Original Research Article

An Observational Study to Compare Epidural Tramadol and Epidural Fentanyl for Postoperative Analgesia in Lower Limb Orthopaedic Replacement Surgeries

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Abtract

Background: Epidural analgesia is considered gold standard method to control pain, early mobilization after joint surgery and increased bowel mobility.

Methods: 58 patients were randomly divided into 2 equal groupsundergoing elective lower limb joint replacement. Group T received 1mg/kg of tramadol and Group F received 1 µg/kg of fentanyl, both diluted till 10 mlof 0.9% normal saline. Postoperatively patients were assessed for visual analogue scale (VAS), sedation score, respiratory rate, haemodynamic, onset of analgesia, quality and duration of analgesia, frequency of epidural dose and any side effects.

Results: In group T and group F the mean time of onset of analgesia was 12.47± 2.51 minutes and 6.15±1.75 minutes respectively($p < 0.001$). In group T and group F mean duration of analgesia was 8.06±1.25 hours and 5.4±0.97 hours respectively ($p <0.001$). VAS was lower side throughout the study in group F. Mean VASwas $p < 0.05$ upto 24 hours and at 48 hours $p>0.05$. In group T 17.2% had vomiting, 13.7% had nausea and in group F 6.8% had vomiting, 6.8% had nausea and 4 patients (13.7%) had episode of purities.

Conclusion: From our study we conclude that fentanyl provided a rapid onset and better quality of analgesia. More repeated top up were required with fentanyl.

Keywords: *Epidural, Fentanyl, lower limb joint replacement surgeries, Postoperative analgesia, Tramadol.*

Introduction

Pain is nowadays considered as the sixth vital sign in postoperative monitoring. Various adverse effects are associated with post-operative pain [1, 2]. According to taxonomy committee of International Association, pain defines as "An unpleasant sensory and/or emotional experience related with actual or potential tissue harm or described in terms of such harm" [3]. For pain control after major surgery epidural analgesia is considered as gold standard analgesic method [5].Known advantage of using epidural analgesia as post-operative analgesia are better analgesia, good pulmonary function, lesser cardiac ischemic events, and early mobilization after joint surgery, increased bowel mobility, associated with an early aggressive mobilization [6]. For post-operative analgesia different drugs like opioids & non-opioids have

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been used successfully. It has been suggested that opioids bind to their specific receptors after given in epidural space [7]. Because of less incidence of side effect such as respiratory depression, nausea and vomiting, itching, urine retention with the use of fentanyl comparing to morphine thus making it the most extensively used drug through epidural.

Tramadol has a weak opioid agonist analgesic property [8]. Tramadol has an affinity to binds with opioid receptors μ, α and δ [9].

Tramadol is a centrally-acting analgesic drug with low but significant action at opioid receptors, and also stops the neuronal reuptake of both noradrenaline and 5-hydroxytryptamine (5-HT) and facilitates 5-HT release.

Fentanyl is a highly lipid-soluble, stimulates μ_1 and μ_2 receptors. Fentanyl is a derivative of phenyl piperidine with a quick onset and lesser duration of action[10]. Fentanyl gives good quality of perioperative analgesia, hemodynamic stability, lesser side effects, and superior quality of postoperative analgesia [11].

Materials and Method

This study was carried out at Dhiraj hospital S.B.K.S. M.I. & R.C., Piparia, Vadodara in department of Anaesthesiology during 2018-2019 for a period of 18 months. This study was a prospective, randomized study. After approval from institutional ethical committee (SVIEC/ON/MEDI/BNPG17/D20135).All the patients were explained clearly about the purpose and nature of the study in the language they can understand. Patients were included in the study only after obtaining a written and informed consent.

Inclusion Criteria:

ž Patients of ASA Grade I to III of either gender.

ž Undergoing elective Lower limb orthopaedic Replacement Surgery

ž Aged between 18-65 years.

Exclusion Criteria:

ž Patient refusal

ž Patients with systemic disease like heart disease, liver disease, kidney disease.

ž Pregnant and lactating women

ž Local infection

ž Coagulopathies

ž Vertebral anomalies

ž Neurological diseases

ž Known allergy to study drug.

ž ASA IV and above.

ž Age <18 years and >65 years

ž Operation last for more than 3 hours.

