"STUDY TO EVALUATE USEFULNESS OF MAGNESIUM SULPHATE AND DEXMEDETOMIDINE AS ADJUVANT TO BUPIVACAINE FOR LOWER LIMB AND ABDOMINAL SURGERIES UNDER EPIDURAL ANAESTHESIA"

By

Dr. MANJULA DEVI S

DISSERTATION SUBMITTED TO SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH CENTER, KOLAR, KARNATAKA

In partial fulfillment of the requirements for the degree of

DOCTOR OF MEDICINE

IN

ANAESTHESIOLOGY

Under the Guidance of

Dr. RAVI .M D.A, DNB, MNAMS
Professor & HOD

DEPARTMENT OF ANAESTHESIOLOGY,
SRI DEVARAJ URS MEDICAL COLLEGE,
TAMAKA, KOLAR-563101

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SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION, TAMAKA, KOLAR, KARNATAKA

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Date :

Place :

Dr. RAVI M. D.A, DNB,MNAMS
Professor & HOD,
Department of Anesthesiology,
Sri Devaraj Urs Medical College,
Tamaka, Kolar.

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, TAMAKA, KOLAR, KARNATAKA.

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Date:

Place: Kolar

Dr DINESH K MD, MNAMS
Professor & HOD,
Department of Emergency Medicine.
Sri Devaraj Urs Medical College
Tamaka, Kolar

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH CENTER, TAMAKA, KOLAR, KARNATAKA

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Dr. RAVI M **D.A, DNB, MNAMS**
Professor & HOD
Department of Anaesthesiology,
Sri Devaraj Urs Medical College,
Tamaka, Kolar

Date:
Place: Kolar

Dr. P N SREERAMULU
Principal,
Sri Devaraj Urs Medical College
Tamaka, Kolar

Date:
Place: Kolar

SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH CENTER, TAMAKA, KOLAR, KARNATAKA

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Department of Anaesthesiology
Sri Devaraj Urs Medical College
K.L. Jalappa Hospital & Research Centre
TAMAKA, KOLAR-563 101.

Head of the Department

Professor And Head
Department of Anaesthesiology
Sri Devaraj Urs Medical College
K.L. Jalappa Hospital & Research Centre
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Date: **Dr MANJULA DEVI S**

Place: Kolar

ABSTRACT

STUDY TO EVALUATE USEFULNESS OF MAGNESIUM SULPHATE AND DEXMEDETOMIDINE AS ADJUVANT TO BUPIVACAINE FOR LOWER LIMB AND ABDOMINAL SURGERIES UNDER EPIDURAL ANAESTHESIA BACKGROUND AND OBJECTIVES:

BACKGROUND AND OBJECTIVE:

Central neuraxial blockade not only provides us good anaesthetic and surgical conditions but it has also advantages over general anaesthesia. To compare the onset time of motor blockade and sensory blockade and duration of motor and sensory blockade, duration of analgesia , hemodynamic stability, and adverse effects if any and number of rescue analgesia in the first 24hours after surgery.

MATERIALS AND METHODS:

After ethical committee clearance and patient consent, the study was been conducted on 90 patients aged 18 to 65 years belonging to ASA- I and II undergoing lower limb and also lower abdominal surgeries, which were randomly divided into 3 groups. GROUP A (control group) received epidural bupivacaine 0.5% (17 ml) + 1ml 0.9% normal saline. GROUP B received epidural Bupivacaine 0.5% (17 ml) + 1ml 0.5mcg per kg dexmedetomidine.

GROUP C received epidural Bupivacaine 0.5% (17 ml) + 1ml 50mg magnesium sulphate. Exclusion criteria include patients with bradyarrythmias, cerebrovascular diseases, neurodegenerative diseases, renal and hepatic diseases, uncontrolled hypertension, bronchial asthma, ischemic heart disease, drug and alcohol abuse and uncontrolled diabetes mellitus.

Qualitative data were represented as proportions and bar charts. Quantitative data were represented as mean, standard deviation. Test of significance was the ANOVA and chi-square test. P value <0.05 statistically significant.

RESULTS:

Group B has rapid onset of action and better hemodynamic stability, where as Group C has better postoperative analgesia with no complications.

KEY WORDS: Epidural anaesthesia, bupivacaine, dexmedetomidine, magnesium sulphate.

ABBREVATIONS

HR	Heart rate
Bpm	Beats per minute
PR	Pulse rate
SBP	Systolic blood pressure
DSP	Diastolic blood pressure
MAP	Mean arterial blood pressure
NIBP	Non invasive blood pressure
ECG	Electrocardiogram
SPO2	Peripheral capillary oxygen saturation
CVS	Cardiovascular system
PA	Per abdomen
RS	Respiratory system
CNS	Central nervous system
VAS	Visual analogue scale
IV	Intravenous
NS	Normal saline
RL	Ringer lactate
$MGSO_4$	Magnesium sulphate
ICU	Intensive care unit
NMDA	N-methyl-D aspartate

IT	Intrathecal
CBC	Complete blood count
HB	Haemoglobin
BT	Bleeding time
CT	Clotting time
WBC	White blood count
RFT	Renal function test
mcg	microgram
Hrs	Hours
mins	Minutes
FDA	Food and drug administration
ETCO2	End tidal carbon dioxide
mmhg	Millimetre of mercury
Kg	Kilogram
cm	Centimetre
SD	Standard deviation
ml	Millilitre
g	Gram
No of	Number of

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INTRODUCTION

Many lower limb and abdominal surgical procedures are commonly done under neuraxial block, either spinal or epidural anaesthesia. Central neuraxial blockade not only provides us good anaesthetic and surgical conditions but it has also advantages over general anaesthesia. Advantages include less airway related and pulmonary complications that include reduced chances of pulmonary aspiration and decreased stress response[1]

Epidural anaesthesia is widely used and a standard technique which is practiced in many surgical procedures. There are various advantages of epidural anaesthesia over spinal anaesthesia that includes slow onset of hypotension, level of blockade and duration of blockade can be extended and mostly used to provide post operative analgesia through catheter. The most dreaded complication of spinal anaesthesia that is postdural puncture headache can be avoided in epidural anaesthesia.

Most common local anaesthetic used in epidural is Bupivacaine. Various drugs have been added as adjuvant to bupivacaine to prolong duration of anaesthesia and analgesia and also it reduces dose dependent side effects. When adjuvants added in neuraxial anaesthesia it should provide stable hemodynamics, better perioperative sedation, and has the ability to provide peri and post operative analgesia. These adjuvants include opioids, midazolam and ketamine.[1] Opioids have many acute side effects like nausea, vomiting, pruritis, respiratory depression, urinary retention and somnolescence.

α-2agonists cause sedation, analgesia, anxiolysis, hypnosis and sympatholysis.[2] They are administered through various routes which include epidural anaesthesia. Dexmedetomidine a well known alpha 2 agonist, 8 times potent than clonidine when added as an adjuvant to bupivacaine administered via epidural route produces synergistic anti nociceptive effect and also prolongs the duration of blockade and analgesia.[3]

Magnesium which is a major cation and 4thmost abundant mineral in the body produces anti nociceptive effects, due to antagonism of calcium and NMDA receptors. This blocks calcium influx and thus reduces acetylcholine release in neuromuscular junctions. NMDA receptors after nociceptive stimuli are involved in pain processing by central sensitization, magnesium prevents this sensitization. Epidural magnesium prolongs duration of analgesia and is a rapid onset of surgical anaesthetic without increasing side effects.[14]

Majority of magnesium use has been in obstetric anaesthesia, but by understanding its pain physiology and action over NMDA receptors it's been widely used as secondary analgesics and adjuvants in neuraxial blockade.[5]

Hence we intend to study the efficacy of dexmedetomidine, an α-2agonist and magnesium sulphate as adjuvants to bupivacaine in epidural anaesthesia.

AIMS AND OBJECTIVES

To administer epidural bupivacaine with normal saline, epidural bupivacaine with dexmedetomidine, epidural bupivacaine with magnesium sulphate each in 30 patients undergoing lower limb and lower abdominal surgeries and document the time of onset and duration of motor and sensory blockade, duration of analgesia, hemodynamic stability and adverse events if any.

To compare the time for motor blockade, sensory blockade and duration of motor and sensory blockade, duration of analgesia, hemodynamic stability, adverse effects if any and number of rescue analgesia in the first 24hours after surgery.

ANATOMY OF EPIDURAL SPACE

Brainstem continues proximally as spinal cord and distally terminates in conus medullaris as filum terminale(fibrous extension) and conus medullaris (neural extension). Spinal cord ends at L1 in adults and L3 in children. Spinal cord is covered by the pia mater, the arachnoid mater, the dura mater. Cerebrospinal fluid (CSF) occupies the subarachnoid space.

Piamater is the highly vascularised structure which closely covers the brain and spinal cord. 500ml of CSF is being produced per day by choroid plexus. Arachnoid mater is a non-vascularised and delicate structure and acts as a barrier for drugs crossing into and out of CSF. Dura mater is the outermost layer which extends from foramen magnum and sacral hiatus and the surrounding dura is the epidural space.[6]

Boundaries of epidural space are

Anteriorly - Posterior Longitudinal ligaments.

Laterally - Pedicles of vertebrae and intervertebral foramina.

Posteriorly - Anterior surface of vertebral body and Ligamentum Flavum.

Above - Foramen Magnum, periosteal and spinal layers of dura fuse together.

