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A Comparitive Study of Plain Lignocaine and Lignocaine with Ketamine for Intravenous Regional Anaesthesia (Ivra) for Upper Limb Surgeries

KEYWORDS: Lignocaine, Ketamine,IVRA, VAS,onset and recovery of sensory and motor blockade.

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ABSTRACT *BACK GROUND : IVRA was one of the most commonly performed technique,however the drawback was rapid onset of pain after tourniquet deflation.In the study , we evaluated the effect of ketamine , an IV induction agent added in sub anaesthetic doses as adjuvant to lignocaine in IVRA to improve analgesia and impair tourniquet pain .*

METHODS: 50 patients of age above 18 years undergoing hand and forearm surgery , were divided into two groups. Both groups received IVRA with plain lignocaine (3mg/kg) diluted with saline to a total volume of 40ml.Group L received only lignocaine, group K received lignocaine and ketamine (0.5mg/kg).Sensory and motor block onset time, their recovery time , tourniquet pain and rescue analgesia were assessed during operation.After tourniquet deflation visual analogue scores at 1,2,4,6,12 and 24 hours ,total analgesic consumption in first 24 hours and side effects were noted.

RESULTS: Onset of motor block was shorter and recovery of motor and sensory block were significantly longer in group K ($p<0.05$).Intraoperative VAS scores , intraoperative fentanyl consumption and number of patients who required fentanyl were significantly lower in group K($p<0.05$). Post operative VAS scores were similar among groups,however total amount of diclofenac used was less in group K($p<0.05$).

CONCLUSION: Addition of Ketamine to IVRA with lignocaine decreased tourniquet pain and post operative analgesic consumption.

INTRODUCTION:

"The relief of pain purchased always at a price. The price both in morbidity and mortality does not greatly differ whatever the agent or agents used" _ RALPH MILTON WATERS.Pain was complex constellation of unpleasant sensory ,perceptual and emotional experiences and certain associated autonomic ,psychological,emotional and behavioural responses.

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

Dr.KARL KOLLAR, a young veinnese ophthalmologist 1884 employed cocaine solution for topical corneal anaesthesia in eye surgery.The first nerve block was performed by William Steward Halsted and Hall was mandibular nerve.

Regional anaesthesia provide an operative conditions when used optimally. It cause least interference with vital functions of the body, avoid polypharmacy and provide excellent intraoperative and post operative analgesia.

IVRA was easy to administer ,reliable and cost effective for short operative procedures of extremities performed on ambulatory . However there were some disadvantages of IVRA , including delayed onset of action ,poor muscle relaxtion , rapid onset of pain after tourniquet . Additives such as opioids , muscle relaxants and NSAIDS have been combined with local anaesthetics to overcome .

Ketamine in sub anaesthetic doses ,used as adjuvant to IVRA has been demonstrated successfully to improve analgesia and to impair tourniquet . It anatogonises NMDA receptors, decreasing post synaptic depolarisation of unmyelinated C fibres.In the study , we evaluate the effects of ketamine 0.5 mg/kg with lignocaine in IVRA for elective hand .

MATERIALS AND METHODS:

This clinical study conducted on 50 patient of either sex , aged above 18 years undergoing upperlimb (forearm and hand) surgery were randomly assigned to control group L (lignocaine) and study group K (ketamine) with consists of 25 each patients.

Preparation of local anaesthetic solution : 10 ml of 2% lignocaine preservative free and plain (i.e, without adrenaline) was made upto 40ml of 0.5%solution and given to control group (L) .For study group(GROUP - K) 40ml 0f 0.5% of lignocaine and 0.5mg of ketamine was given .

INCLUSION CRITERIA ARE : ASA grade 1 and 2, patients undergoing upper limb surgeries , surgical procedures lasting less than 90 min.

EXCLUSION CRITERIA ARE : History of allergy to local anaesthetics , sickle cell anemia and Raynaud's disease and coagualation disorders.

RESCUE ANALGESIA: Fentanly 55µg/kg IV intra operatively and diclofenac sodium 75mg post operatively.

MATERIALS USED FOR IVRA : Esmarch bandage , electronic pneumatic tourniquet with battery backup , with disposable 20ml syringe and 20G IV cannula,2% lignocaine preservative free, 0.9% saline, ketamine , sterile cup.

A thorough pre anaesthetic assessment was done . Solid

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foods were restricted for 6 hours , milk for 4 hours and clear fluids for 2-3 hours prior to surgery.

PROCEDURE: IV cannula was secured in the non operable hand only for fluid administration. Base line BP, HR and MAP were noted. All the patients were explained about the VAS system prior to the procedure.

