Al-smadi RH, Awwad Al-issa KA, Ibrahim EN, Ismael MJ. (May 2015). 2:1 ratio ketamine/propofol mixture infusion is an excellent anesthetic technique for closed reduction of distal lower third radius fracture. *Jour of Med Sc & Tech*; 4(2); Page No: 104 – 107.

Journal of Medical Science & Technology

Original Article Open Access

2:1 ratio Ketamine/propofol mixture infusion is an excellent anesthetic technique for closed reduction of distal lower third radius fracture

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Abstract

Objective of the study was to assess the analgesic effect of 2:1 ratio ketamine/propofol mixture infusion during closed reduction of distal lower third radius fracture. This prospective, double-blind and randomized investigation included 70 patients, of both sexes, aged 30-40 years, classed I-II by the American society of anesthesiologists and scheduled for closed reduction of distal lower third radius fracture at Prince Hashim hospital, Zarqa, Jordan, during the period April 2014-March 2015. Patients were divided into two groups. Group I (n=35) patients received a solution of propofol (0.5mg/kg/hr) with ketamine (0.5mg/kg/hr) in 1:1 ratio and group II patients (n=35) received the ketamine/propofol solution but with 2:1 ratio, infused intravenously in both groups. Postoperative pain was evaluated using a 0-10 visual analog pain scale. Postoperative period of hospital admission was recorded and patient's satisfaction was reported using a 4-point verbal rating scale. Ketamine-propofol solution spared postoperative pain relief in 35% of patients in both groups. Patients in group I had significantly less period of short postoperative admission and total period of hospital admission in comparison with group II. Patients in group I had significantly higher visual analog pain score with non-significant higher need for analgesics in comparison with group II. Patients in group II recorded significant higher satisfaction in comparison with group I. Ketamine-propofol in 2:1 ratio can be used adequately for closed reduction of lower third radius fracture.

Keywords: Analgesia, ketamine, propofol, fracture, radius, pain, post operative

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Received: February 20, 2015 Accepted: April 25, 2015. Published: May 20, 2015.

Introduction

Trauma is one of the most frequent causes for surgery in orthopedic specialty. It is usually correlated with other features such as psychological trauma, pain and anxiety induced by fear of painful procedures. Pain frequently induces hormonal stress reaction and with common correlated release of primary phase reactants which can change the local or systemic immune system [1]. During these critical conditions, pain relief was important to enhance the intended technique planned to save patients lives or the functioning organs or limbs. Any type of anesthesia or analgesia targeting the safety without or with minor adverse effects, the effective enhancing termination of scheduled surgical technique with highest standard of patients and surgeon's satisfaction and the early discharge [2].

Different agents were used alone or in combinations as patterns for analgesia. Intravenous Ketamine 1mg/kg produced optimum serum concentrations in pediatrics scheduled for painful techniques of less than 5 min period and attained concentrations correlated with pain relief action for more than 10 min. Some authors showed that propofol and remifentanyl combination may produce adequate pain relief for the reduction of anterior glenohumeral dislocation, with fast recovery [3]. Other investigations found that triple combination of propofol, fentanyl and low dose ketamine produced beneficial outcome. Santiveri et al, assessed the safety of intravenous ketamine/propofol combination (ketofol) in the same syringe [4], but dosing

correlation ship was still a debate. The objective of our investigation was to assess the analgesic effect of 2:1 ratio ketamine/propofol mixture infusion during closed reduction of distal lower third radius fracture.

Methods

Our prospective, double-blind and randomized investigation included 70 patients, of both sexes, aged 30-40 years, classed I-II by the American society of anesthesiologists and scheduled for closed reduction of distal lower third radius fracture at Prince Hashim hospital, Zarqha, Jordan, during the period April 2014-March 2015, after obtaining written informed consent from all participants and approval from the Jordanian royal ethical and research board review committee. Patients were divided into two groups. Group I(n=35)patients received a solution of propofol (0.5mg/kg/hr) with ketamine (0.5mg/kg/hr) in 1:1 ratio and group II patients(n=35) received the solution with propofol 250 mcg/kg/hr and ketamine 500 mcg/kg/hr in 2:1 ratio, infused intravenously in both groups. Postoperative pain was evaluated using a 0-10 visual analog pain scale. Postoperative period of hospital admission was recorded and patient's satisfaction was reported using a 10-point verbal rating scale**.** Patients with morbid obesity and chronic obstructive airway disease were ruled out from the investigation. Primary intravenous incremental bolus of 300 mcg/kg propofol was administered in all patients groups, with a primary maintenance infusion rate of 100 mcg/kg/min propofol and of ketamine 100 mcg/kg/min(1:1 ratio) in group I and 200 mcg/kg/min(2:1 ratio) in group II. The investigation drug infusion rate was calibrated in 25mcg/kg/min increments during the technique. The investigation drug infusion was stopped at the end of the surgical technique and the duration of surgery and time to adequate recovery were registered.

Patient's pain was assessed at 10-min intervals until the end of the technique. Postoperative pain was evaluated using a 0-10 visual analog pain scale (VAS) with 0 = no pain, 1-3 = mild pain, 4-6 = moderate pain, 7-9 = severe pain and 10 = most severe pain [5]. Postoperative pain was managed with intramuscular sodium diclofenac 75 mg administered on demand at VAS of >4. Patients were discharged when they had mild pain. Postoperative period of hospital admission was recorded. Patients satisfaction regarding the anesthetic protocol was evaluated using a 10-point verbal rating scale ((9-10) = very satisfied, (7-8) = satisfied, (4-6) = somewhat satisfied and (0-3) = dissatisfied).

Statistical analysis: Outcome was investigated using Chi-square test. P-value <0.05 was considered statistically significant.

