

## EVALUATION OF ROLE OF TRANSDERMAL OPIOID IN MANAGEMENT OF CHEST TRAUMA

Shashi Prakash Mishra<sup>1</sup>, Nitesh Trivedi<sup>1</sup>, Mohammad Zeeshan Hakim<sup>1</sup>, T B Singh<sup>2</sup>, Sumit Sharma<sup>1</sup>, Manjaree Mishra<sup>3</sup>

<sup>1</sup>Associate Professor, Department of General Surgery, Institute of Medical Sciences, Banaras Hindu University, Varanasi (U.P.).221005. India

<sup>1</sup>Junior Resident, Department of General Surgery, Institute of Medical Sciences, Banaras Hindu University, Varanasi (U.P.).221005. India.

<sup>1</sup>Assistant Professor, Department of General Surgery, Trauma Centre, Institute of Medical Sciences, Banaras Hindu University, Varanasi (U.P.).221005. India.

<sup>3</sup>Professor, Centre of Biostatistics, Institute of Medical Sciences, Banaras Hindu University, Varanasi (U.P.).221005. India.

<sup>3</sup>Sumit Sharma, Assistant Professor, Department of General Surgery, Trauma Centre, Institute of Medical Sciences, Banaras Hindu University, Varanasi (U.P.).221005. India.

Received : 02/09/2019  
Received in revised form : 20/10/2019  
Accepted : 03/11/2019

**Keywords:**

Fentanyl; Tramadol; VAS score; Ramsay Sedation score, Trauma, Chest.

Corresponding Author:

**Dr. Manjaree Mishra,**

Email: drmanjareemd@gmail.com.

DOI: 10.29228/jamp.42843

Source of Support: Nil,

Conflict of Interest: None declared

*Int J Acad Med Pharm*  
2020; 2 (1); 40-43



### Abstract

**Background:** Transdermal opioids may have important role in pain management in chest trauma. This study aimed to compare transdermal opioids with intravenous opioids for management of chest trauma. **Material and Methods:** 360 patients aged 15-65years with isolated thoracic trauma were included divided into two groups. In Group A and Group B; 50mg parenteral opioid was and 25/50/75/100 mcg Transdermal opioid (Fentanyl patch) was given. In both the groups, after 12 hours, VAS score, Ramsay Sedation score was calculated. Spirometry effort was assessed by incentive spirometry (600 ml or 900 ml or 1200 ml). Assessment was repeated after every 24 hours till discharge. **Result:** In fentanyl patch group 162 (89.5%) patients were male and 19 (10.5%) patients were female while in i.v. tramadol group 152 (94.8%) patients were male and 27 (15.2%) patients were female. At all-time intervals, insignificant relation (p-value>0.05) was observed for RSS score. On day 2 to day 6, the mean VAS score was significantly decreased in fentanyl group as compared to i.v.tramadol group. **Discussion:** The two groups of study were comparable in terms of various patient related, injury related, intervention related, and biochemical and sedation assessment related parameters. However, the pain score related to VAS was significantly less in transdermal patch group than in systemic opioids groups since day 2 to day 6 of study. **Conclusion:** Transdermal fentanyl patch is a good modality to offer early, sustained and potent analgesia in the patients of chest trauma as compared to intravenous tramadol.

## INTRODUCTION

Chest trauma is one of the common types of injury observed in approximately 2/3 of the patients with a varying severity from a simple rib fracture to penetrating injury of the heart or tracheobronchial disruption. Blunt chest trauma is most common with 90% incidence, out of which less than 10% require surgical intervention.<sup>[1]</sup> Mortality observed with chest injury is second highest after head injury, which underlines the importance of initial management.

