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Original Research Article

Intravenous regional anaesthesia using Tramodol hydrochloride and Ketorolac – A Comparative study

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Abstract: Multiple adjuvants had been added to improve the quality of intravenous regional anaesthesia (IVRA). The aim of this study was to compare the effect of tramadol hydrochloride with that of ketorolac as an adjuvant for lidocaine IVRA. This study was conducted at Mamata medical college, Khammam, Telangana state. Sixty patients of ASA grade I was included in this study. They were divided into 3 groups. The patents of group C were given 40ml of 0.5% lignocaine + 1 ml of Normal saline and patients of group K were given 40ml of 0.5% lignocaine + 1 ml of ketorolac (30mg) and group T were given 40ml of 0.5% lignocaine + 1 ml of tramadol hydrochloride (50mg) as intravenous regional anaesthesia using biers' block. The onset time of sensory and motor block was not enhanced by addition of adjuvants. The grade of analgesia was slightly better with the tramadol and ketoral drugs. The tourniquet pain was better tolerated with both drugs. The duration of analgesia was significantly prolonged with both drugs. The VAS scores and patient comfort were better with the tramadol and ketorolac and they brought down the requirement of analgesics during first 24hours. We concluded that both drugs were good adjuvants to lidocaine in IVRA.
Keywords: Intravenous regional anaesthesia, lignocaine, tramadol hydrochloride, Ketorolac.

INTRODUCTION

In the modern era of industrialisation and development where more and more people are exposed to trauma, intravenous regional anaesthesia was a technique which can be adapted for both upper and lower limb operations [1].

Intravenous regional analgesia (IVRA) was introduced into clinical practice by August Bier in 1908 but was forgotten for nearly half a century until it was revived by Holmes in Great Britain in 1963. Since then it became widely popular and numerous reports from all over the world have appeared testifying to its efficacy in properly selected cases. The factors to be considered while performing this technique were possible reaction to the agents used and the anticipated length of procedure. Since the analgesia was dependent upon the uninterrupted presence of the tourniquet, it provides satisfactory analgesia for most surgical procedures on distal parts of the limbs [2].

Intravenous regional anaesthesia may be defined as reversible state of analgesia, produced by administration of local anaesthetics and other analgesics into the venous system of upper and lower extremities. This technique is simple, effective, and cheap and with minimal preventable side effects for operations on limbs especially in emergency situations like patients with full stomach, multiple injuries and un-investigated systemic problems.

The commonly used local anaesthetic solutions in intravenous regional anaesthesia techniques were lignocaine, prilocaine, etodiacine and centribucaine. Other drugs include opioids (fentanyl, tramadol etc), NSAIDS (ketorolac) and ketamine etc. were added as adjuvants. Adding of an adjuvant and use of two drugs result in better quality and duration of block and also decreases the dose requirement of local anaesthetic, thereby reducing the toxicity.

The aim of this was to compare the adjuvant effect of tramadol hydrochloride and ketorolac with lignocaine hydrochloride in intravenous regional anaesthesia.

MATERIALS AND METHODS

The present study was carried out Mamata medical college, Khammam after approval of hospital ethical committee. Sixty patients of ASA Grade I and II undergoing upper limb surgeries were included in the study after taking informed consent from all the Patients. They were divided into three groups. The patents of group C were given 40ml of 0.5% lignocaine + 1 ml of Normal saline and patients of group K were given 40ml of 0.5% lignocaine + 1 ml of ketorolac (30mg) and group T were given 40ml of 0.5% lignocaine + 1 ml of tramadol (50mg) as intravenous regional anaesthesia using biers' block.

Patients with history of adverse reaction to local anaesthetics and peripheral vascular diseases, neurological diseases, epilepsy, myasthenia gravis, myopathies, haemolytic disorders and cardiac arrhythmias were excluded in this study.

After keeping all the emergency lifesaving drugs and equipment ready at hand intravenous line was secured on the opposite hand and infusion of 500ml of ringer lactate was started. Preoperative PR, BP, RR and SPO2 were noted. No premedication was given to the patients in the study. After placement of the patient on the operation table a number 20G cannula was inserted into a prominent vein over the dorsum of the hand and fixed to the limb that has to be operated.

The limb was completely exsanguinated either by elevating limb above the heart level, for about 3-5 mins or by eschmarch bandage. While the limb was still elevated the double cuffed pneumatic tourniquet was applied over upper arm of operating limb and inflated the pressure of the proximal cuff up to 100mm of Hg above the patient's own systolic blood pressure. Then limb was kept in the horizontal position, already prepared solution of that particular group was injected slowly over a period of 2 minutes so as to distribute itself evenly.

