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A COMPARATIVE STUDY OF LIGNOCAINE 0.5% AND ROPIVACAINE 0.2% FOR INTRAVENOUS REGIONAL ANESTHESIA FOR UPPER LIMB SURGERY.

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ABSTRACT

Background: Day care surgeries and ambulatory surgeries have number of advantages for the patient as well as for health care providers and even to hospital staff also. Regional anesthesia has been very popular in day care surgery. Intravenous regional anesthesia is one such simple and reliable technique, with success rates between 94% and 98%.

Objectives: The study aimed to compare intravenous lignocaine 0.5% vs ropivacaine 0.2% in regional anesthesia for elective upper limb surgery.

Material and Methods: Patients included in the study were ASA grade I and II of ages 18-65 years, undergoing elective upper limb surgery. A total of 100 patients were randomly divided into 2 groups. We compared intravenous regional anesthesia by using lignocaine 0.55 with ropivacaine 0.2% for elective upper limb surgery. A detailed history and systemic examination was done to rule out presence of major illness. Routine investigations like haemogram and urine examination was done in all patients.

Results: The difference in mean time of sensory blockade between group L and R was found to be insignificant ($p>0.05$). The difference between mean time of onset of motor blockade between group Land R was found to be significant ($p<0.05$). There was no evidence of side effects after release of tourniquet in 0.2% ropivacaine group as compared to 0.5% lignocaine group. Difference between mean time of recovery from sensory blockade between L and R group was highly significant ($p<0.05$).

Conclusion: From the observations and results of our study we conclude that 0.2% ropivacaine can be used as an alternative to 0.5% lignocaine for intravenous having just the similar onset and intensity of sensory block.

KEYWORDS : Day care surgery, Lingnocaine, Ropivacaine, Intravenous Regional Anaesthesia.

INTRODUCTION:

In today's world more than 60% of all elective surgeries are performed in day care surgical settings. Due to the increasing number of rapid diagnostic and surgical treatment centers around the globe reduced the need for hospitalization.[1] Day care surgeries and ambulatory surgeries have number of advantages for the patient as well as for health care providers and even to hospital staff also. These include patient preference mainly children & elderly, lack of dependence on the availability of hospital beds, low morbidity & mortality, lower incidence of infection & respiratory complications, greater efficiency, lower overall procedural costs and less preoperative testing & postoperative medication.[1]

Regional anesthesia has been very popular in day care surgery. Intravenous regional anesthesia is one such simple and reliable technique, with success rates between 94% and 98%.[2] Intravenous regional anesthesia is commonly used for surgeries lasting 60 - 90 minutes of the forearm. Its use for longer surgical procedures is precluded by the appearance of the discomfort from the tourniquet, which limits the indications for its use. The tourniquet produces ischemia, which contributes to the analgesic action of the local anesthetic by blocking nerve conduction and motor endplate function.

Intravenous regional anesthesia offers many advantages including ease of administration, rapid onset, and rapidly of recovery, muscular relaxation and controllable extent of anesthesia.[2] It is a usual technique of anesthesia for outpatient procedures requiring inexpensive equipment, cost effective and widely applicable to patients of different ages & physical status for operations.

It has disadvantages like tourniquet pain, poor post-operative analgesia, limited time of surgical anesthesia, difficulty in providing a bloodless field if exsanguinations are improper, risk of systemic local anesthetic toxicity if tourniquet is accidentally deflated. Rare complications include development of compartment syndrome and loss of limb.

The local anesthetic most often used is lignocaine 0.5%, which has a relatively brief duration of post-operative analgesia after release of tourniquet. A longer acting agent, such as bupivacaine, initially gained substantial popularity for use during intravenous regional anesthesia but it has been associated with potential serious side effects like prolonged ventricular fibrillation which may be irreversible. Intravenous ropivacaine, compared with bupivacaine and lignocaine in several studies has yielded evidence of less cardiac and CNS side effects but has achieved similar surgical anesthetic conditions.

Aim and Objectives:

The study aimed to compare intravenous lignocaine 0.5% vs ropivacaine 0.2% in regional anesthesia for elective upper limb surgery.

MATERIAL AND METHODS:

A comparative study of intravenous regional anaesthesia (IVRA) using lignocaine 0.5% and ropivacaine 0.2% was carried out in 100 patients, undergoing elective upper limb surgery at Department of Anesthesia in a tertiary care teaching hospital, Unnao.