Below - Sacrococcygeal Membrane.[6]

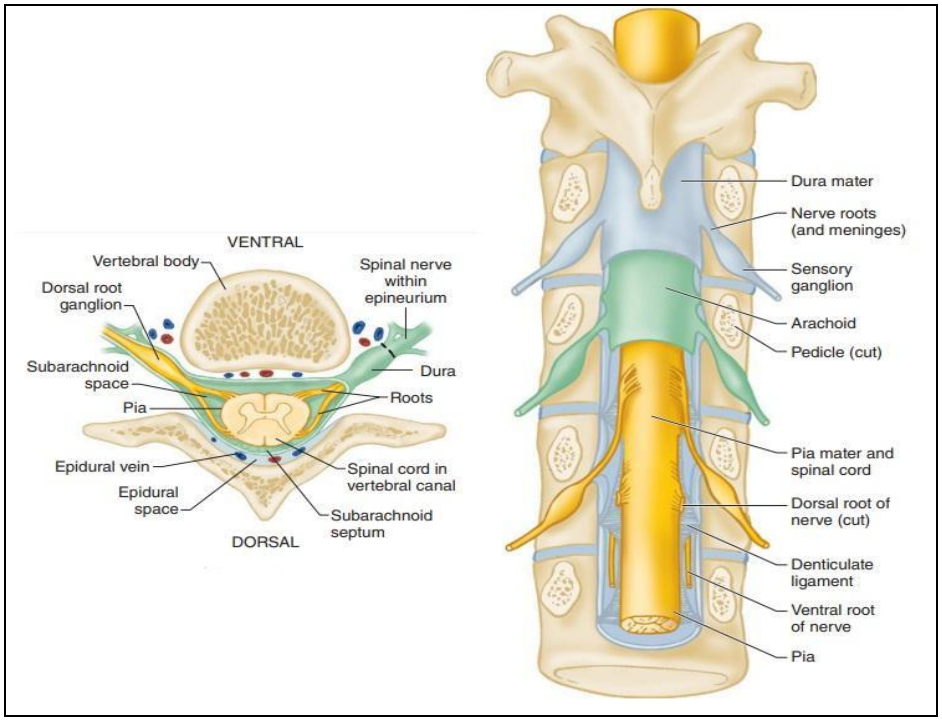


FIG 1: SHOWING BOUNDARIES AND CONTENTS OF EPIDURAL SPACE

Contents of epidural space are

- ✔ Nerve roots
- ✔ Fat
- ✔ Areolar tissue
- ✔ Lymphatics,

Blood vessels including the well-organized Batson's plexus of veins.

Ligamentum Flavum (yellow ligament) is present posterior to epidural space that extends from foramen magnum to sacral hiatus which is thin over cervical region and thickest over lumbar region. Blood supply to the spinal cord is from; ·One Anterior Spinal artery (originating from the vertebral artery), Two Posterior Spinal arteries (originating from the inferior cerebellar artery), and Segmental spinal arteries (originating from the intercostal and lumbar arteries).

Venous drainage

- Three Anterior Spinal veins
- Three Posterior Spinal veins

Finally communicating with the segmental anterior and posterior radicular veins and then into the internal vertebral plexus in the medial and lateral components of the epidural space. No veins are present in the posterior epidural space except for those present caudal to the L5-S1disk.[7]

MECHANISM OF ACTION OF EPIDURAL ANAESTHESIA:

Local anaesthetic binds to the nerve tissue which disrupts nerve transmission and results in neural blockade. Spinal nerve roots and the dorsal root ganglia are the main sites of action.

The rate of speed of neural blockade depends

- ✔Size.
- ✔Surface area.
- ✔Degree of Nerve fibre myelination.

Studies show that S1 and L5 posterior roots are larger and most resistant to blockade in epidural anaesthesia.

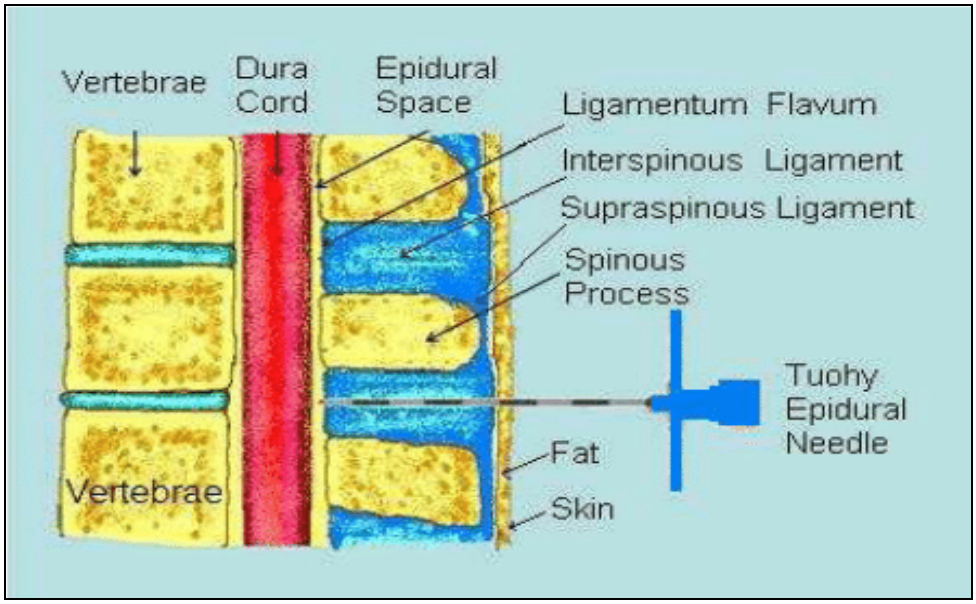


FIG 2: LAYERS FROM SKIN TO EPIDURAL SPACE

Order of blockade: [8]

Small **preganglionic sympathetic fibers (B fibres**, 1 to 3 µm, minimally myelinated) - most sensitive to local anaesthetic blockade.

Sensory C fibres (0.3 to 1 µ, unmyelinated), which conduct cold temperature sensation.

A-delta fibres (1 to 4 µ, myelinated), which conduct pinprick sensation.

A-beta fibres (5 to 12 µ, myelinated), A-gamma fibres (4-8 µ, myelinated)which conduct Joint afferents, pressure and touch sensation last sensory fibres to be blocked.

·Larger A-alpha motor fibres (12 to 20 µm, myelinated) are more resistant than any fibres.

Regression of blockade:

Motor function – Touch – Pinprick - Cold sensation.

INDICATIONS:

- For procedures that involve the lower extremities, perineum, or lower abdomen.
- For postoperative analgesia in acute and also chronic pain like malignancies
- In labour and delivery – labour analgesia/ walking epidurals.
- In patients with pre-existing respiratory disease undergoing abdominal surgery.

CONTRAINDICATIONS:

ABSOLUTE:

- Patient refusal
- Localized sepsis.
- A patient's inability to maintain stillness during needle puncture, which can expose the neural structures to traumatic injury.
- Raised intracranial pressure – Brain stem herniation.

RELATIVE:

Neurological:

- Myelopathy or Peripheral Neuropathy.
- Spinal Stenosis.
- Spine Surgery.
- Multiple Sclerosis – Increased sensitivity to LA – prolonged sensory and motor blockade.
- Spina Bifida.

Cardiac conditions:

- Aortic Stenosis or Fixed Cardiac Output.
- Hypovolemia

Haematological:

- Thromboprophylaxis.
- Inherited Coagulopathy - Hemophilia, Von Willebrand disease, or Idiopathic Thrombocytopenic Purpura.

Infection:

- Systemic infection and Meningitis.[9]

EPIDURAL TECHNIQUE:

Preparation:

Written informed consent to be taken from the patient, on day of surgery vitals to be checked and wide bore cannula secured and extent of surgical field is known for securing epidural catheter at the appropriate level. The procedure done at full sterile condition as a catheter is left in situ.

Epidural needles/ Catheters:

A wide variety of epidural needles are used for epidural anaesthesia. Tuohy needles are most common, needles are 16 to 18 g in size and have a 15- to 30-degree curved, blunt ***"Huber"*** tip - to both reduce the risk of accidental dural puncture and guide the catheter cephalad. The needle shaft is marked in 1-cm intervals so depth of insertion can be identified. The catheter is flexible, calibrated, durable, radiopaque plastic with either a single end hole or multiple side orifices near the tip.[10]

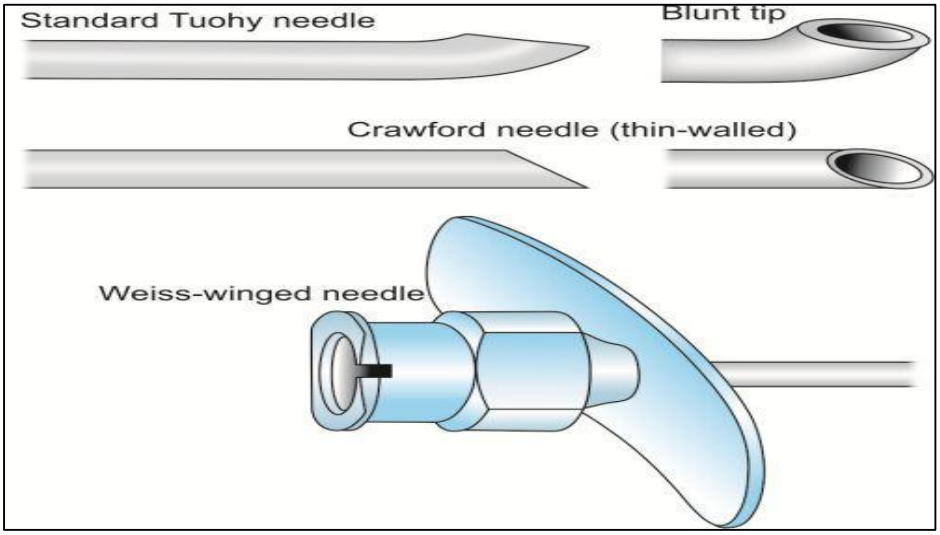


FIG 3: TYPES OF EPIDURAL NEEDLE

IDENTIFICATION OF EPIDURAL SPACE:

1. The Hanging Drop Sign of Gutierrez

2. Loss of Resistance Test of Sicard and Forestier and Of Dogliotti

Position:

Sitting and lateral decubitus position.

Important surface landmark:

- Intercristal line (corresponding to L4-L5 interspace),
- Inferior angle of the scapula (T7 vertebral body),
- Root of scapular spine (T3),
- Vertebra prominence (C7).

Approach:

·Midline.

·Paramedian.

