DEXMEDETOMIDINE AS AN ADJUVANT TO LIGNOCAINE IN INTRAVENOUS REGIONAL ANAESTHESIA

A STUDY OF 60 CASES

DISSERTATION SUBMITTED FOR

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BRANCH X (ANAESTHESIOLOGY)

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CHENNAI,

TAMILNADU

BONAFIDE CERTIFICATE

This is to certify that this dissertation entitled "**DEXMEDETOMIDINE AS AN ADJUVANT TO LIGNOCAINE IN INTRAVENOUS REGIONAL ANAESTHESIA**" submitted by Dr.T.ARUN PRAKASH to the faculty of ANAESTHESIOLOGY, The TamilNadu Dr. M.G.R. Medical University, Chennai, in partial fulfilment of the requirement in the award of degree of M.D., Degree Branch -X (ANAESTHESIOLOGY), for the April 2012 examination is a bonafide research work carried out by him under my direct supervision and guidance.

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DECLARATION

I, Dr.T.ARUN PRAKASH declare that the dissertation titled **"DEXMEDETOMIDINE AS AN ADJUVANT TO LIGNOCAINE IN INTRAVENOUS REGIONAL ANAESTHESIA"** has been prepared by me.

This is submitted to The Tamil Nadu Dr. M.G.R. Medical University, Chennai, in partial fulfilment of the requirement for the award of M.D., Degree, Branch X (ANAESTHESIOLOGY) degree Examination to be held in April 2012.

I also declare that this dissertation, in part or full was not submitted by me or any other to any other University or Board, either in India or abroad for any award, degree or diploma.

Place : Madurai

Date : **Dr. T. ARUN PRAKASH**

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CONTENTS

DEXMEDETOMIDINE AS AN ADJUVANT TO LIGNOCAINE IN INTRAVENOUS REGIONAL ANESTHESIA

ABSTRACT

Background: In this randomized, double-blind, prospective study, the effect of adding dexmedetomidine as an adjuvant to lignocaine in Intravenous regional anesthesia is evaluated in terms of sensory and motor block onset time, intraoperative sedation, incidence of tourniquet pain and postoperative analgesia.

Methods: After informed consent and ethical committee approval, sixty ASA I and II patients scheduled for the hand and forearm surgeries were included in this study .Patients with Raynaud disease, sickle cell anaemia or a history of allergy to local anesthetics and dexmedetomidine were excluded from the study. After the patients had been taken to operating room, blood pressure, peripheral oxygen saturation and heart rate were monitored. Patients divided into two groups, in Group A 3mg/kg 0.5% lignocaine with 0.5micrograms/kg dexmedetomidine and in Group B 3mg/kg 0.5% lignocaine were injected .Before the block,two cannula were placed, one in operative hand and other in the opposite hand. Operating hand is exsanguinated and using double tourniquet technique the drugs were injected in respective groups.

Intraoperatively mentioned vital parameters monitored regularly at 5, 10, 15, 20, 30, 40, 50, 60, 80, 90 and 120minutes. Sensory and motor block onset time, intraoperative sedation, tourniquet pain time, hemodynamics, postoperative analgesia and side effects were noted if present. Sedation was assessed using Ramsay sedation scale and postoperative analgesia assessed by visual analogue scale. Time since tourniquet release to VAS more than 3 is considered total postoperative analgesia and rescue analgesia inj.diclofenac 75mg intramuscularly given and the study is completed.

Results: Both the Groups were comparable in respect of age, sex, weight and duration of surgery. In Group A onset of sensory block is 1.8±0.76minutes and motor block is 13.63±1.54 minutes, in Group B it was 5.27±0.58 minutes and 18.07±1.26 minutes respectively. In Group A sensory and motor recovery time were 18.87±3.27 minutes and 25.6±3.82 minutes and in Group B they were 4.8±0.7 minutes and 2.53±0.51 minutes respectively. Sedation in Group A was 1.77±0.43 and in Group B was 1. In Group A postoperative analgesia is 416.2±45.73 minutes and in Group B was 11.33±0.96 minutes. No side effects were noted.

Conclusion: It is concluded that when Dexmedetomidine 0.5micrograms/kg is added to lignocaine for Intravenous regional anesthesia, it provided quicker onset of sensory and motor blockade, lesser incidence of tourniquet pain, increased duration of post operative analgesia and better haemodynamic stability without any side effects.

Keywords: Dexmedetomidine, tourniquet, postoperative analgesia

INTRODUCTION

Intravenous Regional Anaesthesia (IVRA) since its birth in the hands of August Bier in 1908 has become a valuable instrument in the repertoire of anaesthesiologists. This method enjoyed wide popularity for a time. It is not long before simple and reliable techniques for blocking the brachial plexus developed, and the intravenous method declined in popularity.

It was revived in 1963 by Holmes, who used lignocaine because it appeared to give more reliable anaesthesia than procaine. Today intravenous regional anesthesia with slight technical modifications is an ideal method of providing anaesthesia for minor surgical procedures to the extremities performed on an ambulatory basis. It has the advantages of speed of onset, rapid recovery, reliability of blockade & cost effectiveness.

Adjuvants to local anaesthetics have greatly expanded the potential applications of regional anaesthesia by providing faster onset time, inhibition of tourniquet pain, prolonged post-operative analgesia and improved peri-operative analgesia apart from decreasing the risk of local anaesthetic toxicity.

In this regard, Dexmedetomidine– a parenterally administered α2 agonist have analgesic effects by depressing the nerve action potentials especially in C fibres and also acting at α2-adrenergic receptors located at nerve endings . When given in combination with Local anaesthetics it decreases the peri-operative pain.

Additive effects of these agents result in greater patient satisfaction, rapid hospital discharge , cost effectiveness and minimal risks.

AIM OF THE STUDY

To assess

1. The effectiveness of Dexmedetomidine as an adjuvant in Intravenous regional anesthesia
2. The effectiveness of Dexmedetomidine in preventing tourniquet pain when added as an adjuvant in Intravenous regional anesthesia
3. The duration of postoperative analgesia, when Dexmedetomidine is added as an adjuvant in Intravenous regional anesthesia.

INTRAVENOUS REGIONAL ANAESTHESIA

Intravenous regional anaesthesia (IVRA) was first described by August Bier in 1908. He observed that when local anaesthetic was injected intravenously between two tourniquets on a limb, a rapid onset of anaesthesia occurred in the area between the tourniquets . The technique did not become popular until the 1960s when it was reintroduced by Holmes. Today, the technique is slightly modified, using either a single or a double tourniquet at one site and injecting local anaesthetic as distal as possible to the cuff. The double tourniquet is used to increase safety and to reduce tourniquet pain in the awake patient, but there is a possibility of accidental deflation of the wrong cuff, which may lead to toxic systemic levels of local anaesthetic.

Intravenous Regional Anesthesia is technically simple and does not require specific anatomical knowledge. Success rate is 96–100% with a low incidence of side-effects. It is a reliable, simple and safe method of providing anaesthesia for minor surgical procedures to the extremities if it is administered by experienced clinicians

Advantages and Disadvantages of intravenous regional anaesthesia

Advantages:

It has faster onset and rapid recovery . It is a simple and reliable technique providing good muscle relaxation in the absence of local infection and with adequate equipment.

Disadvantages and Complications

Postoperative analgesia is poor and provides limited time of surgical anaesthesia for less than 90 minutes. There is potential for systemic local anaesthetic toxicity. Nerve damage can occur secondary to direct compression by the tourniquet and very rarely compartment syndrome and loss of limb can occur as complications.

Mechanism of action:

Local anaesthetic diffuses into the small veins surrounding the nerves and then into the vasa nervorum and capillary plexus of the nerves, leading to a core to mantle (centrifugal) conduction block in the nerves involved. Local anaesthetic then diffuses into the small nerves in the skin, blocking their conduction. The tourniquet produces ischaemia, which contributes to the analgesic action of the local anaesthetic by blocking nerve conduction and motor end plate function. Tourniquet application for 20 minutes alone produce analgesia to pinprick without the injection of

any local anaesthetic. However, the speed of onset and the density of anaesthesia are greater with injection of local anaesthetic.

Indications:

Intravenous Regional Anesthesia is used for surgical interventions on the hand, forearm or elbow that will not exceed 1 hour. These include reduction of forearm fractures, excision of wrist ganglia and palmar fasciotomy. Intravenous Regional Anesthesia is particularly useful for tendon grafting because it enables the surgeon to observe movement and tension of the grafted tendon after deflating the tourniquet before closing the wound , anaesthesia continued with a wrist block. Intravenous Regional Anesthesia can also be used for surgery on the foot, ankle or lower leg, for example for removing plates, screws or foreign bodies. Surgery on the elbow or knee is poorly tolerated using Intravenous Regional Anesthesia.

Contraindications

Absolute contraindications include sickle cell disease, Raynaud's disease or scleroderma, allergy to local anaesthetics and patient refusal. Relative contraindications include severe hypertensive or peripheral vascular disease, local infection, and skeletal muscle disorders or Paget's

disease where the local anaesthetic may spread to the systemic circulation through the venous channels in bone.

Procedure

Before the procedure the patient should be starved for 6 hours and monitored closely using standard monitoring . Patient should be placed on a tipping trolley and adequately informed about the procedure and have consented to it.

The equipment required for Intravenous regional anesthesia includes pneumatic tourniquet which is checked for leaks before the procedure, a pressure gauge, Esmarch bandage or Rhys-Davis exsanguinator, local anaesthetic solution, resuscitation equipment and drugs.

INTRAVENOUS REGIONAL ANESTHESIA OF THE ARM:

A 22 G cannula is placed intravenously as distal as possible in the arm to be anaesthetized. Venous access is established in the opposite arm to allow administration of fluids or drugs if necessary. In the double tourniquet technique ,two tourniquets each 6 cm wide is applied on the arm with generous layers of padding, ensuring that no wrinkles are formed and the tourniquet edges do not touch the skin. The arm is exsanguinated either by using the Esmarch bandage or a Rhys-Davis exsanguinator. If this is impossible, exsanguination can be achieved by elevating the arm for

2–3 minutes while compressing the axillary artery. The distal tourniquet is inflated to atleast 100 mmHg higher than the patient's systolic blood pressure or the tourniquet is inflated until the radial pulse was not felt . The proximal tourniquet is inflated to the same pressure. After ensuring inflation, the distal cuff is deflated.

Before injecting local anaesthetic it must be confirmed that no radial pulse is palpable. The local anaesthetic is then injected slowly. A standard volume for injection into the upper limb is 40 ml, which can be increased to 50 ml in a fit, large adult. If the injection is too rapid, the venous pressure may exceed the tourniquet pressure and the local anaesthetic solution may escape into the systemic circulation. Surgical anaesthesia is usually achieved within 15 minutes. The distal tourniquet, which overlies part of the anaesthetized arm, can then be inflated and the proximal one deflated to relieve tourniquet pain.

The cuff should not be deflated until 20 minutes after local anaesthetic injection because systemic toxic doses of local anaesthetic may occur. After 20 minutes, 30% of the injected drug is fixed within the tissues and is unavailable for immediate release into the systemic circulation. Cuff deflation should be performed in cycles with deflation/inflation times of less than 10 seconds until the patient no longer

exhibits signs of systemic toxicity for example, tingling of the lips, tinnitus and drowsiness. Severe signs of systemic toxicity include bradycardia, hypotension, electrocardiogram abnormalities, seizures and loss of consciousness. Maximum blood levels of local anaesthesia occur within 10 minutes of cuff deflation. Therefore, the patient should be monitored closely for 30 minutes following tourniquet release. With lignocaine, 2.5–3 mg/kg, and cuff deflation after 10 minutes, blood levels have been reported to be less than 2 micrograms/ml.

If severe central nervous system intoxication occurs, appropriate resuscitation guidelines should be followed. Emergency drugs must be readily available and 100% oxygen should be administered.

INTRAVENOUS REGIONAL ANESTHESIA OF THE LEG:

The basic technique is the same as for the arm but the dose and volume of local anaesthetic has to be doubled for intravenous regional anesthesia of the leg, which is associated with an increased potential for local anaesthetic toxicity. The tourniquet pressure must be higher in the leg approximately 350–400 mmHg, to occlude blood flow in the femoral artery. This may increase the occurrence of tourniquet pain. Tourniquets may be applied to the thigh, two tourniquets about 9 cm wide or one at the

calf below the head of the fibula and one at the thigh. The latter is for safety in case of distal cuff failure and is not usually inflated.