The treatment of blunt thoracic trauma has undergone dramatic evolution since years. Today, the management focuses on underlying lung injury and optimization of mechanics through chest physiotherapy.<sup>[2]</sup> It is well documented that the most effective management of patients is focussed on

adequate pain control, early mobilisation and aggressive respiratory care with the primary aim of avoiding the delayed complications.<sup>[3]</sup>

Analgesia following blunt chest wall trauma has been well researched and limited consensus exists regarding the optimal analgesic agents and their most efficacious mode of delivery.<sup>[4]</sup> Various authors have investigated the use of oral analgesics such as narcotics and nonsteroidal anti-inflammatory drugs, intravenous (IV) opioids and a number of invasive techniques such as epidurals and intra-thoracic blocks.<sup>[5]</sup>

The use of analgesics as a 'pain relief patch' is gaining popularity. When applied to the skin, these patches can deliver an analgesic drug at a predetermined rate across the dermis to achieve either a local or systemic effect. Transdermal delivery of opioids has been used for many years,

but has not been recommended for use in acute pain due to delayed onset of action and risks of toxicity. The fentanyl patient controlled transdermal system incorporates advantages of patient-controlled analgesia (PCA) with a transdermal delivery system.<sup>[6]</sup> Localized transdermal delivery of drugs may be helpful in the management of chronic neuropathic pain, for example, topical capsaicin and lidocaine patches.<sup>[7]</sup>

Fentanyl represents a more potent analgesic, but with risk of respiratory depression at higher doses. Low dose sustained release formulations can obviate this risk while providing better pain relief and early recovery. Trials of this nature are less frequently performed due to which there is paucity of data in this context.<sup>[8-9]</sup>

The present study was conducted with aim to evaluate and compare the efficacy of fentanyl patch with intravenous Tramadol using various variables like Ramsay Sedation Score, Visual Analogue Scale, arterial blood gas analysis etc.

## MATERIALS AND METHODS

The present study was conducted on a total of 260 patients of chest trauma attending a dedicated Trauma Centre linked with a medical institution of University. The study was approved by Institutional ethical committee and an informed consent was obtained from all study subjects. Patients aged 15-65 years with isolated thoracic trauma were included in the study. Patients having poly-trauma, deranged ABG parameters as PO<sub>2</sub> < 80 and PCO<sub>2</sub> > 48, pregnant patients and those who are non-willing to be the part of study were excluded.

A total of 400 patients were initially enrolled in the study using inclusion and exclusion criteria. The initial resuscitation was done as per ATLS® protocol and blood samples were sent for routine investigations and arterial blood gas analysis (ABG). The patients were allocated to two different Groups A (fentanyl patch group) and B (intravenous tramadol group) using computer generated randomization with 200 patients in each group. The final correlation could be done in 360 patients with 181 in group A and 179 in group B. In Group A 25/50/75/100 mcg transdermal opioid (Fentanyl patch) was given every 72 hours while in Group B 50mg parenteral opioid was given every 4-6 hourly. The baseline Visual Analogue Scale (VAS) and Ramsay's Sedation score was calculated and noted in Performa. These scales are meant for the objective assessment of patient's condition in terms of pain felt by the patient and sedation level of the patient. [Figure 1 and 2]

In both the groups, after 12 hours, VAS score, Ramsay Sedation score was calculated. Spirometry effort was assessed by incentive spirometry (600 ml or 900 ml or 1200 ml). Assessment was repeated after every 24 hours till discharge.

The data obtained was subjected to statistical analysis using SPSS version 20.0 software. Descriptive analysis was done to calculate frequencies, percentages and mean with standard deviations. The qualitative/categorical variables between two treatment regimens were compared using Z test and Chi square. McNemar test was used to compare pre- and post-treatment within treatment regimen. For quantitative variables, Student 't' test was used to compare the mean values between two groups and Paired 't' test was used to compare the mean changes between the groups at the pre- and post-treatment.

## RESULTS

In fentanyl patch group 162 (89.5%) patients were male and 19 (10.5%) patients were female while in i.v. tramadol group 152 (84.8%) patients were male and 27 (15.2%) patients were female. Both the groups were comparable which was statistically insignificant (p=0.283), (Table 1). The mean age of patients in fentanyl patch group was 39.43±14.426 years while in i.v. tramadol group the mean age was 40.11±14.188 years. There was no statistically significant difference was found between both the groups (p=0.722).