A cannula was inserted in a vein of the limb particularly on the dorsum of the hand where surgery was to be done. Pneumatic applied to the arm after exsanguinated with esmarch bandage or elevated the limb for 3 .The proximal tourniquet was inflated to at least 100mg Hg above systolic BP .Esmarch bandage was removed , IVRA solution was injected .He observed tourniquet pain and discomfort in surgeries prolonged for > 40-50 .

Monitors were used ECG with HR , pulse oximetry ,NIBP for every 5 min and MAP, and VAS.

Pain sensation and motor block was assessed by pin prick and asking patients to move fingers respectively.One sensory block was attained , distal tourniquet was inflated and proximal one was deflated. During surgery administer fentanyl 1µg/kg if patient reported VAS >3 , 5mg IV ephedrine for hypotension , 0.5mg atropine for bradycardia, 4mg IV ondansetron for nausea and vomiting . The tourniquet was neither deflated after 30 min nor inflated for > .At the end of the surgery the tourniquet was deflated cyclically and noted the HR and BP post operatively 1 min later. They were monitored in post anaesthetic care unit for 24 hrs . Sensory and motor recovery time were noted.

No side effect was reported in the intra operative period .Two cases were reported as nausea in group- L and one case of nausea and one case of vomiting and two cases of dizziness were reported in group K . The difference between two groups regarding complications statistically insignificant (p>0.05).All complications and treatment with respect to time were recorded (see the table 1).

Table 1: Complications

Post operative complications	Group- L	Group-K
Nausea	2(8%)	1(4%)
Vomiting	0(0%)	1(4%)
Dizziness	0(0%)	2(8%)

Other post operative complications were pain , dizziness, nausea, metallic taste, headache , drowsiness, pruritis and respiratory depression.

Patients with injured upper extremities and full stomach streaming into hospital emergency rooms requires brachial group nerve plexuses block, David L .

OBSERVATION AND RESULTS :

This study was meant for to compare the duration of onset and recovery of sensory and motor blockade when ketamine was added to the IVRA solution, to compare intra operative and post operative recquirement of rescue analgesia and to assess the side effects of the drugs used.

Both groups received IVRA with plain lignocaine (3mg/kg) diluted with saline to a total volume of 0.5% of 40 ml. Group L received only lignocaine, group K received both lignocaine and ketamine 0.5mg/kg.The difference in the MAP and mean pulse rate between the two groups at various timings was statistically insignificant (p>0.05),see the given tables 2and 3 below.

Table 2 Mean Arterial Pressure(MAP)

MAP	GROUP -L	GROUP - K	T – value	p- value
T0	79.84±5.25737	80.92±6.17737	0.6657034582	0.508787 NS
T5	80.44±6.06959	82.76±7.34438	1.217482984	0.229372 NS
T10	79.52±6.80147	81.8±7.14142	1.155946458	0.253424 NS
T20	78.68±5.16978	80.80±6.71019	1.298588775	0.200289 NS
T30	78.84±5.12900	79.64±5.98525	0.5074687629	0.614149 NS
T40	77.92±5.61189	79.44±5.88840	0.9343163829	0.354817 NS
T50	79.2±4.93288	79±6.763874	0.1194517798	0.905416 NS
T60	78.96±5.41202	80.68±3.92343	1.286547039	0.204 422 NS
T2hrs	78.44±4.61952	79.04±4.64112	0.481354163	0.648 922 NS
T4hrs	79.4±5.33072	79.16±5.68389	0.1539938739	0.878260 NS
T 6hrs	78.84±5.81435	77.88±5.81176	0.5838770879	0.526203 NS
T 12hrs	78.24±6.23351	78.08±5.40771	0.09694299459	0.923175 NS
T24 hrs	77.52±5.31601	77.36±5.80143	0.1016684501	0.919443 NS

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The mean time of onset of sensory block was 6.08min in group L and 4.8 min group K which was statistically significant ($p<0.05$). The mean sensory block recovery time was 5±1.58 mins in group-L and 8.08 ±2.11 mins in group-K ,declares a significant difference in sensory block recovery time statistically ($p<0.05$). See the given table -4 below.

Table -4 :Mean time of onset of sensory block and recovery time

	SENSORY BLOCK	
	Onset time	Recovery time
Group –L	6.08±1.322875656	5±1.58113883
Group- K	4.8±1.767295486	8.08±2.119748413
t- value	3.52434362	5.823426605
p- value	<0.0005 S	<0.0001 S