·Modified Paramedian (Taylor approach).

·Caudal.[11]

Epidural test dose:

Before activating epidural anaesthesia or analgesia, always epidural test dose to be given to rule out intravascular or intrathecal placement.

3 ml of lignocaine 1.5% with epinephrine (1 in 2 lakhs dilution) of 5µg/ ml of Adrenaline in per ml of LA is given as test dose. An increase in systolic blood pressure more than 15 mm Hg or an increase in heart rate more than 10 beats/min ascertained intravascular placement of epidural catheter.[12]

COMPLICATIONS:

1. Neurologic:

- Paraplegia
- Cauda Equina Syndrome
- Epidural Haematoma
- Nerve Injury
- Post Dural Puncture Headache (PDPH)
- Transient Neurological Symptoms

2. Cardiovascular:

- Hypotension
- Bradycardia
- Cardiac arrest

3. Respiratory:

Respiratory depression – Neuraxial opioids – dose dependent.

Early – occurs in the first 30 min – with lipophilic drugs.

Late - > 2 hrs after drug administration – Fentanyl, Sufentanil.

4. Infections:

- Bacterial meningitis – Streptococcus viridans.
- Epidural abscess**.**

5. Backache.

6. Nausea and Vomiting.

7. Urinary Retention.

8. Pruritis.

9. Shivering.

Complications specific to epidural anaesthesia:

- Intravascular injection.
- Intrathecal injection[8]

PHARMACOLOGY OF BUPIVACAINE

PHARMACOLOGY

BUPIVACAINE :[13,14]

Bupivacaine which is an amide local anaesthetic first used by L J Telivuo in 1963.

Chemical structure :

Bupivacaine HCL (1-butyl-2', 6' pipecoloxylidide hydrochloride) is along actingamide local anaesthetic, first synthesized in 1957 by Ekernstam.

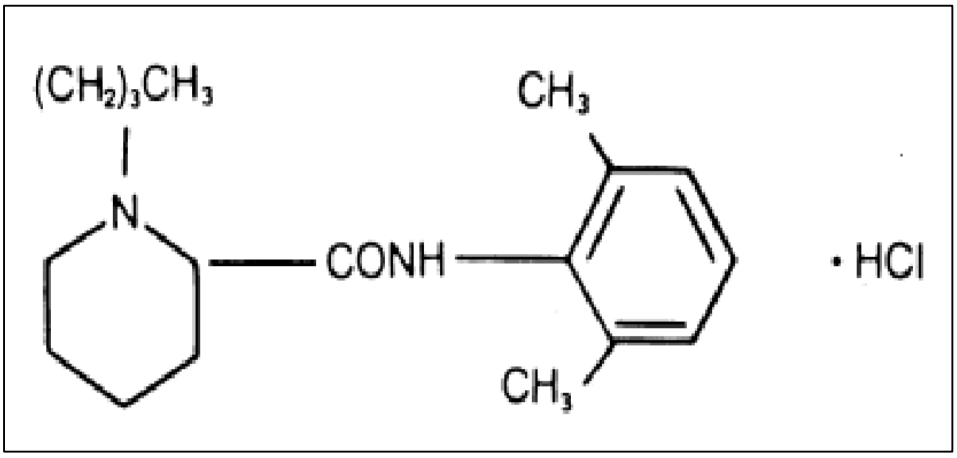


FIG 4: CHEMICAL STRUCTURE OF BUPIVACAINE

Mechanism of action:

Acts by binding to an intracellular portion of sodium channels that blocks sodium influx into nerve cells which prevents depolarization. It inhibits NMDA receptor transmission in the dorsal horn of the spinal cord.

Dose of Bupivacaine: 2-3mg/kg

Onset of action: 5 to 7 minutes

Duration of action: 4 to 6 hours

Pharmacokinetics:

- ✔Molecular weight (base) – 288 daltons.
- ✔Pka - 8.1.
- ✔Bound in plasma - 95%.
- ✔Volume of distribution - 0.9 - 0.4 litres/kg.
- ✔Clearance - 7.1-2.8 ml/min/kg.
- ✔Lipid solubility - 2.4-1.2 hours.
- ✔Peak time - 0.17-0.5 hour.
- ✔Peak concentration - 0.8microgram/ml.
- ✔Toxic plasma concentration - >1.5microgram /ml.
- ✔Plasma protein binding site - alpha1 acid glycoprotein.
- ✔Enzymatic degradation occurs in liver
- ✔Excretion through kidney

Clinical Uses:

✔Central neuraxial blockade (intrathecal, epidural, caudal)

✔For peripheral nerve blocks and infiltration analgesia.

Toxicity:

Toxicity can happen because of accidental intravascular injection or systemic absorption that may depend on the dose administered, presence of adrenaline (adrenaline in solution decreases the systemic absorption by one third), property of the drug and vascularity of the tissue.

Various toxic features are:

- Mild systemic symptoms are circumoral numbness, auditory changes like tinnitus, agitation.
- Central nervous system toxic effects like CNS depression, seizures, coma and respiratory arrest.
- Cardiovascular system toxic features are tachycardia, bradycardia, hypotension or hypertension, ventricular arrhythmias and cardiac arrest. Bupivacaine is more cardio toxic.

Treatment for toxic doses of Bupivacaine:

- Airway management.
- Seizure suppression – Thiopentone/ Benzodiazepines /neuromuscular blocking agents.
- Cardiac arrest – ACLS
- Use small initial doses of epinephrine (10–100 mg boluses), Vasopressin is not recommended. Avoid calcium channel blockers, beta adrenergic blockers, and Local anaesthetics (lidocaine, procaine).
- Ventricular arrhythmias – Amiodarone.

Lipid emulsion therapy - at first signs of LAST, 1.5 ml/ kg bolus of 20% lipid emulsion. Infusion at 0.25 ml/kg/min for at least 10 min after return of circulatory stability, second bolus increasing infusion to 0.50 ml/ kg if circulatory stability is not attained. Upper limit of lipid emulsion for the first 30min is 10 ml /kg.

Cardiopulmonary bypass if lipid emulsion treatment fails.

PHARMACOLOGY OF DEXMEDETOMIDINE

DEXMEDETOMIDINE :[15,16,17,18]

Dexmedetomidine is a highly selective and specific alpha 2 adrenergic agonist.

Chemical formula:

Dexmedetomidine chemical formula (+) 4-(S)-[-1-(2,3-dimethylphenyl]-1H-imidazole monohydrochloride.

Molecular formula: C13H16N2.2HCL

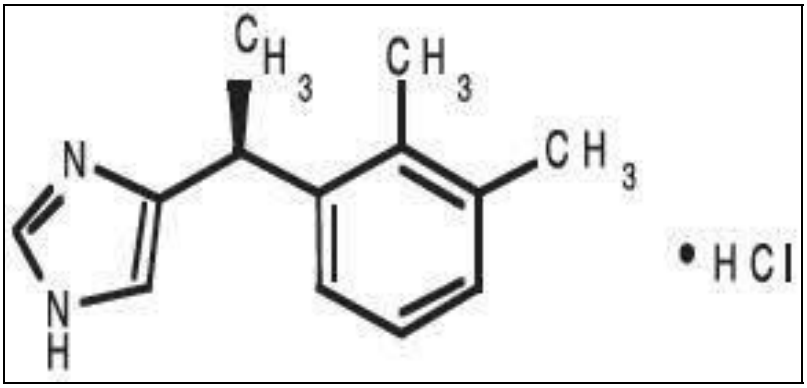


FIG 5: CHEMICAL STRUCTURE OF DEXMEDETOMIDINE

Mechanism of action:

Dexmedetomidine is a centrally acting alpha 2 adreno receptor agonist that activates G proteins in the brainstem which inhibits norepinephrine release thus has sedative and anaesthetic properties.

Pharmacokinetics:

- ✔ Molecular weight : 236.7
- ✔ pKa : 7.1
- ✔ pH : 4.5 to 7
- ✔ Solution is preservative free and has no additives.
- ✔ % protein binding : 94%
- ✔ Total body clearance : 39l/hr
- ✔ Peak plasma concentration : 0.3-1.5ng/ml
- ✔ Distribution half life : 6minutes
- ✔ Elimination half life : 2hours
- ✔ Volume of distribution : 118 litres
- ✔ Rapidly distributed in highly vascular organs such as lung, heart and brain then skeletal muscle and then fat compartment
- ✔ $t^{1/2}$ - 2 hours
- ✔ Metabolised in liver
- ✔ Renal excretion

Pharmacodynamics:

- **Cardiovascular system:**

It reduces heart rate, systemic vascular resistance and myocardial contractility, cardiac output and systemic blood pressure.

- **Central nervous system :**

It reduces cerebral blood flow, alpha a2 receptors are responsible for sedation, anxiolysis and sympatholysis. It also produces analgesic effect

- **Autonomic nervous system :**

It blocks the sympathetic stress response to surgical stimulation.

- **Respiratory system :**

It produces analgesia without respiratory depression.

Clinical uses:

- It is used as analgesic in regional and general anaesthesia
- It provides anxiolysis and sedation
- It is used in sedating intubated cases in an intensive care setting
- Also used for sedation of non-intubated cases during surgical procedure without respiratory depression.

Drug interaction:

Doesn't interact with other anaesthetic agents, it reduces the dose of other analgesic agents.

Adverse effects:

- ✔ Hypotension
- ✔ Hypertension
- ✔ Bradycardia
- ✔ Nausea
- ✔ Atrial fibrillation
- ✔ Dry mouth

Contra indication:

- ✔ Patients with heart block
- ✔ Patients with bradyarrhythmias
- ✔ Hypotension
- ✔ History of allergy to dexmedetomidine

Antagonist of dexmedetomidine:

Atipamezole, a highly selective α2 antagonist is effective, at a dose of50mcg/kg, given intramuscularly.