Results

The investigation enrolled 47 males and 23 females with a mean age of 35.4 years. There were no significant differences between groups in terms of age, sex, ASA and body weight (Table-1).There was no significant difference between groups in terms of surgical time. Time till full recovery was significantly less in group I in comparison with group II. Total anesthesia time for group I was significantly less in comparison with group II (Table-2).

	Group I	Group II	Total study group
Age(years) mean ± SD	35.1 ± 7.8	35.4 ± 7.5	35.4 ± 7.6
Gender M (no,%) F	24(68.6%) 11(31.4%)	23(65.7%) 12(34.3%)	47(67.1%) 23(32.9%)
Body weight(kg) mean ± SD	79.4 ± 12.3	80.3 ± 12.7	79.6 ± 13.1
ASA grade I (no,%) II	26(74.3%) 9(25.7%)	25(71.4%) 10(28.6%)	51(72.9%) 19(27.1%)

Table 1: Showing demographic features.

	Group I	Group II	P
Surgical period (min) Mean ± SD	38.5 ± 4.7	39.2 ± 4.2	>0.05
Total anesthesia period (min) Mean ± SD	46.7 ± 4.6	51.1 ± 4.3	<0.05

Table 2: Showing surgical and anesthesia periods.

Our method, whatever the concentration was used, spared the requirement for postoperative pain relief in 24 patients (34.3%) and demand analgesic was needed in the other 46 patients (65.7%). No patient needed demand analgesic twice. Mean VAS pain scores were significantly reduced in group II in comparison with group I ($p<0.05$) (Table-3). At 20 min after stopping the infusion, 17 patients in group I and 7 patients in group II were candidates for discharge. At 30 min after stopping the infusion, the other 18 patients of group I and 11 patients in group II were candidates for discharge. At 40 min after stopping the infusion, 7 patients of group II were candidates for discharge. At 50 min after stopping the

infusion, 10 patients of group II were candidates for discharge (Table 4).

	Group I	Group II	P
VAS pain score at Mean+/-SD			
5 min	12.2 ± 8.7	5.4 ±4.8	
10 min	18.4 ±10.0	12.2 ±9.1	
20 min	21.4 ±10.0	17.6 ±10.1	
30 min	21.6 ±9.3	20.3 ±9.6	<0.05
40 min	-	21.0 ±8.8	
total	18.4 ± 3.4	15.3 ±3.4	
Need for demand analgesic (no,%) No	11(31.4%)	13(37.1%)	>0.05
Yes	24(68.6%)	22(62.9%)	

Table 3: Postoperative pain profile.

	Group I	Group II
20 MIN	17	7
30 MIN	18	11
40 MIN		7
50 MIN		10

Table 4: Patients discharge and time.

	Group I	Group II	P
Postoperative short admission (min) Mean±SD (range)	24.9 ±4.9(20-30)	41.5 ±3.8 (40-45)	<0.05
Total hospital admission(min) Mean±SD (range)	72.4 ±6.3(60-85)	95.8 ± 6.1 (85-112)	<0.05

Table 5: Postoperative hospital admission.

Mean postoperative short admission and total hospital admission were significantly less in group I in comparison with group II (Table-5). Mean satisfaction score registered for group II (9) was higher in comparison with group I (8) ($p<0.05$).

Discussion

Our investigation showed a design for analgesia method used for short period surgical technique .This method of analgesia permitted termination of the scheduled orthopedic technique adequately. Hospitals, recently, continue to search for analgesic procedures to cut expenses as world is passing a severe economic crisis which had put its burdens also on hospitals and patients. Cost effective principle is an important issue nowadays and by passing complicated anesthesia techniques you avoid also extended hospital stay which also costs a large amount of money.

The patients who were administered 1:1 ketamine/propofol infusion experienced significantly less period of postoperative admission and total period of hospital admission in comparison with 2:1 infusion. Increased propofol dose showed the effect on the result of ketofol analgesia and was in accordance with that demonstrated in literature regarding different ketofol infusion concentrations. Some authors [6] used propofol 1mg/kg and ketamine 0.5mg/kg in a ratio of 2:1 for reduction of forearm fractures in pediatrics and showed that the mixture was effective with fast recovery. Others [7] compared propofol 1.2 mg/kg and ketamine 1mg/kg in a ratio of 1.2:1 versus propofol/fentanyl in the same ratio and demonstrated that both mixtures produced effective pain relief during dressing changes in pediatric burn patients but propofol-ketamine mixture was superior. In accordance with the use of 1:1 infusion, Rapeport et al [8] showed that ketofol 1:1 infusion administered in conjunction with regional anesthesia was excellent in high risk patients and produced benefits including analgesia. Few workers [9] used I.V ketofol (mixed 1:1 ketamine-propofol) for primarily orthopedic techniques and showed that patients who received 1:1 infusion had significantly higher VAS pain scores with no significant increased demand of rescue analgesics bearing in mind that the received dose of ketamine is similar with less analgesic effect. Mustafaeva et al [10] used ketamine/propofol ratio of 1:4 at digestive tract endoscopy and demonstrated that with this ratio, ketofol has optimum pain relief characteristics. Present study showed that patients who received 2:1 ketofol infusion had increased satisfaction in terms of pain relief, while those who received 1:1 were less satisfied due to higher postoperative pain VAS scores and increased need for demand analgesics.

Conclusion

ketofol infusion, whatever the concentration administered, spared the requirement for postoperative demand analgesic in 35% and decreased the requirement for it in the other 65% of patients. ketofol infusion in 2:1 ratio is the suitable analgesic pattern for minor orthopedic procedures with short postoperative and total hospital admission and optimum levels of postoperative analgesia in comparison with 1:1 ketofol infusion.

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