Choice of drugs

Many local anaesthetic drugs, with or without additives, have been used for intravenous regional anesthesia, but 0.5% prilocaine, 3–6 mg/kg, is the drug of choice because it has less systemic toxicity and is partially taken up in the lungs before reaching the systemic circulation. The usual dose is 40 ml (200 mg) without epinephrine. However, the manufacturers have ceased production of 0.5% prilocaine. 1% prilocaine remains available and is licensed for intravenous regional anesthesia, though its stability is not guaranteed if diluted. If prilocaine is unavailable then 0.5% lignocaine, 3 mg/kg, is used. If intravenous regional anesthesia is applied to the leg a larger volume must be injected (up to 100 ml). Prilocaine can be used undiluted for which maximum recommended dose is 400 mg in adults but lignocaine is commonly diluted to lower concentrations (e.g. 0.2–0.25%).For a 60kg patient 9ml of 2% lignocaine diluted to 36ml is 0.5% is used for Intravenous regional anesthesia.

Prilocaine can cause methaemoglobinaemia but unless doses in excess of 600 mg are used it is clinically insignificant in most patients. Although one has to be aware that in patients with anaemia or cardiac

conditions even small amounts of methaemoglobin can significantly impair the oxygen-carrying capacity of their red blood cells. Intravenous regional anaesthesia with prilocaine in these patients should be considered carefully for its benefits.

Other local anaesthetic agents have been used but do not provide superior analgesia or more rapid onset of block. Severe toxic reactions and death have been observed with bupivacaine and its use is contraindicated. In one study, 0.2% ropivacaine was intraoperatively as effective as 0.5% prilocaine but postoperative analgesia was prolonged;

Additives to local anaesthetics have not been consistently shown to have an effect during intravenous regional anesthesia but may increase the length of postoperative analgesia, probably because of a systemic effect following tourniquet release. The reported enhancement of intravenous regional anesthesia with pethidine, 1 mg/kg, may reflect intrinsic local anaesthetic activity of the drug.

It was shown that addition of muscle relaxants produced marked muscle relaxation but did not augment analgesia.

Ketamine alone appears to provide good sensory analgesia but some patients lost consciousness and exhibited the typical features of ketamine anaesthesia after tourniquet release.

Many other drugs have been studied, but only the addition of α2 agonists clonidine 150micrograms or Dexmedetomidine 0.5 micrograms/kg or the non-steroidal anti-inflammatory drugs ketorolac, 20 mg, or tenoxicam, 20 mg, to the local anaesthetic solution appeared to be effective in prolonging postoperative analgesia and relieving tourniquet pain. Guanethidine and calcium-channel blockers have been evaluated in the context of chronic pain management only.

TOURNIQUET

Intravenous regional anaesthesia is a method of producing analgesia of the distal part of a limb by intravenous injection, while circulation to the limb is occluded.

Occlusion of the limb was done previously by winding an esmarch bandage proximally up the arm. At present occlusion of the limb is achieved by pneumatic tourniquet. Unfortunately, the tourniquet is not physiologic and is associated with number of disadvantages.

SITE OF APPLICAION:

The upper arm and thigh have sufficient muscle bulk to distribute the cuff pressure evenly and they are the recommended sites.

CUFF WIDTH:

The American Heart Association concluded that if a sphygmomanometer cuff has a width of 20% greater than the diameter of the upper arm or 40% of the circumference of the thigh to a maximum of 20cm , then the pressure in the underlying central artery will be equal to that in the cuff. Modern silicone cuffs tend to be smaller than this, measuring 90mm cuff width of bladder 70mm size for the arm and 105mm cuff width of bladder 75mm size for the leg.

The tissues immediately underlying the cuff should be protected with cotton wool. This is not necessary with correctly applied modern silicone cuff

PRESSURE:

It is based on the unsedated patient's blood pressure measured on the ward preoperatively. The recommended cuff pressure for the upper limb is systolic blood pressure plus 100mmHg and for lower limb twice systolic blood pressure. This higher pressure is needed because there is often not enough room above the operating site for full sized cuff.

TOURNIQUET TIME:

The recommended time for upper limb is 90minutes. Two hours should be regarded as a maximum but this will not be safe for all patients. The surgeon should be notified about tourniquet time every half an hour. The safest time is the shortest tourniquet time.

PHYSIOLOGIC CHANGES CAUSED BY LIMB TOURNIQUETS:

Neurologic effects are abolition of somatosensory evoked potentials and nerve conduction which occurs with in 30minutes , application for more than 60minutes causes tourniquet pain and hypertension , application for more than 2hours may result in

postoperative neuropraxia and evidence of nerve injury may occur at a skin level underlying the edge of the tourniquet

MUSCLE CHANGES:

It produces cellular hypoxia with in 8minutes , decrease in the cellular creatine level , progressive cellular acidosis , endothelial capillary leak after 2hours and progressive coldness of limb.

SYSTEMIC EFFECTS OF TOURNIQUET INFLATION:

Arterial and pulmonary artery pressures become elevated, although this effect is usually slight to moderate if only one limb is occluded

SYSTEMIC EFFECTS OF TOURNIQUET RELEASE:

They are transient fall in core temperature, transient metabolic acidosis , transient fall in central venous oxygen tension ,transient increase in central venous carbondioxide tension , rapid release of acid metabolites into central circulation , transient fall in pulmonary and systemic arterial pressures, transient increase in end – tidal carbondioxide and increased oxygen consumption.

TOURNIQUET PAIN:

Patients receiving spinal anaesthesia may develop a poorly defined aching or burning sensation in the distal extremity about one hour after tourniquet inflation. Although the mechanism and neural pathways for this

severe aching and burning sensation defy precise explanation, unmyelinated, slow –conduction C fibres, which are relatively resistant to local anaesthetic blockade, probably play a critical role. Even during general anaesthesia, tourniquet pain can be revealed by a gradually increasing mean arterial blood pressure. The tourniquet pain and its accompanying hypertension influenced by many factors including anaesthetic techniques, intensity and level of block, choice of local anaesthetic and supplementation of the block with opioids. Cuff deflation invariably and immediately relieves the sensation of tourniquet pain and its hypertension. Systemic opioids namely inj.fentanyl 1micrograms/kg can be used in relieving tourniquet pain.

PHARMACOLOGY OF LIGNOCAINE

Lignocaine is a synthetic amide-linked anaesthetic of intermediate potency and duration. In 1943 Lofgren synthesized Lignocaine in Sweden. First used by Gordh in 1948.

Lignocaine is the standard to which all other local anaesthetics are compared. It is currently the most widely used local anaesthetic. In addition, it is a popular antiarrythmic. It can be given by all routes.

Mechanism of action:

Lignocaine prevent transmission of nerve impulses by inhibiting passage of sodium ions through ion-selective sodium channels in the nerve membranes. This slows the rate of depolarization such that the threshold potential is not reached and thus action potential is not propagated. But resting membrane potential is not altered. Lignocaine binds to the inner portion receptor (i.e Sodium channel) after entering the cell membrane.

Physiochemical properties:

Molecular weight 234

Weak base with a pka 7.6 – 7.8

Very stable, not decomposed by boiling, acids or alkalies

It is less lipid soluble than that of Bupivacaine

Pharmacokinetics:

Absorption:

It is absorbed from the site of application or injection into the blood stream. Rate of absorption depends on the blood flow to the area and use of epinephrine.

Metabolism and Excretion:

Metabolised in liver by oxidative dealkylation to monoethylglycine xylidide followed by hydrolysis of this metabolite to xylidide. Metabolism is dependant on hepatic blood flow. Monoethylglycine xylidide has 80% activity of the parent drug and xylidide has 10% activity of the parent drug. 75% of xylidide is excreted in the urine as 4 – hydroxyl – 2,6 – dimethylaniline.

Onset of action:

It has rapid onset occurring for topical anaesthesia in 5-10 minutes, for conduction anaesthesia in small nerves it is 5-10 minutes and for large nerves it is 10-15 minutes and for Intravenous administration it is 1-2 minutes.

It has protein binding of 70% bounded to α1 acid glycoproteins with volume of distribution 91 litres. Lignocaine has a triphasic distribution

Rapid distribution phase (α): In this phase, the drug is distributed to highly vascular regions with $t^{½}$ α of 1 minute. Next is slow disappearance phase (β): here the drug is distributed to slowly equilibrating tissues with $t^{½}$ β of 9.6 min.Last is slow transformation and excretion phase (δ) : Where the $t^{½}$ δ is 1.6 hrs with clearance of 0.95 litres per minute.

Availability:

a) 5% heavy 2 ml ampoules which contain 50 mg of lignocaine / ml with 75 mg – 100 mg of dextrose

b) 2% ligcocaine (xylocard) without preservative – 50 ml vial for intravenous use

c) 2% lignocaine – plain – 30 ml vial –contains methyl and propyl paraben as preservative

d) 2% lignocaine with 1 in 200000 Adrenaline

e) 4% lignocaine with 1 in 200000 Adrenaline – 30 ml vial.

f) 4% lignocaine viscus

g) 4% lignocaine aqueous solution

h) 10% lignocaine spray

i) 2% lignocaine Jelly

j) 2% lignocaine ointment

k) 5% lignocaine ointment

Pharmacodynamics:

Local actions:

Causes nerve blockade with loss of pain and temperature sensation, touch, motor power and vasomotor tone in the region supplied by the nerves blocked.

Systemic actions:

The results of systemic absorption from the site of administration or intravenous administration

1. **Cardiovascular system:**

It has a stabilizing effect on the cell membranes of cardiac tissue. Lignocaine depresses myocardial automaticity by antagonizing the spontaneous phase IV depolarization and reduces the duration of effective refractory period. Myocardial contractility and conduction velocity are depressed at higher concentrations. These effects result from direct cardiac muscle membrane changes occurring due to cardiac sodium channel blockade. It stabilizes the membrane of damaged and excitable cells, tending to suppress ectopic foci.

2. **Vascular smooth muscle :**

Produces vasodilatation

3. **Respiratory system :**

Lignocaine depresses hypoxic drive (the ventilatory response to low P_aO_2).Apnea can result from phrenic and intercostal nerve paralysis or depression of the medullary respiratory center following direct exposure to the local anaesthetic agents.Relaxes bronchial smooth muscle.Intravenous lignocaine may be effective in blocking the reflex bronchoconstriction associated with intubation.

4. **Central nervous system** :

Produces a sequence of stimulation followed by depression. Produces sedation on intravenous administration.Intravenous administration decreases cerebral blood flow and attenuates the rise in intracranial pressure that accompanies intubation.Infusion of lignocaine is capable of reducing the Minimal Alveolar Concentration of volatile anaesthetics by 40%.

5. **Musculoskeletal:**

Lignocaine is myotoxic leading to lytic degeneration, edema and necrosis.

6. **Haematological** :

It decreases coagulation and enhances fibrinolysis

Indications:

1. For infiltration block, peripheral nerve blocks, epidural, spinal and topical anaesthesia & intravenous regional anaesthesia.
2. Antiarrythmic:

   Lignocaine is a class IB antiarrythmic.It is used to treat

   a) Ventricular tachyarrythmias
   b) Arrythmias following acute Mycardial Infarction during cardiac surgery
   c) In digitalis toxicity – because it does not worsen AtrioVentricular – block
3. Prevention or treatment of increases in intracranial pressure during intubation - antitussive effect may be the reason.
4. Reflex induced bronchospasm is also attenuated by intravenous administration of lignocaine
5. Suppresses noxious reflexes such as coughing & sympathetic stimulations associated with endotracheal suctioning and intubation.
6. Used intravenously as an analgesic for certain chronic pain states
7. Used as a supplement to general anaetheisa.

Contraindications:

1. Hypersensitivity
2. Should not be used with vasoconstrictor in digits of hand, feet and penis
3. Stokes Adams syndrome, severe degree of heart block

Doses:

Maximum recommended dose :

a) Plain - 3 mg / kg

b) with adrenaline - 7 mg / kg

c) for reflex suppression - 1.5 mg / kg iv.