PHARMACOLOGY OF MAGNESIUM SULPHATE

MAGNESIUM SULPHATE :[19,320,21,22,23]

- Used as an anaesthetic induction agent
- Used in surgery for pheochromocytoma
- Used in cardiac rhythm disorders as it acts as an membrane stabilizing agent
- During ischaemia it provides cellular protection and it also improves myocardial contractility. Magnesium is the 4th common cation in the body and second most common intracellular cation.

Chemical formula:

Chemical formula of magnesium sulphate is $MgSO_4$

Molecular formula: $MgSO_4.7H_2O$

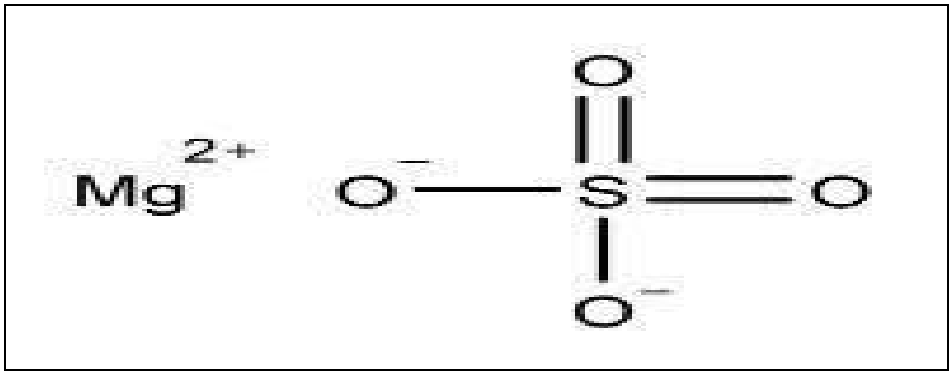


FIG 6: CHEMICAL STRUCTURE OF MAGNESIUM

SULPHATE

Mechanism of action:

It acts as calcium antagonist and inhibits vasoconstriction, it blocks NMDA receptors and decreases intracellular calcium and also inhibits Ryanodine receptors decreasing muscle contraction.

Pharmacokinetics:

- Molecular weight : 246.48
- pH : 6
- Solution has no bacteriostatic, antimicrobial agents and preservative free.
- Protein binding : 25-30%
- Total body clearance : 1.21 l/hr
- Half life :43.2hours
- Absorbed in Gastrointestinal tract
- Renal excretion
- Normal plasma magnesium level ranges from 1.2 to 2 mEq/L

Pharmacodynamics:

- **Cardiovascular system :**

  It inhibits calcium uptake and influences myocardial contractility

- **Respiratory system :**

  Magnesium acts as bronchodilator

- **Musculoskeletal :**

Magnesium decreases the effect of acetylcholine and increases the threshold of axonal excitation. Hypomagnesemia induces neuromuscular hyperexcitability, while hypermagnesemia causes neuromuscular weakness.

- **Central nervous system :**

Reduces excitability of nerves, acts as an anticonvulsant, inhibits NMDA receptor and thus acts as an analgesic

- **Genitourinary system :**

  Acts as a tocolytic and has mild diuretic property

- **Hematologic system :**

  Reduces platelet activity

Clinical uses:

- It has tocolytic property and also has hypotensive action in preeclampsia by maintaining uterine blood flow and fetal oxygenation
- It has bronchodilator action
- Used in perioperative analgesic adjuvant
- Used in chronic pain states as it blocks NMDA receptors

Drug interactions:

- Dose of barbiturates, opioids, general anaesthetics and other CNS depressants should be titrated as magnesium also has central depressant effects
- Excessive neuromuscular blockade happens if dose of neuromuscular agent is not reduced in patients receiving parenteral magnesium
- Magnesium given along with cardiac glycosides can result in heart block

Adverse effects:

- Magnesium intoxication that includes hypotension, depressed reflexes, flushing, sweating, flaccid paralysis, hypothermia, circulatory collapse, cardiac and CNS depression that leads to respiratory paralysis.
- Hypocalcemia

Contra indication:

✔ Patients with skeletal muscle disorder

✔ Hypocalcemia

✔ Decreased renal function

✔ Myasthenia gravis

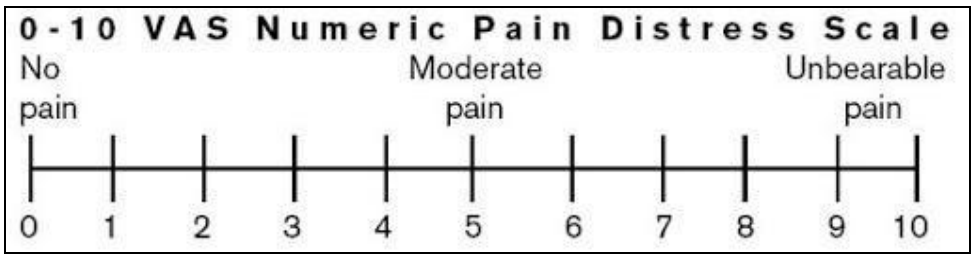
Plasma concentration of magnesium sulphate (mEq/L)	Effect
1.2 - 2	Normal
4 - 8	Therapeutic
5- 10	ECG changes (prolonged PR interval, widened QRS complex)
>10	Muscle weakness; deep tendon reflexes are lost
>15	SA/AV node block; respiratory paralysis
>20	Cardiac arrest

Antagonist:

Calcium gluconate (10ml of 10% solution over 10minutes) given intravenously.

ASSESSMENT OF PAIN

Pain is a highly subjective expression and affects many aspects of life. Hence measuring it is an important task for a physician. Many validated scales are available. It cannot be stressed more that the patient's self report should be accepted and acted upon. In rare cases, there may be an exaggeration by the patient, so the physician must exert vigilance. Because pain is dynamic, it should be reassessed regularly and adjustments to therapy made as appropriate. Unidimensional self report scales are a very simple, useful, valid method to assess pain. A visual analogue scale (VAS) consists of a 10 cm line, which has no pain in the beginning and worst pain in the end.[24]


0-10 VAS Numeric Pain Distress Scale
No pain
Moderate pain
Unbearable pain
0 1 2 3 4 5 6 7 8 9 10

REVIEW OF LITERATURE :

Aantaa R, Kanto J et al in 1990 designed a study by infusing dexmedetomidine before induction for minor gynaecological surgeries to evaluate the dose reduction of anaesthetic agent. It was found that dexmedetomidine reduced the induction dose and also post operative recovery was good by assessing visual analogue scale.[25]

Koinig H, Wallner T et al in 1998 carried a study in 46 patients undergoing arthroscopic knee surgery with total intravenous anaesthesia, in this study patient received intravenous magnesium sulphate preoperatively and intraoperatively to assess intraoperative and postoperative analgesic requirement comparing patient who received magnesium sulphate and patient who dint receive magnesium sulphate, it was found that patient who received magnesium reported reduced analgesic requirement.[26]

Kamibayashi T, Maze M in 2000 stated in their study that dexmedetomidine, more potent alpha 2 agonist can also be used as a single sedative agent or as adjunct that reduces the patient requirement for other additional agents for sedation and analgesics and also reduces the requirement of anaesthetics.[1]

Kroin JS, McCarthy RJ et al in 2000 found in their study on rats that magnesium potentiates analgesic action of opioid when added intrathecally along with opioids and they have concluded that magnesium can be an useful adjunct when used in neuraxial anaesthesia, they have also mentioned in their study that magnesium delays onset of tolerance.[27]

Li X, Eisenach J in 2001 stated in their study that alpha 2 adrenergic agonist given intrathecally or epidural produces antinociceptive effect and also alters spinal neurotransmission by reducing excitatory neurotransmitter releasing from peripheral afferents thus can be used in acute and chronic neuropathic pain.[28]

Buvanendran A, McCarthy RJ et al in 2002 conducted a prospective randomised study, where it was identified that magnesium added intrathecally along with fentanyl potentiates the analgesic action of opioids in patients during cesaearan section. The study included 52 patients where it got divided into two groups. One group received intrathecal bupivacaine with fentanyl alone and other group received intrathecal bupivacaine with fentanyl and magnesium sulphate, it was concluded that magnesium along with fentanyl given intrathecally prolongs the analgesic action of opiod.[29]

Ozalevli M, Cetin TO, Unlugenc H, Guler T, in 2005 conducted a study in 102 patients by adding magnesium intrathecally along with bupivacaine fentanyl to know its onset of motor and sensory block along with analgesic effect, conclusion was made that, in patients undergoing lower extremity surgery, magnesium sulphate was added intrathecally(50 mg) to spinal anaesthesia induced by Bupivacaine and Fentanyl significantly delayed the onset of both sensory and motor blockade, but also prolonged the period of anaesthesia without additional side-effects.[30]

Kanazi GE, Aouad MT, Jabbour-Khoury SI, Al Jazzar MD in 2006 prospective, double-blind study - 60 patients undergoing transurethral resection of prostate or bladder tumor, under spinal anesthesia were selected and comparison between clonidine and dexmedetomidine along with bupivacaine given intrathecally done. The onset times to reach peak sensory and motor levels, and the sensory and motor regression times, were recorded. Hemodynamic changes and the level of

sedation were also recorded. The study concludes that Dexmedetomidine, clonidine, when added to intrathecal bupivacaine, produces prolonged in the duration of the motor and sensory block with better hemodynamic stability.[31]

Arcioni R, Palmisani S, Tigano S et al in 2007 studied whether supplementation of spinal anaesthesia when combined intrathecally and also epidurally infused magnesium reduced patients post operative requirement of analgesia in 120 patients in orthopedic surgery, it was concluded that supplementation of spinal anaesthesia with combined intrathecal and also epidural magnesium sulphate significantly reduces patients post operative analgesic requirements.[32]

Bilir S. Gulec A. Erkan A. Ozcelik. in 2007 they conducted a study on fifty patients who underwent hip surgery to receive either fentanyl or fentanyl plus magnesium sulphate for 24 hours for epidural analgesia. Ventilatory frequency, heart rate, blood pressure, assessing pain using a visual analogue scale (VAS), sedation scores and fentanyl consumption were recorded in the postoperative period. They found there was no significant difference between groups in time and also the first analgesic requirement. The groups were similar with respect to haemodynamic and respiratory variables, sedation, pruritis, and nausea. It has been concluded that co-administration of magnesium for postoperative analgesia results in a reduction of fentanyl requirement.[33]

