Comparative Study of Analgesic Effects in Intravenous Regional Anesthesia With Lidocaine VS Lidocaine With Paracetamol IV

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ABSTRACT *Context: Comparison of Analgeic Effects in Intravenous Regional Anesthesia with Lidocaine Vs Lidocaine with Paracetamol IV.*

AIM: aim of our study was to compare the Analgeic Effects in Intravenous Regional Anesthesia with Lidocaine Vs Lidocaine with Paracetamol IV

Settings and Design: This clinical study was conducted at Government General Hospital, Kurnool. 50 patients of ASA Grade I and II of either sex aged above 18 years, undergoing upper limb (forearm and hand) surgery were randomly assigned to group L & P, each group consisting of 25 patients and surgery was done under Intravenous Regional Anaesthesia.

Materials and Methods: Group-L Received lignocaine 0.5% 40 ml

Group-LP Received lignocaine 2% 10ml + IV Paracetamol 30 ml.

Statistical Analysis Used: Analysis of Variance was used to study the significance of mean of various study parameters between the two groups. Student's t test was used to compare the two groups on mean values of various parameters. The p-value <0.05 is considered significant.

Results: In our study, except Sensory block onset time, Sensory block recovery time, Onset of motor block, motor block recovery time, Intraoperative rescue analgesia, Postoperative analgesia the difference was statistically significant.

Conclusion: 1.   The time of onset of motor block was significantly lower in Group LP who received 0.5% lidocaine diluted with intravenous acetaminophen 300 mg to a total volume of 40 ml.

2. There was no significant difference in onset of sensory blockbetween the groups.

3. The sensory block recovery time was significantly longer in Group LP than in Group L.

4. The motor block recovery time was also significantly longer in Group LP than in Group L.

INTRODUCTION

"The relief of pain is purchased always at a price. The price both in morbidity or mortality does not greatly differ, whatever the agent or agents used" - RALPH MILTON WATERS. The main objective of the anaesthesiologist is to provide analgesia for surgery, but the present day anaesthesiologist is also involved in treating chronic intractable pain, providing obstetric analgesia and providing intensive respiratory care.

Even though general anaesthesia was the earliest technique adapted to provide analgesia for surgery, the search for an alternative was made in order to overcome the problems and complications related to situations like 'full stomach', in emergency surgeries.

The regional analgesia, a term coined by HARVEY CUSHING in the year 1901, opened a new era to provide analgesia by the application of local anaesthetic to the nerves to block the area of their distribution.

Regional anaesthesia traces its origin to Dr. KARL KOLLER, a young Viennese ophthalmologist who in 1884 employed a solution of cocaine for topical corneal anaesthesia in patients undergoing eye surgery. Once the clinical activity of cocaine became apparent, efforts were made to identify the active portion of the cocaine molecules and to synthe-size new compounds that possessed local anaesthetic activity.

The first nerve block was performed by WILLIAM STEWARD HALSTED & HALL. The first nerve to be blocked was mandibular nerve.

Most of the local anaesthetic agents developed in 1900 to 1940 were basically amino-ester compounds. They lost their importance due to their shorter duration of action, associated allergic reactions and systemic toxicity. This paved the way to synthesis of newer agents namely-amino amide compounds in the 1940's with less potential for such allergic reactions. Subsequently newer amino amides have revolutionised the field of regional anaesthesia catering to the varying demands of modern surgery.

Regional anaesthesia may provide ideal operative conditions when used optimally. It is said to cause the least interference with the vital physiological functions of the body with reduced stress response, avoids poly pharmacy and provides an alert, awake and co-operative patient when compared to conventional methods. The adequately administered regional anaesthesia provides excellent intraoperative pain control and also good relief of postoperative pain.

Since regional blocks are less stressful to the patients, they could form the ideal anaesthesia of choice for emergency surgery in unprepared patients.

IV regional anaesthesia (IVRA) is easy to administer, reliable, and cost-effective for short operative procedures of the extremities performed on an ambulatory basis.[1] However, there are some disadvantages of IVRA, including delayed onset of action, poor muscle relaxation, and rapid onset of pain at the operative site after the tourniquet has been deflated.[2] Additives such as opioids and muscle relaxants have been combined with local anaesthetics to improve these problems.[3] Although various non steroidal anti-inflammatory drugs (NSAIDs), such as ketorolac,[4] tenoxicam,[5] and aspirin[6] in IVRA, have been demonstrated successfully to improve analgesia, there are no clinical studies evaluating paracetamol when added to lidocaine for IVRA.

Paracetamol (acetaminophen) possesses very little anti-inflammatory activity, and studies suggest the possibility that the site of action of its antinociceptive effect may be in the central nervous system.[7] However, several studies have demonstrated peripheral antinociceptive properties of paracetamol in different pain models.[8,9] Pactiv (10 mg/mL, Pfizer,India) is an injectable paracetamol solution. In this study, we evaluated the effect of an IV solution of paracetamol when added to lidocaine in IVRA for elective hand surgery

MATERIALS AND METHODS

This clinical study was conducted at Govenment General Hospital , Kurnool. 50 patients of ASA Grade I and II of either sex aged above 18 years, undergoing upper limb (forearm and hand) surgery were randomly assigned to group L & P , each group consisting of 25 patients and surgery was done under Intravenous Regional Anaesthesia during April 2011 to September 2012.

PREPARATION OF THE LOCAL ANAESTHETIC SOLUTIONS

10 ml of 2% lignocaine was taken in sterile cup. For the control group, the volume was made upto 40 ml by adding 30 ml normal saline to give a clinical concentration of 0.5%. Lignocaine drug solution must be preservative free and plain i.e., not adrenaline containing.

For the study group, 10 ml 2% ligonocaine was taken in sterile cup and 30 ml (300 mg) of paracetamol was added.

Intra Venous Regional Anaesthesia was given according to the following combinations.

Group-L Received lignocaine 0.5% 40 ml

Group-LP Received lignocaine 2% 10ml + IV Paracetamol 30 ml

Inclusion criteria
1. ASA 1 and 2 patients.

