Postoperative Analgesia With Tramadol in Orthopedic Surgery: Continuous Infusion Versus Repetitive Bolus Administration

Waqar Hassan, Muhammad Inam, Abdul Satar, Mohammad Arif

ABSTRACT

Objective — *To compare the effect of infusion of tramadol with repetitive administration of bolus on postoperative pain in orthopedic surgery.*

Study design — *Comparative study.*

Place & Duration of study — *Department of Orthopedics and Spine Surgery Hayatabad Medical Complex Peshawar, form October 2009 to April 2010.*

Methodology — *Patients with American Society of Anesthesia clinical grade I and II, age >18 year scheduled for ambulatory orthopedic and trauma surgery were included.* Half of the randomly selected patients were placed in infusion group (Group I) who received an initial intravenous loading dose of 100 mg tramadol followed by an infusion of 12 mg/hour tramadol for 24 hours after recovery from anesthesia; if necessary, repeated bolus of 50 mg tramadol was given. Half of randomly selected patients were in bolus group (Group II).These patients received a placebo infusion instead of tramadol infusion and only received bolus doses of 50 mg on demand.

Results — *The pain relief was assessed as excellent or good by 78 % of group I and 70 % of group II patients. In group I, 65 % requested only one or no repetitive bolus, compared with 40 % in group II, while two or more bolus were demanded by 30 % in group I and 60 % in group II. The average analgesic consumption after 6 hours was 222 +/- 50 mg tramadol in group I and 200 +/- 50 mg tramadol in group II, respectively. After 24 hours it was 438 +/- 50 mg tramadol in group I and 250 +/- 50 mg tramadol in group II. While the consumption during the first 6 hours was comparable. From then on the consumption in group I increased significantly. Side effects were reported by 30 % in both the groups.*

Conclusion — *Continuous infusion is better than bolus in term of easy administration and better pain control throughout postoperative care.*

Key words — *Tramadol, Postoperative pain, Orthopedic surgery.*

INTRODUCTION:

Severe postoperative pain is a common reason for delay in hospital discharge. Unrelieved pain is likely to cause adverse effect on more than one body system.[1] Effective pain relief can lead to earlier return to work and psychological benefits.[1] Orthopedic patients had the highest incidence of pain (16.1%) in post anesthesia care unit.[2] Postoperative pain relief can be achieved by several methods, including use of systemic opioids and regional anesthesia with intrathecal or epidural opioids or local anesthesia.[3]

On demand analgesia using a patient controlled analgesia (PCA) system is regarded as the ideal option for systemic opioids analgesia, but it is not yet commonly used.[3] The use of repetitive bolus on regular basis or on demand is the most frequent form of administration of analgesia in postoperative pain therapy. In previous studies the pain relief was

Correspondence:
Dr. Waqar Hassan
Department of Orthopedic and Spine Surgery
Postgraduate Medical Institute
Hayatabad Medical Complex Peshawar
E mail: waqarlrh1@yahoo.com

assessed as excellent or good by 76.5% of infusion group and 65.6% of bolus group.[4] Among drugs used in analgesia, tramadol is an atypical opioid which acts as a weak agonist for all types of opioids receptors and nonopioid mechanism by inhibiting noradrenaline uptake and stimulation of serotonin release.[5] This is a safe analgesia for relief of postoperative pain and is long acting than diclofenac sodium.[6] Moreover it does not cause respiratory depression compared to other opioids.[7]

Combination of tramadol and ketorolac are also effective and safe .[8] Combination of other analgesics are used rarely and needed in refractory cases only. Aim of this study was to find out better mode of analgesic in term of effective pain relief.