Table 3 Mean Pulse Rate

Mean Pulse Rate	GROUP-L	GROUP-K	t- value	p- value
T0	84.48±7.8693	83.24±8.7667	0.5262874725	0.601111 NS
T5	82.24±6.6035	81.76±6.7161	0.2548101907	0.799958 NS
T10	80.44±7.5170	82.44±7.2346	0.9585006973	0.342613 NS
T20	79.64±7.6587	80.04±8.0024	0.180556702	0.857475 NS
T30	76.88±6.0368	80±7.1355	1.669045921	0.101618 NS
T40	77.24±5.3329	77.2±12.3119	0.01490615374	0.988168 NS
T50	77.72±5.9408	79.56±5.7884	1.109158491	0.272888 NS
T60	77.52±6.2457	76.48±13.5834	0.3478124706	0.729501 NS
T2hrs	76.48±5.4092	77.68±5.2338	0.7971471845	0.429291 NS
T4hrs	75.92±4.5361	77.44±5.0173	1.123616332	0.266764 NS
T6hrs	75.4±3.6628	78.08±6.0133	1.90311984	0.063031 NS
T12hrs	74.8±4.1321	77.24±15.4199	0.7643334144	0.448409 NS
T24hrs	75.28±3.9740	77.68±5.8432	1.698132099	0.095957 NS

The mean time of onset of motor block was 12.08±2.75 mins in group-L and 8.4 ±2 mins in group –K shows difference statistically significant ($p<0.05$).Mean time of motor block recovery was 6±1.32 mins in group – L and 8.16±2.37 mins in group – K were shows statistically difference ($p<0.05$).see the table -5 below.

Table-5: 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- K	8.4±2	8.16±2.374868417
t- value	5.407867705	3.972844221
p- value	<0.0001 S	0.00023754258 S

Mean tourniquet pain onset was 30 min in group –L and 44 mins in group – K reveals the difference was statisticaly and clinicaly significant (<0.05).see the table -6 below.

Table -6: Mean tourniquet pain onset time(Mean TPOT)

	Mean TPOT (min)
Group-L	30±9.2
Group-K	44±6.6
P –value	0.04362537 S

RESCUE ANALGESIA: The mean fentanyl recquired for group –L was 55.4 µg/kg and for group –K was 26.12µg/kg discloses the significant difference statistically ($p<0.05$) between them intra operatively but in post operatively the mean diclofenac requirement for group – L was 114 mg and for group –K 78 mg shows statistically significant difference ($p<0.05$) between the two groups i.e, more requirement for group – L.see the table 7 below.

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Table -7: Rescue analgesia

	Group- L	Group – k	t- value	p- value
Intra operative fentanyl (µg/kg)	55.4± 22.06052281	26.12± 30.56321318	3.65225478	0.0012621515 S
Post operative diclofenac (mg)	114± 38.24264635	78± 26.33913438	3.876349695	0.000321580095

Intra operative VAS scores at 20 mins and 30 mins were significantly lower in group – K ($p<0.05$) when compared to group – L .VAS scores at all other time intervals intra operatively and post operatively were insignificant.see the table – 8 given below.

Table -8: VAS score

	Group	VAS Score								Chi square	P value
		0	1	2	3	4	5	6	7		
T0	L	21	4							0.9764197324	0.3230843 NS
	K	25									
T5	L	22	3							0.003649373882	0.9981769 NS
	K	21	3	1							
T10	L	15	8	2						4.6	0.1002588 NS
	K	21	2	2							
T20	L	3	4	8	4	6				21.63458385	0.0002369 S
	K	20	3	2							
T30	L	8		5	2	10				15.1301219	0.0044388 S
	K	21	2	2							
T40	L	12	3	5	1	3	1			4.182	0.6520620 NS
	K	8	2	5	2	2	5	1			
T 50	L	13	3	6	1		2			0.3478338945	0.9992300 NS
	K	13	3	5	1	1	1	1			
T60	L	6		5	4	3	5	2		5.342008182	0.6183025 NS
	K	3	1	7		1	8	3	2		
T2 hrs	L	6	2	7		3	5	2		8.712215321	0.1904214 NS
	K		2	16	1	3	2	1			
T 4 hrs	L	2	3	13	3	2	1	1		1.767607048	0.9397834 NS
	K	1	1	16	4	2	1				
T6 hrs	L	1	3	11	4		4	1	1	2.513193776	0.9261002 NS
	K		4	15	5		1				
T12 hrs	L	2	5	4	5	3	5	1		9.792152847	0.1336822 NS
	K	2	6	13	1	1	2				
T24 hrs	L	7	14	4						3.436363636	0.1793920 NS
	K	13	8	4							

Khaled,Nasr et.al did not find any significant difference between patients who received 40ml of 0.5% of lignocaine and 40ml of 0.5 %lignocaine and ketamine with regards to changes in HR ,BP and ,when ketamine was given as an adjuvant in IVRA .This was due to the fact that tourniquet was not deflated before 30.

According to Khaled,Nasr,Hegazy et,al mean fentanyl required for group -L 55.4±22µg and for group-K was 26.12±30.5.The difference for rescue analgesia was statistically significant ($p<0.05$).