2. Patients undergoing upper limb surgeries.

3. Surgical procedure which is expected to be finished in 90 minutes.

Exclusion criteria
1. History of allergy to local anaesthetics.

2. Sickle cell anaemia.

3. Raynaud's disease.

4. Coagulation disorders.

Materials used particularly for IVRA
1. Esmarch's bandage

2. Electronic pneumatic tourniquet with battery back up.

3. Disposable 20 ml syringe

4. Intravenous cannula 20 gauge

5. Lignocaine 2% preservative free.

Figure 5– Necessary equipments for IVRA.

PREPARATION OF THE PATIENT AND TECHNIQUE
Patient should have fasted for at least six hours before elective surgery. Procedure was explained to patient including the feeling of tourniquet application and informed consent was taken. Patient received no pre medication. Full resuscitation equipment (Boyle's machine, O_2 source, ETT, oral airways, laryngoscopes, suction apparatus, drugs like adrenaline, atropine, steroid, thiopentone, diazepam, etc.) with leak proof tourniquet was kept ready. (tourniquet width should be 40% of extremity circumference for the gauge pressure to accurately reflect arterial intra luminal pressure under the cuff. If the cuff is narrower, the pressure reading will be high and if larger reading will be low). On the table in supine position, intravenous line was established. BP cuff and Pulse oximeter were applied on the opposite arm.

The two groups were named L, and P depending on the drug used.

Group L : Lignocaine 2% 10 ml + Normal Saline 30 ml

Group LP : Lignocaine 2% 10 ml + Paracetamol 30 ml (1%)

Baseline blood pressure and heart rate were noted in all the patients and the mean arterial pressure was calculated. An intravenous cannula was inserted in the hand which was not to be operated

All the patients were explained about the Visual analogue scoring system prior to the procedure.

A cannula was inserted in a vein of the limb where surgery

was to be done. We selected a vein on the dorsum of the hand if possible. Pneumatic tourniquet applied in the arm.

Figure 6 : Upper limb with an IV Cannula inserted on the hand and with tourniquet applied on the arm

The limb was exsanguinated with the Esmarch bandage. But in patients where this was not possible because of a wound or pain, the limb was kept elevated for three minutes. The proximal tourniquet was inflated to at least 100 mm Hg above the systolic blood pressure. The Esmarch bandage was removed and the IVRA solution is injected.

Figure 7: Upper limb after exsanguination with an Esmarch'sbandage.

Figure 8: Injection of drug, the proximal tourniquet is in the inflated state.

After injection pain sensation was assessed at every 60 seconds interval by pinprick using a 22 gaugen needle.

At the same time motor block was assessed by asking the patient to move his fingers and wrist and noted whether complete block is attained.

Once sensory block was attained the distal tourniquet was inflated and the proximal one deflated. The I.V cannula was then removed. MAP, HR, Spo$_2$ and VAS were recorded

at 0, 5, 10, 15, 20, 30, 40, 50 min ,1 hr, 2 hr, 4 hr, 6 hr, 12 hr, 24 We also looked for cardiovascular or respiratory disturbances or any other complications.

During surgery, if the patient reported VAS> 3, fentanyl 1µg/kg was given and requirement for analgesics (dose and time) was recorded. 5 mg IV ephedrine was given for hypotension (systolic arterial blood pressure< 90 mm Hg or 50 mm Hg lower than the normal value), 0.5 mg IV atropine was given for bradycardia (HR<50/min), and 4 mg IV ondansetron for nausea and vomiting. Oxygen was administered with a face mask . All of these complications were also recorded with respect to time

The tourniquet was not deflated before 30 min and was not inflated more than 1.5 h. At the end of surgery, the tourniquet deflation was performed by the cyclic deflation technique.

Postoperatively heart rate and blood pressure were noted one minute after tourniquet deflation. The mean arterial pressure was calculated.

Sensory recovery time was noted (time elapsed after tourniquet deflation up to recovery of pain in all innervated areas determined by pinprick test done every 60 s). Motor block recovery time was noted (the time elapsed after tourniquet deflation up to movement of fingers). Patients were monitored in the Post anaesthesia care unit for thirty minutes before shifting back to the ward.

In the postoperative period we noted complications like:-

- Pain at the injection site

- Dizziness

- Nausea

- Met alic taste

- Head ache

- Drowsiness

- Pruritus

- Respiratory depression (rate less than ten breaths per minute)

- Any other complications

Patients were assessed for 24 h in the postsurgical ward for MAP, HR and Spo$_2$ were recorded at 1, 2, 4, 6, 12, and 24 hrs. Postoperatively. Patients were questioned for pain and VAS >3, and 75 mg IM diclofenac was given; analgesic requirement (time and total amount) was recorded.

OBSERVATION AND RESULTS
The study population consisted of 50 patients posted for elective upper limb surgery. They were randomly allocated into two groups of 25 each.

Group L: received 40 ml of 0.5% lignocaine alone.

Group LP: received 0.5% lidocaine (10 ml of 2% lidocaine) diluted with intravenous acetaminophen 300 mg to a total volume of 40 ml.

The following observations were made during the course of the study.

Table 1 : Age distribution

	Group L	Group LP	t value	P value
Age	37.8 ± 13.341664	36.2 ± 14.56594	0.4050092156	0.68727014 **NS**

The mean age was 37.8 ± 13.341664 years in group L and 36.2 ± 14.56594 years in Group LP. The difference in the mean age was statistically insignificant (P> 0.05). Thus the two groups were more or less homogenous with regards to age distribution. The values of age are given above in table 1 and shown in graph 1below.
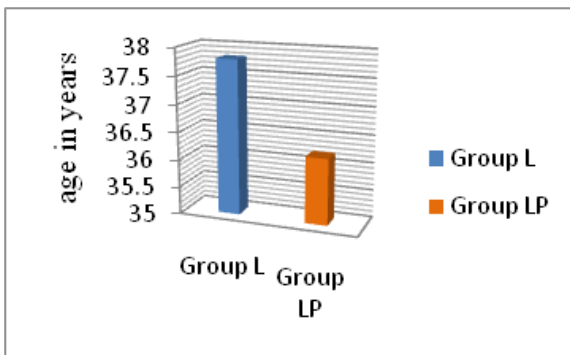
Graph 1: Age distribution