Patients who underwent major surgery during the period year 2018 (Jan-Dec) were taken for the study in the present series. Patients included in the study were ASA grade I and II of ages 18 – 65 years, undergoing elective upper limb surgery. Patients excluded from the study were: Patients with known history of allergy to local anaesthetics and medical conditions where it is not advisable to apply tourniquet. Major systemic diseases where the risk of local anaesthetic toxicity is increased and the dose required needs to be modified. Patients with history of epilepsy. Duration of surgery > 120 minutes. Disease where NSAIDS like diclofenac sodium is contraindicated as it is used for the relief of tourniquet pain in our study. Pregnancy and patients on beta blockers, benzodiazipines and cimetidine as these drugs may modify local anaesthetic toxicity.

Procedure

Patients were randomly divided into 2 equal groups of equal size L and R respectively. Every even number patient received lignocaine and every odd number patient received ropivacaine. Informed consent for the procedure was taken from patients after the approval from the hospital ethical committee. A detailed history and systemic examination was done to rule out presence of major illness. Routine investigations were done in all patients. Total leukocytes count, blood sugar level, kidney function tests , liver function test, electrocardiography and X-ray chest were performed as indicated prior to surgery. The procedure was explained to the patients.

It was confirmed that there is no leak in the tourniquet prior to the procedure. A 20 gauge intravenous catheter was inserted in the opposite hand for crystalloid infusion. A small intravenous catheter (e.g. 22 gauges) was introduced in the dorsum of the patient's hand of the arm to be anaesthetized. The arm to be anaesthetized was elevated for at least 3-5 minutes to allow passive exsanguniation, which occurs due to large veins emptying into the more proximal circulation. A pneumatic tourniquet was placed around the upper arm, and the proximal cuff was inflated to 100 mmHg above the systolic blood

pressure. Circulatory isolation of arm was verified by inspection, absence of radial pulse, loss of pulse oximetery reading is ipsilateral index finger.

40 ml of 0.5% lignocaine, which was prepared by adding preservative free 5% lignocaine to 40 ml was used to achieve IVRA and the dose used was 4 mg/kg. Maximum dose was 200 mg or 40 ml of 0.2% of ropivacaine. Dose used was 1.5 mg/kg. Maximum dose used was 80 mg.

Symptoms of local anaesthetic toxicity were treated by increasing the pressure of tourniquet, seizures by inj. Diazepam 0,1mg/kg iv and manual ventilation with 100% oxygen. Hypotension was treated by IV fluidsand vasopressors as needed.

Assessment

Pin prick with 22 gauge short beveled needle was used to assess sensory block every 30 sec. Dermatomal senory distribution of medial and lateral brachial cutaneous, ulnar (little finger, hypothenar eminence) median (thenar eminence, index finger) and radial (for arm and first web space) nerves were used to assess patient's response. Patient who received general anesthesia were considered as failure and were not included for the analysis.

Recovery of sensory block was defined as the time elapsed from tourniquet deflation to recovery of sensations in the dermatomes which was determined by pin prick test.The subject was asked to flex and extend his finger, wrist and elbow to assess the motor function.

The time elapased from injection of drug to complete motor block up to 15 minutes was defined as the onset of motor block.

Motor block was graded as followed:

Grade 4 – no movement
Grade 3-movement only at interphalyngeal joint
Grade 2-movemnet at interphalengial and wrist joint
Grade 1- reduced movement at interphalengial, wrist and elbow joint as compared to opposite forearm.

The time elapsed from tourniquet deflation to the movement of finger, hand and forearm comparable to opposite forearm was defined as the recovery of motor block. After sensory and motor block, the distal tourniquet was inflated to 100mmhg above systolic blood pressure, the proximal tourniquet was deflated and the surgery was started.

After the inflation of the distal tourniquet MAP, heart rate and Spo2 were monitored at every 5 minutes during the procedure and post operatively till complete recovery of sensory and motor block. During the procedure, patient was continuously watched for signs of local anaesthetic toxicity and tourniquet pressure on pressure gauge.

Visual analogue scale (0 -No pain 10- worst pain imaginable) was used for the assessment of pain before and after tourniquet application. When VAS was more then 4, injection diclofinac 1.5mg/kg diluted up to 10ml saline given for tourniquet pain.