In the present study mean post operative diclofenac requirement was 114±38.2mg in group-L and 78±26.3 mg in group – K ,expresses significant difference statistically between two groups ($p<0.05$).Intra operative VAS scores at 20 and 30 mins were significantly lower in group – K ($p<0.05$).

In present study the mean tourniquet pain onset time was 30±9.2 mins in group – L and 44±6.6 mins in group – K , the resulted difference between the two groups was statistically significant ($p<0.05$).

Alok kumar,DK Sharma et.al found that there was no difference in HR,BP and between two groups. Also they observed mean onset time for tourniquet pain was 26.67 mins in group- L while none in group – K complained of pain after an average duration of 35 mins ($p<0.0001$).

Khaled,Nasr,Hegazy et al used lornoxicam for post operative analgesia ,a newer NSAID.The mean amount of lornoxicam was 12.8mg in group- L and 6.4± 8.0 mg in group – K . The difference was statistically significant ($p<0.0001$).

SIDE EFFECTS:

According to Alok kumar ,DK Sharma et al no post operative side effects were observed in group – L and one patient had dizziness in group – K .

According to G Mohammed,Akhter Naqeeb et al two patients were developed restlessness and two patients were developed bradycardia in group – L. One patient developed dizziness and one patient developed muscle fasciculations in group – K.

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In present study post operative nausea occurred in two patients in group – L and one in group – K .Post operative vomiting occurred in one patient in group - K and dizziness developed in two patients in group – K .There were no intra operative side effects in any group.see the table 9 below.

Table -9 Side effects

Side effects	Intra operative		Post operative	
	Group - L	Group – K	Group - L	Group – K
Nausea	0	0	2	1
Vomiting	0	0	0	1
Convulsions	0	0	0	0
Dizziness	0	0	0	2
Any others	0	0	0	0

DISCUSSION:

The technique of IVRA was first described by August Bier in using procaine as local anaesthetic agent .Holmes in subsequently repopularised by using lignocaine while circulation was occluded. Many local anaesthtic agents like , , and have been used for this technique. Because of many complications associated with their use, only lignocai has been employed popularly.

IVRA was techniqually simple ,cheap ,safe , easy with rapid onset of analgesia and rapidly increase turn .The duration of action was controllable and cost effective with success rate of 94-96% though anaesthesia was not as satisfactory as general anaesthesia.

Disadvantage with IVRA were local anaesthetic toxicity, tourniquet pain , lack of post operative analgesia. Various modalities were tried to overcome these disadvantages like change of local anaesthetic , modification of technique and addition of adjuvants.

DRUGS AND DOSAGE: Patients were divided into 2 groups of 25 each.

Group L 2% lignocaine of 10 ml + normal saline 30 ml

Group K 2% lignocaine of 10 ml + ketamine 0.5 mg/kg in 30 ml of normal saline.

Lignocaine was considered one of the least toxic local anaesthetic agent.In IVRA with conventionally placed tourniquet over upper arm a relatively large dose of 3mg/kg was recquired to ensure adequate analge .

Ketamine , a phenyl piperadine derivative , exerts a non competitive blockade of NMDA receptors. In addition to spinal cord,NMDA receptors have also been identified on peripheral unmyelinated sensory axons .So ketamine can attenuate the tourniquet pain via NMDA .

In our study we used 0.5mg /kg of ketamine and it was clearly demonstrated the benefit, when compared to a contro.

In our study the dose of lignocaine was fixed and not according to the body weight of the patient .A number of studies 40ml lignocaine 0.5 % was used for IVRA which provide an adequate analgesia without serious side .

Khaled , Nasr ,Hegazy et.al used fentanyl 1µg/kg for tourniquet pain and diclofenac 75mg for post operative pain with VAS >3.Also they used fentanyl for tourniquet pain and lornoxicam for post operative pain releif.

Chandrashekara PM et. al believed that unpremedicated patients were co-operate better.So in the present study also no premedication but with good verbal assurance was given to the patients to ensure good co operation for better assessment of quality of analgesia .

CONCLUSION:

The present study demonstrated that administration of ketamine 0.5mg in 30 ml of normal saline to 0.5% of lignocaine for IVRA ,significantly lowered the time of onset of sensory block and motor block.Recovery time for sensory and motor block were significantly longer. Number of patients who required fentanyl and the amount of fentanyl required intra operatively as a rescue agent was significantly lowered.Onset of tourniquet pain was significantly longer.Post operative diclofenac as a rescue analgesia requirement was significantly lowered.No significant difference in cardiovascular and respiratory parameters during intra operative and post operative periods.There were no side effects in intraoperative period in both groups.In post operative period there was no significant difference in incidence of side effects between the two groups.

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