Drug interactions:

β Blockers:

Coadministration of beta blockers, increases serum levels of lignocaine and its toxicity by decreasing lignocaine's metabolism.

Anticonvulsant agents:

Increases lignocaine's metabolism

Non depolarizing muscle relaxant

Blockade is potentiated by lignocaine

Opioids and α_2 adrenergic agonists :

Potentiate lignocaine's pain relief

Antiarrythmic agents

Potentiate the cardiac effects of lignocaine

Toxicity:

Mostly due to systemic absorption of locally administered lignocaine or due to accidental intravenous administration of large doses of lignocaine. The central nervous system is mostly vulnerable.

Blood levels and symptoms:

4 micrograms / ml	:	Light headedness, tinnitus, circumoral and tongue numbness (anticonvulsant and antiarrhythmic activity)
6 micrograms / ml	:	visual disturbances
8 micrograms / ml	:	muscular twitching
10 micrograms / ml	:	convulsions
12 micrograms / ml	:	Unconsciousness
15 micrograms / ml	:	Coma
20 micrograms / ml	:	respiratory arrest
26 micrograms / ml	:	cardiovascular collapse

Treatment of toxicity:

Continuous monitoring of Cardiovascular and Respiratory status helps to identify the toxicity earlier.

- If convulsions occur barbiturates or benzodiazepines can be given.
- Succinylcholine 1mg/kg to paralyse the patient and aids in controlling the seizures.
- Cardiac toxicity like fibrillation can be treated by defibrillation
- Ventilatory support – 100 % oxygenation, intubation and ventilation
- Maintain B.P. by rapid infusion of I.V. fluids, use of vasopressors and put the patient in Trendelenberg's position.
- Maintain fluid and electrolyte balance.

Adverse effects:

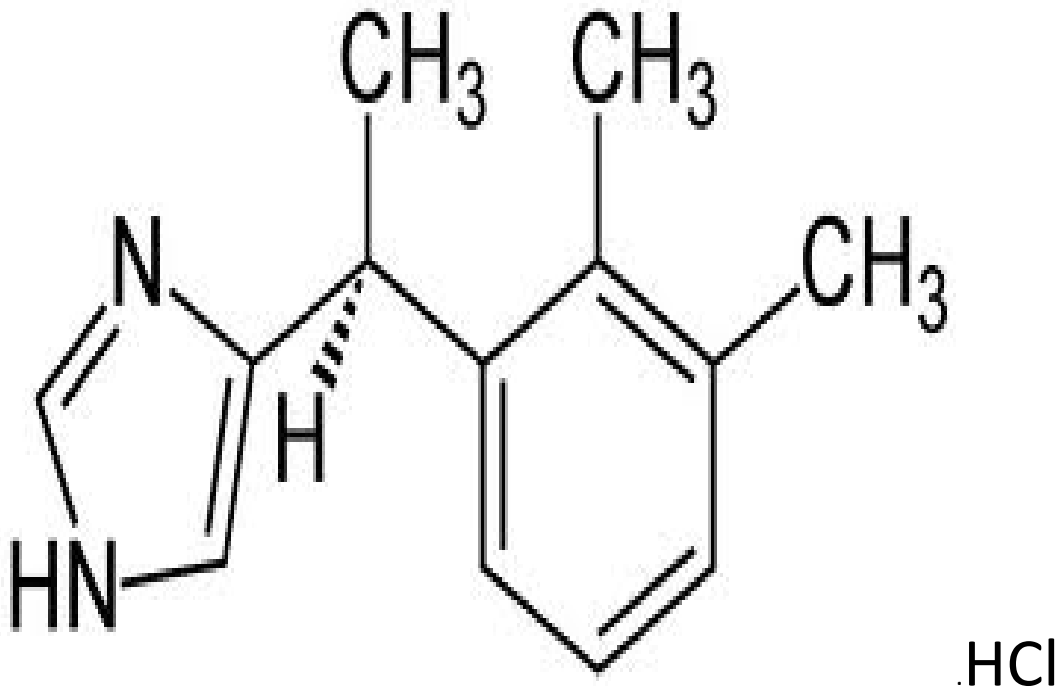
1. Allergic and hypersensitivity reactions

   Due to the preservative used – methyparaben

2. Cardiovascular system :

   Bradycardia, hypotension

DEXMEDETOMIDINE HYDROCHLORIDE



PHARMACOLOGY OF DEXMEDETOMIDINE

Dexmedetomidine hydrochloride is a 4-((s)-alpha,2,3-trimethylbenzyl) imidazole monohydrochloride or 4-[(1r)-1-(2,3-dimethylphenyl) ethyl]-3h-imidazole hydrochloride.

Molecular weight 236.74 1043

Dexmedetomidine is a new alpha2-agonist used as a short-term (less than 24 h) sedative analgesic in the intensive care unit. Clonidine is the prototype of alpha2- agonist. Dexmedetomidine when compared to clonidine is a much more selective alpha 2-adrenoceptor agonist, the alpha2/alpha1 selectivity of dexmedetomidine is 1620 and hence is 8 times more powerful alpha2-adrenoceptor than clonidine . In addition, dexmedetomidine is shorter-acting drug than clonidine and has a reversal drug for its sedative effect, atipamezole. These properties render dexmedetomidine suitable for sedation and analgesia during the whole perioperative period: as premedication, as an anesthetic adjunct for general and regional anesthesia, and as postoperative sedative and analgesic.

Alpha2-receptors are found in many sites throughout the body. Alpha2-adrenoceptors are found in peripheral and central nervous systems, in effector organs such as the liver, kidney, pancreas, eye ,vascular smooth muscles and platelets . Alpha2-adrenoceptors are divided into three

subthypes; the *subtype a*, the predominant subtype in central nervous system, is responsible for the sedative, analgesic and sympatholytic effect; the *subtype b,* found mainly in the peripheral vasculature, is responsible for the short-term hypertensive response, and the *subtype c*, found in the central nervous system , is responsible for the anxiolytic effect.

Pharmacodynamics of dexmedetomidine

The highest densities of alpha2- receptors are found in the locus ceruleus, the predominant noradrenergic nuclei of the brainstem and an important modulator of vigilance. Presynaptic activation of the alpha2-a adrenoceptor in the locus ceruleus inhibits the release of norepinephrine and results in the sedative and hypnotic effects in addition, the locus ceruleus is the site

of origin for the descending medullospinal noradrenergic pathway, known to be an important modulator of nociceptive neurotransmission.

Stimulation of the alpha2-adrenoceptors in this area terminates the propagation of pain signals leading to analgesia. Postsynaptic activation of alpha2-adrenoceptors in the CNS results in decrease in sympathetic activity leading to hypotension and bradycardia. At the spinal cord, stimulation of alpha2-receptors at the substantia gelatinosa of the dorsal horn leads to inhibition of the firing of nociceptive

neurons and inhibition of the release of substance p10. Also, the alpha2-adrenoceptors located at the nerve endings have a possible role in the analgesic mechanisms of alpha2-agonists by preventing noradrenaline release.

Pharmacokinetics of dexmedetomidine

Dexmedetomidine, an imidazole compound, is the active d-isomer of medetomidine. Following intravenous administration, dexmedetomidine exhibits the following pharmacokinetic parameters: a rapid distribution phase with distribution half-life (t ½ α) of 6 minutes ; elimination half-life (t ½ β) of 2 hours; volume of distribution (vss) 118 litres. Dexmedetomidine exhibits linear kinetics when infused in the dose range of 0.2-0.7 micrograms/kg/h for not more than 24 hours. Dexmedetomidine undergoes almost complete biotransformation through direct glucuronidation and cytochrome p450 metabolism. Metabolites of biotransformation are excreted in the urine (95%) and feces. The average protein binding of dexmedetomidine is 94%. Dexmedetomidine is a white powder that is freely soluble in water and pka of 7.1

Dosage

It is supplied as 100 micrograms/ml 2 ml vial which must be diluted with 48 ml of 0.9% sodium chloride solution prior to administration. For

adult patient, dexmedetomidine is administered by a loading infusion of 0.5-1 micrograms/kg over 10 minutes, followed by a maintenance infusion of 0.2 to 0.7 micrograms/kg/hr. The effect appears in 5-10 minutes, and is reduced in 30-60 minutes. The maintenance infusion is adjusted to achieve the desired level of sedation.

Perioperative uses of dexmedetomidine

i – Premedication

Dexmedetomidine possesses anxiolytic, sedative, analgesic, antisialogogue and sympatholytic properties. Intramuscular dexmedetomidine at a dose of 1 microgram/kg is used for premedication .

ii – Intraoperative uses of dexmedetomidine

Intraoperative uses of dexmedetomidine include its use as adjunct to general anesthesia, as adjunct to regional anesthesia, in monitored anesthesia care (MAC), or as a sole agent for total intravenous anesthesia (TIVA).

iii – Use of dexmedetomidine in the postoperative period

Dexmedetomidine's special properties favor its use in the recovery room. In addition to its sympatholytic effects, analgesic effects , decreased rate of shivering and the preservation of respiratory function allows the continuation of the dexmedetomidine infusion in the extubated,

spontaneously breathing patient. The possibility of ongoing sedation and sympathetic block could be beneficial in reducing high rates of early postoperative ischemic events in high-risk patients undergoing non-cardiac surgery.

Contraindication

i) Pre-existent severe bradycardia and conduction problems.

ii) In patients with reduced ventricular functions (ejection fraction<30%)

iii) In patients who are hypovolemic or hypotensive.

Adverse effects

The common adverse effects of dexmedetomidine include hypotension, hypertension, nausea, bradycardia, atrial fibrillation, hypoxia and various atrioventricular blocks.

REVIEW OF LITERATURE

1. Addition of dexmedetomidine to lidocaine for intravenous regional anaesthesia. Esmaoglu, A.; Mizrak, A.; Akin, A.; Turk, Y.; Boyaci, A. Erciyes University Medical Faculty, Department of Anaesthesiology and Reanimation, Kayseri, Turkey.

   Esmaoglu et al tested the use of adjuncts for intravenous regional anaesthesia (IVRA) for surgical procedures in terms of their intraoperative effects and postoperative analgesia in forty patients undergoing hand surgeries.They concluded that addition of 1 micrograms kg^{-1} dexmedetomidine to lidocaine in intravenous regional anaesthesia improved the quality of anaesthesia and decreased analgesic requirements, but had no effect on the sensory and motor blocks onset and regression times.

2. Adding dexmedetomidine to lidocaine for intravenous regional anesthesia. Memis D, Turan A, Karamanlioglu B, Pamukcu Z, Kurt I. department of anesthesiology and biostatistics, Trakya university medical faculty,edime,Turkey

   A recent study by Memis et al found that the addition of dexmedetomidine 0.5 micrograms kg^{-1} to lidocaine for Intravenous regional anaesthesia leads to significant decreases in sensory and motor

blocks onset time ,improves quality of anesthesia , postoperative analgesia without any side effects.

3. Dexmedetomidine: Clinical Application as an Adjunct for Intravenous Regional Anesthesia. Usha Ramadhyani, MD,Jason L. Park, MD,Dominic S. Carollo, MS, MD,Ruth S. Waterman, MD, Bobby D. Nossaman, MD

   Intravenous regional anesthesia is limited by the development of tourniquet pain and its inability to provide postoperative analgesia. In this study it was found that adding dexmeditomedine as an adjuvant in intravenous regional anaesthesia improved block quality, prolong post deflation analgesia and decreased tourniquet pain.

4. Adding clonidine to lidocaine for intravenous regional anesthesia prevents tourniquet pain.Gentili M, Bernard JM, Bonnet F.

   Gentili et al were the first to report the efficacy of clonidine in intravenous regional anaesthesia in decreasing tourniquet pain. Reuben and Sklar evaluated the safety and efficacy of administering intravenous regional anaesthesia with 1 micrograms/kg clonidine in the management of complex regional pain syndrome of the knee and found that clonidine was a useful treatment modality for its management without significant side effects.

5. Clonidine versus ketamine to prevent tourniquet pain during intravenous regional anesthesia with lidocaine .Gorgias NK, Maidatsi PG, Kyriakidis AM,

They compared the efficacy of a 1 micrograms/kg clonidine added to intravenous regional anaesthesia with lidocaine to prevent tourniquet pain and found that the addition of 1 micrograms/kg clonidine to lidocaine for intravenous regional anaesthesia delayed the onset of unbearable tourniquet pain and decreased analgesic consumption for tourniquet pain relief.

