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Research Article

INTRAVENOUS REGIONAL ANESTHESIA - A PROSPECTIVE COHORT STUDY

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A R T I C L E I N F O

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A B S T R A C T

Background: The inability to provide effective postoperative analgesia is one of the major disadvantages of intravenous regional anesthesia (IVRA). We designed a prospective, cohort study to compare and evaluate the effect of adding paracetamol or ketorolac as adjuvants to 0.5% preservative free lignocaine for intravenous regional anesthesia on various parameters in IVRA.

Methods: The study was a prospective cohort study done in Government Medical College, Thrissur, from March 2014 to July 2015. The study subjects were American Society of Anaesthesiologists I and II patients of either sex, aged 20-60 years, weighing between 45kg – 65kg, undergoing elective forearm procedures in Govt. Medical College, Thrissur. Patients with major systemic illnesses like liver disease, kidney disease, raynauds disease and sickle cell anemia were excluded.

Results: The mean sensory block onset time was lower in lignocaine / paracetamol group (3.6 ± 1.9) compared to lignocaine/ ketorolac group (6.1± 2.1) which was statistically significant. Cases who were in lignocaine /paracetamol group reported pain early in first twenty and forty minutes, although statistically not significant (P value > 0.05). But patients in lignocaine /ketorolac group reported pain later at fifty to sixty minutes, although statistically not significant (P value > 0.05). Most cases who were in lignocaine /paracetamol group reported pain early in the post operative period, although statistically not significant (P value > 0.05).

Conclusion: The mean sensory block onset time was lower in patients who received IVRA with lignocaine paracetamol group. There was no statistically significant difference in the duration of analgesia as well as the post perative pain onset time in either lignocaine/ paracetamol or lignocaine/ ketorolac group.

INTRODUCTION

Intravenous regional anesthesia (IVRA) is easy, reliable and cost effective when used in short operative procedures of hand or forearm. It is the method of producing analgesia in the distal part of a limb by I.V injection of a local anesthetic solution into the vein of the same limb, while circulaton to the limb is occluded by the application of tourniquet. The local anesthetic diffuses from the peripheral vascular bed to nonvascular tissue such as axons and nerve endings. Success rates are between 94 – 98 percent[1]. The local anesthetic diffuses from the peripheral vascular bed to nonvascular tissue such as axons and nerve endings. Both the safety and the efficacy of this regional anesthetic procedure depend on interruption of blood flow to the involved limb and gradual release of the occluding tourniquet. Intravenous regional anesthesia has been used primarily for surgical procedures on the upper limbs [2].

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MATERIALS AND METHODS

Aim of the study was to compare and evaluate the effect of adding paracetamol or ketorolac as adjuvants to 0.5% preservative free lignocaine for intravenous regional anesthesia on sensory block onset time, tourniquet pain and postoperative analgesia in patients undergoing elective forearm surgeries. The study was a prospective cohort study done in Government Medical College, Thrissur, from March 2014 to July 2015. The study subjects were American Society of Anaesthesiologists I and II patients of either sex, aged 20-60 years, weighing between 45kg – 65kg, undergoing elective forearm procedures in Govt. Medical College, Thrissur. Patients with major systemic illnesses like liver disease, kidney disease, raynauds disease and sickle cell anemia were excluded.

RESULTS

The mean age of study population was 32.5 (9.7) yrs. Mean (SD) duration of surgery was 46.3 (13.0) minutes, mean (SD) tourniquet application time was 55.8 (12.2) minutes, mean (SD) sensory block onset time was 4.9 (2.3) minutes, mean (SD) tourniquet pain onset time was 45.8 (7.9) minutes. 37.5

% of study population had intra operative fentanyl consumption. Among the study population, 37.5% came for implant removal, 12.5% came for ganglion excision. 45% of population had fractures involving radius and ulna, 2.5 % had scaphoid surgeries. Remaining 2.5% came for finger surgeries. Among cases in lignocaine /paracetamol group, 75% were males and 25% were females. Among cases in lignocaine/ ketorolac group, 70% cases were males and 30% cases were females. The mean (SD) age of lignocaine /paracetamol group was 31.1(9.9) yrs, and that of lignocaine/ ketorolac group was 33.9 (9.6)yrs. The mean (SD) weight of lignocaine/paracetamol group was 69.9 (7.9), and that of ligocaine/ ketorolac was 65.6 (7.0)kg. The mean (SD) height of lignocaine /paracetamol group was 167.8(8.1)cm, and that of lignocaine/ketorolac group was 166.2(7.4)cm.