In fentanyl patch group, 69 (38%) patients have injury at right side and 52 (29%) have injury at left side while in i.v. tramadol group, 77 (43%) patients have injury at right side and 50 (28%) at left side. On comparing site of injury both the groups were comparable. In fentanyl patch group, 60 (33%) patients had bilateral injury while in i.v. tramadol group 52 (29%) had bilateral injury which was comparable and statistically insignificant (p=0.521). In Fentanyl patch group, 151 (83.4%) patients ICD was inserted while in i.v. tramadol group 149 (83.5%) patients ICD was inserted. Both the groups were comparable in respected to ICD insertion (p=1.981), (Table 2). On comparing mean PO<sub>2</sub>, pCO<sub>2</sub> and SO<sub>2</sub> between two groups on Day 1 to Day 6, a statistically insignificant relation was observed at various time intervals. In Fentanyl patch group and i.v. tramadol group, the mean pH, BE level and lactate were comparable in both the groups, showing insignificant relation at different time interval.

In fentanyl patch group, single rib fracture was present in 21 (11.6%) patients, multiple rib fracture was present in 131 (72.4%) patients and no rib was fractured in 29 (16.1%) cases. While in i.v. tramadol group, single rib fracture was present in 16 (8.9%) patients, multiple rib fracture was present in 140 (78.5%) patients and no rib was fractured in 23 (12.7%) patients. The association of single / multiple rib fracture in both the groups were comparable and statistically insignificant (p=0.644). In fentanyl group, haemothorax was present in 108 (59.7%) patients, pneumothorax was present in 45 (24.9%) patients and hemopneumothorax was

present in 28 (15.5%) patients in CECT while in i.v. tramadol group, haemothorax was present in 100 (55.7%) patients, pneumothorax was present in 41 (22.8%) patients and hemopneumothorax was present in 38 (21.5%) patients.

On comparing mean spirometry effort between two groups. The mean spirometry effort was comparable in both the groups at different time interval, showing an insignificant relation between different time intervals.

On day 1, all the patients in fentanyl patch group and i.v. tramadol group had RSS score 2. On day 2, in fentanyl group 180 (99.4%) patients had RSS score 2 while in i.v. tramadol group 179 (100%) had RSS score 2. Only one patient in fentanyl group had RSS score 6. On day 3, all the patients in fentanyl patch group and i.v. tramadol group had RSS score 2. On day 4, in fentanyl group 1 (0.6%) had RSS score 1 and 180 (99.4%) patients had RSS score 2 while in i.v. tramadol group, all the patients

(100%) had RSS score 2. On day 5, in fentanyl group 1 (0.8%) had RSS score 1 and 180 (99.2%) patients had RSS score 2 while in i.v. tramadol group 3 (1.7%) patient had RSS score 1 and 176 (98.3%) patients had RSS score 2. On day 6, in fentanyl group 3 (1.4%) had RSS score 1 and 178 (98.6%) patients had RSS score 2 while in i.v. tramadol group 5 (2.9%) patient had RSS score 1 and 174 (97.1%) patients had RSS score 2. Overall, the RSS score was comparable in both the group at different time interval. At all-time intervals, insignificant relation (p-value>0.05) was observed for RSS score.

On day 1, the mean VAS score 7.359±0.5357 in fentanyl patch group and 7.481±0.7487 in i.v. tramadol group which showed no significant difference (p=0.138). On day 2 to day 6, the mean VAS score was significantly decreased in fentanyl group as compared to i.v. tramadol group (Table 3).

**Table 1: Distribution of sex between two treatment group**

Sex	Fentanyl patch	Intravenous Tramadol
Male	162	152
Female	19	27
Total	181	179

$X^2=1.153$ ;  $p=0.283$

**Table 2: Comparison of ICD insertion between two groups**

ICD	Group			
	Fentanyl patch		Intravenous Tramadol	
	No.	%	No.	%
Yes	151	83.4	149	83.5
No	30	16.6	30	16.5
Total	181	100	179	100

