0.09 ns

**Table 2: VAS, FRS, BRS and RSS scores in groups**

	Group c	Group s
HR ch>20% Gr.S	4/20(20%)	3/20(15%)
BP ch.>20% Gr. C	5/20(25%)	4/20(20%)
Rescue analgesic	2/20(30%)	0/20(10%)
SVT/ AF	2/20(10%)	1/20(5%)
Wound infection	0/20(0%)	0/20(0%)
Delayed healing	0/20(0%)	1/20(5%)
Pneumothorax	1/20(5%)	0/20(0%)

**Table 3: Hemodynamic, rescue analgesic and post procedural data**



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Appendix 3 : Behavioral rating scale(BRS)							
<b>Face</b>	<b>0</b>	Face muscles relaxed	<b>1</b>	Facial muscle tension, frown, grimace	<b>2</b>	Frequent to constant frown, clenched jaw	<b>Face score:</b>
<b>Restlessness</b>	<b>0</b>	Quiet, relaxed appearance, normal movement	<b>1</b>	Occasional restless movement, shifting position	<b>2</b>	Frequent restless movement may include extremities or head	<b>Restlessness score:</b>
<b>Muscle tone*</b>	<b>0</b>	Normal muscle tone	<b>1</b>	Increased tone, flexion of fingers and toes	<b>2</b>	Rigid tone	<b>Muscle tone score:</b>
<b>Vocalisation**</b>	<b>0</b>	No abnormal sounds	<b>1</b>	Occasional moans, cries, whimpers and grunts	<b>2</b>	Frequent or continuous moans, cries, whimpers or grunts	<b>Vocalisation score:</b>
<b>Consolability</b>	<b>0</b>	Content, relaxed	<b>1</b>	Reassured by touch, distractible	<b>2</b>	Difficult to comfort by touch or talk	<b>Consolability score:</b>

<b>Ramsay scale for the assessment of the level of sedation</b>	
<b>LEVEL OF ACTIVITY</b>	<b>POINTS</b>
Patient anxious, agitated or restless	1
Patient cooperative, orientated and tranquil	2
Patient responding only to verbal commands	3
Patient with brisk response to light glabella tap or loud auditory stimulus	4
Patient with sluggish response to light glabella tap or loud auditory stimulus	5
Patient with no response to light glabella tap or loud auditory stimulus	6

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