This study was conducted on 58 patients of American society of anaesthesiologist's (ASA) grade –I, II & III of either gender posted for orthopaedic lower limb replacement surgeries i.e. cemented bipolar, total hip replacement, total knee replacement, modular bipolar. 58 patients were divided into 2 equal groups randomly. Postoperatively the drug was administered by the anaesthesiologist related with study. Group T (Tramadol group n= 29) received 1mg/kg of tramadol in 10 ml of 0.9 % normal saline. And Group F (Fentanyl group n= 29) received 1 μg/kg of fentanyl in 10 ml of 0.9 % normal saline.

Preoperative Assessment:

Pre operatively patients were assessed for physical examination and laboratory investigations. Patients were explained about the epidural technique. Its advantage and disadvantage were explained. Patients were also educated about the usage of Linear visual Analogue scale (VAS –Figure 1) for assessment of the intensity of post-operative pain. All the patients were kept nil per oral overnight, a night before surgery.

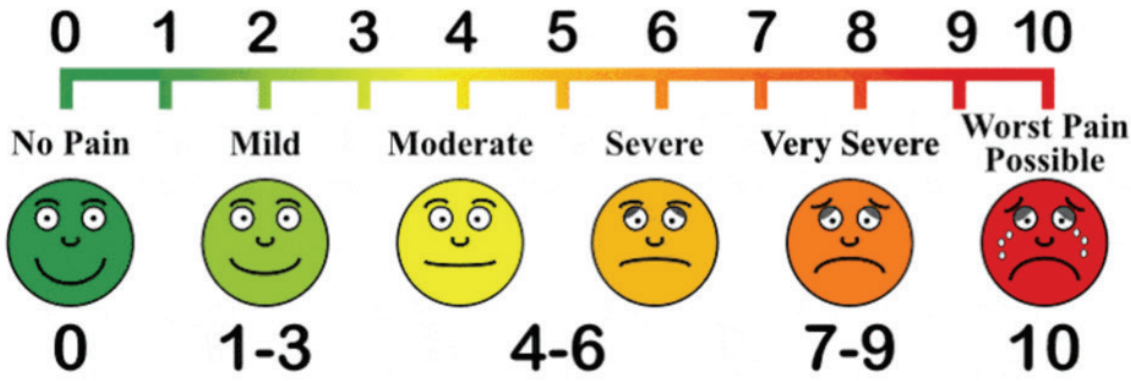

Figure 1 Visual analogue scale (VAS)

Inside the operating room, an intravenous (i.v.) line was secured with 18-Gauge vein flow. Baseline heart rate (HR), non-invasive systolic, diastolic and mean arterial blood pressure (SBP, DBP, MAP), continuous electrocardiogram (ECG) monitoring and oxygen saturation SpO_2 were recorded.

All patients were pre medicated with inj. glycopyrrolate 0.2mg, inj. ondansetron 4 mg and inj. ranitidine 50 mg i.v. followed by preloading with inj. Ringer's lactate 10ml/kg prior to spinal anaesthesia.

In sitting position, 18 G epidural Tuohy needle was introduced in L_{2-3} interspinous space. The epidural space was identified with hanging drop method and 20 G epidural catheter was inserted in the space up to 5 cm. 3 ml of 2% lignocaine with adrenaline (1:200000) was given as a test dose to rule out intrathecal or intravascular placement of epidural catheter. Sub arachnoid block was performed in L_{3-4} space using 25 G Quincke's spinal needle with inj. bupivacaine 0.5% heavy. No analgesics were administered during the intraoperative period and patient was shifted to postoperative ward after completion of surgery. Patients were monitored for vitals.

Postoperatively all patients were shifted to recovery room. Patients were assessed at 30 minutes intervals for first two hours then at 4, 8,12,18,24, 48 hour after giving first dose of epidural opioid. Epidural dose was provided upon pain (VAS>5) in postoperative period. Group T (Tramadol group) received 1mg/kg of tramadol in 10 ml of 0.9 % normal saline. And Group F (Fentanyl group) received 1 µg/kg of fentanyl in 10 ml of 0.9 % normal saline via epidural catheter. The drugs were repeated during first 48 hours whenever patients had VAS score > 5. Patients were monitored for onset of analgesia (assessed as 0 hour), duration of analgesia, quality of analgesia, frequency of requirement of drug, HR, SBP, DBP, MAP, SpO_2, RR, VAS, Ramsay sedation scale and any side effects or complication.