The tourniquet was not deflated before 25 minute and was not kept inflated for more than 2 hours. At the end of the surgery, the distal tourniquet was deflated by a cyclic inflation deflation technique. Distal tourniquet was deflated for initial 1 minute, then reinflated for 1 minute, and again deflated and then removed from the extremity. After tourniquet deflation, patients were continuously monitored for cardiac arrhythmias and blood pressure changes and CNS side effects like dizziness, light headedness, tinnitus or presence of metallic taste.

Post-operative analgesia was assessed every 15 minutes as per VAS in the first hour and later every one hour till score was 4 or more. When VAS >4, inj. diclofinac in a dose of 1.5 mg/kg diluted in 10 ml normal saline was given. Time required for administration of first analgesic was noted down. Time elapsed from tourniquet release to administration of first analgesic was noted down. Time elapsed from tourniquet release to administration of first analgesic was considered as duration of post-operative analgesia. Patients were followed up for 24 hours post operatively for occurrence of local effects like skin rash, oedema, hematoma and neurological injury and are treated as needed.

RESULTS:

GROUP L: Patients received *intravenous regional anaesthesia* with 0.5% lignocaine (preservative free) 4mg/kg diluted in saline up to 40 ml (maximum dose 200 mg)

GROUP R: Patients received *intravenous regional anaesthesia* with 0.2% ropivacaine (preservative free) 1.5mg/kg (maximum dose 80mg). Demographic data related to age, sex and weight were taken into consideration in both the groups.

Table 1: Duration of Surgical Procedures

Duration of Surgery (min)	Group L (No of Patients)	Group R (No of Patients)
41-50	09	08
51-60	10	09
61-70	25	23
71-80	06	10
Total	50	50
Mean ± SD	7.5±3.80	7.5±2.40

Table shows that no significant difference was found in mean operative time of surgery between two groups i.e 0.95 (p>0.05)

Table 2: Tourniquet Time

Torniquet Time (mins)	Group L (no. Of Patients)	Group R (no. Of Patients)
51-60	4	3
n61-70	9	11
71-80	8	6
81-90	9	10
TOTAL	30	30
Mean ± S.D. (mins)	7.5 ± 2.38	7.5 ± 3.69

No significant difference was found in tourniquet time between the two groups i.e 0.96 (P>0.05)

Table 3: Side effect after release of Tourniquet

VAS Score	Group L (No of Patients)	Group R (No of Patients)
Lightheadedness	4	0
Metallic taste	1 (2%)	0
Tinnitus	1 (2%)	0

There was no evidence of side effects after the release of tourniquet in 0.2% ropvacaine group as compared to 0.5% lignocaine group.

Table 4: Grade of Sensory Blockade

GRADE OF SENSORY BLOCKADE	GROUP L (no. of patients)	GROUP R (no. of patients)
1	0	0
2	0	0
3	20	20
4	8	12
MEDIAN	4	6

The difference in grade of sensory blockade was statistically insignificant (P>0.05)

Table 5: Grade of Motor Blockade

GRADE OF MOTOR BLOCKADE	GROUP L (no. of patients)	GROUP R (no. of patients)
1	0	0
2	14	19
3	11	11
4	3	2
MEDIAN	7	6.5

The difference in grade of motor blockade was statistically insignificant (P>0.05)

DISCUSSION:

Intravenous regional anaesthesia is safe, simple to administer and effective method of providing anaesthesia for surgeries on the extremities. It is ideal for short procedures on an ambulatory basis. Local anaesthetics such as lignocaine, prilocaine are commonly administered for intravenous regional anaesthesia. However, the anaesthetic agents commonly used for example lignocaine 0.5% has a relatively short duration of action, which may affect the duration of intra operative analgesia, tourniquet tolerance and redistribution of drug after tourniquet release.

Ropivacaine, a newer amide local anaesthetic is structurally related to bupivacaine with almost similar duration of action. However, ropivacaine causes less depression of cardiac conduction. Clinical use

of ropivacaine is well established for epidural anaesthesia and peripheral nerve blocks.

The potential use of local anaesthetics that would provide anaesthesia of greater duration than lignocaine with less toxicity than bupivacaine prompted the present comparison of ropivacaine 0.2% and lignocaine 0.5% for intravenous regional anaesthesia In our study, the two groups did not differ with respect to mean age of patients, mean weight of patients, mean of tourniquet time, mean duration of surgery, no statistically significant difference was found between both the groups group ($p>0.05$).