Table 2: Weight distribution

	Group L	Group LP	t value	P value
Weight	58.48 ± 5.803160	56.24 ± 8.4324769	1.094137537	0.27935502 NS

The mean weight was 58.48 ± 5.803160 years in group L and 56.24 ± 8.4324769 years in Group LP. The difference in the mean weight was statistically insignificant (P> 0.05). Thus the two groups were more or less homogenous with regards to Weight distribution. The values of Weight are given above in table 2 and shown in graph 2 below.
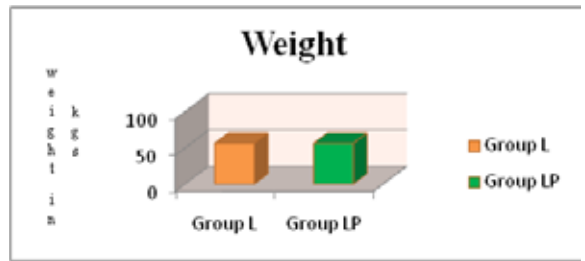
Graph 2: Weight distribution

Table 3: Sex distribution

	Group L	Group LP
Male	19 (76%)	15 (60%)
Female	6 (24%)	10 (40%)
Chi square value	0.8272058824	
P value	0.3630817236 NS	

In the study population, the male patients constituted 19 and 15 in group L and Group LP respectively and the female patients constituted 6 and 10 in group L and Group LP respectively.

The difference between the two groups regarding sex distribution was statistically insignificant (P > 0.05). Thus two groups were more or less homogenous with regard to sex distribution and are depicted in table 3 above and graph 3 below.
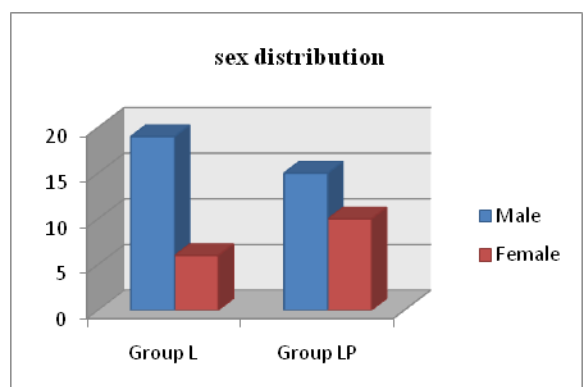
Graph 3: Sex distribution

Table 4: Mean arterial pressure

MEAN ARTERIAL PRESSURE	Group L	Group LP	t value	P value
T0	79.84 ± 5.25737577	80.92 ± 6.177378085	0.6657034582	0.50878726 N**St**
T5	80.44 ± 6.069596	82.76 ± 7.344385	1.217482984	0.22937212 **NS**
T10	79.52 ± 6.801470	81.8 ± 7.141428429	1.155946458	0.25342441 **NS**
T20	78.68 ± 5.169784	80.88 ± 6.710191	1.298588775	0.20028941 **NS**
T30	78.84 ± 5.129002	79.64 ± 5.985259	0.5074687629	0.6141498 **NS**
T40	77.92 ± 5.611892	79.44 ± 5.888406	0.9343163829	0.35481732 **NS**
T50	79.2 ± 4.932882	79 ± 6.763874629	0.1194517798	0.905416 **NS**
T60	78.96 ± 5.412023	80.68 ± 3.9234338	1.286547039	0.20442289 **NS**
T 2hr	78.44 ± 4.619523	79.04 ± 4.641120	0.4581354163	0.64892256 **NS**
T 4hr	79.4 ± 5.330728	79.16 ± 5.683895	0.1539938739	0.87826021 **NS**
T 6hr	78.84 ± 5.814350	77.88 ± 5.811769	0.5838770879	0.56203696 **NS**
T 12 hr	78.24 ± 6.233511	78.08 ± 5.407711	0.09694299459	0.92317532**NS**
T 24 hr	77.52 ± 5.316013	77.36 ± 5.801437	0.1016684501	0.91944337 **NS**

The difference in the mean arterial pressure between the two groups at 0 min, 5min, 10 min, 20 min, 30min, 40min, 50 min,60 min, 2hr, 4hr, 6hr, 12hr, 24 hr was statistically insignificant (P> 0.05) in both groups L and Group LP. The values of mean arterial pressure are given above in table 4 and shown in graph 4 below.
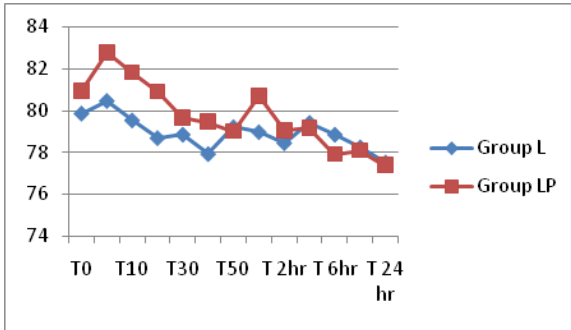
Graph 4: Mean arterial pressure

Table 5:Mean pulse rate

HEART RATE	Group L	Group LP	t value	P value
T0	84.48 ± 7.869349825	83.24 ± 8.766793408	0.5262874725	0.60111197 NS
T5	82.24 ± 6.603534407	81.76 ± 6.716149691	0.2548101907	0.79995828 NS
T10	80.44 ± 7.517091535	82.44 ± 7.234638899	0.9589006973	0.34261369 NS
T20	79.64 ± 7.658764043	80.04 ± 8.002499509	0.180598702	0.85747573 NS
T30	76.88 ± 6.036831398	80 ± 7.135591542	1.669045921	0.1016189 NS
T40	77.24 ± 5.33291665	77.2 ± 12.31191834	0.01490615374	0.98816884 NS
T50	77.72 ± 5.940819248	79.56 ± 5.788494335	1.109158491	0.27268813 NS
T60	77.52 ± 6.245798588	76.48 ± 13.58344581	0.3478124706	0.7296017 NS
T 2hr	76.48 ± 5.409251535	77.68 ± 5.233864092	0.7971471845	0.4292912 NS
T 4hr	75.92 ± 4.536151085	77.44 ± 5.017303393	1.123616332	0.26676413 NS
T 6hr	75.4 ± 3.662876829	78.08 ± 6.013318551	1.90311984	0.063031494 NS
T 12 hr	74.8 ± 4.123105626	77.24 ± 15.41990066	0.7643334144	0.44840985 NS
T 24 hr	75.28 ± 3.974082703	77.68 ± 5.843229701	1.698132099	0.095957506 NS