El-Hennawy AM, Abd-Elwahab AM et al in 2009 compared the analgesic effects and side effects of dexmedetomidine and clonidine added with caudal bupivacaine in paediatric patients undergoing lower abdominal surgeries of 60 patients. Hemodynamic variables, end tidal sevoflurane and emergence time were monitored. Post-operative analgesia, use of analgesics and side effects assessed during the postoperative in the first 24hours. Thus it was concluded that addition of

dexmedetomidine or clonidine to caudal bupivacaine significantly promoted analgesia in children undergoing lower abdominal surgeries with no significant advantage of dexmedetomidine over clonidine and without increase in incidence of side effects.[34]

Ghatak T, Chandra G, Malik A, Singh D, Bhatia VK in 2010. They did prospective randomised double-blind study to establish the effect of adding magnesium or clonidine, as adjuvant, to epidural bupivacaine in lower abdominal and lower limb surgeries. A total of 90 ASA grade I and II patients posted for lower abdominal and lower limb surgeries were enrolled to receive either magnesium sulphate or clonidine along with epidural bupivacaine for surgical anesthesia .The study concludes that magnesium sulphate is a predictable and safe adjunct to epidural bupivacaine for rapid onset of anaesthesia & clonidine for prolonged duration of anaesthesia with sedation.[35]

Sukhminder Jit Singh Bajwa, Sukhwinder Kaur Bajwa, Jasbir Kaur in 2011, Dexmedetomidine and clonidine added with epidural anaesthesia: A comparative evaluation. A randomized study was carried out which included 50 adult female patients between age of 44 and 65 years of ASAI/II grade who undergone vaginal hysterectomies. Onset of analgesia, sensory and motor block levels, sedation, duration of analgesia and also side effects were observed. Dexmedetomidine is a better neuraxial adjuvant compared to clonidine.[36]

Jain d, Khan RM et al in 2011 evaluate the perioperative effect of epidural dexmedetomidine, in conjunction with intrathecal bupivacaine in 60 patients posted for lower limb orthopedic surgeries and it was concluded that addition of dexmedetomidine epidurally prolongs the duration of analgesia and decreases the number of rescue analgesics in patients posted for lower limb orthopedic surgery.[37]

Sukhminder Jit Singh Bajwa, Vikramjit Arora, Jasbir Kaur in 2011 evaluated the efficacy of dexmedetomidine and fentanyl for analgesia in lower limb orthopedic surgeries. This study was done in 100 patients and authors concluded that dexmedetomidine is a better adjuvant than fentanyl as it provides comparable stable hemodynamics , early onset and establishment of sensory anesthesia, prolongs post op analgesia, lower consumption of LA for epidural analgesia and provides better sedation levels[38]

Abir Hassan Aly Knadil et al in 2012 evaluated the analgesic efficacy of magnesium sulphate when added to epidural bupivacaine in patients undergoing surgery in the lower limb. 60 patients posted for lower limb orthopedic surgery were studied. VAS was significantly less in the magnesium group intra operatively and post operatively with reduced rescue analgesics and reduction on PCEA fentanyl consumption. Thus it was concluded that magnesium added epidurally provides better intraoperative analgesia, without increasing the incidence of side effects compared to bupivacaine alone.[39]

Sonali Banwait, Sujata Sharma and Rajesh Sood in 2012 evaluated the efficacy of single bolus administration of magnesium epidurally as an adjuvant to epidural fentanyl for postoperative analgesia in 60 patients posted for total hip replacement under combined spinal epidural anaesthesia. The results of the investigations showed that a single bolus of epidural magnesium as an adjuvant to fentanyl for post operative analgesic requirement results in prolonged duration of analgesia as compared to epidural fentanyl alone. Concomitant administration of magnesium reduces the requirement for breakthrough analgesics with no increased incidence of side effects.[40]

Shahi V, Verma AK, Agarwal A, Singh CS in 2014 conducted a prospective randomized study of comparing dexmedetomidine and magnesium sulfate along with epidural bupivacaine in 120 patients to determine the motor and sensory onset of action and duration of analgesia post operatively, they have concluded that dexmedetomidine group showed rapid onset of action and prolonged duration of action with better post operative analgesia when compared to magnesium sulphate group.[41]

Mohammad W, Mir SA, Mohammad K, Sofi K. in 2015 Compared postoperative pain relief in patients undergoing an elective thoracotomy with thoracic epidural analgesia using single shot magnesium and clonidine as adjuvant to bupivacaine. In a randomized prospective study, 60 patients of American Society of Anesthesiologists physical status I-III of either sex, between 20 and 60 years undergoing elective unilateral thoracotomy, were allocated to three equal groups of 20 patients. They concluded that thoracic epidural analgesia using bupivacaine with clonidine is an efficient therapeutic modality for post-thoracotomy pain. Magnesium as an adjuvant provided quality postoperative analgesia decreasing the need for postoperative rescue analgesia and incidence of postoperative shivering without causing sedation[42]

Goyal V, Kubre J, Radhakrishnan K. in 2016 conducted study in 100 pediatric population using using dexmedetomidine as adjuvant in caudal anaesthesia with bupivacaine and concluded that it increases the duration of caudal anaesthesia and improves the hemodynamic stability in babies undergoing infraumbilical surgeries.[43]

Sayed JA, Kamel EZ et al in 2018 conducted a study in 120 pediatric cases to evaluate the usefulness of adding dexmedetomidine and magnesium sulphate together as adjuvant in caudal anesthesia and they have concluded in their study that when

both dexmedetomidine and magnesium sulphate is added together in caudal anaesthesia it prolongs the time of first analgesic requirement.[44]

Yan MJ, Wang T et al in 2019 evaluated a study to compare dexmedetomidine and sufentanil along with ropivacaine for epidural analgesia after thoracotomy. This was a double blinded prospective study that was conducted in 120 patients who underwent lung lobectomy. The study concludes that dexmedetomidine, superior than sufentanil in providing postoperative analgesia, as it also possess sedative property with very few side effects.[45]

Yehia MF, Ahmad AEA et al in 2019 conducted a study in 60 patients undergoing total knee replacement comparing magnesium sulphate and dexmedetomidine as adjuvant to epidural bupivacaine to assess postoperative analgesic requirement and concluded that both magnesium and dexmedetomidine are considered as safe adjuvant to epidural bupivacaine, with dexmedetomidine has superior analgesic property along with sedation.[46]

LiL, FangM, WangC, et al in 2020 concludes that when epidural bupivacaine given along with magnesium sulphate than given alone provides better analgesic property and also reduces number of rescue analgesia.[47]

METHODOLOGY

METHODS AND MATERIALS :

Source of data:

90 patients undergoing lower abdominal and lower limb surgeries at

R. L. Jalappa Hospital and Research Centre, Tamaka , Kolar, from January 2019 to June 2020 were included in the study.

Method of collection of data:

Inclusion criteria:

- Patients belonging to
- ASA Grade I and II
- Both genders
- Age group between 18 to 60 years

Exclusion criteria:

Patients suffering from

- ❑ Cardiovascular disease: chronic hypertension, advanced heart block, severe ventricular dysfunction
- ❑ Hypovolemia
- ❑ Bradycardia
- ❑ Hepatic impairment
- ❑ Diabetes mellitus
- ❑ Pregnancy and lactating mothers
- ❑ Patients who are on sedatives and hypnotics.
- ❑ Patients with known allergy to dexmedetomidine
- ❑ Patients refusal.

SAMPLING PROCEDURE:

➢ All patients were evaluated one day prior to surgery, during pre operative evaluation and informed consent was taken.

➢ The ethical committee approval was taken to conduct the study.

The following investigations were done pre operatively

- ❑ Complete haemogram.
- ❑ Bleeding time and clotting time.
- ❑ Random blood sugar.
- ❑ Blood urea and serum creatinine.
- ❑ Serum electrolytes.
- ❑ Urine analysis for sugar, albumin and microscopy.
- ❑ ECG and chest x-ray.
- ❑ No special investigations were required.

➢ An elaborated clinical examination was conducted and necessary investigations sent and reviewed before surgery.

➢ Airway assessment was done using the Mallampati score. Spine examination done and spine deformities were ruled out

➢ Fasting of 6 hours was ensured and were premedicated with Tab. Alprazolam 0.5 mg and Tab. Ranitidine 150 mg and the drugs were repeated 2 hours before the surgery. Patients were randomly allocated into three groups of 30 each. Randomization done by computer generated table.

➢ Patients were segregated into three groups of 30 patients each

GROUP A (control group) received epidural bupivacaine 0.5%(17 ml) + 1ml 0.9% normal saline.

GROUP B received epidural Bupivacaine 0.5%(17 ml) + 1ml 0.5mcg per kg dexmedetomidine.

GROUP C received epidural Bupivacaine 0.5%(17 ml) + 1ml 50mg magnesium sulphate.

➢ After securing a venous access using a 18G cannula, the patient was preloaded with Ringer's Lactate infusion at a rate of 5ml/kg/hr.

➢ On arrival to the operation room, baseline HR, NIBP, ECG, SPO2 were recorded and monitoring were started.

➢All patients received a standard epidural block under full aseptic conditions in sitting position. Skin was infiltrated with 1% lidocaine (2ml) by a 26G hypodermic needle. Epidural space was identified at L2-3 or L3-4 interspace using a loss of resistance technique via a midline approach with an 18G Touhy's needle. The epidural catheter was then advanced 3 to 5cm cephalad into the epidural space. After the procedure, the patient was turned supine slowly .

➢Correct placement of the catheter was verified by a test dose of 3ml lidocaine 2% with adrenaline (1:2,00,000) after confirming negative backflow of blood and CSF. The patients were then given epidural medications accordingly to the allocated groups. All study drugs were diluted to 1ml in 0.9% normal saline. Thus the total volume of the epidural anesthesia was 18ml in all the groups. The time of drug injection was noted and recorded as 0.