Onset of analgesia: Is the time between administrations of the drug (VAS > 5) till VAS score become less than 5.

Period of analgesia: Time duration from onset of analgesia (VAS < 5) till participant complains of pain (VAS > 5).

Quality of analgesia: Was assessed by using pain score and compared in both the groups.

Ramsay Sedation Scale (Table 1): Was used as tool for assessing level sedation.

Table1 Ramsay sedation scale

Score	Response
1	Anxious or restless or both
2	Cooperative, oriented and tranquil
3	Responding to verbal commands
4	Brisk response to stimulus
5	Sluggish response to stimulus
6	No response to stimulus

Statistical calculation: A P-value < 0.05 was considered significant.

Results and Observations

A total number of 58 patients in the age group of 18 – 65 years belonging to ASA grade –I, II & III of either gender posted for orthopaedic lower limb replacement surgeries were enrolled in this study. Patients were divided into 2 equal groups randomly. Postoperatively upon VAS>5 drugs were administeredepidurally by the anaesthesiologist related with study.

Group T (Tramadol group) received 1mg/kg of tramadol in 10 ml of 0.9 % normal saline.

Group F (Fentanyl group) received 1 µg/kg of fentanyl in 10 ml of 0.9 % normal saline.

In this study, mean age in group T and group F was 49.24±11.33 and 49.03±13.9 years respectively. In Group T, 23 patients were male and 6 patients were female where as in group F, 11 patients were male and 18 patients were female.

The average time of onset of analgesia in group T and group F was 12.47 and 16.15 minutes respectively. The range lied between 9 to 18 minutes in group T and 3 to 10 minutes in group F (Figure 2). P value was <0.001 (Significant).

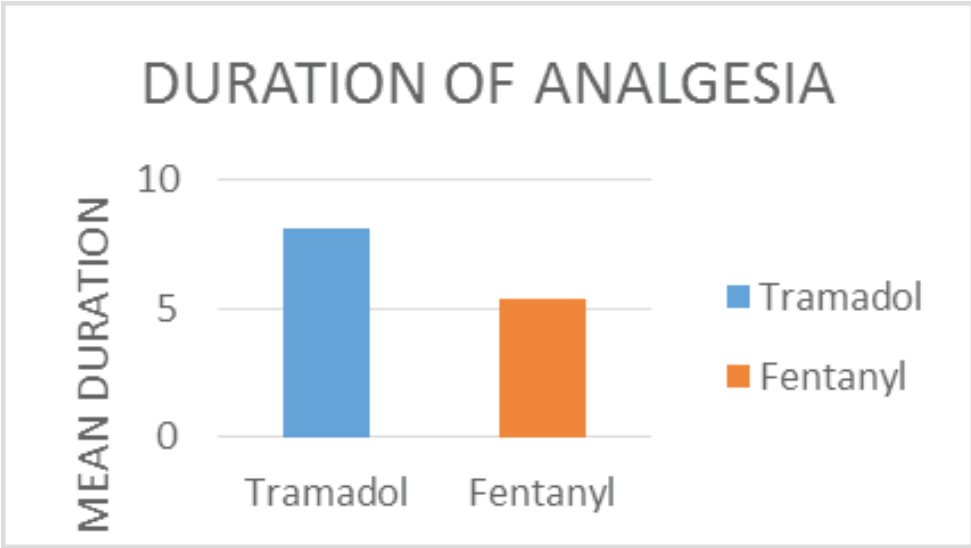

Figure 2: Onset of analgesia (range, mean± SD)

Range of duration of analgesia in Group T lied between 6 to 12 hours with Mean±SD of 8.06±1.25 hours and in Group F lied between 4 to 8 hours with Mean±SD of 5.4±0.97 hours (Figure 3). P value was <0.001(Significant).