METHODOLOGY:

This was a comparative study conducted in the Department of Orthopedic Surgery, Postgraduate Medical Institute / Hayatabad Medical Complex Peshawar, from October 2009 to April 2010. Sample size was 214, using 76.5% proportion of pain of infusion group, 65.5% proportion of pain for bolus group, 80% power and 5% significance level. All patients with American Society of Anesthesia clinical grade I and II, age >18 year were scheduled for orthopedic and trauma surgery were included. After approval by hospital ethical committee and fulfilling the inclusion criteria the patients who gave consent were registered. Opioids, local anesthetics, anti-emetics or nonsteroidal anti-inflammatory drugs were avoided in 24 hours before or during surgery. Half of the randomly selected patients were placed in infusion group (Group I) who received an initial intravenous loading dose of 100 mg tramadol followed by an infusion of 12 mg/hour tramadol for 24 hours after recovery from anesthesia; if necessary, repeated bolus of 50 mg tramadol was given. Half of randomly selected patients were in bolus group (Group II).These patients received a placebo infusion instead of tramadol infusion and only received bolus doses of 50 mg on demand.

The observer bias were addressed by blinding the observer recording of pain using Visual Analog Score (VAS). Computer generated numbers were allocated to either group I or group II and placed in opaque envelops and revealed after the patients' registration.

Pain relief was monitored by VAS at 30 min, 1hour, 3 hours, 6 hours, 12 hours, 18 hours and 24 hours after recovery from anesthesia. The range of VAS of 0-4, 5-7, 8-10 were considered as mild, moderate and severe pain respectively. Retrograde assessment of analgesia was done by patient after 6 hours and 24 hours by Verbal Rating Score (VRS). Amount of analgesia given in milligram in 6 hours and 24 hours was calculated and also repetitions of bolus dose in both the groups were noted. Blood pressure, pulse, respiratory rate and any side effect of tramadol were noted.

SPSS software version 11 was used to analyze the data. Mean ± S.D was calculated for age, respiratory rate, blood pressure and pulse rate. Frequencies and percentages were presented for gender, blood pressure, heart rate, pain relief and demand of tramadol between the two groups. To find the correlation/association between two groups' Chi-square test and t-test were applied so is to find the significances. P value 0.05 was considered significant.

RESULTS:

A total of 214 patients were included in this study. In group I, mean age was 40 ±11.71 year while in group II, 40 ±11.29 year. In group I 72(67%) patients were males and 35 (33%) females. In group II, 61 (57%) patients were males and 46 (43%) females. Pain distribution between infusion and bolus groups (groups I and II) is shown in table I. Postoperative nausea and vomiting (PONV) was reported in 70 (65%) patients in group I while 40 (37%) patients in group II had same complaints. In Infusion group I, 83 (78%) patients had relief from pain while in bolus group, 70 (65%) patients had relief from pain.

Tramadol was requested by 70 (65%) patients for one time and 32 (30%) patients for 2 times in group I, whereas in group II, 43 (40%) demanded tramadol for one time and 65 (60%) patients requested for 2 times. Total consumption of tramadol between

Table I: Mean Pain Scores at Different Interval

		Groups	
		Group I	Group II
Mean Pain Scores	30 Min	5±1	5±2
	1 Hour	4±2	4±2
	3 Hours	3±3	4±2
	6 Hours	3±2	3±2
	12 Hours	2±2	2±2
	18 Hours	2.3±2	2±2
	24 Hours	1±2	1±2

Group I: Infusion group
Group II: Bolus group

Table II: Total Amount of Tramadol Consumed (N=214)			
		Group	
		Infusion Group	Bolus Group
Consumption of Tramadol	In 6 hours	223.5± 53.7	176.6± 63.1
	In 24 hours	449.5± 66	201.6± 83.9

infusion and bolus groups in 6 and 24 hours is shown in table II.