The difference in the mean pulse rate between the two groups at 0 min,5min, 10 min, 20 min, 30min, 40min, 50 min,60 min, 2hr, 4hr, 6hr, 12hr, 24 hr was statistically insignificant (P> 0.05) in both groups L and Group LP. The values of pulse rate are given above in table 5 and shown in graph 5 below.
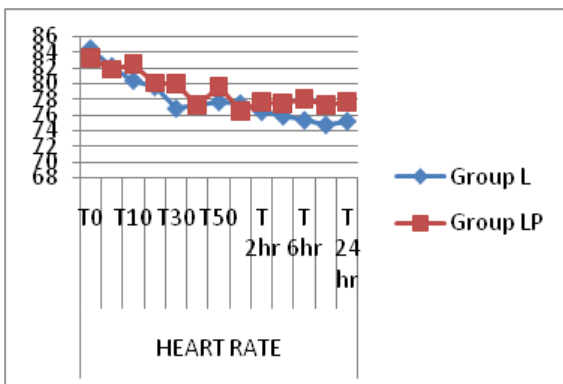
Graph 5: Mean pulse rate

Table 6: Mean time of onset of sensory block and recovery time

	Sensory block	
	Onset time	Recovery time
Group L	6 ± 1.322875656	5 ± 1.58113883
Group LP	5.04 ± 1.767295486	8.08 ± 2.119748413
t value	1.17434362	5.823426605
P value	0.0640178 NS	< 0.0001 S

The mean time of onset of sensory block was 6 ± 1.322875656 minutes in group L and 5.04 ± 1.767295486 minutes in Group LP. The difference in the mean time of onset of sensory block between group L and Group LP was statistically not significant (P> 0.05).

The mean time of Sensory block recovery was 5 ± 1.58113883 minutes in group L and 8.08 ± 2.119748413 minutes in Group LP. The difference between the two groups regarding the mean time of Sensory block recovery was statistically significant (P< 0.05).

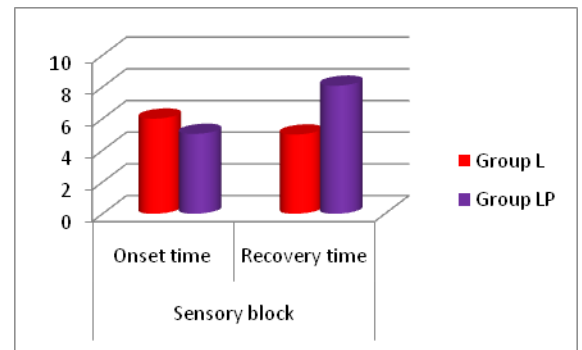**Graph 6: Mean time of onset of sensory block and recovery time**

Table 7: Mean time of onset of motor block and recovery time

	Motor Block	
	Onset time	Recovery time
Group L	12.08 ± 2.75257455	6 ± 1.322875656
Group LP	8.4 ± 2	8.16 ± 2.374868417
t value	5.407867705	3.972844221
P value	< 0.0001 S	0.00023754258 S

The mean time of onset of motor block was 12.08 ± 2.75257455 minutes in group L and 8.4 ± 2 minutes in Group LP. The difference between the two groups regarding the mean time of onset of motor block was statistically significant (P< 0.05).

The mean time of motor block recovery was 6 ± 1.322875656 minutes in group L and 8.16 ± 2.374868417 minutes in Group LP. The difference between the two groups regarding the mean time of motor block recovery

was statistically significant (P< 0.05).

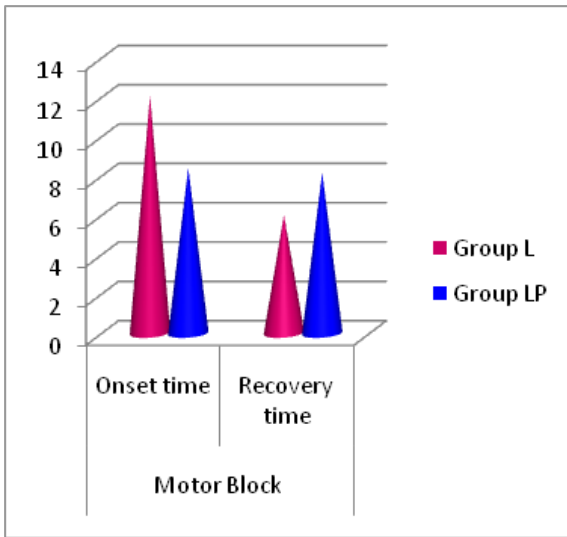**Graph 7: Mean time of onset of motor block and recovery time**

Table 8: Rescue analgesia

	Group L	Group LP	t value	P value
Intraoperative Fentanyl (µg/kg)	55.4 ± 22.06052281	26.12 ± 30.56321318	3.65225478	0.0012621515 S
Postoperative Diclofenac (mg)	114 ± 38.24264635	78 ± 26.33913438	3.876349695	0.00032158009 S

Intraoperative analgesia:
Mean fentanyl required for Group L is 55.4 ± 22.06052281micrograms and for Group LP is 26.12 ± 30.56321318micrograms. The difference between the two groups regarding rescue analgesia is statistically significant (P <0.05)

Postoperative analgesia:
In present study mean postoperative diclofenac was 114 ± 38.24 in Group L and 78 ± 26.34 in Group LP. The difference between the two groups is statistically significant (P <0.05)