Table 1

Variable	Lignocaine / Paracetamol mean (SD)	Lignocaine/ Ketorolac mean (SD)	P value
Age (yrs)	31.1 (9.9)	33.9 (9.6)	0.353
Weight (kg)	69.9 (7.9)	65.6 (7.0)	0.073
Height (cms)	167.8 (8.1)	166.2 (7.4)	0.522
Duration of operation (mts)	48.8 (12.2)	43.75 (13.62)	0.225
Tourniquet application time (mts)	57.3 (12.0)	54.3 (12.5)	0.437
Sensory block onset time (mts)	3.6 (1.9)	6.1 (2.1)	0.001
Touniquet pain onset time (mts)	46.8 (8.3)	44.8 (7.6)	0.433

The mean sensory block onset time was lower in lignocaine / paracetamol group compared to lignocaine/ ketorolac group which was statistically significant. The mean tourniquet application time and tourniquet pain onset time were higher in lignocaine / paracetamol group although it was not statistically significant (P value > 0.05). There was no statistically significant difference in the baseline demographic data also between the two groups.

Table 2 Pain rating

	Lignocaine / Paracetamol	Lignocaine / Ketorolac	P value
20 minutes	2 (10%)	0	0.487
40 minutes	2 (10%)	1 (5%)	1.00
50 minutes	1 (5%)	2 (10%)	1.00
60 minutes	1 (5%)	2 (10%)	1.00
End of surgery	14 (70%)	15 (75%)	0.765

Cases who were in lignocaine /paracetamol group reported pain early in first twenty and forty minutes, although statistically not significant (P value > 0.05). But patients in lignocaine /ketorolac group reported pain later at fifty to sixty minutes, although statistically not significant (P value > 0.05) (Table 2, Figure 1)

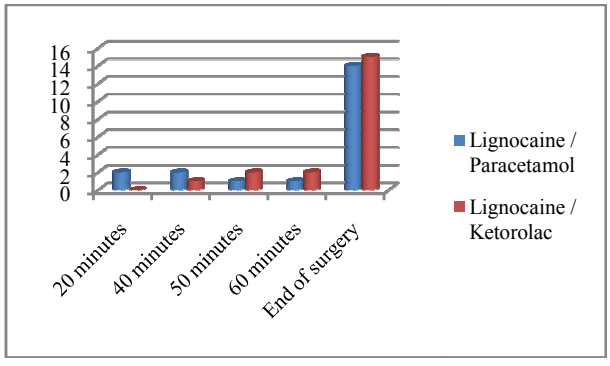

Figure 1

Table 3 Post operative pain rating

Post op pain onset	Lignocaine / Paracetamol	Lignocaine / Ketorolac	P value
30 minutes	5 (25%)	1 (5%)	0.182
45 minutes	6 (30%)	5 (25%)	0.716
1 hour	5 (25%)	2 (10%)	0.407
1.5 hour	2 (10%)	5 (25%)	0.407
2 hour	1 (5%)	3 (15%)	0.342
2.5 hour	1 (5%)	2 (10%)	1.00
3 hour	0	2 (10%)	0.487

Most cases who were in lignocaine /paracetamol group reported pain early in the post operative period, although statistically not significant (P value > 0.05). Most patients in lignocaine /ketorolac group reported pain later after one hour compared to lignocaine /paracetamol group which were statistically not significant (P value < 0.05) (Table 3, Figure 2).