6. Lurie et al. evaluated the efficacy of 1 micrgramsg/kg clonidine added to intravenous regional anaesthesia -lidocaine in decreasing the onset of severe tourniquet pain and found that it delayed the onset time

7. Fentanyl and Dexmedetomidine premedication before intravenous regional anesthesia in minor outpatient hand surgery.

Jaakola et al. demonstrated the analgesic efficacy of dexmedetomidine in human tourniquet pain. In their study, a single intravenous dose of fentanyl and dexmedetomidine (0.25, 0.5, and 1 micrograms/kg) was administered. They found that dexmedetomidine clearly demonstrated an analgesic effect in the tourniquet pain .

8. Jaakola assessed the efficacy and safety of intravenous dexmedetomidine as a premedication before intravenous regional anaesthesia . She found that 1 micrograms/kg dexmedetomidine was an effective premedication before intravenous regional anaesthesia because it reduced patient anxiety and sympathoadrenal responses.

9. Addition of dexmedetomidine or lornoxicam to prilocaine in intravenous regional anaesthesia for hand or forearm surgery .Kol IO, Ozturk H, Kaygusuz K, Gursoy S, Comert B, Mimaroglu C. Department of Anaesthesiology, Cumhuriyet University School of Medicine, Sivas, Turkey.

    Addition of dexmedetomidine or lornoxicam to prilocaine in intravenous regional anaesthesia decreased Visual Analogue pain scores, improved anaesthesia quality and decreased analgesic requirement.

10. A systematic review of adjuncts for intravenous regional anaesthesia for surgical procedures. Andrew Choyce MBCHB FRCA and Philip Peng, MBBS FRCPC. From the Department of Anaesthesia, King's college Hospital, Denmark Hill, London, UK and the Toronto Western Hospital, Canada.

The authors tested the use of adjuncts for intravenous regional anaesthesia (IVRA) for surgical procedures in terms of their intraoperative effects and postoperative analgesia.

They concluded that, there is good evidence to recommend Non-steroidal anti-inflammatory drugs in general and ketorolac in particular for improving post operative analgesia after intravenous regional anaesthesia. Clonidine also appears to improve post operative analgesia and prolong tourniquet tolerance. Opioids are disappointing by this route. Only 30 mg meperidine has substantial postoperative benefit but at the expense of post deflation side effects. Muscle relaxants improve motor block and aid fracture reduction.

11. An evaluation of the analgesic efficacy of intravenous regional anaesthesia with lidocaine and ketorolac using a forearm versus upper arm tourniquet. Scott s. Reuben, MD., Robert B. Steinberg, MD, PhD, Holly Maciolek, RN and Poornachandran Manikantan MD, Department of Anaesthesiology, Tuffs University School of Medicine, Massachusetts.

In this study, they assessed the analgesic efficacy of administering intravenous regional anaesthesia by administrating lidocaine and ketorolac with either a forearm or upper arm tourniquet

for outpatient hand surgery. They concluded that forearm tourniquet intravenous regional anaesthesia with 0.5% lidocaine and ketorolac provides both a longer duration of sensory block and prolonged postoperative analgesia compared with upper arm intravenous regional anaesthesia.

12. Local anaesthetic adjuvants for neuraxial and peripheral blockade – James R. Hebl, MD, Department of Anaesthesiology Mayo – clinic, USA.

In this study, they studied about various local anaesthetic additives such as opioids, alpha – 2 agonists (clonidine), acetylcholine esterase inhibitors(neostigmine) and N methyl – D aspartate receptor antagonists (Ketamine) and Non-steroidal anti-inflammatory drugs .

They demonstrated that more effective postoperative analgesia can be achieved when Ketorolac is used in conjunction with lidocaine for intravenous regional anaesthesia . They hypothesized that more effective analgesia was obtained during intravenous regional anaesthesia administration because a higher concentration of ketorolac existed at the site of surgical trauma, where inflammatory mediator synthesis occured.

13. Comparision of wound infiltration with ketorolac Versus intravenous regional anaesthesia with ketorolac for postoperative analgesia

following ambulatory hand surgery.- Reuben SG, Duprat MM, Tufts University school of Medicine, spring field, Massachusetts, USA.

The purpose of this study was to assess the analgesic effectiveness of ketorolac administered with lidocaine via intravenous regional anaesthesia (IVRA) or via wound infiltration following ambulatory hand surgery. They concluded that ketorolac provides similar postoperative analgesia after ambulatory hand surgery when administered with lidocaine either by intravenous regional anaesthesia or by wound infiltration.

14. Intravenous Regional Anaesthesia using prilocaine and neostigmine.

A. Turan, B. Karamanlyog M, D. Memis, G. Kaya and Z. Paukcy ; Department of Anaesthesiology and Reanimation, Trakya University, Turkey.

In this study, thirty patients undergoing hand surgery were randomly assigned to two groups to receive intravenous regional anaesthesia. They have used 0.5 mg of neostigmine as a additive. They found shortened sensory and motor block onset times, improved quality of anaesthesia and prolonged sensory and motor block recovery times, and prolonged time to first analgesic requirement in neostigmine group.

15. 0.5 % versus 1.0% 2 – chloroprocaine for Intravenous Regional Anaesthesia : A prospective randomized, Double – Blind Trial.

    Stephan C. Marsch, MD, D Phil, Mathias Sluga, MD, Wolfgang studer, MD, Jonas Barandun, MD, Domenic Scharplatz, MD and wolf gang Ummentioter MD, From the Departments of Anaesthesia and surgery, Switzerland.

    In this randomised prospective double – blind study they tested the hypothesis that compared with 40 ml chloroprocaine 0.5 %, 40 ml chloroprocaine 1 % results in an earlier onset of analgesia duration and improves distal tourniquet tolerance during intravenous regional anaesthesia. These beneficial effects must be weighed against a fourfold increase in signs of systemic local anaesthetic toxicity.

MATERIALS AND METHODS

This is a prospective randomized double blind control study conducted at Government Rajaji Hospital attached to Madurai Medical College.

After obtaining approval from the ethical committee 60 patients of ASA grade I & II age between 20-60 years who came for upper limb surgeries lasting for less than 90 minutes were included in this study.

Patients with history of allergy to local anaesthetics, sickle cell disease, raynaud's disease, scleroderma, local infection, Pagets disease and patients with inadequate starvation less than 6 hours and patients who had contraindication to Dexmedetomidine were excluded from this study. Preanaesthetic evaluation was done.

All patients were premedicated with Inj. Midazolam 0.15mg/kg intramuscularly 45 minutes before surgery. Resuscitation equipment and drugs were kept ready. The initial pulse rate, blood pressure and arterial oxygen saturation were recorded and then continous monitoring was done during the procedure.

A 22 G cannula was placed intravenously as distal as possible in the arm to be anaesthetized. Venous access was established in the opposite arm to allow administration of fluids or drugs if necessary. The double

tourniquet was applied on the arm with generous layers of padding, ensuring that no wrinkles are formed and the tourniquet edges do not touch the skin. The arm was exsanguinated by using Esmarch bandage. If this was impossible, exsanguination was achieved by elevating the arm for 2-3 minutes while compressing the axillary artery.

The proximal tourniquet was inflated to at least 100 mm Hg higher than the patients systolic blood pressure. Before injecting local anaesthetic, radial pulse was palpated and confirmed that there was no pulse. The local anaesthetic is then injected slowly over 90 seconds. A standard volume of 40 ml of 0.5% lignocaine or 40 ml of 0.5% lignocaine with 0.5micrograms/kg dexmedetomidine was injected. Patients were divided into two groups according to the drug which they received .Group A patients received 40 ml of 0.5% lignocaine with 0.5micrograms/kg Dexmedetomidine and Group B patients received 40 ml of 0.5% lignocaine and after achieving surgical anaesthesia, the distal tourniquet which overlies part of the anaesthetized arm was inflated and the proximal one was deflated. After that the surgeons were allowed to proceed.

Intraoperatively, Pulse rate, Blood Pressure, Respiratory rate, SPO2, signs of drug toxicity were monitored regularly. If patient complained of tourniquet pain (VAS >3), they were supplemented with Inj. Fentanyl 1

microgram/kg IV and intercostobrachial nerve block with local infiltration around the cuff. The cuff was not deflated until 30 minutes after local anaesthetic injection even if surgery was completed before 30 minutes and not inflated more than 90 minutes. Cuff deflation was performed in cycles with deflation / inflation times of less than 10 seconds until the patient no longer exhibits signs of systemic toxicity. Patients were observed for 30 minutes after surgery.

Intraoperatively the following parameters were noted :

1 Onset of action with sensory and motor blockade

2. Pulse rate, Blood Pressure, Respiratory rate, SPO2 were monitored regularly at 5,10,15,20,30,40,50,60,75,90 and 120minutes

3. Duration of surgery

4. Sedation score

5. Need of Rescue analgesia

6. Side effects

7. Duration of blockade after cuff deflation both sensory & motor

Post operatively the time to first analgesic requirement was noted

RAMSAY SEDATION SCORE

1- Patient anxious and agitated or restless

2- Patient co-operative, oriented, and tranquil

3- Patient responds to commands only

4- Patient exhibits brisk response to light glabellar tap or loud auditory stimulus

5- Patient exhibits a sluggish response to light glabellar tap or loud auditory stimulus

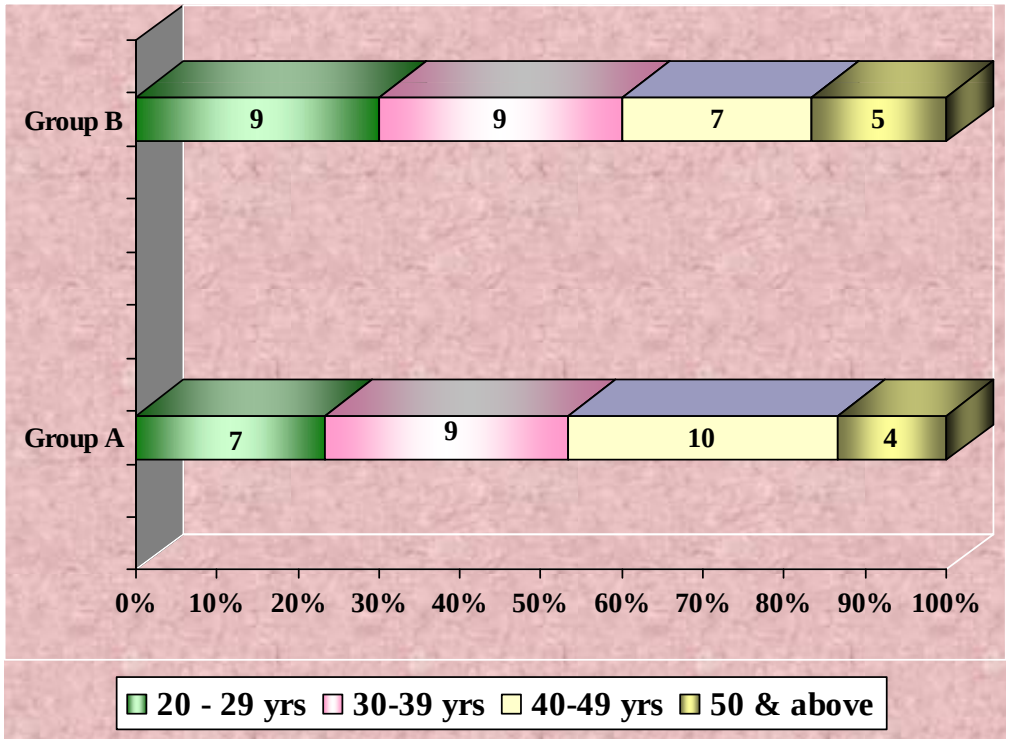
6- Patient exhibits no response

DATA ANALYSIS

In this study totally 60 patients were included. Patients were divided into two groups according to the drug which they received . Group A patients received 40 ml of lignocaine with 0.5microgram/kg Dexmedetomidine and Group B patients received 40 ml of 0.5% lignocaine. Data analysis was done with the help of computer using **Epidemiological Information Package (EPI 2010)** developed by Centre for Disease Control, Atlanta.