Graph 8: Rescue analgesia

Table 9: Mean Tourniquet pain onset time:

	Mean TPOT(min)
Group L	30 ± 9.2
Group LP	44 ± 6.6
P value	0.04362537

Mean tourniquet pain onset time was 30 ± 9.2 minutes in Group L and 44 ± 6.6 minutes in Group LP. The difference between the two groups is statistically significant (P <0.05)

Graph 9: Mean Tourniquet pain onset time:

Table 10: VAS Score

	Group	VAS 0	1	2	3	4	5	6	7	Chi Square	P value
T0	L	21	4							0.9764197324	0.3230843 NS
	LP	25									
T5	L	22	3							0.003649373882	0.9981769 NS
	LP	21	3	1							
T10	L	15	8	2						4.6	0.1002588 NS
	LP	21	2	2							
T20	L	3	4	8	4	6				21.63458385	0.0002369 S
	LP	20	3	2							
T30	L	8		5	2	10				15.1301219	0.0044388 S
	LP	21	2	2							
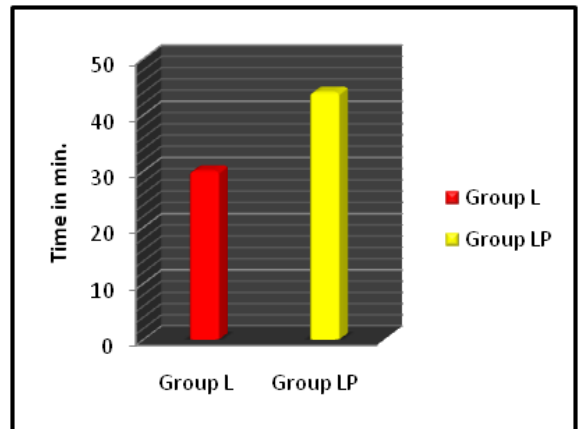
	Group	VAS								Chi Square	P value
		0	1	2	3	4	5	6	7		
T40	L	12	3	5	1	3	1			4.182	0.6520620 NS
	LP	8	2	5	2	2	5	1			
T50	L	13	3	6	1		2			0.3478338945	0.9992300 NS
	LP	13	3	5	1	1	1	1			
T60	L	6		5	4	3	5	2		5.342008182	0.6183025 NS
	LP	3	1	7		1	8	3	2		
T2Hr	L	6	2	7		3	5	2		8.712215321	0.1904214 NS
	LP		2	16	1	3	2	1			
T4Hr	L	2	3	13	3	2	1	1		1.767607048	0.9397834 NS
	LP	1	1	16	4	2	1				
T6Hr	L	1	3	11	4		4	1	1	2.513193776	0.9261002 NS
	LP		4	15	5		1				
T12Hr	L	2	5	4	5	3	5	1		9.792152847	0.1336822 NS
	LP	2	6	13	1	1	2				
T24Hr	L	7	14	4						3.436363636	0.1793920 NS
	LP	13	8	4							

Intraoperative VAS Scores at 20 min and 30min were significantly lower in Group LP (P<0.05) when compared with Group L. VAS scores at all other time intervals intraoperatively and postoperatively were insignificant.

Table 11: Complications

P.O complications	Group L		Group LP	
	N	%	N	%
Nausea	2	8 %	1	4 %
Vomiting	0	0 %	1	4 %

No side-effect was reported in the intra-operative period. Two cases reported to have nausea in group L and one case of nausea and one case of vomiting were reported in postoperative period in Group LP. This difference between the two groups regarding complications was statistically insignificant (P>0.05).

DISCUSSION
"Man uses his arm and hands constantly…. As a result he exposes his arms and hands to injury constantly…. Man also eats constantly….. Man stomach is never really empty….. The combination of mans prehensibility and his unflagging appetite keeps a steady flow of patients with injured upper extremities and full stomach streaming into hospital emergency rooms". This is why brachial plexus is so frequently the favourite group of nerves[88].

Intravenous regional anaesthesia is a simple method of producing analgesia of the extremity by the intravenous injection of a local anaesthetic, while the circulation is occluded[62].

The necessity of regional analgesia for the surgery of the limbs has been recognized for long, in cases where general anaesthesia is a risky procedure, especially in the presence of full stomach.

In this age of increasing mechanization and accidents, a technique of anaesthesia which is simple, cheap, easily applicable, safe and time saving has to be employed to cope with the increasing work load and to effect rapid turnover[53].

The technique of IVRA was first described by August Bier in 1908 using procaine as the local anaesthetic agent. Holmes subsequently repopularised the method in 1963 using lignocaine. Since then many workers have proved the effectiveness of IVRA and the technique has become a useful addition to the anesthesiologist's armamentarium, which meets the above mentioned requirements.

Many local anaesthetic agents like procaine, bupivacaine[89], prilocain[90], mepivacaine[91] and ropivacaine[92] have been used for this technique. Because of many complications associated with their use, only lignocaine has been employed popularly.

IVRA is technically simple, easy to perform and onset of analgesia is rapid. The duration of action is controllable and is not governed by local anesthetic agent used but by the time for which the tourniquet is kept inflated. IVRA is cost effective with success rate of 94 - 96% though anaesthesia is not as satisfactory as general anaesthesia.

Disadvantages with IVRA were local anesthetic toxicity, tourniquet pain, lack of postoperative analgesia. Various modalities were tried to overcome these disadvantages, like change of local anaesthetic, modification of technique, addition of adjuvants .

Selection of drugs:
Lignocaine is considered one of the least toxic LA agent. Dosage of 1-2 mg/kg is used for treating ventricular arrhythmias or attenuating the cardiovascular response to endotracheal intubation. In IVRA with conventionally placed tourniquet over the upper arm a relatively large dose of 3 mg/kg is required to ensure adequate analgesia.[93]

A systematic review by Choyce and Peng[93] suggested that NSAIDs have the most to offer as adjuncts to IVRA. NSAIDs either as part of IVRA or wound infiltration resulted in an analgesic benefit lasting longer than the same dose parenterally administrated.

