ORIGINAL ARTICLE

A CLINICAL COMPARATIVE STUDY OF ANALGESIC EFFECT OF TRAMADOL AND PENTAZOCINE IN POST-OPERATIVE PATIENTS FOLLOWING UPPER ABDOMINAL SURGERY

T. Jamuna[1], J. Radha[2], Y. Nicolas Israel[3]

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ABSTRACT: The post-operative pain can be treated by various approaches. Aim of this randomised prospective study was to compare two drugs (Tramadol and Pentazocine). 100 adult patients of both sexes of ASA status 1 & 2 posted for elective upper abdominal surgery were randomly assigned into two groups of 50 each, where Group 1 received Tramadol intravenously and Group 2 received Pentazocine intravenously as post-operative pain management. The efficacy of the analgesic effect of intravenous Tramadol & Pentazocine was compared during post-operative pain management. It was observed that Tramadol has got more potent analgesic action compared to equianalgesic dose of Pentazocine.

KEYWORDS: Post-operative pain, Upper abdominal surgery, Tramadol & Pentazocine.

INTRODUCTION: Inspite of the spectacular advances in pain relief during surgery, relief of pain in the post-operative period still remains a problem. At the present moment, analgesic drugs still serve as sheet anchor for this purpose. Their undesirable side effects however make many a physician wary of their application in adequate doses where such effects could be disastrous, particularly where pain relief is sought for after upper abdominal surgery.[1]

"Major post-operative pain" is defined as severe post-operative pain that could endanger life if inadequately relieved and for which more vigorous and effective treatments may be justified although carrying a risk. When the severity of post-operative pain is less, the balance of risk and benefit is different. Superimposed on this concept is our professional and humanitarian duty to relieve suffering as much as feasible and safe.

The opioids are the traditional treatment for major pain by actions thought to be largely with in the C.N.S. however there are types of acute pain that are opioid sensitive and types that are less so.

Of the opioids the full mu-agonists are still the drugs of choice for systemic treatment of the severest types of acute pain.

The mu-receptors have followed others in being sub classified (into mu-1 and mu-2 receptor sub groups) on the basis of deferential blockade, but this has so far only allowed the potential separation of constipation from analgesic and respiratory effects.[2]

Adverse physiological sequelae of post-operative pain are numerous, but may be minimized with well coordinate pain therapy including the use of epidural narcotics or patient controlled analgesia. Patients who have significant post-operative pain, many demonstrate

anxiety, fright, insomnia and helplessness, which often exacerbate their perceptions of pain. These emotional components can make the post-operative recovery period an unpleasant and ominous experience. In addition pain increases sympathoadrenal outflow of catecholamines and may result in dysrhythmias, tachycardia and hypertension which may induce myocardial ischemia in susceptible patients because of increased myocardial oxygen demand or reduced supply.

Other pain related stress responses include activation of the coagulation system, platelet aggregation, and altered fibrinolysis. These alterations serve to enhance clotting and may lead to post-operative complications such as deep vein thrombosis, pulmonary embolism and myocardial ischemia and infarction. Pain also plays a role in the pathogenesis of post-operative pulmonary complications. Especially after upper abdominal and thoracic operations. Loss of lung volumes due to acute restrictive pulmonary dysfunction secondary to pain may result in relative hypoxemia major atelectasis and pulmonary consolidation.

Effective pain management also may decrease the incidence of post-operative impairment of muscle function and physical mobility and delayed return to normal activities as well as patient anxiety and psychological disturbances related to severe post-operative pain.

Post-operative pain can induce neuroendocrine stress responses such as the increased release of cortisol, aldosterone, and antidiuretic hormone, which may contribute to post-operative hyperglycemia, oliguria, and water retention.

Anesthesiologist can contribute greatly to their institution and society if they can reduce the incidence of post-operative complications and shorten intensive care unit and recovery room stay, the length of hospitalization and overall costs by applying new approaches to pain management.[3]

The purpose of the present study is to compare the analgesic effect of Tramadol with that of Pentazocine in relief of post-operative pain, following upper abdominal surgery.

The study consists of Tramadol in a dose of 50mg as bolus intravenous injection, and another 50mg, via drip (I.V. intravenous) post operatively for major upper abdominal surgery and comparing its effects (Analgesia, sedation, psychotomimetic actions, respiratory and C.V.S. effects) with an equipotent dose i.e., 30mg of Pentazocine administered intravenously to patients under identical circumstances.