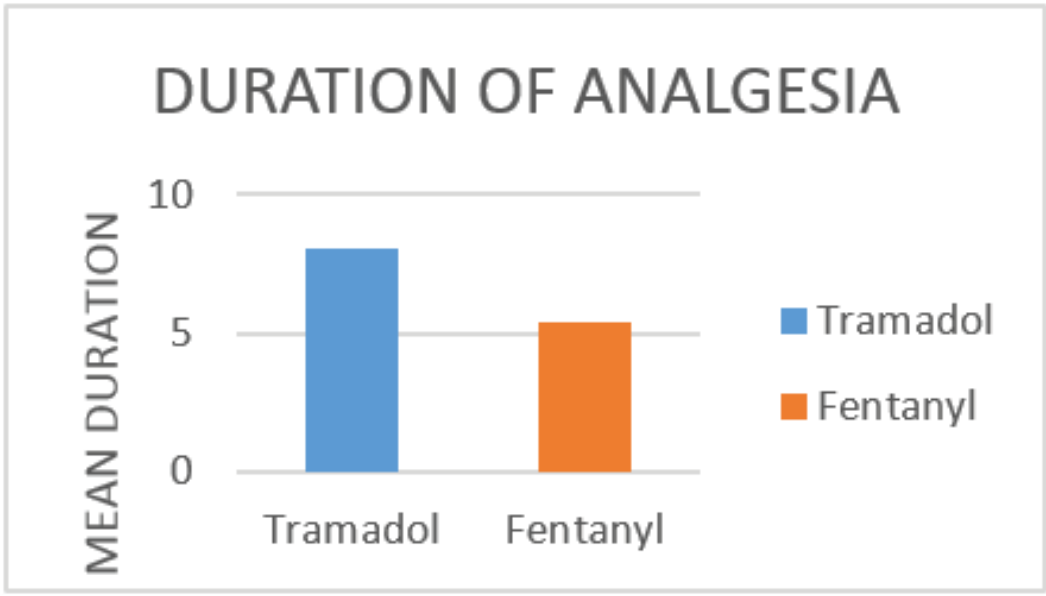

Figure 3: Mean duration of analgesia

VAS score of two different group (Group Tramadol and Group Fentanyl) were recorded at 0, 30, 60, 90 minutes & at 2, 4, 8, 12, 18, 24, 48 hours. VAS score at 0 minutes defines VAS score before giving first dose when patient complaint of pain postoperatively.

P value at 0 minute (P>0.05) signified that mean VAS score before giving dose was not statistically significant. Mean VAS score at 30, 60, 90 minutes & at 2, 4, 8, 12, 18, 24, 48 hours was highly significant (P<0.001). At 18 hour P value was <0.05 which was significant and at 48 hours p value was >0.05 not significant. VAS Score of fentanyl was significantly at lower side at maximum time (Figure 4). This data shows that pain control in group F (Fentanyl) was significantly better than in Group T (Tramadol).

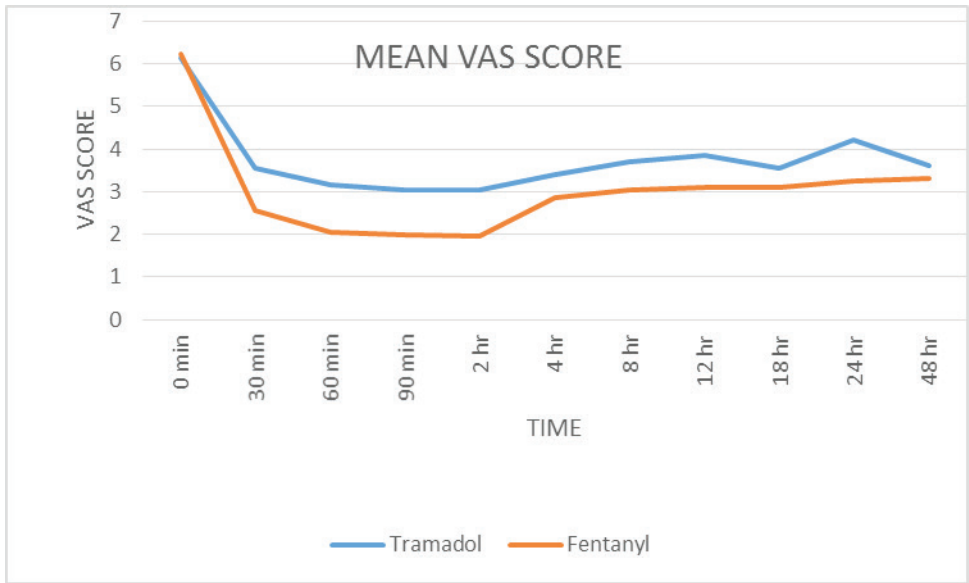

Figure 4Quality of analgesia mean VAS

The number of epidural top-up requirement was high in group F as compared to group T (Figure 5). On calculating p value, it was found that it is statistically significant at 4, 24 and 48 hours.