DISCUSSION:

Tramadol is an atypical opioid. It can be given for analgesia both intraoperatively and in postoperative period. Repeated demand for analgesia is extra burden for nursing staff. Continuous infusion of analgesia with initial loading dose is effective in terms of patient satisfaction. Tramadol has been compared with morphine as primary analgesics in a double blind manner by making use of PCA, thus allowing the patients to titrate, without interference, their analgesic needs and to balance them against side-effects.[9,10] Since large inter individual variations exist in opioid requirements for pain relief, their consumption by PCA may not be a rigorous analgesic outcome measure, yet these variations should apply with the same magnitude to both the groups. In one randomized, double-blinded, placebo-controlled study of post-thoracotomy pain relief showed that intravenous tramadol in the form of a bolus followed by continuous infusion was as effective as epidural morphine.[11] Our study also showed excellent and good results in term of pain relief when initial loading dose of 100 mg followed by 12 mg /hour continuous infusion provided.

Tramadol has proved to be an effective and well tolerated analgesic in the management of moderate to severe acute postoperative pain in adults. A slow intravenous bolus of 100 mg followed by titration (50 mg every 10 to 20 minutes, to a total dose of 250 mg) is usually recommended as the initial dosing scheme.[12] Maintenance is usually achieved with additional doses of 50 to 100 mg every 4 to 6 hours, to a maximum dose of 600 mg per day. Administration of tramadol by patient-controlled analgesia also proved to be effective in many trials.[13] However, the rational basis for these recommendations for postoperative pain management is unclear and the ED50 has not been reported.

It has been observed in a previous study in which tramadol was compared with morphine via subcutaneous route with patient controlled analgesic technique that the postoperative analgesic effect with tramadol was comparable.[14] In 4000 patient they found that subcutaneous route is more convenient than intravenous route of administration and equally effective with similar dose of morphine consumption and similar pain score.[15]

Not much work has been done on comparison of continuous intravenous sustained dose with bolus administration on demand. As PCA devices are costly and need patient control we did not use this device. Taking as guide line from previous studies initial loading dose were given (100 mg) for both the groups. Two studies have shown greater consumption of tramadol but both used a continuous background infusion in addition to PCA boluses. Similarly in our study consumption of tramadol in 24 hours is comparable to other studies and it is high in continuous infusion group than bolus group.[16]

The high tramadol usage demonstrated in our study compared with others, may be explained by a number of factors. Firstly the type of surgery performed influence the degree of postoperative pain and amount of analgesia in the form of on demand bolus to relieve it. Only one of previous report included patients recovering from major orthopedic surgery, but they were combined with other patients who had undergone gynaecological surgery.[17] The average tramadol consumption was 258 mg over 21 hours but represented the needs of possibly two dissimilar groups of patients.[18] Secondly the loading dose of analgesia given to our patients in immediate postoperative period was probably too small as we have abandoned all type of analgesia before and during operation to compare and calculate average total dose of tramadol in 24 hours to relieve postoperative pain. Inadequate initial control of the pain, as reflected by the high VAS score, would account for the high consumption and total dose requested soon after surgery. However, it is clear from our study, that once analgesia with tramadol becomes effective, the average hourly consumption, together with pain score, decreased rapidly.

The subcutaneous route of administration for

tramadol, as opposed to the intravenous route, may alter its apparent potency via change in rate of absorption and metabolism. This is not the case for morphine which remains as effective whether given by any other route.[17] The major active metabolite of tramadol, O-desmethyle tramadol is said to have a higher affinity for opioid receptors than its parent compound,[18] and its concentration at any time may be affected by the way tramadol is administered.

The total amount of tramadol requested by our patients was more in first three to four hours after surgery. In early postoperative period, patients were in pain (as shown by their high VAS Scores), still drowsy and need more rescue doses. Hence, the importance of providing early adequate pain control with generous individualized loading dose of analgesia. The emetognic effect of tramadol is well described and recognized as one of its more troublesome side effects.[19] Tramadol scored slightly better than morphine for other unwanted side effects especially as regards urinary retention. In both groups moderate and comparable decrease in blood pressure and small increase in heart rate was observed from 12 hours onward, postoperatively.

CONCLUSIONS:

Tramadol is an effective analgesic agent when administered through intravenous route with constant rate of infusion. Large doses however, are necessary to achieve adequate early postoperative pain relief. Tramadol remained effective in both infusion and bolus forms but it was convenient to use infusion. Tramadol has similar side effects in both the groups.