In this current study we have investigated whether the addition of paracetamol to IVRA solution decreased tourniquet pain, intraoperative opioid use, and effects on sensory and motor block duration.   Paracetamol is generally considered to be a weak inhibitor of the synthesis of prostaglandins. However in vivo effects of paracetamol are

similar to those of the selective cyclooxygenase-2 inhibitors but, unlike the selective cyclooxygenase-2 inhibitors, paracetamol does not suppress inflammation.[94,95] Several studies have suggested different mechanisms for the antinociceptive action of paracetamol, including N-methyld- aspartate,[96] and the effect on cannabinoid receptors.[97,98] The analgesic effect of paracetamol was found to be prevented by cannabinoid receptor (CB1) antagonists, suggesting the endocannabinoid system to be the long-sought mechanism of action of paracetamol.[97,99]

Selection of dose:
In our study the dose of the drugs used were fixed and was not calculated according to the weight of the patient. We observed that in a number of studies 40 ml lignocaine 0.5% was used for IVRA which provided adequate analgesia without serious side effects.[85,86]

There were few 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 lidocaine. We anticipate that larger doses of acetaminophen would increase the efficacy of analgesic during IVRA but optimal dose of acetaminophen could not be determined.

Myoung Jin Ko, Jeong Han Lee et all[86] used fentanyl 1microgram/kg for tourniquet pain and 50 mg tramadol for postoperative pain. Sen H, Kulahci Y, Bicerer E et all[87] used fentanyl 1microgram/kg for tourniquet pain and 75mg tramadol for postoperative pain.

In our study we used fentanyl 1microgram/kg for tourniquet pain and diclofenac 75 mg for postoperative pain VAS >3.

Age:
Reviewing the available literature, it is evident that IVRA is frequently used in patients aged between 18-60 years Elhakim M and Sadek RA[100] carried out IVRA on patients aged between 25-55 years. Sanjay Kherde et al[101] carried out IVRA on patients aged between 15-55 years. Palecha S et al [102] employed IVRA on patients above the age of 20 years.

In the present study patients selected were between the ages 18-70 years. The above age group was selected to ensure better co-operation and also this age group Patients commonly present with upper limb problems.

Premedication:
Many workers like Chandrashekara PM et al[54]. Ware RJ,[103] Walied Y Abdulla et al.,[56] Sztark F et al.[57] believed that unpremedicated patients co-operate better. Therefore in the present study also no premedication with good verbal assurance was given to the patient to ensure good co-operation and for better assessment of the quality of analgesia.

Exsanguination:
The success of IVRA is dependent to a great extent on the degree of exsanguination of the limb involved and application of tourniquet.[62] Exsanguination can be achieved either by simple gravity drainage alone or by the combined use of Esmarch's bandage and gravity drainage as advised by Holmes,[62] Chandrashekara PM et al[54].

In the present study the exsanguination was obtained by the combined use of Esmarch's bandage and gravity drainage.

Tourniquet:
Tourniquet was applied in IVRA with the intention of restricting analgesia to the part of the limb distal to the tourniquet, which forms the basis for the success of intravenous regional anaesthesia and to prevent the incidence of side effects.

Chandrashekara PM et al.[54] had used only one tourniquet above the site of surgery for the technique of IVRA. He used latex rubber bandage as tourniquet. He observed tourniquet pain and discomfort in surgeries, which were prolonged for more than 40-50 minutes. Holmes,[62] Charles Sorbie and Chacha,[50] Janardhan et al.[104] have advocated the use of double tourniquet method with the second tourniquet on the anaesthetized portion of the extremity distal to the proximal one to prevent tourniquet pain and discomfort. In the present study two tourniquets were used. One Pneumatic and latex rubber bandage and was used as tourniquet.

Cardiovascular and respiratory parameters:
In the present study cardiovascular parameters studied had no significance   during the intraoperative and postoperative period between the two groups. Similarly there was no significant difference in oxygen saturation between the two groups during the intra-operative and post-operative period.

Sen H, Kulahci Y et al[87] did not find any significant difference between the patients who received 40 ml of 0.5% lignocaine and 40 ml of 0.5% lignocaine with IV Paracetamol admixture regards to changes in pulse rate, blood pressure and oxygen saturation.

Myoung Jin Ko, Jeong Han Lee et al[86] found no significant difference in heart rate, blood pressure and oxygen saturation between the patients who received 40 ml of 0.5% lignocaine and 40 ml of 0.5% lignocaine with IV Paracetamol admixture.

Hence the observations of the present study with regards to changes in cardiovascular and respiratory parameters concur with observations of the above mentioned authors.

Sensory Characteristics:
Sensory block onset time:
In the present study the mean time of onset of sensory block was 6 ± 1.322875656 minutes in group L and 5.04 ± 1.767295486 minutes in Group LP. The difference between the two groups regarding the mean time of onset of sensory block was not statistically significant (P> 0.05).

According to Sen H, Kulahci Y et al[87]. the mean time of achieving onset of sensory block was 7 ±3 minutes in patients who received 40 ml of 0.5% lidocaine and 5 ± 2 minutes in patients who received 0.5% lidocaine diluted with intravenous acetaminophen 300 mg to a total volume of 40 ml. The difference between the two groups with respect to the mean time of complete sensory block was not statistically significant (P> 0.05).

According to Myoung Jin Ko, Jeong Han Lee et al[86] the mean time of achieving onset of sensory block was 3.6 ± 1.6 minutes in patients who received 40 ml of 0.5% lignocaine and 2.3± 1.4 minutes in patients who received 0.5% lidocaine diluted with intravenous acetaminophen

300 mg to a total volume of 40 ml . The difference between the two groups with respect to the mean time of achieving onset of sensory block was statistically significant (P< 0.05).

Thus the observation of the present study with regards to the mean time of complete sensory block concurs with the observations of the Sen H, Kulahci Y et al. [87]

Sensory block recovery time:
In the present study, the mean time of Sensory block recovery was 5 ± 1.58113883 minutes in group L and 8.08 ± 2.119748413 minutes in Group LP. The difference between the two groups regarding the mean time of Sensory block recovery was statistically significant (P< 0.05).