MATERIALS AND METHODS: Selection of Cases: Hundred patients in the age group of 15 to 80 years, belonging to either sex, posted for elective upper abdominal surgery at government general hospital, Kurnool were selected.

Pre operatively patients had general systemic examination and a careful evaluation of their cardiovascular, respiratory and liver functions. All investigations were within normal limits. Patients with an abnormality of any of the systems were excluded from the study. A brief explanation regarding the study was made at the preoperative visit, so that they will not be unduly worried by the repeated post-operative visits made by the observer.

Premedication: All cases were pre medicated with Atropine Sulphate 0.6mg and Diazepam 5mg, given intravenously 15 minutes before operation.

Anaesthesia: All cases were induced with 250 to 300mg of 2.5% Thiopentone Sodium and intubated with cuffed oral endotracheal tube under 75 to 100mg of Suxamethonium Chloride.

Anaesthesia was maintained with 33(1/3%) oxygen and 66(2/3%) nitrous oxide; and injection, Pancuronium Bromide in dose of 4 to 5mg. No volatile anaesthetic agent, no analgesic or sedative was given during operation. Additional dose of injection Pancuronium in doses of 0.5mg was given when required.

At the end of surgery, reversal of residual neuromuscular block was done by intravenous injection of 1.2mg of Atropine Sulphate and 2.5mg of Noestigmine Methylsulphate. Respiratory adequacy was accessed and in the case of inadequacy, patient was ventilated with 100% oxygen using a face mask, and on additional dose of Neostigmine 0.5mg and Atropine 0.25mg was given. Patients were shifted to post-operative ward when they regained their reflexes, and respiratory adequacy. The patients were divided randomly into two groups of 50 each, for comparative study. In the post-operative ward, after about 15 minutes. When patients complained of pain, injection of Tramadol Hydrochloride 50mg intravenously as bolus, another 50mg added to I.V. drip, to one group (Group 1) of patients and injection of Pentazocine 30mg intravenously was given to other group (Group 2) of patients. The injections were given to the patients after assessing the severity of pain, residual, sedation, pulse rate, blood pressure (systolic and diastolic) and respiratory rate.

Pulse rate, systolic and diastolic blood pressure, respiratory rate, severity of pain, degree of sedation, pain relief at the end of half an hour and one hour and total duration of analgesia were noted every half an hour for seven hours after injection of analgesic and the results were tabulated. Patients were observed for side effects like nausea, vomiting, drowsiness, sweating, dysphoria and psychotomimetic effects.

Assessment of severity of pain: Pain is a subjective experience and so it is difficult to assess its severity objectively. Attempts to quantify the experience however are much more difficult. In clinical evaluation of severity of pain, two basic approaches are possible.

1. **Introspective Methods:** In which patients or trained observes mat attempt to assess the severity of pain.
2. **Behaviourist Methods:** In which some physical parameter, which is altered in the presence of pain is measured.

In our method of study, our approach for assessment of pain was based on introspective method, where in both the patient and observer graded the severity of pain. The observations were all made by the same person.

Pain Intensity		**Pain Relief**	
Type of pain	**Score**	**Pain Relief**	**Score**
None	0	None	0
Slight	1	Slight	1
Moderate	2	Moderate	2
Severe	3	Severe	3

Nominal scales used for assesssing pain intensity and pain relief

Assessment of sedation: In this study, sedation was assessed by the same observer. The following scale was used to assess the degree of sedation.

Sedation	Score
Poor	0 Patient awake and apprehensive
Fair	1 Awake but neither apprehensive nor drowsy
Good	2 Asleep, but arousable

OBSERVATION AND RESULTS: The results of a series of 50 cases are shown in table 1 to 13. Patients in this series belonged to the age group of 16 to 75 years. The age, sex, weight, distribution in both groups was shown in the following tables.

All the patients in the present study complained of pain within 15 minutes of the end of anaesthesia in post-operative period. The pain intensity, pain relief, sedation were assessed using the normal scale described in previous section.

The observations regarding the results are illustrated in tables 1 to 13.

Nature of operation	No. of cases		Percentage of total No. of cases	
	Group 1	Group 2	Group 1	Group 2
G. J. Vagotomy	35	27	70	54
Laparotomy	15	23	30	46

Table 1

Duration of Surgery Maximum: 2 hours.
Minimum: 1 hour.
Average: 90 minutes.