REFERENCES:

1. Ekman EF, Koman LA. Acute pain following musculoskeletal injuries and orthopedic surgery: Mechanism and management. J Bone Joint Surg. 2004;86-A:1316-27.
2. Chung F, Ritchie E, Su J. Postoperative pain in ambulatory surgery. Anesth Analg. 1997;85:808-16.
3. Stamer UM, Höthker F, Lehnen K, Stüber F. Postoperative analgesia with tramadol and metamizol: Continual infusion versus patient controlled analgesia. Anaesthetist. 2003;52:33-41.
4. Rüd U, Fischer MV, Mewes R, Paravicini D. Postoperative analgesia with tramadol: Continuous infusion versus repetitive bolus administration. Anaesthetist. 1994;43:316-21.
5. Bhattacharya R, Dutta B. Postoperative analgesia with local anesthetic and opioid combinations, using double space CSE Technique. Indian J Anaesth. 2007;51:409-14.
6. Hashmi ZA, Bashir G, Shah SA. Comparison of the efficacy of tramadol hydrochloride versus diclofenac sodium for postoperative pain control in the first twenty four hours. Ann Pak Inst Med Sci. 2006;2:239-42.
7. Sarnee A, Zia K, Mumtaz MH. Effect of buprenorphine, pentazocine and tramadol on respiration. Pak J Med Sci. 2004;20:46-50.
8. Lepri A, Sia S, Catinelli S, Casali R, Novelli G. Patient-controlled analgesia with tramadol versus tramadol plus ketorolac. Minerva Anestesiol. 2006;72:59-67.
9. Saleem M. History of pain relief and pain management. Rawalpindi. The Army Press. 1994,6-13.
10. Espinet A, Handesson DJ, Facenda KA, Morriscon LMN. Does pre incisional thoracic extradural block combined with diclofenac reduce post operative pain after abdominal hysterectomy. Br J Anaesth. 1996;76:209-13.
11. Pasqualucci A, de Angelis V, Contardo R, Colò F, Terrosu G, Donini A, et al. Pre emptive analgesia: Intraperitoneal local anaesthetic in laparoscopic cholecystectomy. A randomized double blind study. Anesthesiology. 1996; 85:11-29.
12. Colins R, Brandner B, Bronley LM, Woolf CJ. Is there any clinical advantage of increasing the pre-emptive dose of morphine or combining pre incisional with post operative morphine administration? Br J Anaesth. 1995;74:369-99.
13. Wu C, Yu J, Yeh C. Pre incisional dextromethorphan treatment decreases post operative pain and opioid requirement after laparoscopic cholecystectomy. Anaesth Analg. 1999; 88:1331-4.
14. Shoem SR, Watkin GL, Kahn JJ. Control of early postoperative pain with bupivacain in pediatric tonsillectomy. Ear Nose Throat.

1993;72:5630-56.

15. Beilin B, Galina G, Yardeni IZ, Bessler H. Tramadol does not impair the phagocytic capacity of human peripheral blood cells. Can J Anaesth. 2005 ;52:1035-9.

16. Johansen M, Harbo G, Illum P. Preincisional infiltration with bupivacaine in tonsillectomy. Arch Otolaryngol Head Neck Surg. 1996;122:261-3.

17. Bean Lijewski JD. Glossopharyngeal nerve block for pain relief after paediatric tonsillectomy, retrospective analysis and two cases of life threatening upper airway obstruction from an interrupted trial. Anaesth Analg. 1997; 84:1232-8.

18. Whipple JK, Quebbeman EJ, Lewis KS, Gottlieb MS, Ausmam RK, Difficulties in diagnosing narcotic overdoses in hospitalized patients. Ann Pharmacother. 1994; 28:446-50.

19. Alexander JI, Hill RG. Postoperative pain control. Oxford Blackwell Scientific Publication. 1987; 14:1178–89.