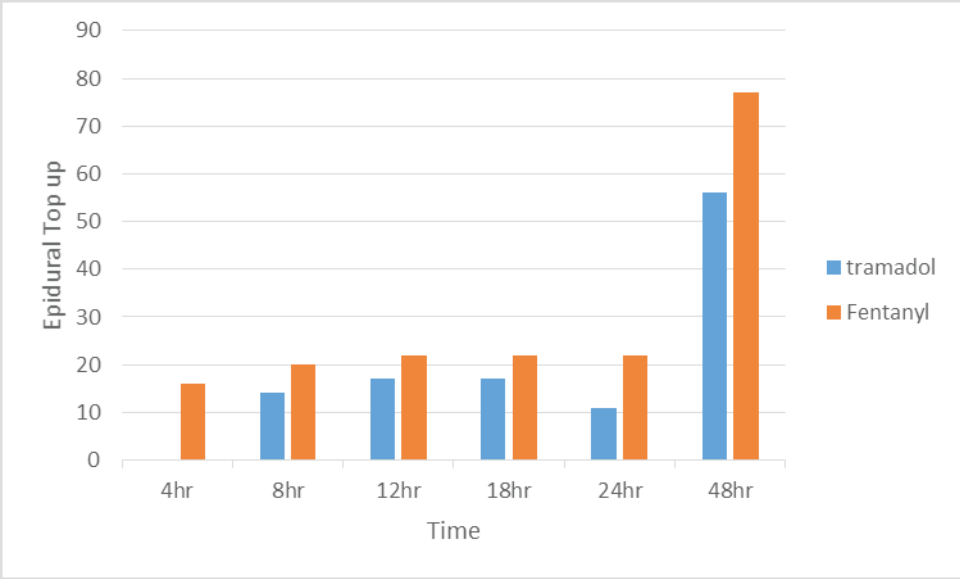

Figure 5Epidural top-up Requirement in 48 hours

The frequency of top-up requirement was high in group F compare to group T. In group T maximum patients (i.e. 15) required 5 top-ups, 2 patients required 3 top-ups, 7 patients required 4 top-ups and 5 patients required 6 top-ups in 48 hours . In group F maximum patients (i.e. 9) required 6 top-ups, 3 patients required 5 top-ups, 6 patients required 7 top-ups, 7 patients required 8 top-ups and 4 patients required 9 top-ups in 48 hours. P value (<0.05) was statistically significant for patients requiring 4, 5, 7, 8 top ups in 48 hours. P value for patients who required 3, 6, and 9 top-up were statistically insignificant.

Sedation score was observed by using **Ramsay Sedation Scale (Table 1)**. In group T, 97.8% of patients were having score of 2 and 2.2% of patients were having score of 3 where as in group F 86.5% of patients were having score of 2 and 13.5%.

In both groups haemodynamic parameters were comparable P value was >0.05 not significant.

Side effects of both the drugs were recorded. In group T, 5 patients (17.2%) of patients had vomiting, 4 patients (13.7%) of patients had nausea and no patient had episode of purities on comparing with group F, 2 patients (6.8%) of patients had vomiting, 2 patients (6.8%) of patient had nausea and 4 patients (13.7%) had episode of purities.While comparing group T to group F, P value was statistically insignificant for vomiting and nausea but p value was statistically significant for pruritus.