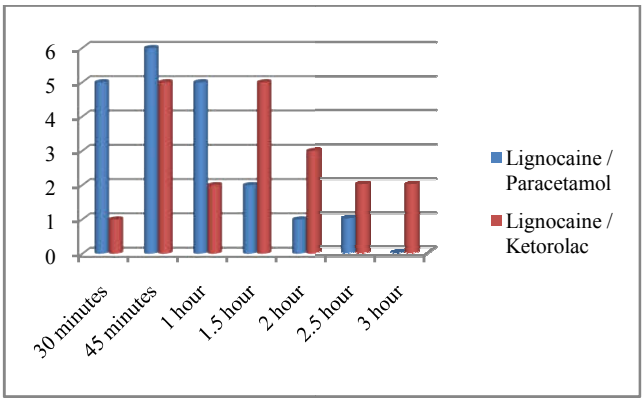

Figure 2

Table 4

Post op pain onset	Intraoperative fentanyl	No intraoperative fentanyl	P value
30 minutes	0	6 (24%)	0.067
45 minutes	4 (26.67%)	6 (24%)	1.00
1 hour	3(20%)	4 (16%)	1.00
1.5 hour	4 (26.67%)	3 (12%)	0.392
2 hour	2 (13.3%)	3 (12%)	1.00
2.5 hour	2 (13.3%)	1 (4%)	0.545
3 hour	0	2 (8%)	0.519

Cases who received fentanyl during the intraoperative period reported pain later in the post operative period, although statistically not significant (P value < 0.05) (Table 4)

DISCUSSION

Intravenous regional anaesthesia uses local anaesthetics administered to one particular limb by occluding the arm proximally to provide conduction blockade. Intravenous regional anaesthesia has many advantages. It is simple and reliable with rapid recovery. Despite these advantages intravenous regional anaesthesia has its own limitations like lack of postoperative analgesia and tourniquet pain which causes discomfort to the patient. However the present study attempted to eliminate these disadvantages by adding either paracetamol or ketorolac as an adjuvant to preservative free lignocaine and to find out which one improves the quality of intravenous regional anaesthesia of lignocaine by decreasing sensory block onset time, better tourniquet pain relief, less intra operative opioid consumption and prolonged post operative analgesia.

In this study both Group LP (lignocaine with Paracetamol) and Group LK (lignocaine with ketorolac) patients were comparable in respect of age, sex, weight , duration of surgery

and type of surgery. The primary outcome of this study was - addition of paracetamol to lignocaine for IVRA decreased onset time of sensory block compared to the LK group and it is statistically significant with a p value of 0.001. This finding correlates with the study conducted by Myoung *et al* [3]. Sensory block onset was evaluated in the dermatomal sensory distribution of the medial and lateral antebrachial cutaneous, ulnar, median, and radial nerves and no sensory spairing was noticed in both groups.

Patients who were in LP group reported tourniquet pain early in first forty minutes, although statistically not significant. But patients in LK group reported tourniquet pain later at fifty to sixty minutes, although statistically not significant. But majority (70%) of patients in both groups reported no tourniquet pain. This clearly states that addition of either paracetamol or ketorolac to lignocaine in IVRA is associated with improved tourniquet tolerance.

In the parent study conducted by Myoung *et al*.(30) Visual analogue score (VAS) after tourniquet inflation was found to be higher in LK group and thus the addition of paracetamol to ligonocaine was found to delay the tourniquet pain onset time. This does not correlate with our study. The probable reason is that the dose of ketorolac which was used in the study by Myoung *et al*(30) was 10 mg whereas our study used 20 mg ketorolac. Ketorolac 10 mg when added to IVRA may be insufficient to reduce tourniquet pain. Studies have indicated that optimal dose of ketorolac for IVRA is 20 mg(32).