Sex	No. of cases		Percentage of total no. of cases	
	Group 1	Group 2	Group 1	Group 2
Male	40	39	80	78
Female	10	11	20	22

Table 2: Sex Determination

Age distribution	No. of cases		Percentage of total no. of cases	
	Group 1	Group 2	Group 1	Group 2
17-19	4	4	8	8
20-29	3	16	6	32
30-39	17	20	34	40
40-49	18	5	36	10
50-59	3	3	6	6
60-69	3	2	6	4

Table 3: Age of patients

Tramadol Group: Pentazocine Group:

Mean age group=38.3 yrs Mean age group=35.5yrs.

Minimum age=17yrs Mean age (male) 42.1yrs Minimum age=16yrs Mean age (Male) =32.1yrs.

Maximum age 75yrs Mean age (female) 34.6yrs Maximum age=61yrs Mean age (Female) =39.4 yrs.

Weight distribution	No. Of cases		Percentage of total no. of cases	
	Group 1	Group 2	Group 1	Group 2
30-40	10	9	20	18
41-50	15	21	30	42
51-60	19	13	38	26
61-70	4	7	8	14

Table 4: Weight distribution

Mean weight (kg) 55.1 Mean weight (kg) = 56.5kgs.

Maximum weight (kg) = 75 Maximum weight = 69kgs.

Minimum weight (kg) = 32 Minimum weight = 32kgs.

Time	Total No. of cases	No. of cases having pain						Total No. of cases having pain		Total No. of cases relieved of pain		% of cases with total pain relief	
		Slight		Moderate		Severe							
		Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
0 Hrs	50	2	-	8	12	40	38	50	50	-	-	-	-
½ Hrs	50	20	20	15	16	8	-	43	36	7	14	14%	28%
1 Hrs	50	18	22	2	15	0	-	20	37	30	13	60%	26%
2 Hrs	50	14	20	4	13	0	-	18	33	14	17	28%	34%
3 Hrs	50	8	16	0	8	0	2	8	26	42	24	84%	48%
4 Hrs	50	4	13	2	7	0	3	6	23	444	27	88%	54%
5 Hrs	50	12	20	18	21	2	-	32	45	18	8	36%	10%
6 Hrs	50	24	20	20	22	3	-	47	42	3	8	6%	16%

Table 5: Assessment of severity of pain after tramadol/pentazocine injection

Table 5 shows the assessment of pain after injection of Tramadol 44 cases got relieved of their pain completely at the end of 4th hour. After injection of Pentazocine, 27 cases got relieved of their pain completely with in 4th hour. It also shows that maximum No. of cases (45) having pain at the end of 6th hour.

Time	No. of cases						Percentage of cases with fair to good sedation	
	poor		Fair		Good			
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
0 Hrs	50	50	-	-	-	-	-	-
½ Hrs	29	10	13	13	8	27	42%	80%
1 Hrs	25	8	17	20	8	22	50%	84%
2 Hrs	20	9	21	18	9	23	60%	82%
3 Hrs	16	10	25	16	9	24	68%	80%
4 Hrs	9	10	27	20	14	20	82%	80%
6 Hrs	12	13	20	21	18	16	76%	74%
7 Hrs	20	25	23	10	7	15	60%	50%

Table 6: Sedation

Table 6 shows the sedative effect of Tramadol as maximum cases i.e., 41 had fair to good sedation at the end of 4th hour. The sedative effect of Pentazocine Maximum No. of cases (42) had fair to good sedation at the end of one hour.

TIME	No change 0-3		No. of cases											
			Decrease in the respiratory rate						Increase in the respiratory rate					
			Slight 4-6		Moderate 7-10		Severe Above 10		Slight 4-6		Moderate 7-10		Severe Above 10	
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
0 Hrs	-	-	-	-	-	-	-	-	16	14	20	26	14	10
½ Hrs	19	18	15	8	4	3	6	2	4	12	2	7	-	-
1 Hrs	21	19	17	8	9	-	0	-	2	17	1	6	-	-
2 Hrs	24	24	16	10	8	1	1	-	1	11	-	2	-	2
3 Hrs	21	20	19	8	10	6	-	-	-	12	-	3	-	1
4 Hrs	15	22	21	9	10	2	1	-	2	10	1	5	-	2
6 Hrs	40	20	2	10	3	3	0	-	2	9	1	6	2	2
7 Hrs	34	20	2	8	1	4	-	-	8	8	3	8	2	2

Table 7: Changes in respiratory rate

Table 7 shows the changes in the respiratory rate after injection of Tramadol as 31 cases slight to moderate fall in respiratory rate at the end of 4th hour. One case showing severe fall in the respiratory rate. 3 cases had increased in respiratory during that period.