$X^2=0.001$ ;  $p=1.981$

**Table 3: Comparison of mean VAS score between two groups at different time interval**

VAS	Fentanyl patch Mean±SD N=181	Intravenous Tramadol Mean±SD N=179	p-value
Day 1	7.359±0.5357	7.481±0.7487	0.138
Day 2	6.508±0.6881	7.177±0.7470	<0.001
Day 3	5.497±0.7426	6.177±0.7470	<0.001
Day 4	4.599±0.6730	5.179±0.7161	<0.001
Day 5	3.746±0.6804	4.230±0.7318	<0.001
Day 6	3.243±0.4642	3.456±0.6288	0.030

## DISCUSSION

Pain due to rib fracture has a negative influence on respiratory physiology. Deep breathing, coughing and respiratory physiotherapy may be difficult to be performed without effective analgesia. The effective treatment of pain may thereby improve the patient's respiratory mechanics. Therefore, the patient may presumably be able to perform respiratory physiotherapy more comfortably and, as a result, the early mobilization of the patient may prevent pulmonary complications and better outcomes.

In our study, we observed that both the groups were comparable in terms of sex ratio with statistically insignificant difference (p=0.283). Similar findings were observed in study by Solak O et al (2013).<sup>[10]</sup> Similar to our study, the results of study

conducted by Dogrul BN et al (2020),<sup>[11,12]</sup> showed that the final outcome of the study was not affected by the side of injury.

In present study, both the groups were comparable in respected to ICD insertion with no statistically significant difference in between two groups. (p=1.981). Similar results were observed by Barton ED et al (1995),<sup>[13]</sup> Massarutti D et al (2006),<sup>[14]</sup> showing an insignificant difference in their result with respect to ICD insertion.

We compared ABG parameters like pO<sub>2</sub>, pCO<sub>2</sub>, SO<sub>2</sub>, pH, BE between both the groups and observed that all these parameters were comparable showing an insignificant difference statistically. Similar results were observed in study conducted by Vohra T et al (2013),<sup>[15]</sup> it was found that the ABG parameters like pO<sub>2</sub>, pCO<sub>2</sub>, SO<sub>2</sub>, pH, BE etc. were

comparable in both the study groups without any statistical significance. In our study, the mean lactate level in both the groups was comparable and statistically insignificant at different time intervals. Studies carried out by Lavery et al (2000),<sup>[16]</sup> and Cerovic et al (2003),<sup>[17]</sup> concluded that there was no significant difference in outcomes were seen on the basis of lactate levels ABG of patient.

The association of single / multiple rib fracture in both the groups were comparable and statistically insignificant (p=0.644) in our study. In a similar study conducted by Solak O et al (2013),<sup>[10]</sup> no significant difference was observed between the two groups in terms of number of fractured ribs. In accordance with our study, studies done by Sharma A et al (2008),<sup>[18]</sup> showed as insignificant difference in outcomes of patients whether they have haemothorax, pneumothorax or hemopneumothorax. We observed that the mean spirometry effort by patients between two groups at different time interval was comparable in both the treatment groups. Similar results were observed by Sum SK et al (2020).<sup>[19]</sup>

We compared Ramsay Sedation Score (RSS) between two groups at all-time intervals and observed that the RSS score was comparable in both the group at different time interval. There is paucity of literature related to RSS comparing fentanyl and iv tramadol. However, in our study we found that level of sedation was comparable between the two groups.

The comparison of mean VAS score between two groups at different time interval on day 2 to day 6, the mean VAS score was significantly decreased in fentanyl group as compared to i.v. tramadol group. Essay et al (2010)<sup>20</sup> concluded that fentanyl patch has better outcomes than iv tramadol in terms of VAS score.

## CONCLUSION

The results of this study can help us to conclude that transdermal fentanyl patch is a good modality to offer early, sustained and potent analgesia in the patients of chest trauma as compared to intravenous tramadol. The application being non-invasive and having comparable side effect (mainly sedation) can thus be advocated for routine use in the patients of chest trauma having stable clinical condition and without serious physiological and biochemical derangements.