According to Sen H, Kulahci Y et al[87] the mean time of Sensory block recovery was 5 ± 3 minutes in patients who received 40 ml of 0.5% lignocaine and 8 ± 2 minutes in patients who received 0.5% lidocaine diluted with intravenous acetaminophen 300 mg to a total volume of 40 ml. The difference between the two groups with respect to the mean time of Sensory block recovery was statistically significant (P< 0.05).

According to Myoung Jin Ko, Jeong Han Lee et[86] al the mean time of Sensory block recovery was 3.0 ± 2.0 minutes in patients who received 40 ml of 0.5% lignocaine and 2.6 ± 1.0 minutes in patients who received 0.5% lidocaine diluted with intravenous acetaminophen 300 mg to a total volume of 40 ml . The difference between the two groups with respect to the mean time of Sensory block recovery was not statistically significant (P> 0.05).

Thus the observation of the present study with regards to the concurs with respect to the mean time of Sensory block recovery concurs with the observations of the Sen H, Kulahci Y et al[87] .

Motor Characteristics:
Onset of motor block:
In the present study, the mean time of onset of motor block was 12.08 ± 2.75257455 minutes in group L and 8.4 ± 2 minutes in Group LP. The difference between the two groups regarding the mean time of onset of motor blockwas statistically significant (P< 0.05).

According to Sen H, Kulahci Y et al[87]. the mean time of achieving onset of motor block was 12 ± 4 minutes in patients who received 40 ml of 0.5% lignocaine and 8 ± 4 minutes in patients who received 0.5% lidocaine diluted with intravenous acetaminophen 300 mg to a total volume of 40 ml. The difference between the two groups with respect to the mean time of complete sensory block was statistically significant (P< 0.05).

Myoung Jin Ko, Jeong Han Lee et al[86] did not assess the onset of motor block as motor block was not achieved even after IVRA in pilot study. Thus the observation of the present study with regards to the mean time of achieving motor block concurs with the observations of the Sen H, Kulahci Y et al[87] .

Motor block recover time:
In the present study, the mean time of motor block recovery was 6 ± 1.322875656 minutes in group L and 8.16 ± 2.374868417 minutes in Group LP. The difference between the two groups regarding the mean time of motor block recovery was statistically significant (P< 0.05).

According to Sen H, Kulahci Y et al[87]. the mean time of motor block recovery was 6 ± 2 minutes in patients who received 40 ml of 0.5% lignocaine and 8 ± 4 minutes in patients who received 0.5% lidocaine diluted with intravenous acetaminophen 300 mg to a total volume of 40 ml. The difference between the two groups with respect to the mean time of motor block recovery was statistically significant (P< 0.05).

Myoung Jin Ko, Jeong Han Lee et al[86] did not assess the motor block recovery as motor block was not achieved even after IVRA in pilot study.

Thus the observation of the present study with regards to the concurs with respect to the mean time of motor block recovery concurs with the observations of the Sen H, Kulahci Y et al.[87]

Intraoperative rescue analgesia:
In present study mean fentanyl required for Group L is 55.4 ± 22.06052281micrograms and for Group LP is 26.12 ± 30.56321318micrograms. The difference between the two groups regarding rescue analgesia is statistically significant (P <0.05).

Intraoperative VAS scores at 20 and 30 minutes were significantly lower in Group LP (P<0.05).

According to Sen H, Kulahci Y et al[87] mean fentanyl required for Group L is 78 ± 12 and for Group LP is 58 ± 14. The difference between the two groups regarding rescue analgesia is statistically significant (P <0.05).

According to Myoung Jin Ko, Jeong Han Lee et al[86] mean fentanyl required for Group L is 35.3±33.1 and for Group LP is 22±28.7. The difference between the two groups regarding rescue analgesia is not statistically significant (P >0.05).

In present study number of patients who required fentanyl in Group L is 22 and 11 patients in Group LP. The difference between the two groups is statistically significant (P <0.05).

According to Sen H, Kulahci Y et al[87] number of patients who required fentanyl in Group L is 13 and 3 patients in Group LP. The difference between the two groups is statistically significant (P <0.05).

According to Myoung Jin Ko, Jeong Han Lee et al[86] number of patients who required fentanyl in Group L is 11 and 8 patients in Group LP. The difference between the two groups is not statistically significant (P >0.05).

Tourniquet pain onset time:
In present study the mean tourniquet pain onset time was 30 ± 9.2 minutes in Group L and 44 ± 6.6 minutes in Group LP. The difference between the two groups is statistically significant (P <0.05).

According to Sen H, Kulahci Y et al[87] the mean tourniquet pain onset time was 15.4 ± 5.6 minutes in Group L and 25 ± 5 minutes in Group LP. The difference between the two groups is statistically significant (P <0.05).

According to Myoung Jin Ko, Jeong Han Lee et al[86] the mean tourniquet pain onset time was 26.4 ± 10.7 minutes

in Group L and 42 ± 32.2 minutes in Group LP. The difference between the two groups is statistically significant (P <0.05).

Thus the observation of the present study with regards to the   mean time of onset of tourniquet pain concurs with the observations of the Sen H, Kulahci Y et al[87] and Myoung Jin Ko, Jeong Han Lee et al[86].

Postoperative analgesia:
In present study mean postoperative diclofenac was 114 ± 38.24 in Group L and 78 ± 26.34 in Group LP. The difference between the two groups is statistically significant (P <0.05).

According to Sen H, Kulahci Y et al[87] mean amount of postoperative diclofenac was 120 ± 75 in Group L and 64 ± 56 in Group LP. The difference between the two groups is statistically significant (P <0.05).

According to Myoung Jin Ko, Jeong Han Lee et al[86] mean amount of postoperative tramadol was 30 ± 25.1 in Group L and 10.0 ± 20.5 in Group LP. The difference between the two groups is statistically significant (P <0.05).