Using this software range, frequencies, percentages, means, standard deviations, chi square and 'p' values were calculated. Kruskul Wallis chi-square test was used to test the significance of difference between quantitative variables and Yate's chi square test for qualitative variables. A 'p' value less than 0.05 is taken to denote significant relationship.

Age distribution



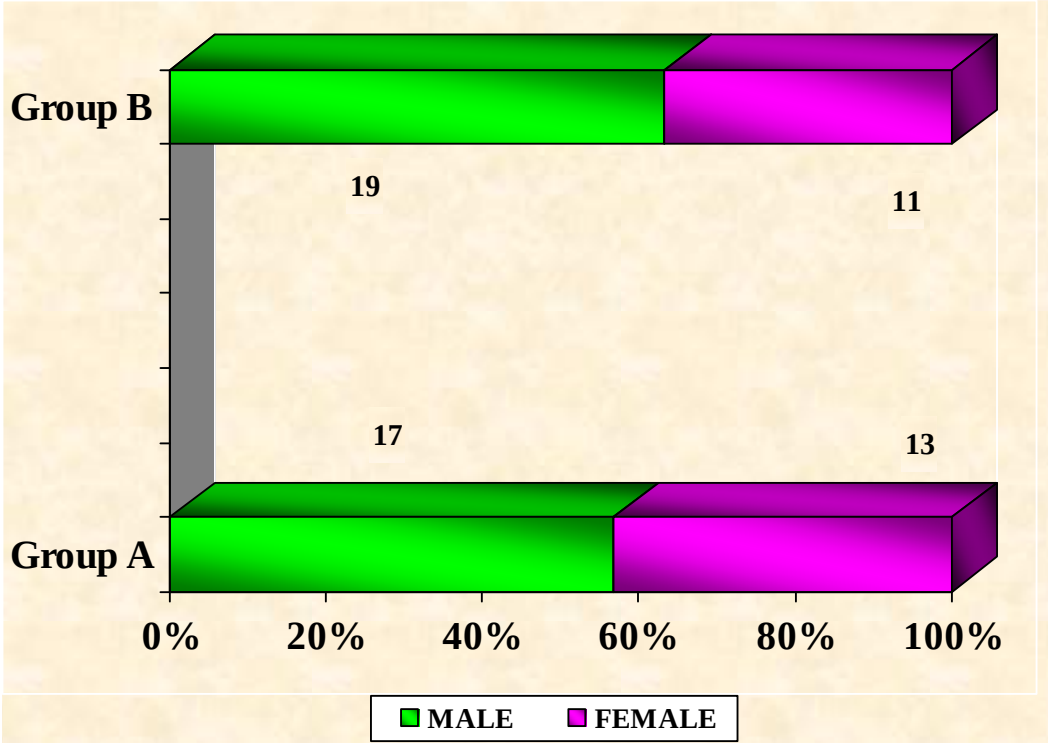
OBSERVATION AND RESULTS

Age distribution

Age group	Group A		Group B	
	No	**%**	**No**	**%**
20 – 29 years	7	23.3	9	30
30 – 39 years	9	30	9	30
40 – 49 years	10	33.3	7	23.3
50 & Above	4	13.3	5	16.7
Total	30	100	30	100
Range	23 – 53 years		20-56 years	
Mean	37.8 years		36.8 years	
SD	8.7 years		10.8 years	
'p'	**0.6148** **Not significant**			

Mean age of group A was 37.8 years and that of group B was 36.8 years. There was no significant difference (p = 0.6148).

Sex distribution

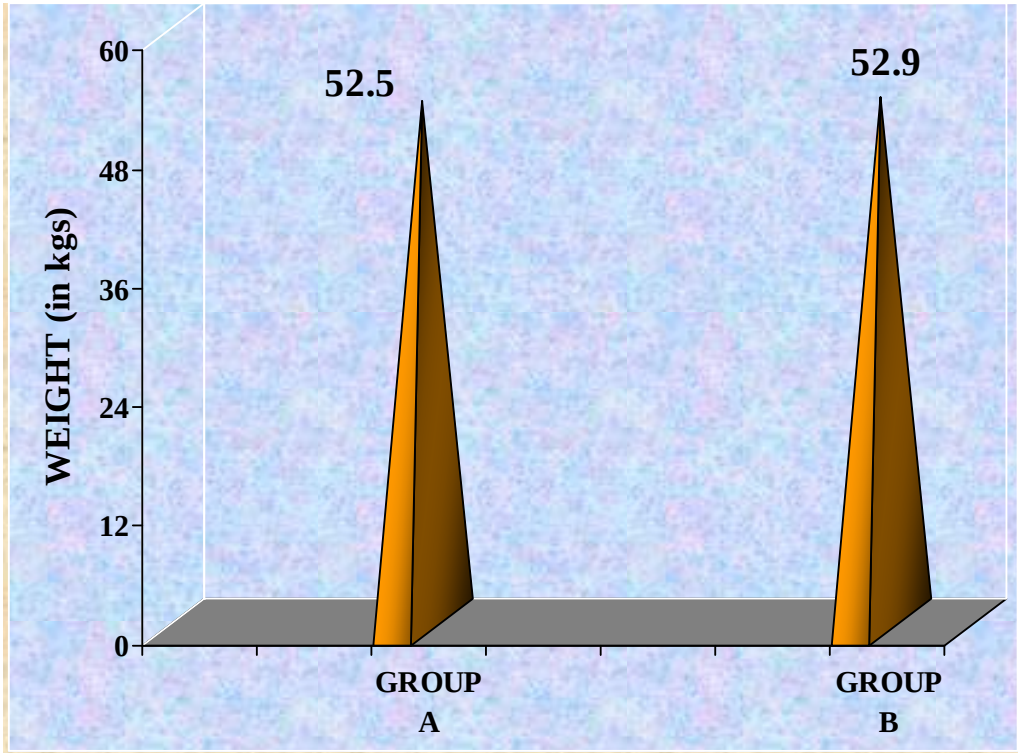


Sex distribution

Age group	Group A		Group B	
	No	**%**	**No**	**%**
Male	17	56.7	19	63.3
Female	13	43.3	11	36.7
Total	30	100	30	100
'p'	**0.7921 Not significant**			

56.7 % of Group A and 63.3% of Group B were males. The sex distribution did not have any statistically significant difference ($p > 0.05$).

Weight

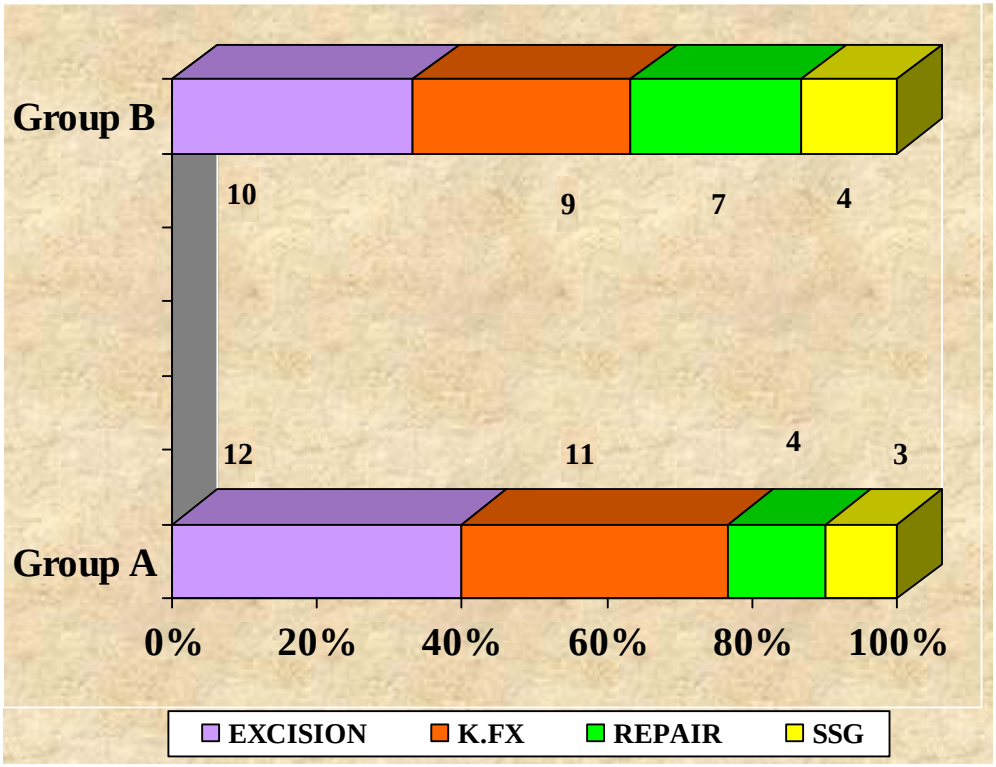


Weight

Parameter	Weight (in kgs)	
	Group A	**Group B**
Range	43 – 60	45 – 62
Mean	52.5	52.9
SD	5.0	5.5
'p'	**0.8471** **Not significant**	

Mean weights of the two groups of patients (52.5 kgs and 52.9 kgs) were not significantly different (p = 0.8471).

TYPE OF SURGERY

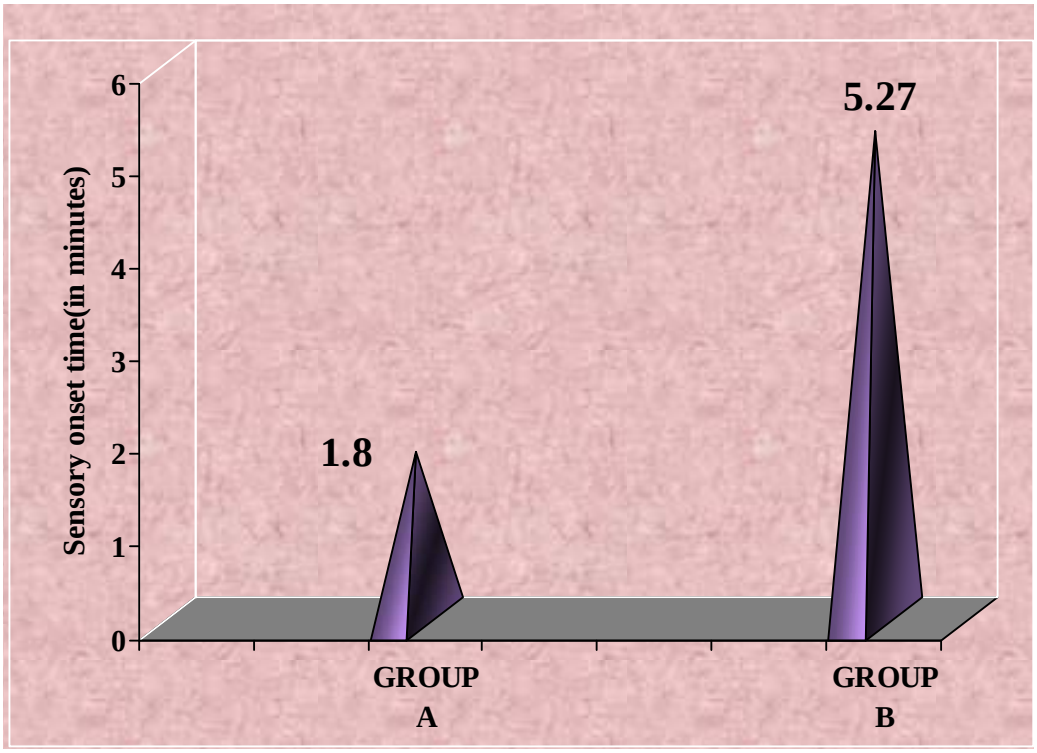


TYPE OF SURGERY

Surgery done	Group A		Group B	
	No	%	No	%
Ganglion excision	12	40	10	33.3
K .Fix for # phalanx	11	36.7	9	30
Tendon Repair	4	13.3	7	23.3
SSG	3	10	4	13.3
Total	30	100	30	100

Ganglion excision and k wire fixation for # phalanx were the most common surgeries performed in both the groups