Discussion

Treating postoperative pain is very challenging and prime concern for anaesthesiologist[12]. Among all operative procedures orthopaedic procedure is one of the most painful. Postoperative ambulation can aggravate the pain in these patients. There are many advantages of use of regional anaesthesia techniques for patients undergoing lower limb orthopaedics replacement surgeries, benefits includes less intra operative bleeding, less chances of thromboembolic complications and less chances of perioperative mortality[13, 14]. In combine spinal and epidural technique catheter is kept in situ in postoperative period this can be used for the purpose of intraoperative anaesthesia and postoperative analgesia

To control post-operative pain guidelines have been produced by the agency of health care policy and research, public health service U.S. are to decrease the

incidence and intensity of acute pain, patient's education about the need of communication for unrelieved pain, comfort and satisfaction of patient should enhance, contribute to fewer postoperative complications and in some cases shorter stays. [15] Adequate pain relief results in decrease in hospital stay time reduces cost and increases patient satisfaction, improve quality of life. Epidural use opioids gives advantage over systemic administration. Opioids acts on receptor in spinal cord and provide better quality of analgesia, less sedation score and better physiological function[16].

Girish P. Joshi et al [17] did a study to compare the efficacy of epidural fentanyl infusion with i.v. morphine via a patient-controlled analgesia system and observed that the postoperative pain scores were significantly lesser in the group epidural than in the Group IV-PCA throughout the study period.

The aim of our study was to compare post-operative analgesic efficacy of epidural tramadol vs fentanyl in lower limb orthopaedic replacement surgery.

Our study was conducted on 58 patients including either gender, patient aged between 18 years to 65 years. Patients were divided into 2 equal groups randomly, group T for drug tramadol and group F for drug fentanyl.

The demographic data of two groups were comparable in term of age weight and gender, which was consistent with the study of Dr **Ruchi Gupta** et al in 2011[18].

ONSET OF ANALGESIA: In our study, average time of onset of analgesia in group F was faster than group T. P value <0.001 which was significant. **Dr Jitendra Raghunath et al [19]** in 2014 were observed in their study that mean onset of analgesia in tramadol (group A) was 16.2 ± 2.82 and in fentanyl (Group B) was 12.2 ± 2.37 minutes. **Ujjwala B Khairmode et al [20]**in 2016 carried a comparative study between epidural tramadol and fentanyl they observed that mean onset of analgesia in group T was 13.08±2.6 and in group F was 5.79±1.46 minutes. In 2017 **L. Giridhar Naik and et al [21]**observed thatthe onset of analgesia was shortest (3.75 ± 0.36 minutes) in fentanyl group followed by tramadol (7.76 ± 0.65 minutes) and buprenorphine (13.98 ± 1.46 minutes) groups which was statistically significant. Result of our study was similar to above studies, from this we could conclude that the onset of onset of analgesia with fentanyl was shorter than tramadol.

Duration of Analgesia

In our study range of duration analgesia in Group T lies between 6 to 12 hours with mean and standard deviation of 8.06±1.25 hours and in Group F range of duration analgesia lies between 4 to 8 hours with mean and standard deviation of 5.4±0.97 hours. P value was <0.001 statistically significant. Duration of analgesia in group T was significantly more in comparison to group F. **Ujjwala B Khairmode et al [20]**observed duration of analgesia in group1 Mean±SD of 6.2±0.5 hours while in group 2 ranged between 3-4hrs with a mean of 3.48±0.4 hours. **Dr. Jitendra Raghunathet al[19]** observed that the mean duration of analgesia with tramadol (group A) was 4.92±0.74 hours which was significantly higher than with fentanyl (group B) i.e., 3.06±0.38 hours. **L. Giridhar Naik and et al [21]** observed that the duration of analgesia was 3.8725 ±0.31 hours in fentanyl group 7.23 ±0.56 hours in tramadol group which was statistically significant. **Ruchi guptaet al [18]** observed that mean duration of analgesia with epidural tramadol was 6.25±1.58 hours.

Epidural use of tramadol and fentanyl in similar studies showed some variation in duration of analgesia with compare to our study but in all the studies duration of analgesia with tramadol was longer than fentanyl.

VAS score of two groups

In our **study VAS score of** both groups were recorded at 0, 30, 60, 90 minutes & at 2, 4, 8, 12, 18, 24, 48 hours.P value calculated at 0 minute (P>0.05) was not significant Mean VAS score at 30, 60, 90 minutes & at 2, 4, 8, 12, 18, 24 hours was highly significant (P<0.001). This data shows that pain control in group F (fentanyl) was significantly better than in Group T (Tramadol). **Ujjwala B Khairmode et al [20]** noted that VAS score was significantly lower in group fentanyl than group tramadol for first 24 hours and quality of analgesia was better in group fentanyl. **Sugimoto M et al[22]** observed that patients receiving epidural fentanyl 25 µg having significantly superior pain control than with patients receiving epidural fentanyl 12.5 µg. **Swarna**

Banerjee and et al[23] concluded that pain score was significantly lower in group butorphanol, fentanyl than in group nalbuphine. **Dr. Preeti more et al** [24] noticed that VAS score in group tramadol was higher than in group butorphanol.