After injection of Pentazocine, 11 cases had slight to moderate fall and 13 cases had slight to moderate rise at the end of second hour.

TIME	No change 0-10		No. of cases											
			RISE IN PULSE RATE						FALL IN PULSE RATE					
			Slight 11-20		Moderate 21-30		Severe Above 30		Slight 11-20		Moderate 21-30		Severe Above 30	
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
0 Hrs	16	24	13	12	8	4	7	-	5	10	1	-	-	-
½ Hrs	26	36	10	4	2	4	-	-	7	4	5	2	-	-
1 Hrs	25	40	4	4	3	2	1	-	10	3	6	1	1	-
2 Hrs	23	38	5	8	1	1	1	-	15	2	3	1	2	-
3 Hrs	20	30	7	6	2	2	-	-	10	10	8	2	3	-
4 Hrs	31	29	10	6	2	3	-	-	6	8	1	4	-	-
6 Hrs	30	34	8	5	3	6	1	1	5	2	3	2	-	-
7 Hrs	30	20	10	10	7	5	1	-	2	12	-	3	-	-

Table 8: Changes in pulse rate

Table 8 shows changes in pulse rate. After injection of Tramadol, 31 cases had no change in pulse rate. 12 cases had slight to moderate rise in pulse rate. 7 cases showing slight to moderate fall in pulse rate at the end of 4th hour. After injection of Pentazocine, 9 cases had slight to moderate rise in pulse rate at the end of 2nd hour. 38 cases had no change, 3 cases had slight to moderate fall in pulse rate.

TIME	No change 0-10		No. of Patients											
			RISE IN SYSTOLIC BLOOD PRESSURE						FALL IN SYSTOLIC BLOOD PRESSURE					
			Slight 11-20		Moderate 21-30		Severe Above 30		Slight 11-20		Moderate 21-30		Severe Above 30	
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
0 Hrs	20	20	14	10	6	6	-	-	7	8	2	5	1	1
½ Hrs	27	24	11	18	5	4	-	1	5	2	2	1	-	-
1 Hrs	31	22	5	10	-	6	-	2	11	6	3	3	-	1
2 Hrs	30	23	10	10	3	5	-	-	6	6	1	5	-	1
3 Hrs	24	20	14	8	6	6	-	-	5	7	1	5	-	4
4 Hrs	26	24	12	10	8	3	-	1	3	6	1	4	-	2
6 Hrs	38	30	8	8	-	2	-	1	2	5	2	3	-	1
7 Hrs	34	34	13	3	-	2	-	2	1	4	2	5	-	-

Table 9: Changes in systolic blood pressure (mm of hg)

Table 9 shows, after injection of Tramadol, 26 cases with no change in blood pressure. 20 cases showing slight to moderate rise in blood pressure. 4 cases showing slight to moderate fall in blood pressure during 4th hour. After injection of Pentazocine, 15 cases showed slight to moderate rise. 9 cases had slight to moderate fall. On case showing severe fall. 23 cases, showing no change at the end of 2nd hour.

TIME	No change 0-10		No. of Patients											
			RISE IN DIASTOLIC BLOOD PRESSURE						FALL IN DIASTOLIC BLOOD PRESSURE					
			Slight 11-20		Moderate 21-30		Severe Above 30		Slight 11-20		Moderate 21-30		Severe Above 30	
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
0 Hrs	25	33	18	8	4	3	-	-	2	5	1	1	-	-
½ Hrs	28	30	17	9	1	2	-	-	3	6	1	3	-	-
1 Hrs	29	35	8	7	-	2	-	-	5	4	4	2	4	-
2 Hrs	32	40	4	4	-	2	1	-	8	2	3	1	2	1
3 Hrs	36	43	4	2	-	1	-	-	5	2	3	2	2	-
4 Hrs	23	45	5	2	-	1	-	-	10	2	7	-	5	-
6 Hrs	40	47	2	1	3	1	-	-	-	1	3	-	2	-
7 Hrs	32	47	12	1	3	1	-	-	3	1	-	-	-	-

Table 10: Changes in diastolic blood pressure (mm of hg)

Table 11 shows, after injection of Tramadol, 23 cases with no change in blood pressure. 5 cases showing slight rise in blood pressure. 22 cases showing slight to severe fall in blood pressure. After injection of Pentazocine, 40 cases showed no changes. 6 cases shows slight to moderate rise. 3 cases showed slight to moderate fall. One case showing severe fall at the end of 2nd hour.