SENSORY ONSET TIME

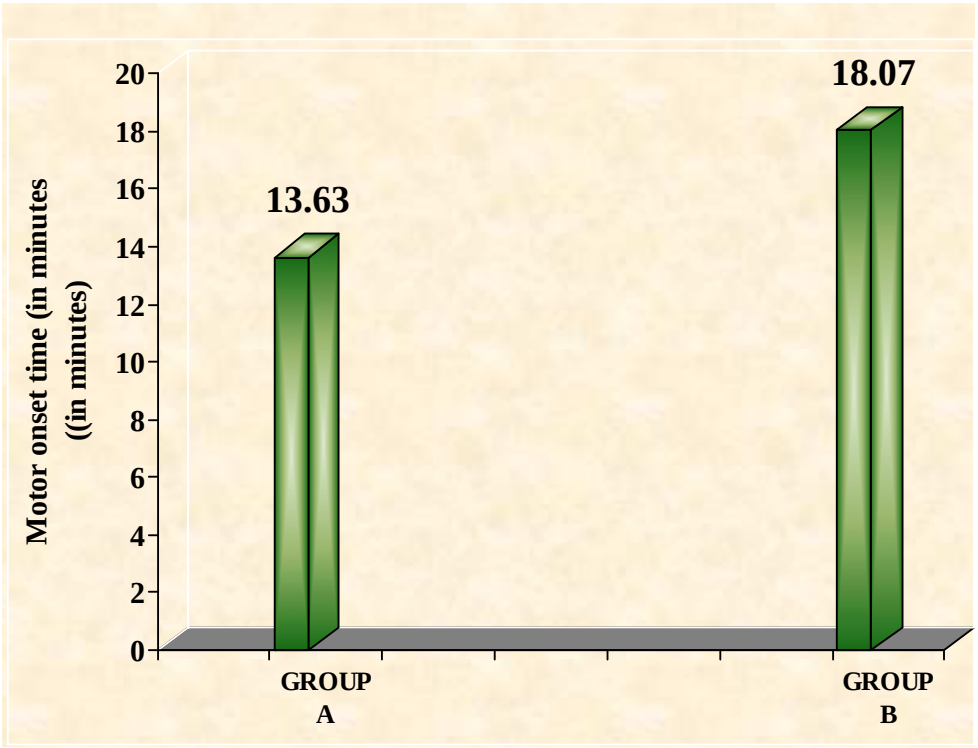


Sensory onset time

Parameters	**Sensory onset time (in minutes)**	
	Group A	**Group B**
Range	1-3	4-6
Mean	1.8	5.27
SD	0.76	0.58
'p'	**0.0001 Significant**	

The sensory onset time of Group A was 1.8 $\pm$ 0.76 minutes, This is significantly lower than the sensory onset time of Group B (5.27 $\pm$ 0.58 minutes) with a 'p' value of 0.0001

MOTOR ONSET TIME

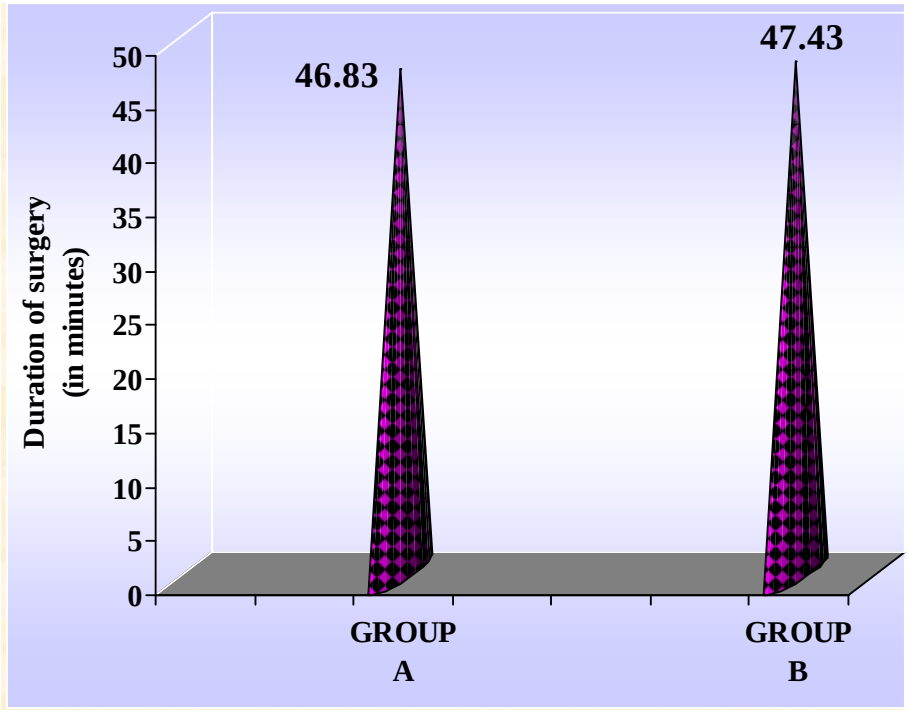


Motor onset time

Parameters	Motor onset time (in minutes)	
	Group A	**Group B**
Range	10-15	16-20
Mean	13.63	18.07
SD	1.54	1.26
'p'	**0.0001 Significant**	

The motor onset time of Group A (13.63 $\pm$1.54 minutes) was statistically significant (p = 0.0001) from that of Group B (18.07 $\pm$1.26 minutes).

DURATION OF SURGERY

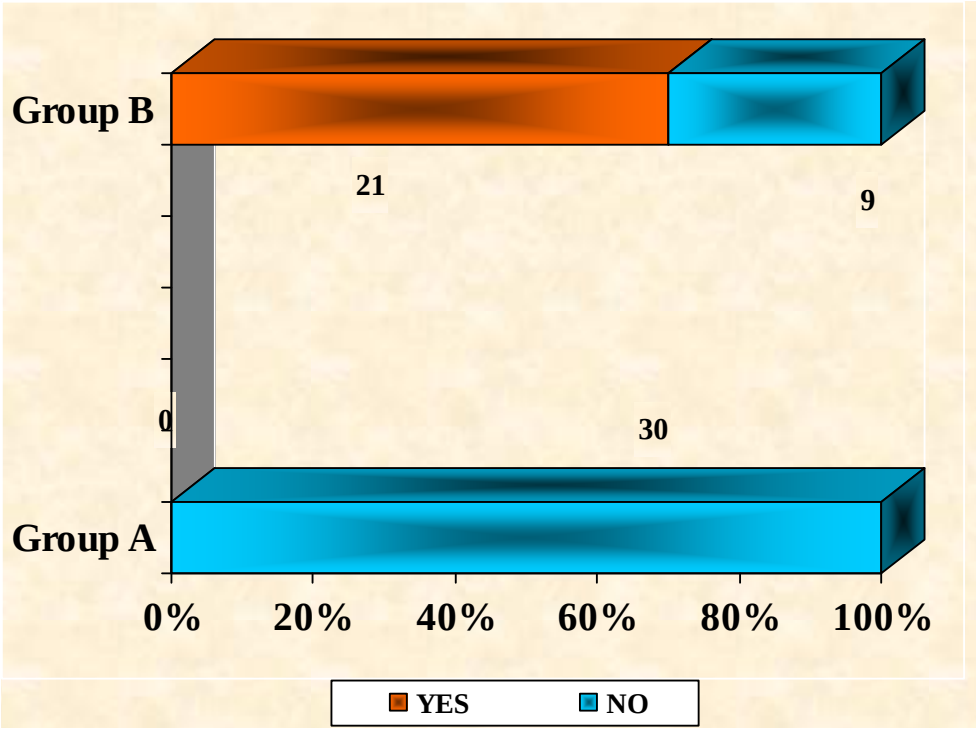


DURATION OF SURGERY

Parameters	Duration of surgery (in minutes)	
	Group A	**Group B**
Range	39-56	40-55
Mean	46.83	47.43
SD	5.07	4.79
'p'	**0.6354 Not significant**	

Duration of surgery was similar in both the groups with no statistically significant difference.

RESCUE ANALGESIA

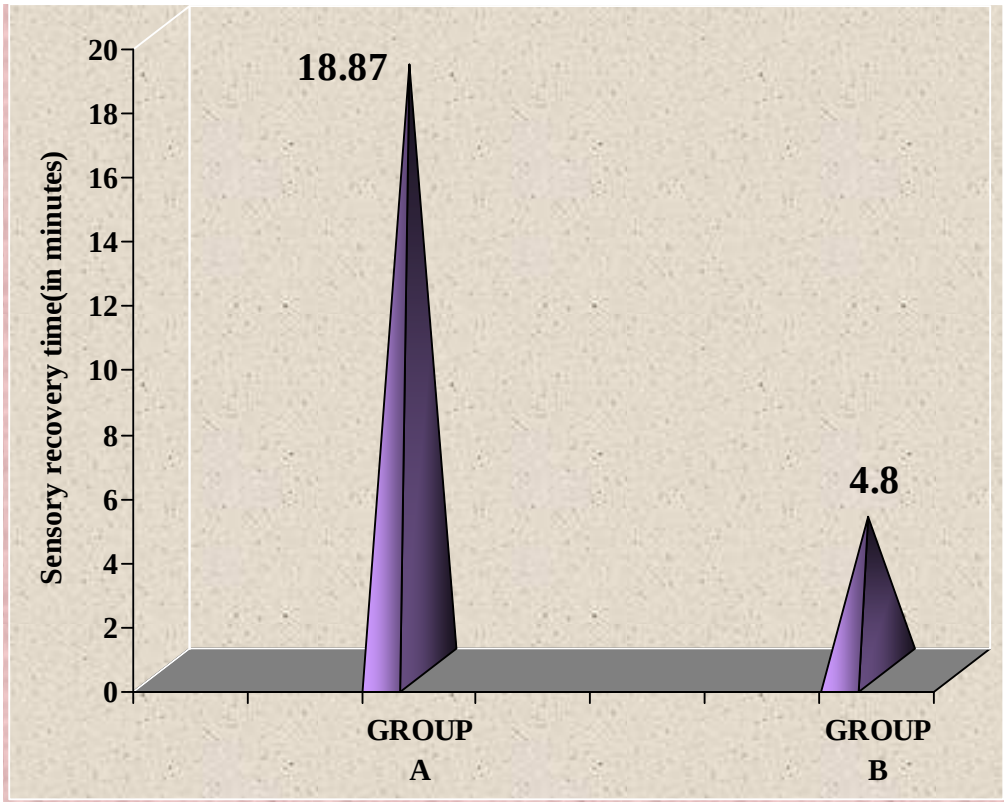


RESCUE ANALGESIA

Rescue Analgesia	Group A		Group B	
	no	**%**	**no**	**%**
Yes	-	-	21	70
No	30	100	9	30
'p'	**0.0001 Significant**			

21 cases in Group B required rescue analgesia whereas not even a single patient in Group A required it. This was statistically significant ($p = 0.0001$).

SENSORY RECOVERY TIME

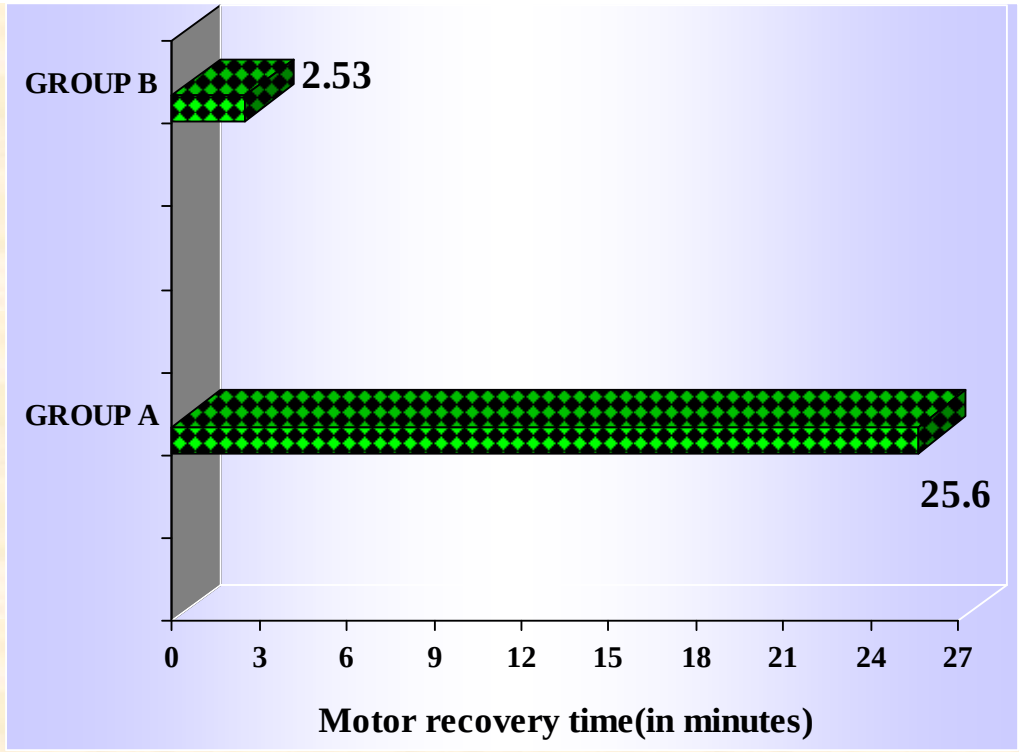


SENSORY RECOVERY TIME

Parameters	**Sensory Recovery Time (in minutes)**	
	Group A	**Group B**
Range	10-22	3-6
Mean	18.87	4.8
SD	3.27	0.71
'p'	**0.0001 Significant**	

Sensory recovery time after the release of tourniquet was 18.87 $\pm$ 3.27 minutes in Group A and it was significantly lower at 4.8 $\pm$ 0.71 minutes in Group B.