Epidural top-up

We noted the top up requirement at 4, 8, 12, 18, 24, 48 hours and found that the number of epidural top-up requirement was high in group F as compare to group T. Calculated p value was statistically significant at 4, 24 and 48 hours. Similarly, when we compare total number of top-ups required in each patient in 48 hours total number of doses required with fentanyl was high as compared to tramadol and calculated p value was statistically significant for patients required 4, 5, 7, 8 top ups in 48 hours on comparing both the groups. **Ujjwala B Khairmode et al** [20]found that top-up required was higher in group fentanyl compared to group T. **L.Giridhar Naik and et al** [21] found that fentanyl because of its shorter duration of analgesia it had to be given more frequently than tramadol and buprenorphine. Our result was comparable with these studies and from this we could conclude that due to its short duration of action frequency of top-up required with fentanyl was higher than tramadol.

Comparing sedation score

In group T, 97.8% of patients were having score of 2 and 2.2% of patients were having score of 3 where as in group F 86.5% of patients were having score of 2 and 13.5% of patients were having score of 3. **Ujjwala B Khairmode et al** [20]in group tramadol out of 40 patients 6 patients were fully awake and 34 patients were slightly drowsy where as in group fentanyl out of 40 patients 2 patients were fully awake and 32 patients were slightly drowsy, 6 patients were asleep but easily arousable. Calculated p value was statistically insignificant. **Swarna Banerjee and et al** [23] found that 32% of patients were sedated with butorphanol and 20% of patients were sedated with fentanyl.**Vicker MD et al** [8] compare tramadol and pethidine and found lower sedation score with tramadol.From our study and similar studies concluded that sedation score with fentanyl was slightly lower side as compare to tramadol but it was statistically insignificant. None of the patient required any medical intervention for sedation.

No significant difference was noted in pulse rate, systolic and diastolic blood pressure in both the group $p>0.05$.

Side Effects:

In our study group T, 5 patients (17.2%) of patients had vomiting, 4 patients (13.7%) of patients had nausea and no patient had episode of purities on comparing with group F, 2 patients (6.8%) of patients had vomiting, 2 patients (6.8%) of patient had nausea and 4 patients (13.7%) had episode of purities. **Jasleen Kaur et al** [25]had 25 % incidence of pruritus in patients receiving fentanyl. **Jitendra Raghunath et al** [19]found that incidence of nausea was 33% with tramadol and 10% with fentanyl, incidence of vomiting was 10 % with tramadol. 13.33 % patient had incidence of pruritus who received fentanyl and none of the patient had episode of pruritus with tramadol. **Ujjwala B Khairmode et al** [20]found that incidence of nausea and vomiting was 2.5% with fentanyl which is 17.5% and 12.5% in case of tramadol. **Santosh Kumar et al** [26]found that 6 out 30 patients had incidence of pruritus when fentanyl was used as an adjuvant. **L. Giridhar** [21]found that 6 out 20 patients with tramadol and 4 out of 20 patients with fentanyl had incidence of nausea & vomiting. 3 patients had pruritus with fentanyl. Our study had a similar result with above studies. It was higher in case of tramadol but it was statistically insignificant whereas incidence of pruritus was significantly high with fentanyl than tramadol.

Conclusion

From our study we concluded that fentanyl was having better quality and early onset of analgesia with compare to drug tramadol. But due to shorter duration of action of fentanyl the frequency of top-up doses requirement was high with fentanyl as compare to tramadol. Sedation with both the drugs was comparable with no serious out come and none of the patients required any treatment for that. There were no serious side effects with both the drugs. Nausea and vomiting was noticed in both the groups, with slightly high incidence with tramadol, whereas incidence of pruritus

was only seen with fentanyl.

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Conflict of Interest- Nil

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