Time when the tourniquet was applied, when the solution was injected, time of onset of sensory loss and motor loss were all recorded. BP, PR, RR and SPO2 were also recorded. The quality of analgesic block and muscle relaxation and grading of analgesia was assessed.

After completion of surgical procedure the tourniquet was released by using yo-yo technique. Post operatively PR,BP, RR and SPO2 were observe for every 10mins for about 1hr. after that patient was given a 10inch long visual analogue scale to assess the intensity of pain post operatively.

STATISTICAL ANALYSIS

We determined that, to detect 15% difference in analgesic requirement, a sample size of 20 patients in each group will permit a power of 80% and type I error probability of null hypothesis at 0.05. Data were analyzed using SPSS (version 13 for Windows; SPSS Inc., Chicago, Illinois, USA) software. Quantitative data were presented as mean ± SD, whereas qualitative data were presented as frequency distribution. A P value of less than 0.05 was considered as a cut off value for significance.

RESULTS

The present study was conducted at Mamata Medical College, Khammam, Telangana state. There was no difference with regards to the age, sex, weight and ASA grades between the two groups. There was no significant difference between the three groups of the study as regards the duration of the operation and type of the surgery (table 1).

Table 1: Demographic data

	Group C	Group K	Group T
Age (years)	33.25±8.54	32.44±14.44	37.00±13.38
Weight (kgs)	57.44±4.68	58.32±4.74	54.22±7.22
Sex (M/F)	10/10	14/6	12/3
ASA Grade I/II	12/8	15/5	13/7
Average Surgery duration (min)	44.53±6.48	50.25±5.24	48.51±3.23
Average tourniquet duration in (min)	60.25±9.42	59.35±8.26	54.28±6.25

Values were given as Mean±S.D.

Pulse rate, blood pressure and oxygen saturation were recorded pre, intra and post operatively. There was no significant change between the all three groups but there was a slight fall in PR, BP was noted after tourniquet release in all three groups.

The mean time of onset of sensory loss and motor loss was slightly higher in Ketorolac and Tramadol groups compared to control group. The mean duration of analgesia was significant in adjuvant added groups compared to control group whereas no difference exist between Ketorolac and Tramadol groups (table 2).

Table 2: Comparison of sensory and motor loss and analgesia between groups

Parameter	Group C (control)	Group K (Ketoroloc)	Group T (Tramadol)
Mean time of onset of sensory loss(min)	3.15±0.35	3.45±1.21	3.25±0.56
Mean time of onset of motor loss (min)	8.05±1.46	9.15±1.23	9.10±1.90
Mean duration of analgesia (min)	65.45±9.22	86.10±10.42*	86.20±9.36*

Grading of analgesia was done in all three groups according to the below data and results were shown in table 3.

Grade I: Inadequate analgesia, operation not possible and no muscle relaxation

Grade II: Adequate analgesia, operation possible and weak grip present

Grade III: Complete analgesia loss of pain only and slight movements of fingers only

Grade IV: Complete loss of all sensations and complete motor paralysis

Table 3: Comparison of Analgesia grades among the groups

Grades of analgesia	Group C (No)	Group K(No)	Group T (No)
Grade I	0	0	0
Grade II	2(10%)	0	1(5%)
Grade III	3(15%)	2(10%)	1(5%)
Grade IV	15(75%)	18(90%)	18(90%)
Total	20	20	20

The mean time of first complaint of proximal tourniquet pain was significantly prolonged in adjuvant groups compared to control but values were in comparable in Ketorolac and Tramadol groups.

Table 4: The mean time of first complaint of proximal tourniquet pain

Group	Mean time of complaint of proximal tourniquet pain
Group C	28.00 ± 4.23
Group K	49 ± 6.44
Group T	50.75±2.33

Post-operative pain control with injection voveran 100mg I.M was given when patient complained of pain. Post -operative number of analgesics required in 24 hour after completion of surgery in each group were given in table 5. All the patients of control group required of analgesics and requirement was decreased in adjuvant groups. Tramadol was more effective than ketorolac.

Table 5: Total number of analgesics required in 24 hours

Group	Group C			Group K			Group T		
1.Patients requiring no analgesics	0			4(20%)			6(30%)		
2.Patients requiring analgesics	20 (100%)			16 (80%)			14(70%)		
a.No of doses	1	2	3	1	2	3	1	2	3
b.No of cases	5	8	7	11	4	1	10	4	0
c. percentage	25%	40%	35%	55%	20%	5%	50%	20%	0%

After the tourniquet release the patients were given a 10inch long visual analogue scale and they average scores for the severity of pain was recorded in all three groups. VAS score in control group was more lies between 5-6, whereas it was mild in both Ketorolac and Tramadol groups (2-4). Stable hemodynamics without post-operative nausea vomiting and pruritus was found in all three groups. Only one patient in control group developed bradycardia, hypotension and pulmonary oedema. And the patient was successfully resuscitated.