MOTOR RECOVERY TIME

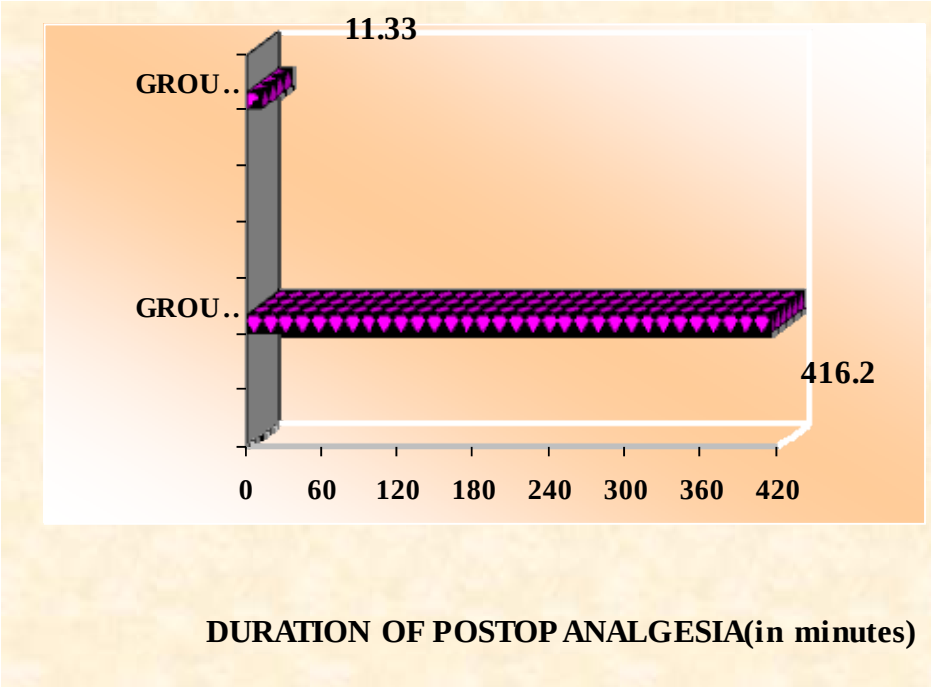


MOTOR RECOVERY TIME

Parameters	**Motor Recovery time (in minutes)**	
	Group A	**Group B**
Range	15 – 35	2-3
Mean	25.6	2.53
SD	3.83	0.51
'p'	**0.0001 Significant**	

Motor recovery time was significantly longer (25.6 $\pm$ 3.83 minutes) for Group A than for Group B (2.53 $\pm$ 0.51 minutes) which is statistically significant with a 'p' value of 0.0001

DURATION OF POSTOPERATIVE ANALGESIA



DURATION OF POSTOPERATIVE ANALGESIA (VAS > 3)

Parameters	**Time when VAS > 3 (in minutes)**	
	Group A	**Group B**
Range	280 – 490	10-13
Mean	416.2	11.33
SD	45.73	0.96
'p'	**0.0001 Significant**	

VAS reached a score of 3 at 416.2 $\pm$ 45.73 minutes in Group A and at 11.33 $\pm$ 0.96 minutes in Group B. This difference was statistically significant with a 'p' value of 0.0001.

MEAN ARTERIAL PRESSURE

MAP at	MAP Value (Mean±SD) for		'p'	Significance
	Group A	Group B		
1 minute	94.9 ± 4.9	95.0 ±5.7	0.8581	Not Significant
5 minutes	95.5 ±3.3	94.8 ±3.6	0.623	Not Significant

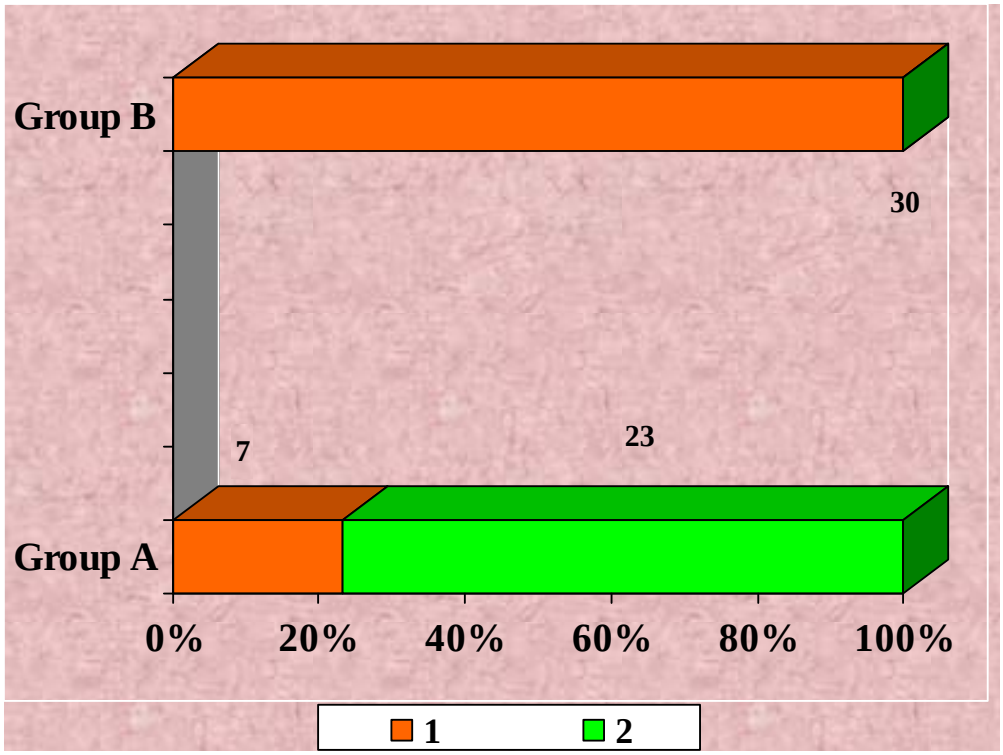
Mean arterial pressures for both the groups were similar at 1 minute and at 5 minutes ($p > 0.05$) which is not statistically significant.

PULSE RATE

Pulse rate at	Pulse rate (Mean ± SD) for		'p'	Significance
	Group A	Group B		
1 minute	82.7± 5.8	81.6 ±6	0.3926	Not Significant
5 minutes	82.0 ±4.7	82.1 ±4.9	0.9465	Not Significant

Both at 1 minute and at 5 minutes, there was no statistically significant differences in the pulse rates between the two groups.

SEDATION SCORE



SEDATION SCORE

Sedation score	Group A		Group B	
	No	**%**	**No**	**%**
1	7	23.3	30	100
2	23	76.7	-	-
Total	30	100	30	100
Range	1-2		1	
Mean	1.77		1	
SD	0.43		-	
'p'	**0.0001 Significant**			

In group A, 7 cases had a sedation score of 1 and 23 had a score of 2. In group B, 30 cases had sedation score of 1.

DISCUSSION

Intravenous regional anaesthesia uses local anaesthetics administered to one particular limb by occluding the arm proximally to provide conduction blockade. It must be safe, not threatening or unpleasant to the patient, allow adequate surgical access to the operative site, and cause as little disturbance as possible to the internal homeostatic mechanisms.

Intravenous regional anaesthesia has many advantages. It is simple, reliable with rapid onset and 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. In this study, we attempted to eliminate these disadvantages by adding Dexmedetomidine as an adjuvant.

Comparison of results:

In this study both Group A(lignocaine with Dexmedetomidine) and Group B (lignocaine only) patients were comparable in respect of age, sex, weight and duration of surgery.

In my study, the onset of sensory and motor blockade was rapid in Group A compared to Group B. Duration of blockade after cuff

deflation, both sensory and motor has similar recovery profile. This results correlate with studies conducted by Esmaoglu, A et al.

Incidence of tourniquet pain which was assessed by supplementation during surgery was significantly less in Group A (0%) than Group B (70%) which was statistically significant and the p value is 0.0001. Similar study conducted by Memis et al shows incidence of tourniquet pain was less with when Dexmedetomidine as an additive.

The duration of post operative analgesia which was assessed by time to first analgesic requirement, in Group A is 416.2 ± 45.73 minutes and in Group B is 19.4+/- 11 minutes. The p value is 0.0001, which is highly significant. The sedation score in Group A was 1.77±0.43 and in Group B was 1.00. The p value is 0.0001

The mechanism of tourniquet pain remains unclear despite the role of A fibers and unmyelinated C fibere.Dexmedetomidine depress nerve action potentials, especially in C fibres, by a mechanism independent of the stimulation of α-2-adrenergic receptors . This mechanism accounts for strengthening of the local anesthetic block achieved by perineural administration of the drug and could be implicated in the effect seen in this study. Finally, α-2-adrenergic receptors located at nerve endings may have a role in the analgesic

effect of the drug by preventing norepinephrine release. In this study,it is found that dexmedetomidine, in addition to its local anesthetic effect, delayed the onset of tourniquet pain and reduced intra- and postoperative analgesic requirement.

Considering all the above said factors Dexmedetomidine in the dose of 0.5micrograms/kg can be used as a adjuvant for intravenous regional anaesthesia with improved duration of postoperative analgesia
and decreased incidence of tourniquet pain.

SUMMARY

This study was carried out at Govt. Rajaji hospital, Madurai, in 60 patients of age 20-60 years, with ASA physical status I, who underwent forearm and hand surgeries. They were divided into two groups of 30 each.

Group A : Intravenous regional anesthesia with 40ml of 0.5% lignocaine with dexmedetomidine 0.5micrograms/kg added as an adjuvant

Group B : Intravenous regional anesthesia with 40ml of 0.5% lignocaine

This study showed that

1. Dexmedetomidine when added with lignocaine in Intravenous regional anesthesia provided longer duration of postoperative analgesia than with lignocaine alone.
2. Sensory and motor onset time were decreased in Group A than Group B
3. Patient comfortability in terms of sedation is better in Group A than Group B
4. Less incidence of tourniquet pain in Group A than Group B
5. Cardiovascular stability was similar in both the groups
6. No side effects were noted in both the groups.

CONCLUSION

From the data and the statistical analysis it is concluded that when Dexmedetomidine 0.5micrograms/kg is added to lignocaine for Intravenous regional anesthesia, it provided quicker onset of sensory and motor blockade, lesser incidence of tourniquet pain , increased duration of post operative analgesia and better haemodynamic stability without any side effects .