Thus the observation of the present study with regards to the mean amount of postoperative analgesia concurs with the observations of the Sen H, Kulahci Y et al[87] and Myoung Jin Ko, Jeong Han Lee et al[86].

Side effects:
According to Sen H, Kulahci Y et al[87] Only postoperative side effect that occurred was nausea in two patients in Group L and three patients in Groups LP.

According to Myoung Jin Ko, Jeong Han Lee et al[86] there were no intra or postoperative side effects

In present study postoperative nausea occured in two patients in Group L and one patient in Group LP . Postoperative vomiting occurred in one patient in Group LP.

SUMMARY
The present study entitled "COMPARATIVE STUDY OF ANALGESIC EFFECTS IN INTRAVENOUS REGIONAL ANAESTHESIA WITH LIDOCAINE Vs LIDOCAINE WITH PARACETAMOL IV" was undertaken at Kurnool medical college , Kurnool from April 2011 to September 2012. The study population consisted of 50 patients who were allocated into two groups of 25 each belonging to ASA class I and II.

Group L (n = 25): received 40 ml of 0.5% lignocaine alone.

Group LP (n = 25): received 0.5% lidocaine diluted with intravenous acetaminophen 300 mg to a total volume of 40 ml.

The following parameters were studied in all patients

1. Time of onset of sensory loss.

2. Time of onset of motor block.

3. Sensory block recovery time.

4. Motor block recovery time.

5. Tourniquet pain onset time.

6. Rescue analgesia intra and postoperatively.

7. Changes in cardiovascular and respiratory parameters during intra- operative and postoperative period.

8. Side-effects during intra-operative and post-operative period.

Table 12 : SUMMARY OF RESULTS
The following table shows the results obtained in the present study,

	Group L	Group LP	P value
Mean age (in years)	37.8 ± 13.341664	36.2 ± 14.56594	0.68727014 NS
Mean weight (kgs)	58.48 ± 5.803160	56.24 ± 8.4324769	0.27935502 NS
Sex distribution(male:female)	19:6	15:10	>0.05
Mean Sensory block Onset time	6 ± 1.322875656	5.04 ± 1.767295486	0.0640178 NS
Mean Sensory block recovery time	5 ± 1.58113883	8.08 ± 2.119748413	< 0.0001 S
Mean time of onset of motor block	12.08 ± 2.75257455	8.4 ± 2	< 0.0001 S
Mean time of recovery of motor block	6 ± 1.322875656	8.16 ± 2.374868417	0.00023754258 S
Intraoperative Fentanyl (micrograms)	55.4 ± 22.06052281	26.12 ± 30.56321318	0.0012621515 S
Postoperative Dicolfenac(mg)	114 ± 38.24264635	78 ± 26.33913438	0.00032158009 S
Mean Tourniquet pain onset time	30 ± 9.2	44 ± 6.6	0.04362537 S
Side effects			
Intraoperative period			
Nausea	0	0	
vomiting	0	0	
Convulsions	0	0	
Giddiness	0	0	
Any others	0	0	
Postoperative period			
Nausea	2	1	
vomiting	0	1	
Convulsions	0	0	
Giddiness	0	0	
Any others	0	0	

Sensory Characteristics:
Sensory block onset time:
The mean time of onset of sensory block was 6 ± 1.322875656 minutes in group L and 5.04 ± 1.767295486 minutes in Group LP. The difference between the two groups regarding the mean time of onset of sensory block was not statistically significant (P> 0.05).

Sensory block recovery time:
The mean time of Sensory block recovery was 5 ± 1.58113883 minutes in group L and 8.08 ± 2.119748413 minutes in Group LP. The difference between the two groups regarding the mean time of Sensory block recovery was statistically significant (P< 0.05).

Motor Characteristics:
Onset of motor block:
The mean time of onset of motor block was 12.08 ± 2.75257455 minutes in group L and 8.4 ± 2 minutes in Group LP. The difference between the two groups regarding the mean time of onset of motor block was statistically significant (P< 0.05).

Motor block recovery time:
The mean time of motor block recovery was 6 ± 1.322875656 minutes in group L and 8.16 ± 2.374868417 minutes in Group LP. The difference between the two groups regarding the mean time of motor block recovery was statistically significant (P< 0.05)

Intraoperative rescue analgesia:
Mean fentanyl required for Group L is 55.4 ± 22.06052281 micrograms and for Group LP is 26.12 ± 30.56321318 micrograms. The difference between the two groups regarding rescue analgesia is statistically significant (P <0.05)

Intraoperative VAS scores at 20 and 30 minutes were significantly lower in Group LP (P<0.05)

Tourniquet pain onset time:
Mean tourniquet pain onset time was 30 ± 9.2 minutes in Group L and 44 ± 6.6 minutes in Group LP. The difference between the two groups is statistically significant (P <0.05)

Postoperative analgesia:
Postoperative diclofenac was 114 ± 38.24 in Group L and 78 ± 26.34 in Group LP. The difference between the two groups is statistically significant (P <0.05)

Side effects:
There were no intraoperative complications. Postoperative nausea occurred in two patients in Group L and one patient in Group LP and postoperative vomiting occurred in one patient in Group LP.

CONCLUSIONS
From the present study it can be concluded that:

- The time of onset of motor block was significantly lower in Group LP who received 0.5% lidocaine diluted with intravenous acetaminophen 300 mg to a total volume of 40 ml.
- There was no significant difference in onset of sensory block between the groups.
- The sensory block recovery time was significantly longer in Group LP than in Group L.
- The motor block recovery time was also significantly longer in Group LP than in Group L.
- Number of patients who required fentanyl and the amount of fentanyl required intraoperatively as rescue analgesia was significantly lower in Group LP than in Group L.
- Tourniquet pain onset time was significantly longer in Group LP than Group L.
- Postoperative requirement of diclofenac was significantly lower in Group LP than in Group L.
- There was no significant difference between Group LP and Group L with respect to changes in cardiovascular and respiratory parameters during intra-operative and postoperative period.
- There were no side-effects in the intra-operative period in both groups. In the post-operative period, there was no significant difference between the two groups with respect to the incidence of side-effects.

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