## REFERENCES

1. Ludwig C, Koryllos A. Management of chest trauma. *J Thorac Dis* 2017; 9(Suppl 3):S172-S177.
2. Gibbons J, James O, Quail A, et al. Relief of pain in chest injury. *Br J Anaesth*.1973; 45:1136-38.
3. Easter A. Management of patients with multiple rib fractures. *American Journal of Critical Care* 2001; 10(5): 320–327.
4. Berben SA, Meijs T, van Dongen R, et al. Pain prevalence and pain relief in trauma patients in the Accident and Emergency Department. *Injury* 2008; 39:578–585.
5. Kerr-Valentic MA, Arthur Ma, Mullins RJ, et al. Rib fracture pain and disability: can we do better? *Journal of Trauma* 2003; 54: 1058–1064.
6. Latasch L and Luders S: Transdermal fentanyl against postoperative pain. *Acta AnaesthesiolBelg*1989; 40:113-9.
7. von Bormann B, Ratthey K, Schwetlick G, Schneider C, Muller H and Hempelmann G: Postoperative pain therapy by transdermal fentanyl. *AnasthIntensivtherNotfallmed* 1998; 23: 3-8.
8. Ringe JD, Faber H, Bock O, Valentine S, Felsenberg D, Pfeifer M, Minne HW and Schwalen S: Transdermal fentanyl for the treatment of back pain caused by vertebral osteoporosis. *Rheumatol Int* 2002; 22: 199-203.
9. Noyes M and Irving H: The use of transdermal fentanyl in pediatric oncology palliative care. *Am J Hosp Palliat Care* 2001; 18: 411-6.
10. Solak O, Oz G, Kokulu S, Solak O, Dogan G, Esme H et al. The Effectiveness of Transdermal Opioid in the Management Multiple Rib Fractures: Randomized Clinical Trial. *Balkan Medical Journal*. 2013; 30(3):277-281.
11. Simon BJ, Cushman J, Barraco R, et al. (2005) Pain management guidelines for blunt thoracic trauma. *Journal of Trauma* 59(5): 1256–1267.
12. Dogrul BN, Kiliccalan I, Asci ES, Peker SC. Blunt trauma related chest wall and pulmonary injuries: An overview. *Chin J Traumatol*. 2020; 23(3):125-138. doi:10.1016/j.cjtee.2020.04.003
13. Barton ED, Epperson M, Hoyt DB, Fortlage D, Rosen P. Prehospital needle aspiration and tube thoracostomy in trauma victims: a 6-year experience with aeromedical crews. *J Emerg Med* 1995; 13:155–63.
14. Massarutti D, Trillo` G, Berlot G, Tomasini A, Bacer B, D'Orlando L, et al. Simple thoracostomy in prehospital trauma management is safe and effective: a 2-year experience by helicopter emergency medical crews. *Eur J Emerg Med* 2006; 13:276–80.
15. Vohra T, Paxton J. Abnormal arterial blood gas and serum lactate levels do not alter disposition in adult blunt trauma patients after early computed tomography. *West J Emerg Med*. 2013; 14(3):212-217. doi:10.5811/westjem.2012.3.6905
16. Lavery RF, Livingston DH, Tortella BJ, Sambol JT, Slomovitz BM, Siegel JH. The utility of venous lactate to triage injured patients in the trauma center. *Jour Am Col Surg* 2000; 190:656-64.
17. Cerovic O, Golubovic V, Spec-Marn A, Kremzar B, Vidmar G. Relationship between injury severity and lactate levels in severely injured patients. *Intensive Care Medicine* 2003; 29:1300-5.
18. Sharma A, Jindal P. Principles of diagnosis and management of traumatic pneumothorax. *J Emerg Trauma Shock*. 2008; 1(1):34-41. doi:10.4103/0974-2700.41789.
19. Sum SK, Peng YC, Yin SY, et al. using an incentive spirometer reduces pulmonary complications in patients with traumatic rib fractures: a randomized controlled trial. *Trials*. 2019; 20(1):797. Published 2019 Dec 30. doi:10.1186/s13063-019-3943-x
20. Easter A. Management of patients with multiple rib fractures. *American Journal of Critical Care* 2001; 10(5): 320–327.