TIME	No. of cases											
	Nausea		Vomiting		Drowsiness		Sweating		Dysphoria		Psychotomimetic effects	
	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2	Group 1	Group 2
0 Hrs	-	-	-	-	-	-	-	-	-	2	-	-
½ Hrs	3	4	4	5	1	2	-	-	1	2	1	3
1 Hrs	5	7	5	4	1	3	1	2	-	-	-	2
2 Hrs	7	5	1	3	-	1	2	3	-	1	1	1
3 Hrs	2	3	-	4	2	-	1	1	-	1	-	1
4 Hrs	1	1	3	-	-	1	2	2	-	-	-	2
6 Hrs	-	-	-	4	1	3	-	-	-	-	-	-
7 Hrs	-	-	1	1	1	1	-	-	1	-	-	-

Table 11: Side effects

Table 11 shows incidence of side effects after injection of Tramadol, 12 cases having Nausea and vomiting, 6 cases complaining of excessive sweating. After injection of Pentazocine, 20 cases had nausea and vomiting. 11 cases had drowsiness, 8 cases had sweating 6 cases had dysphoria 9 cases complained of psychomimetic effects.

DISCUSSION: In the present study, an attempt has been made to compare the use and study the efficacy of TRAMADOL 100mg intravenously and equivalent doses of PENTAZOCINE 30mg intravenously, in the management of post-operative pain following major upper abdominal surgery where pain is severe. The observations and results are discussed under the following headings.

ANALGESIC ACTION: Tramadol has been proved to be one sixth to one tenth as potent as morphine, taking into account both intensity and duration of action.

In the present study, (Tramadol Group) 2 patients (4%) had slight pain, 8 patients (16%) had moderate pain, and 40 patients (80%) had severe pain in post-operative period before administration of TRAMADOL 100mg injection.

In all cases, the onset of action started within 30 minutes. Peak analgesic effect reached within 4 hours, 44 cases (88%) got relieved of their pain completely within 4 hours. 6 cases (12%) had slight pain even at the end of 4 hours.

In pentazocine group, 12 (24%) cases had moderate and 38 (76%) cases had severe pain in the post-operative period. In all these cases, the onset of analgesia was having a mean period of 30 minutes. Peak analgesia was reached at the end of 90 minutes.

SEDATION: Sedation with tramadol is maximum at the end of 4th hour (82%) with good sedation in 14 cases. Moderate sedation in 27 cases and poor sedation in 9 cases.

Sedation with PENTAZOCINE is maximum at the end of 3rd hour. 40 cases (80%) with poor sedation in 10 cases (20%).

ACTION ON RESPIRATORY SYSTEM: Both the drugs significantly reduce the respiratory rate. In the present study in both groups the respiratory frequency was very much increased immediately after the surgical procedure. After the administration of the analgesic, both groups of patients showed marked improvement in their respiratory pattern within 1 hour, the rate has decreased, respiration ceased.

With Tramadol, 31 cases (62%) had slight to moderate fall in respiratory rate, 1 case showed severe fall in respiratory case, 3 cases showed increase in respiratory rate at the end of 4th hour.

With Pentazocine, 11 cases showed slight to moderate fall in respiratory rate. 10 cases showed slight increase and 5 cases with moderate increase in respiratory rate while 22 cases showed no change at the end of 4th hour.

ACTION ON CARDIOVASCULAR SYSTEM: In the present study both groups did show rise in pulse rate and blood pressure after the administration of analgesic. Pulse rate increase is more with Pentazocine. Fall in pulse rate is greater during 3rd hour with both Tramadol and Pentazocine.