Following parameters of blockade characteristics and hemodynamic parameters were noted:

I. SENSORY BLOCKADE:

a. Onset of sensory blockade

b. Time to achieve T6 sensory level

c. Quality and extent of sensory blockade

II. MOTOR BLOCKADE

a. Onset of motor blockade

b. Quality of motor blockade

III. TWO SEGMENT REGRESSION

IV. TIME FOR FIRST EPIDURAL TOP UP

V. HEMODYNAMIC STABILITY

VI. SIDE EFFECTS AND COMPLICATIONS

- Sensory blocks were assessed bilaterally by loss of pin prick sensation with short hypodermic 22G needle in mid clavicular line. Motor blocks were assessed by Modified Bromage scale.

MODIFIED BROMAGE SCALE:

1- Free movement of legs and feet, with ability to raise extended leg.

2- Inability to raise extended legs and knee flexion is decreased, but full flexion of feet and ankles is present.

3- Inability to raise leg or flex knees, flexion of ankle and feet present.

4- Inability to raise leg, flex knee or ankle or move toes.

Onset of sensory blockade:

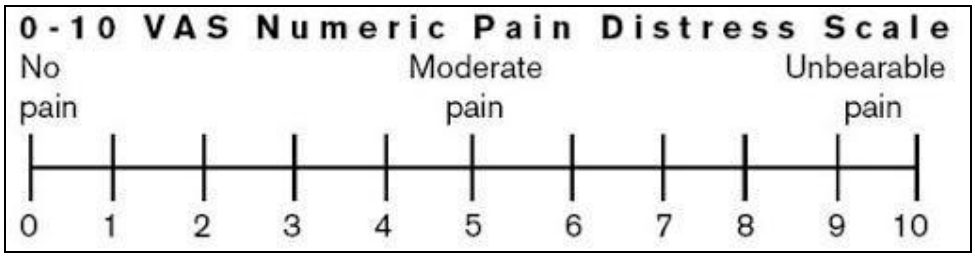
This was subjectively assessed by complaint of sensation of tingling or warmth in the patient's limbs. It was confirmed by loss of pin prick sensation at L1. Measured from the time of injection of the drug to loss of pin prick at L1 noted in minutes.

Time to achieve T6 sensory level:

It was taken as the time when drugs administered to attain T6 sensory level were noted in minutes.

Quality and extent of sensory block:

The maximum level of sensory blockade was noted. The quality of sensory blocks were assessed by standard 10 point visual analogue scale. The patients were asked to evaluate their plan on standard 10 point visual analogue pain scale (VAS 0 = no pain, VAS 10 = worst possible pain)



VAS was assessed every 10minutes. In the event of pain, (VAS > 4), intraoperatively a bolus of epidural bupivacaine 0.25%(6ml) was administered, post operatively a bolus of epidural bupivacaine 0.125%(8ml) was administered.

Onset of motor blockade:

It was subjectively assessed by the feeling of heaviness of leg and confirmed by modified bromage scale score of 1. Measured from the time of injection of the drug to modified bromage score of 1

Quality of motor blockade:

Quality of motor block was assessed by using modified bromage scale. The maximum score achieved was noted.

Two segment regression:

The time for regression of the sensory level by two dermatomes was recorded. It was noted in minutes.

Time for first epidural top-up:

Time for the first epidural top up dose was recorded. In the event of pain, when VAS > 4, bolus of epidural top up was given and it is noted down in minutes.

Hemodynamic stability:

Monitoring consisted of heart rate, non-invasive arterial blood pressure, SpO2 at the interval of 5minutes for the first 30minutes and 20minutes interval thereafter.

Hypotension- defined as systolic BP< 90mmHg or >30% decrease in baseline values. It was treated with rapid infusion of intravenous ringer lactate 250ml and 6mg of intravenous mephentermine if there was no response to intravenous fluid administration.

Bradycardia was defined as heart rate < 60/min or >30% decrease in baseline value. Bradycardia treated with injection atropine 0.6mg intravenously.

Respiratory depression- defined as fall in respiratory rate <10breaths/min or fall of peripheral oxygen saturation <90%, treated with oxygen supplementation of 5lit/min by face mask.

Intravenous fluids were administered in the form of ringer lactate solution in calculated doses depending on the patient's body weight and further adjusted as per blood loss during the surgery. Colloid and blood was administered as per the loss and requirement.

Side effects and complications:

Occurrence of any adverse events (intra operatively or post operatively) was recorded such as hypotension, bradycardia, nausea vomiting, shivering. The total duration of the surgery was recorded. Patients were followed up for 48hours and the epidural catheter was removed after 48hours.

STATISTICAL ANALYSIS:

Study design : Randomised double blind study.

Data was entered in Ms Excel, MS word and analyzed using SPSS 22 version software.

Qualitative data was presented in the form of proportions and bar charts was used to represent graphically. Quantitative data was presented as mean, standard deviation. The one-way analysis of variance (ANOVA) was employed to determine whether there were any statistically significant differences between the means of three or more independent (unrelated) groups. P value <0.05 was been considered as statistically significant.

FORMULA:

$$n = \frac{2Sp^2 [S_{1-\alpha/2} + S_{1-\beta}]^2}{\mu^2 d}$$

$$S^2_p = \frac{S_1^2 + S_2^2}{2}$$

S_1^2 = standard deviation in first group

S_2^2 = standard deviation in second group

μ^2 = mean difference between sample

α = significance level

$1-\beta$ = power

Sample size of study were based on time to acquire T10 by Vaibhav Shahi et al in a comparative study of magnesium sulfate vs dexmedetomidine as an adjuvant to epidural bupivacaine observed a variance estimate of four with 95% confidence interval with 80% power with equal allocation to detect a difference of 10% time in achieving T8 blockade, the required sample size per group was 30.[41]

RESULTS:

TABLE NO 1 :

GENDER DISTRIBUTION OF SUBJECTS BETWEEN THREE GROUPS:

Gender	Group A	Group B	Group C	Total
Female	10(33.3%)	8(26.7%)	9(30%)	27(30%)
Male	20(66.7%)	22(73.3%)	21(70%)	63(70%)
Total	**30(100%)**	**30(100%)**	**30(100%)**	**90(100%)**

In this study 27% were female and 63% were male and there was no significant difference in gender between three groups (P=0.853), chi square test was used.

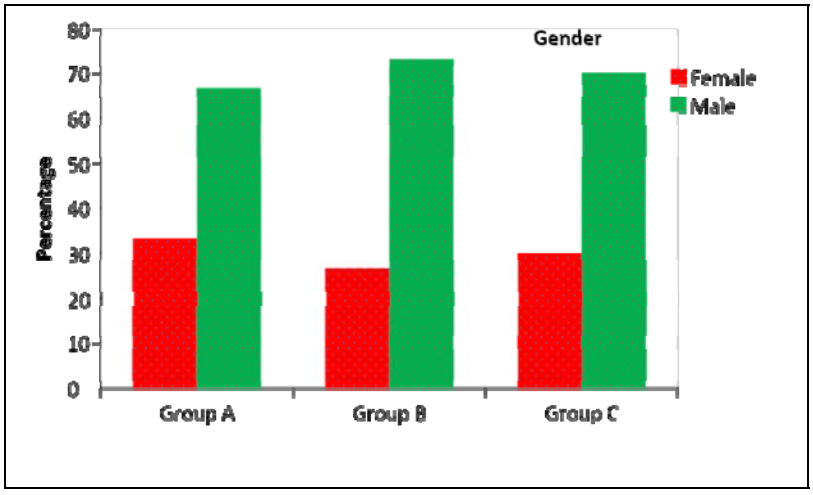


FIGURE NO 7: BAR DIAGRAM SHOWS GENDER DISTRIBUTION BETWEEN THREE GROUPS

TABLE NO 2:

AGE DISTRIBUTION OF PATIENTS BETWEEN THREE GROUPS

Age in years	Group A	Group B	Group C	Total
<20	3(10%)	0(0%)	0(0%)	3(3.3%)
20-30	7(23.3%)	7(23.3%)	7(23.3%)	21(23.3%)
30-40	5(16.7%)	8(26.7%)	9(30%)	22(24.4%)
41-50	9(30%)	4(13.3%)	6(20%)	19(21.1%)
51-60	6(20%)	10(33.3%)	8(26.7%)	24(26.7%)
>60	0(0%)	1(3.3%)	0(0%)	1(1.1%)
Total	30(100%)	30(100%)	30(100%)	90(100%)
Mean±SD	39.13±13.31	42.82±13.48	41.67±12.54	41.20±13.06

There were no significant difference in mean age groups with P value 0.543

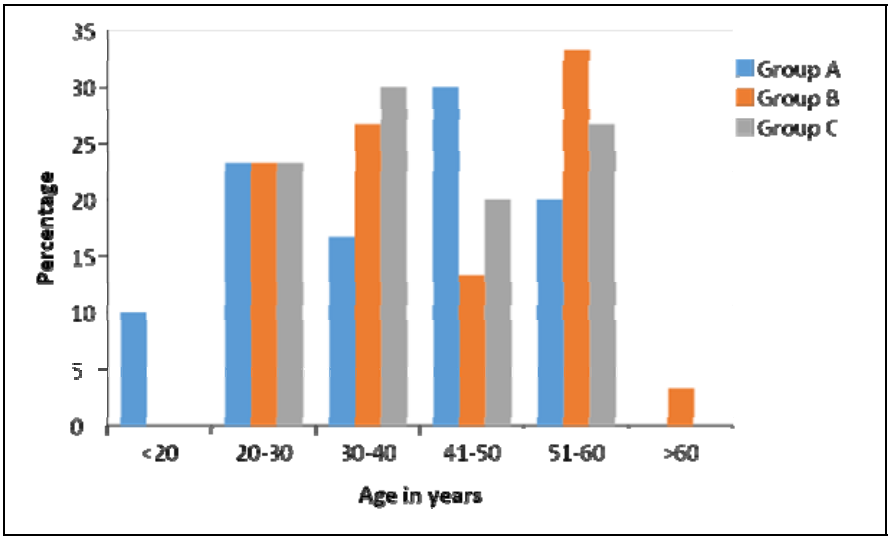


FIGURE NO 8 : BAR DIAGRAM SHOWING AGE DISTRIBUTION BETWEEN THREE GROUP

TABLE NO 3:

ASA GRADE DISTRIBUTION IN THREE GROUPS

ASA	Group A	Group B	Group C	Total
I	26(86.7%)	20(66.7%)	25(83.3%)	71(78.9%)
II	4(13.3%)	10(33.3%)	5(16.7%)	19(21.1%)
Total	30(100%)	30(100%)	30(100%)	90(100%)

In this study 71% belongs to ASA I and 19% belongs to ASA II. There was no significant difference in ASA grading with P value of 0.126%

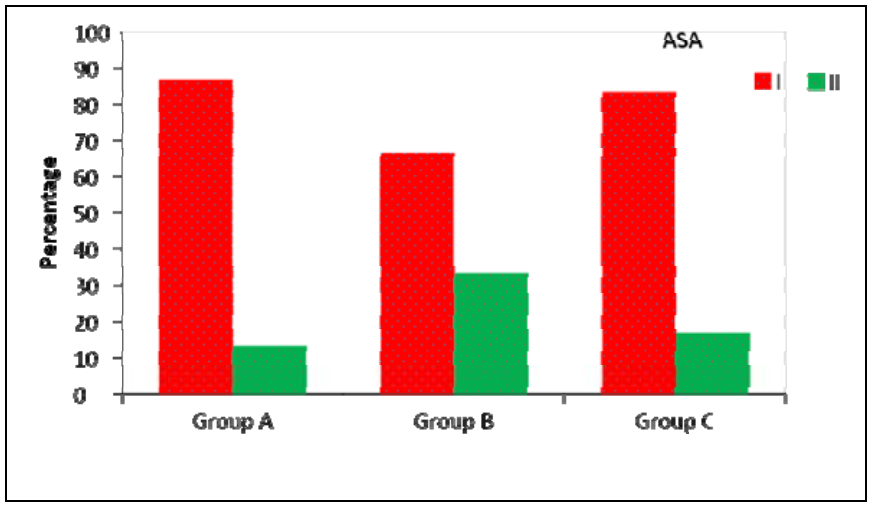


FIGURE NO 9: BAR DIAGRAM SHOWING ASA GRADE DISTRIBUTION IN THREE GROUPS:

TABLE NO 4:

HEART RATE (bpm) COMPARISON BETWEEN THREE GROUPS:

PR (BPM)	Group A	Group B	Group C	Total	P value
PRE-OPERATIVE VITALS	83.83±8.07	81.7±11.02	79.4±9.15	81.64±9.56	0.201
0	86.43±8.98	81.57±9.96	79.47±8.96	82.49±9.66	0.015*
3	85.1±9.33	77.37±8.61	76.77±7.24	79.74±9.18	<0.001**
5	83.3±8.98	74.2±8.51	74.77±7.48	77.42±9.25	<0.001**
10	83.33±10.09	68.9±7.49	74.13±8.64	75.46±10.57	<0.001**
20	83.2±9.52	67.73±8.18	75.53±8.44	75.49±10.72	<0.001**
30	83.97±9.96	64.87±8.25	76.17±8.78	75±11.91	<0.001**
40	83.63±9.34	63.03±7.69	77.33±9.83	74.67±12.42	<0.001**
50	84.4±10.11	63.6±7.43	77.93±9.54	75.31±12.54	<0.001**
60	88.14±11.98	64.24±6.2	77.19±15.61	77.11±15.39	<0.001**
90	97.91±10.83	63.33±4.45	75.63±13.15	77.41±17.65	<0.001**
120	101.17±10.3	63.5±4.32	86±7.21	83.07±18.93	<0.001**

Baseline HR (bpm) were comparable in three groups, which were 86.43±8.98, 81.57±9.96 and 79.47±8.96 in group A, group B and group C respectively

In group A there were no significant difference in PR, even after 30 minutes of epidural bupivacaine it remained at 83.97±9.96 and there was increased PR seen after 1hour of epidural bupivacaine with normal saline, it was 101.17±10.3 after 120min of epidural.

In group B after 10minutes of epidural bupivacaine with dexmedetomidine PR dropped to 64.87±8.25 and it remained on the lower side all though the procedure without tremendous increase in PR. It was 63.5±4.32 even after 120 minutes of epidural.

In group C, PR remained the same all through the procedure, after 30minutes of epidural bupivacaine with magnesium sulphate it was 75±11.91 and it was 86±7.21 after 120minutes of epidural.

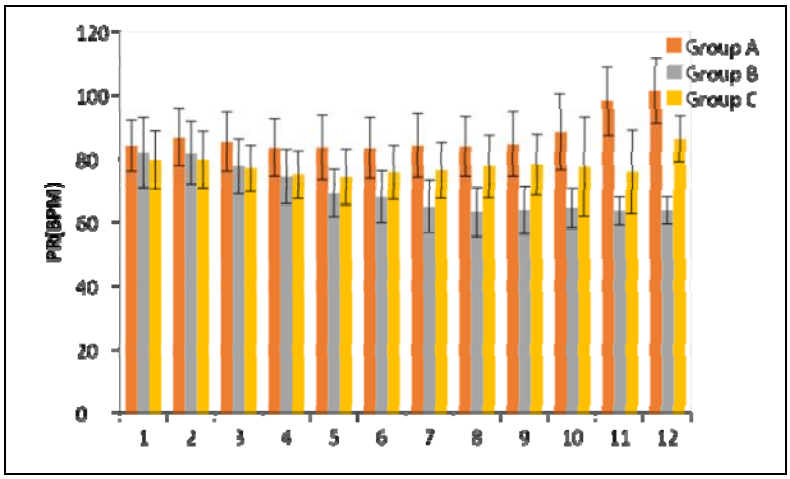


FIGURE NO 10: BAR DIAGRAM SHOWING COMPARISON OF HEART RATE IN THREE GROUPS

TABLE NO 5:

SYSTOLIC BLOOD PRESSURE- COMPARISON IN ALL THREE GROUPS

SBP (mmHg)	Group A	Group B	Group C	Total	P value
PRE-OPERATIVE VITALS	129.67±14.23	128.33±14.13	125.33±7.31	127.78±12.32	0.382
0	133.63±13.16	129.6±14.11	125.13±11.26	129.46±13.22	0.043*
3	130.03±11.67	120.37±14.82	120.57±9.32	123.66±12.84	0.003**
5	127.7±11.88	113.63±12.52	116±9.28	119.11±12.78	<0.001**
10	127.57±12.57	107.3±11.88	113.63±9.66	116.17±14.15	<0.001**
20	126.63±11.7	105.7±10.39	113.87±10.91	115.4±13.91	<0.001**
30	128.53±14.05	103.9±10.7	114.37±10.98	115.6±15.62	<0.001**
40	124.97±27.39	103.83±9.07	116.53±14.32	115.11±20.36	<0.001**
50	131.3±12.17	104.67±10.45	117.53±14.81	117.83±16.58	<0.001**
60	132.5±13.07	105.81±10.06	117.96±14.48	119.27±16.75	<0.001**
90	144.42±6.56	104.44±12.14	116.5±14.93	120.44±20.95	<0.001**
120	146±7.27	108±3.46	131.33±7.09	127.87±18.52	<0.001**

Baseline SBP in all the three groups were 133.63±13.16, 129.6±14.11 and 125.13±11.26 in group A, group B and group C respectively.

In group A there were fall in SBP only after 40minutes of epidural which was 124.97±27.39 and was gradually increasing as the time proceeded, it was 146±7.27 after 120 minutes of epidural.

In group B there was a significant fall in SBP after 10minutes of epidural which was 107.3±11.88 and it remained on the lower side all through the procedure , it was 108±3.46 after 120 minutes of epidural.

In group C there was fall in BP after 10minutes of epidural but it was not significant when compared to group B which was 115.6±15.62, and there was no much change thereafter, it was 127.87±18.52 after 120minutes of epidural

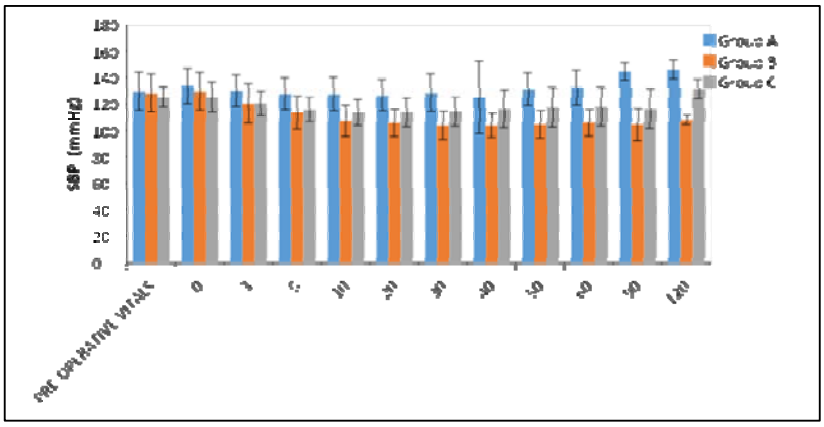


FIGURE NO 11: BAR DIAGRAM SHOWING COMPARISON OF SBP IN ALL THREE GROUPS

TABLE NO 6:

DIASTOLIC BLOOD PRESSURE- COMPARISON IN ALL THREE GROUPS

DBP (mm Hg)	Group A	Group B	Group C	Total	P value
PRE-OPERATIVE VITALS	84.10±12.35	79.9±10.82	80.33±13.51	81.44±12.29	0.350
0	86.13±11.21	80.97±10.13	82.30±9.07	83.13±10.29	0.130
3	83.53±11.10	73.30±10.33	76.77±14.47	77.87±12.71	0.005**
5	81.13±10.8	68.17±10.59	76.17±8.49	75.16±11.26	< 0.001**
10	77.40±17.10	64.20±9.46	72.57±15.2	71.39±15.16	0.002**
20	80.80±10.5	61.03±10.95	74.57±9.87	72.13±13.25	<0.001**
30	80.87±11.05	60.47±10.87	73.60±10.60	71.64±13.68	<0.001**
40	81.07±12.31	61.10±9.51	74.73±12.93	72.3±14.27	<0.001**
50	81.70±11.44	61.97±8.20	72.87±12.49	72.18±13.46	<0.001**
60	84.21±11.94	61.54±8.18	74.42±13.42	73.79±14.67	<0.001**
90	90.31±6.55	61.00±8.53	75.50±12.34	74.84±15.50	<0.001**
120	94.67±8.41	65.33±3.88	90.67±2.08	82.13±15.33	<0.001**

Baseline DBP in all three groups were 86.13±11.21, 80.97±10.13 and 82.30±9.07 in group A, group B and group C respectively.