BIBLIOGRAPHY

1. Brown BL, Fink BR. The history of neural blockade and pain management. Holmes CMCK. Intravenous regional neural blockade. In: Cousins MJ, Briden baugh PO (Eds) Neural Blockade in clinical anesthesia and Management of pain, 3rd ed. Philadedphra : Lippincott-Raven, 1998 : 3-34 & 395 – 410.
2. Good man and Gillman's text book of pharmacology
3. Text book of pharmacology – K.D. Tripathy 6th edition
4. Esmaoglu, A,Mizrak, A, Akin, A, Turk, Y, Boyaci, A. Addition of dexmedetomidine to lidocaine for intravenous regional anaesthesia European Journal of Anaesthesiology 2005 - 22 ; 6 ; 447-451
5. Memis D, Turan A, Karamanlioglu B, Pamukcu Z, Kurt I. Adding dexmedetomidine to lidocaine for intravenous regional anesthesia. Anesth Analg 2004; 98: 835-840.
6. Usha Ramadhyani, MD,Jason L. Park, MD,Dominic S. Carollo, MS, MD,Ruth S. Waterman, MD, Clinics 2010 28; 4 ; 709-722Bobby D. Nossaman, MD .Dexmedetomidine: Clinical Application as an Adjunct for Intravenous Regional Anesthesia. Anesthesiology.
7. Reuben SS, Steinberg RB, Kreitzer JM, Duprat KM. Intravenous regional anaesthesia using lignocaine and ketorolac.

8. Gentili M, Bernard J-M, Bonnet F. Adding clonidine to Lignocaine for intravenous regional anaesthesia prevents tourniquet pain. Anaesthesia Analgesia 1999, 88 : 1327 – 30.
9. Lundell J, Silverman DG, Brull SJ et al : Effect of local injection of ketorolac on post-burn by peralgesia. Anaesthesiology 1994, 81: A960.
10. Reuben SS, Duprat KM: Comparison of wound infiltration with ketorolac versus intravenous regional anaesthesia with ketorolac foro postoperative analgesia following ambulatory hand surgery. Regional Anaesthesia 1996, 21 : 565-568.
11. Andrew choice, Philip peng. A systemic review of adjuncts for intravenous regional anaesthesia for surgical procedures.
12. Elhakim M, Sadek RA : Addition of atracurium to Lignocaine for intravenous regional anaesthesia. Acta Anaesthesia Scandinavica 1994; 38 : 54-4.
13. Armstrong P, Brockway M, Wildsmith JA. Alkalinisation of prilocaine for intravenous regional anaesthesia. Anaesthesia 1990 ; 45: 11-3.
14. G. Edward Morgan, Jr. Maged S. Mikhail, Michael J. Murray ; Clinical Anesthesiology. 4th edition

15. Ronald D. Miller, Miller's Anesthesia 7th edition.

16. Keith G. Hillman, Iain H.W. Oxford Hand book of Anaesthesia.

17. Hoffman V, Vercauteren M, Vansteenberge.A, AdviaensenH. Intravenous regional anesthesia. Evaluation of a different additives to prilocaine. Acta Anaesthesia Belg. 1997 ; 48 ; 71-6.

18. A Calovschi I, Cristea T, Margarit S, Gavrus R. Tramadol added to Lignocaine for intravenous regional anesthesia. Anesthesia Analgesia 2001 ; 92, 209-14.

19. James R. Hebl, Local Anesthetic Adjuvants for Neuraxial and peripheral Blockade.

20. Eisenach JC, Dekock M, Klimscha W: alpha 2 – Adrenergic agonists for regional anaesthesia. Anesthesiology 1996, 85: 655-674.

21. A. Turan, B. Karamanlyog M, D. Memis, G. Kaya and Z. Paukcy ; Department of Anaesthesiology and Reanimation, Trakya University, Turkey.Intravenous Regional Anaesthesia Using Prilocaine and Neostigmine

22. Stephan C. Marsch, MD, D Phil, Mathias Sluga, MD, Wolfgang studer, MD, Jonas Barandun, MD, Domenic Scharplatz, MD and wolf gang Ummentioter MD, From the Departments of Anaesthesia and surgery, Switzerland. 0.5 % versus 1.0% 2 – chloroprocaine for

Intravenous Regional Anaesthesia : A prospective randomized, Double – Blind Trial.

PROFORMA

DEXMEDETOMIDINE AS AN ADJUVANT TO LIGNOCAINE IN INTRAVENOUS REGIONAL ANESTHESIA

Name : Age / Sex :

IP No. : Weight :

Diagnosis : ASA Risk :

Surgery :

Premedication :

Group A: Intravenous regional anesthesia with 40ml of 0.5% lignocaine with dexmedetomidine 0.5micrograms/kg added as an adjuvant

Group B : Intravenous regional anesthesia with 40ml of 0.5% lignocaine

1. Onset of action Sensory :

   Motor :

2. Side effects noted :

3. Duration of surgery :

Time	Pre	5	10	15	20	30	40	60	75	90	120
HR											
BP											
Sedation											

4. Supplementation :

5. Duration blockade after cuff deflation Sensory :

   Motor :

6. Post operative :

   Time to first analgesic requirement

Group A																			
SNO	NAME	AGE YRS	SEX	IP NO	WT KG	DIAGNOSIS	SURGERY	SENSORYONSET TIME MIN	MOTOR ONSET TIME MIN	DUR ATIONOF SURGERY	RESCUE ANALGESIA	SENSORY RECOVERY TIME MIN	MOTOR RECOVERY TIME MIN	TIME WHENVAS >3 MIN	MAP		PR		SEDATION
															1 min	5min	1min	5min	
1	Pandiyarajan	26	m	33208	52	Gang	Excisi	1	12	40	no	10	20	480	96	99	76	80	2
2	Sasikumar	33	m	32795	60	Gang	Excisi	1	10	43	no	20	30	300	92	97	86	83	2
3	Jeyanthi	23	f	36500	50	Gang	Excisi	1	11	44	no	22	28	390	95	100	88	79	2
4	Rameshwari	33	f	34201	53	#RF2	K Fix	3	12	45	no	12	20	280	90	96	84	87	2
5	Periyakarupan	43	m	37045	55	#RF5	K Fix	3	10	39	no	15	25	475	98	101	80	89	2
6	Suseela	32	f	35767	56	Gang	Excisi	1	12	41	no	10	15	490	102	94	90	84	2
7	Vanaraj	40	m	40047	57	#RF3	K Fix	2	14	50	no	22	35	470	88	92	87	85	1
8	Ranjitha	24	f	43015	47	Gang	Excisi	1	15	43	no	16	27	450	97	93	81	78	2
9	Muthu	43	m	33870	56	Gang	Excisi	2	14	40	no	18	24	415	96	99	76	73	2
10	Kumar	34	m	40869	60	Gang	Excisi	3	15	42	no	20	30	430	102	94	90	84	1
11	Eswari	33	f	38667	54	Gang	Excisi	2	13	45	no	18	28	410	88	91	71	78	2
12	Rajeshwari	29	f	32884	57	Gang	Excisi	3	15	41	no	20	24	416	88	92	87	85	2
13	Selvam	40	m	35771	50	R FA	SSG	1	15	49	no	22	30	430	97	93	81	78	1
14	Pandi	52	m	38992	54	FTI	Repair	2	12	50	no	20	25	450	102	94	90	84	2
15	Ramu	39	m	36778	48	#RF3	K Fix	2	13	52	no	18	22	415	99	93	74	80	2
16	Vasanthi	37	f	37988	43	#LF4	K Fix	1	15	51	no	19	25	400	90	96	84	87	2
17	Mari	42	m	35884	48	#RF2	K Fix	1	14	48	no	20	26	390	98	101	80	89	2
18	Rajammal	45	f	35771	56	#lF5	K Fix	2	15	47	no	22	30	390	88	92	87	85	1
19	Pandeeswari	52	f	38992	53	Gang	Excisi	1	14	43	no	21	25	450	97	93	81	78	2
20	Murugan	49	m	37988	57	L FA	SSG	3	15	45	no	20	22	420	96	99	76	73	2
21	Kuppan	39	m	35991	45	FTI	Repair	2	15	55	no	20	27	380	102	94	90	84	2
22	Rakku	42	f	34779	55	FTI	Repair	3	14	53	no	22	25	400	88	91	71	78	2
23	Raju	45	m	36683	49	#RF3	K Fix	2	15	52	no	19	29	410	88	92	87	85	1
24	Muthu	50	m	32772	43	#LF2	K Fix	2	13	55	no	20	24	460	97	93	81	78	2
25	Meenakshi	27	f	33763	50	Gang	Excisi	1	15	42	no	22	23	425	96	99	76	73	1
26	Kumar	29	m	33225	56	Gang	Excisi	2	14	45	no	19	26	385	102	94	90	84	2
27	Ramaye	40	f	35569	45	R FA	SSG	2	15	56	no	21	28	390	90	96	84	87	2
28	Marimuthu	35	m	35583	57	#RF5	K Fix	1	14	49	no	19	27	410	98	101	80	89	2
29	Pandi	53	m	32662	60	#LF3	K Fix	2	13	54	no	20	25	450	92	97	86	83	2
30	Devi	26	f	32289	50	FTI	Repair	1	15	46	no	19	23	425	95	100	88	79	1

Group B																			
1	Selvam	25	m	33802	52	Gang	Excisi	5	20	42	no	3	2	12	92	97	86	83	-
2	Lakshmi	20	f	32476	45	Gang	Excisi	6	18	44	S	4	2	11	90	96	84	87	-
3	Rajendran	35	m	36603	54	#RF3	K Fix	4	19	54	S	5	3	11	98	101	80	89	-
4	Dinesh	25	m	34108	60	FTI	Repair	5	20	47	s	4	2	10	102	94	90	84	-
5	Eswari	27	f	37065	47	Gang	Excisi	5	19	41	no	5	2	11	88	91	71	78	-
6	Devagi	30	F	40058	48	Gang	Excisi	6	17	42	no	4	3	12	103	97	80	84	-
7	kaliammal	32	f	38651	45	Gang	Excisi	5	19	42	no	5	2	11	100	95	75	79	-
8	Karthik	29	m	43209	57	Gang	Excisi	6	20	40	no	4	3	10	102	94	90	84	
9	Nagalaksmi	40	f	36470	52	L FA	SSG	5	18	47	s	4	2	12	88	92	87	85	-
10	Anandavalli	34	f	38992	47	FTI	Repair	6	16	52	s	5	3	10	97	93	81	78	-
11	Nagarajan	46	m	32287	55	FTI	Repair	5	20	53	s	5	2	13	96	99	76	73	-
12	Velliammal	56	f	40138	45	#RF2	K Fix	6	18	49	s	4	2	11	90	96	84	87	-
13	Irulandi	50	m	33879	56	#LF3	K Fix	5	17	46	s	5	3	12	91	94	79	82	-
14	Saravanan	35	m	40208	60	#RF2	K Fix	6	19	50	s	5	3	11	101	96	83	89	-
15	Kuppan	56	m	38665	48	R FA	SSG	5	18	49	s	6	3	10	88	92	87	85	-
16	Pandiselvi	40	f	34456	45	L FA	SSG	4	19	43	no	5	3	12	97	93	81	78	-
17	Vellusamy	52	m	42335	57	Gang	Excisi	5	18	42	no	5	3	11	96	99	76	73	-
18	Rajendran	49	m	39237	53	Gang	Excisi	6	17	45	s	5	3	10	102	94	90	84	-
19	Mani	35	m	40336	58	Gang	Excisi	6	18	41	no	5	2	11	88	91	71	78	-
20	Satheesh	32	m	32265	62	FTI	Repair	5	16	46	s	6	3	13	88	92	87	85	-
21	Selvi	23	f	38896	47	FTI	Repair	5	19	54	s	5	3	12	97	93	81	78	-
22	Vellian	48	m	39335	59	#RF2	K Fix	6	17	47	s	5	2	11	96	99	76	73	-
23	Raju	25	m	37552	52	L FA	SSG	5	16	55	s	6	3	13	90	96	84	87	-
24	Krishnan	45	m	43116	59	#RF3	K Fix	5	19	53	s	5	2	11	98	101	80	89	-
25	Sathyan	22	m	37795	60	#LF4	K Fix	5	17	48	s	6	3	10	89	84	86	83	-
26	Muthalgu	26	f	33315	49	#RF2	K Fix	5	18	54	s	5	3	12	104	99	70	76	-
27	Vijayan	42	m	47765	48	#LF5	K Fix	5	19	51	s	5	2	11	87	90	73	80	-
28	Ramu	38	m	39226	60	Gang	Excisi	5	16	42	no	4	2	13	102	94	90	84	-
29	Maniammal	35	f	44553	52	FTI	Repair	6	18	53	s	5	2	11	101	96	85	79	-
30	Subramani	53	m	39965	55	FTI	Repair	5	17	51	s	4	3	12	90	96	84	87	-