DISCUSSION

The inability to provide effective postoperative analgesia was one of the major disadvantages of IVRA. A large number of adjuvants like NSAIDs, Opioids, α2 agonists, muscle relaxants, NMDA agonist had been added to local anaesthetic to reduce tourniquet pain and thereby increase tourniquet tolerance and enhance postoperative analgesia.

Surgical trauma results in postoperative pain by means of direct mechanical damage to nerve endings, as well as release of endogenous chemical mediators, leading to the activation of nociceptors. If these pain pathways are pharmacologically blocked before surgical trauma, the changes can be diminished or abolished [3]. IVRA, a venous technique founded by August Gustav Bier in 1908 and so called the Bier's block[4] , acts by anesthetizing the peripheral nerve endings and also the nerve trunks. Hence, by the end of surgery, when the tourniquet is released, there is very little amount of the drug left in the vessels and cannot produce toxic side effects if washed into the systemic circulation.

The ketorolac and tramadol used as components of intravenous regional anaesthesia to supress the intraoperative pain and enhance the post-operative analgesia. Ketorolac was a NSAID that interferes with the synthesis of pain mediators at the site of trauma by suppression of cyclooxygenase (COX) enzymes, and so interferes with the arachidonic acid pathway. Increased levels of prostaglandine E (PGE) and I2 at the site of surgery stimulate the nociceptors, and so ketorolac suppresses these mediators by inhibiting both COX-1 and COX-2[5]. Ketorolac was a safer parenteral NSAID which minimises the sensitisation of peripheral nociceptors. Ketorolac was the only NSAID that is approved for intravenous use and it acts by interference with the synthesis of inflammatory mediators [6] .The dose was selected as 30mg based on the previous studies [7,8].

Tramadol was a synthetic opioid it minimises respiratory depression shows more stable hemodynamics with minimal post-operative nausea and vomiting. It was given parentally was effective for pain relief with minimal side effects [8].

The onset of sensory and motor blockade found out by various studied was better with addition of ketorolac or tramadol [8, 9]. The study was shown that both drugs were good adjuvants to the lignocaine and provided effective peri-operative analgesia and they prolonged post-operative analgesia too. But in our study the sensory block was slightly delayed with ketorolac. Onset of motor block was same in two groups. The duration of analgesia was significantly prolonged in both groups compared to control group. The mean time of complaint of proximal tourniquet pain was significantly long in both drugs comparative to control group. We assessed the effect of analgesia and grading was done from I to IV in all three groups. Grade IV (complete loss of sensation with motor paralysis) analgesia indicates better quality with good success rate. Majority of patients acquire grade IV analgesia.75% of patients in the control group attain grade IV, where as it is 90% in group K and T. the VAS scores in ketoral and tramadol groups were mild to moderate lying in between 2- 4 on scale of 0 to 10 . It shows better quality and duration of blockade. The post-operative analgesic dose required in ketoral and tramadol groups were significantly less than the control group. 20% of the patients require 2doses of analgesics post-operatively in ketoral and in tramadol group during the first 24hrs where as it was 75% in control group showing the addition of adjuvants to lignocaine had resulted in significant prolongation of pain relief post-operatively. These results were in comparison with the previous studies [10, 11]. In contrast Gregoire Longlois and co-workers [12] found that the addition of tramadol did not reduce tourniquet pain and post -operative pain during IVRA. Tramadol with lidocaine can act as good adjuvant and it reduces the analgesic requirement in first 24 hours [13-15].

The complications of IVRA usually were caused by the systemic toxicity of the agent used [16&17].Only one patient in control group showed bradycardia and Ketorolac and Tramadol group patients do not showed any side effects.

CONCLUSION

Upper arm intravenous regional anaesthesia with addition of tramadol 50mg or ketorolac 30 mg to 100mg of lignocaine (40ml of 0.5% solution) provides a safe better and effective analgesia both intra-operatively and post-operatively without any significant side effects. Even though onset of blockade was not affected much the technique provides both longer duration of sensory block and post-operative analgesia compared with the conventional upper arm IVRA with lignocaine. The post-operative analgesics requirement in 24hrs was significantly brought down using both drugs.

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