With Pentazocine, 9 cases (18%) had slight to moderate rise in pulse rate, 38 cases (76%) had no change, 3 cases (6%) had slight to moderate fall in pulse rate, at the end of 2nd

hour. With Tramadol, 31 cases (62%) had no change in pulse rate, 12 cases (24%) had slight to moderate rise, 7 cases (14%) showed slight to moderate fall at the end of 4th hour.

SYSTOLIC BLOOD PRESSURE:

A) **Pentazocine Group:** 15cases (30%) showed slight to moderate rise, 9 cases (18%) had slighjt to moderate fall. 1 case (2%) showing severe fall. 23 casers(46%) showed no change at the end of 2nd hour.

B) **Tramadol Group:** 30 cases (60%) showed no change 13 cases (26%) showed slight to moderate rise, 7 cases (14%) showed slight to moderate fall in blood pressure at the end of 2nd hour.

DIASTOLIC BLOOD PRESSURE:

A) **Pentazocine Group:** 40 cases (80%) showed no change 6 cases showed slight to moderate rise in blood pressure, 3 cases (6%) showed slight to moderate fall in blood pressure, 1 case (2%) showed severe fall at the end of 2nd hour.

B) **Tramadol Group:** 32 cases (64%) showed no change 4 cases (8%) showed slight rise. 1 case (2%) severe rise, 8 cases (16%) showed slight fall, 3 cases (6%) showed moderate fall 2 cases (4%) showed severe fall in blood pressure at the end of 2nd hour.

SIDE EFFECTS: In the present study, with Tramadol, 12 cases (24%) had nausea and vomiting, 6 cases (12%) complained of excessive sweating 7 cases (14%) had drowsiness, 4 cases (8%) had dysphoria. 2 cases (4%) showed psychotomimetic effects.

With Pentazocine, 20 cases (40%) had nausea and vomiting, 11 cases (22%) had drowsiness, 8 cases (16%) had sweating. 6 cases (12%) had dysphoria 9 cases (18%) complained of psychotomimetic effects like anxiety, night mares, weired thoughts and hallucinations.

SUMMARY AND CONCLUSIONS: SUMMARY: A comparative clinical study of one hundred cases was carried out at Government General Hospital, Kurnool to study the efficacy of Tramadol hydrochloride and Pentazocine in the management of Post-operative pain following major surgical procedures (Upper Abdominal), where pain is severe. Sedatives analgesics and volatile anaesthetic agents were withheld as premedicants or supplementary during anaesthesia. In the post-operative period, after full recovery and after complaining of pain, a group of 50 patients was given 30mg of Pentazocine intravenously and another group of 50 patients was given 50mg of Tramadol intravenously as bolus and another 50mg added to the drip and the analgesic efficacy and side effects were compared after periodical intervals.

Observations were made regarding their analgesic efficacy, sedative potency, changes in respiratory rate, heart rate, systolic and diastolic blood pressure, and side effects like nausea, vomiting, drowsiness sweating, dysphoria and psychomimetic effects for a period of 7 hours after the injection. Results were tabulated and conclusions were drawn from them.

CONCLUSIONS:

1) Tramadol has got more potent analgesic action compared to equianalgesic dose of Pentazocine. Mean duration of analgesic with Tramadol is more than that with Pentazocine.
2) Though the onset was delayed, Tramadol produced fairly good, sedation for a prolonged period than Pentazocine.
3) Compared to Pentazocine Tramadol produced more respiratory depression.
4) Except for a slight tendency to increase systolic blood pressure and to decrease diastolic blood pressure, Tramadol possessed greater cardiovascular stability than Pentazocine.
5) The common side effects observed were nausea, vomiting and drowsiness.

The above observations and conclusions suggest that Tramadol presents an advance in the post-operative analgesia in that fewer injections may be needed to provide satisfactory pain relief without undesirable side effects.

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ORIGINAL ARTICLE

AUTHORS:

1. T. Jamuna
2. J. Radha
3. Y. Nicolas Israel

PARTICULARS OF CONTRIBUTORS:

1. Incharge Professor & HOD, Department of Anaesthesiology, Sri Venkateshwara Medical College, Tirupati.
2. Incharge Professor, Department of Anaesthesiology, Sri Venkateshwara Medical College, Tirupati.
3. Post Graduate, Department of Anaesthesiology, Sri Venkateshwara Medical College, Tirupati.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. T. Jamuna,
4-4-1047 C10, Nehru Nagar,
Tirupati-517501, Andhra Pradesh.
E-mail: talisettijamuna@gmail.com

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