The onset of sensory block was comparable in lignocaine group (5±2.09) and ropivacaine group (4.29±3.25). The difference in mean time of onset of sensory block between lignocaine group and ropivacaine group was found to be statistically insignificant (P=0.369) similar to Maximilian W.B. et al[5] 1999. Thus our study is supported by their study.

In our study the onset of motor block in lignocaine group was 3.75±2.43 and ropivacaine group was 4.28±3.25. The difference in mean time of onset of motor block between lignocaine group and ropivacaine group was found to be statistically significant (P=0.0486). Delayed onset of motor block seen with ropivacaine is due to its lesser ability to penetrate large milinated motor fibers, thus it has selective action on pain transmitting A-Delta and C nerve fibers rather than A-Beta fibers which are involved in motor function. Peng Philip W.H. et al[6] in 2002 observed similar onset between 0.5% lignocaine and 0.375% ropivacaine group. T.T. Niemi et al[7] in 2006 reported similar development of motor block between 0.5% prilocaine group and 0.2% ropivacaine group.

In our study we did not observe any pain on injection of intravenous regional anaesthestic solution. Neither skin rash nor hematoma was seen. Alparslan Turan et al[8] in 2005 reported pain on injection of intravenous regional anaethetic solution in 3 patients in magnesium group and none in the lignocaine group. Acalovschiet al[9] in 2001 noticed skin rash below tourniquet when he added 100 mg tramadol to intravenous regional anaethetic solution. Scott Reuben et al[10] in 2002 reported hematomas at local site when he used ketorolac.

None of the patients in our study develop any local complications after use of 0.5% lignocaine and 0.2 % ropivacaine for intravenous regional anaesthesia as we did not use magnesium, tramadol or keterolac. In our study the comparison of grade of sensory between lignocaine group and ropivaciane was statistically insignificant ($P>0.05$). The comparison of grade of motor block between ropivacaine group and lignocaine group was statistically insignificant ($P>0.05$).

A double cuffed tourniquet was used in our study thus none of our patients had VAS more then 4 after inflation of distilled tourniquet and non of the patients required any analgesic for tourniquet pain. In our study there were no evident side effects after the release of tourniquet in ropivacaine group. In our study the mean time of recovery from sensory block was 6.43±5.537 in lignocaine group and 2.26 ±6.658 in ropivacaine group, the difference was found to be highly statistically significant ($p =0.0001$) Maximilian W. B et al[5] in 1999 also observed longer duration of sensory block in ropivacaine group and attributed this to more complete and persistent binding leading to slow release of ropivacaine into systemic circulation.

In our study the mean time of our recovery from motor block was 11.4±6.409 minutes in lignocaine group and 27.1±6.794 minutes in ropivacaine group which was highly statistically significant ($p= 0.0001$).
Chan V. W et al[11] in 1999 noticed that the recovery from motor block was slowest in the high dose ropivacaine group (1.8 mg/ kg). Motor block was sustained in high dose ropivacaine group for 70 minutes which was significantly longer than the lignocaine group.

In our study, the mean time for first analgesic was 15.83±7.670 minutes in Lignocaine group and 38.43±13.850 minutes in ropivacaine group. The difference between both the groups was statistically significant ($p=0.0001$). This is due to more lipophilic nature of ropivacaine which stays at the local site for longer time than lignocaine. About 15.6 % of the dose of ropivacaine stays at the local site for up to 20 mins after the release of tourniquet. Attenasoff et al[4] in 2001 observed that the time until first intake of pain medication after injection was longer for 0.2 % ropivacaine group (median 47 min, range 27-340 min) as compared to 0.5% lignocaine group (median 34 min, range 2-140 min, $p < 0.05$). The number of patients to whom analgesic were administered in the post anaesthetic care unit was lower in the ropivacaine group than in the ropivacaine group.

Limitations of study:
As it was a single centre study the results cannot be genralized to entire population. Furthermore comprehensive and multicentric studies including meta analysis of various earler studies should be done, to have a more meaningful and high impact results.

CONCLUSION:
From the observations and results of our study we conclude that 0.2% ropivacaine can be used as an alternative to 0.5% lignocaine for intravenous having just the similar onset and intensity of sensory block. The duration of sensory and motor block is prolonged along with prolonged post-operative analgesia in 0.2% ropivacaine group, and also safely as compared to 0.5% lignocaine.

Prolonged early post-operative analgesia along with increased safety, are a striking advantages of 0.2% ropivacaine over 0.5% lignocaine used for intravenous regional anaesthesia.

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