In present study, post operative numerical pain rating scale showed lower numerical pain rating scores and prolonged post operative analgesia with LK group compared to LP group though it is not statistically significant. This correlates well with the parent study by Myoung *et al*, where the post op VAS score and post op analgesic consumption was lower in ketorolac –lignocaine group compared to the paracetamol-lignocaine group.(30) Myoung *et al* postulated that Ketorolac 10 mg when added to IVRA may be insufficient to reduce tourniquet pain but its anti-inflammatory effect and systemic circulation after tourniquet deflation may reduce postoperative pain.(30)

80% of patients in LP group complained of pain (NPS >3) within 60 mts after tourniquet deflation in the post op period whereas in 5% cases, post op analgesia extended upto 2.5 hours. In the LK group, only 30% of patients complained of pain within 60 mts while 80% of cases had (NPS >3) within 2 hrs and 10 % cases had analgesia extended upto 3 hrs. Post op analgesia was assessed till the demand of pain medication by the patient, that is moderate to severe pain. Intraoperative fentanyl consumption was associated with prolonged post operative analgesia in both LP and LK groups although it is not statistically significant. While >60% of patients who had no intra op fentanyl developed moderate to severe pain by 1 hour, majority of those who had IV fentanyl intraop developed pain by 1 ½ hours to 2 hours only.

Sen H *et al* (35) found that the addition of 300mg paracetamol to lignocaine in intravenous regional anaesthesia was associated with decreased tourniquet pain, increased quality of anaesthesia and improved post operative analgesia when compared to IVRA with lignocaine and I.V paracetamol intra op. Reuben *et al*(31) postulated that using ketorolac to 0.5% lignocaine for intravenous regional anesthesia would suppress intraoperative tourniquet pain and enhance postoperative analgesia. The patients who received IVRA reported significantly lower verbal analog pain scores at 15 and 30 min after tourniquet inflation and less postoperative pain with lower visual analog scale (VAS) pain scores at 30 and 60 min, and required no fentanyl for control of early postoperative pain in the postanesthesia care unit PACU.

Both studies prove the improved quality of anaesthesia with addition of paracetamol or ketorolac to lignocaine in IVRA, so it may be possible that ketorolac and paracetamol has got more or less similar efficiency in improving the quality of tourniquet pain and improving post operative VAS scores and we postulate that may be the reason for getting a statistically non significant difference between LP and LK groups in tourniquet pain onset time and post operative analgesia duration.

There were some limitations in this study. The dose of intravenous acetaminophen 300 mg was fixed for the reason that when intravenous acetaminophen over 300 mg was mixed then the total volume of IVRA solution would be too large and would be difficult to control the concentration of ligocaine. We anticipate that larger doses of acetaminophen would increase the efficacy of analgesic during IVRA but optimal dose of acetaminophen could not be determined.

Another limitation is that we could not asses motor block because of unncecessary delay in starting surgery. As some of the surgical procedures were very short lasting less than 30 minutes, we had to deflate the tourniquet after 40mts and in that case tourniquet pain onset time was taken as the duration of tourniquet application time. This gave a false interpretation of early onset of tourniquet pain. Also assessment of post op analgesia becomes less significant after the first dose of opioid (when NPS >3) in the post op period. As most of the patients demanded rescue analgesia within 2-3 hours, we couldnot assess the post op analgesia for the entire 4 hour period as mentioned in the protocol.

The variability in intraoperative pain or postoperative pain depending on the type of surgery performed such as forearm fracture reduction and fixation procedures, implant removal and ganglion excision etc could not be standardized. The study encountered difficulty in exanguinating the limb in case of painful forearm fractures due to poor patient cooperation and most of the time sensory block onset time was found to be prolonged in both LP and LK groups. Also it was noticed that there was high intra operative fentanyl consumption and shorter duration of post op analgesia in this type of procedures. So we postulate that IVRA is a good anaesthetic plan for minor procedures like implant removal, ganglion excision , tendon release etc, but may not be a good option in case of fresh fractures for ORIF.

CONCLUSION

The sensory block onset time was lower in patients who received lignocaine and paracetamol for intravenous regional anesthesia. The duration of action of analgesia with lignocaine/ paracetamol was lower compared to analgesia with lignocaine/ketorolac with early onset of pain in intraoperative period in analgesia with lignocaine/paracetamol although statistically not significant. Post operative period was associated with early onset of pain in lignocaine/paracetamol group compared to lignocaine/ketorolac which was not statistically significant.

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