In group A there was no much in fall in DBP after 40minutes of epidural it was 81.07±12.31 and it remained the same all throughout the procedure and started increasing as time proceeded, it was 94.67±8.41after 120minutes of epidural.

In group B there was a significant reduction in DBP after 20minutes of epidural it was 61.03±10.95 and it was on the lower side thereafter, it was 65.33±3.88 after 120minutes of epidural.

In group C there was no much reduction in DBP, it was 73.60±10.60 after 30minutes of epidural and there was no much change thereafter. It was 90.67±2.08 after 120minutes of epidural.

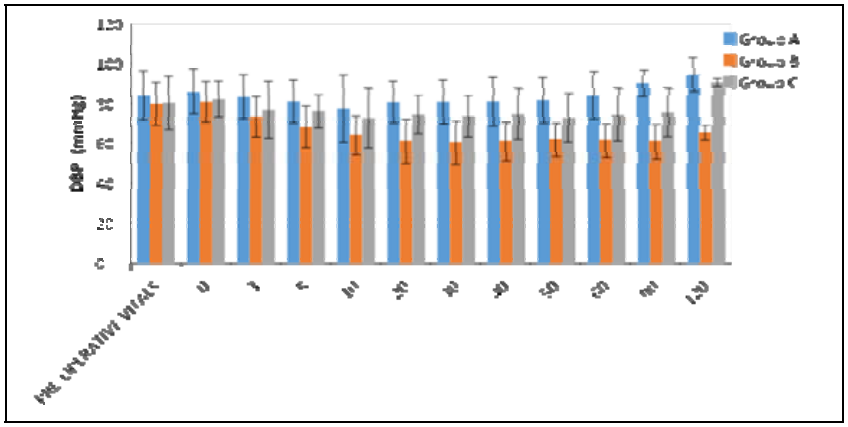


FIGURE NO 12: BAR DIAGRAM SHOWING COMPARISON OF DBP IN ALL THREE GROUPS

TABLE NO 7:MEAN ARTERIAL BLOOD PRESSURE- COMPARISON IN ALL THREE GROUPS

Mean arterial blood pressure (mm Hg) (mins)	Group A	Group B	Group C	Total	P value
PRE-OPERATIVE VITALS	99.29±12.27	96.04±10.76	93.56±12.03	96.30±11.81	0.170
0	101.90±11.35	97.17±10.66	96.60±9.51	98.56±10.69	0.108
3	98.97±10.72	88.93±10.83	91.43±11.89	93.11±11.84	0.002**
5	96.60±10.69	83.37±10.30	89.53±7.99	89.83±11.05	<0.001**
10	94.20±12.93	78.47±9.52	86.27±11.29	86.31±12.93	0.002**
20	96.20±10.47	76.03±10.18	87.63±9.80	86.62±13.03	<0.001**
30	96.77±11.74	74.93±9.51	87.17±10.21	86.29±13.75	<0.001**
40	95.70±14.79	75.37±8.40	88.67±12.85	86.58±14.83	<0.001**
50	98.20±11.22	76.10±8.52	87.73±12.95	87.34±14.2	<0.001**
60	98.40±15.56	74.78±11.77	88.92±13.49	87.75±16.81	<0.001**
90	97.07±24.61	73.00±14.47	81.50±21.92	83.55±22.49	0.010**
120	111.83±7.65	79.67±2.16	104.33±2.08	97.47±16.05	<0.001**

Baseline mean arterial blood pressure in all three groups were 101.90±11.35, 97.17±10.66 and 96.60±9.51 in group A, group B and group C respectively.

In group A MAP remains constant and there is no much fall in MAP, it was 95.70±14.79 after 40minutes of epidural, and it was 111.83±7.65 after 120minutes of epidural.

In group B significant reduction of MAP is seen after 30minutes of epidural and it was 74.93±9.51, it was stable all through the procedure and it was 79.67±2.16 after 120minutes of epidural

In group C MAP remains constant without increase or decrease from its basal value, it was 79.67±2.16 after 30minutes of epidural, and it was 104.33±2.08 after 120minutes of epidural.

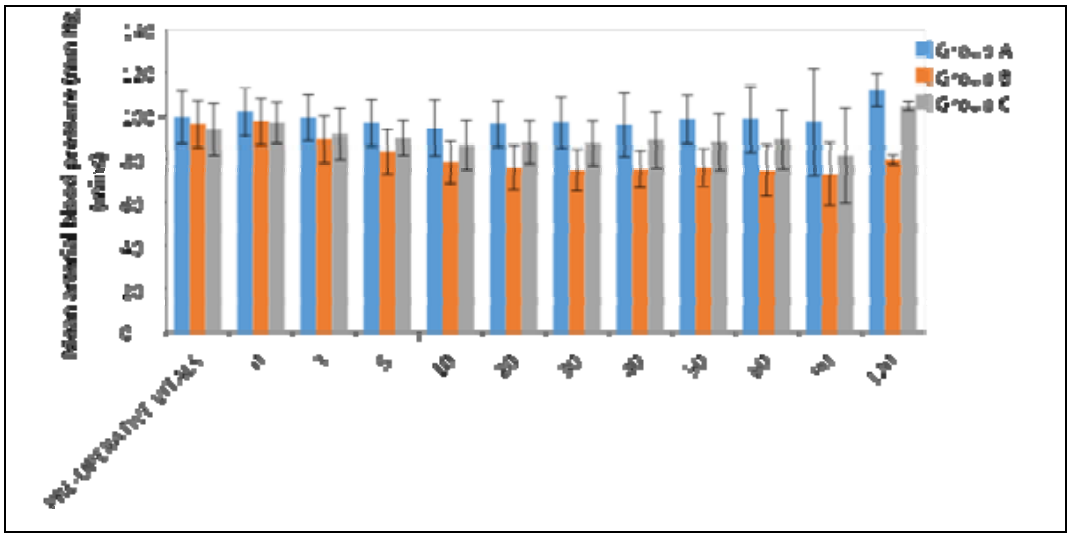


FIGURE NO 13 : DAR DIAGRAM SHOWING COMPARISON ON MAP IN ALL THREE GROUPS.

TABLE NO 8:

COMPARISON OF SPO2 IN ALL THREE GROUPS

SPO2(%) (mins)	Group A	Group B	Group C	Total	P value
PRE-OPERATIVE VITALS	99.33±0.92	99.17±0.91	99.50±0.73	99.33±0.87	0.329
0	99.57±0.63	99.63±0.61	99.33±0.84	99.51±0.71	0.227
3	99.13±0.82	99.3±0.7	99.07±0.87	99.17±0.8	0.510
5	98.93±1.01	98.97±0.89	98.83±1.09	98.91±0.99	0.866
10	98.8±1.03	98.77±2.34	99.13±0.9	98.9±1.56	0.607
20	98.97±0.89	99.00±0.95	98.7±1.06	98.89±0.97	0.423
30	99.00±0.87	99.13±0.82	98.9±1.06	99.01±0.92	0.619
40	98.97±0.96	99.10±0.80	99.17±0.91	99.08±0.89	0.680
50	99.07±0.74	99.27±0.69	99.17±0.87	99.17±0.77	0.607
60	99.23±0.9	99.52±0.51	99.23±0.82	99.33±0.77	0.284
90	99.17±0.58	99.31±0.79	99.13±0.83	99.22±0.72	0.801
120	99.67±0.52	99.67±0.52	99.67±0.58	99.67±0.49	1.000

There was no significant change in saturation in all three groups.

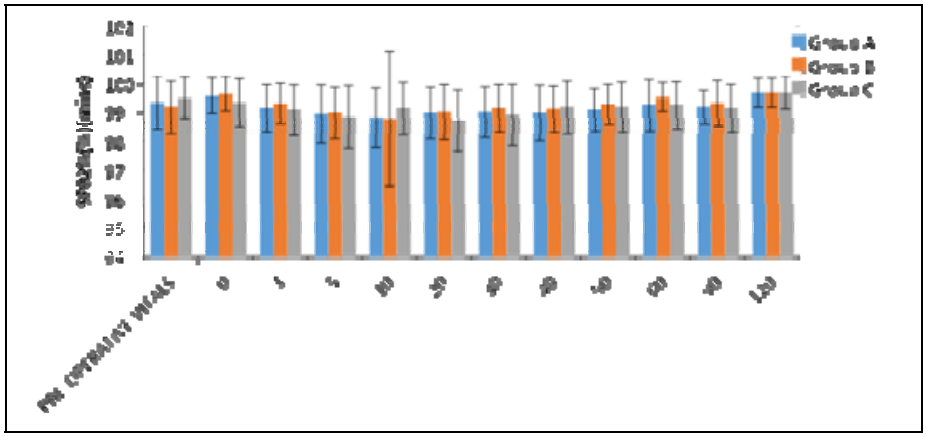


FIGURE NO 14 : BAR DIAGRAM SHOWING COMPARISON OF SPO2 IN ALL THREE GROUPS.

TABLE NO 9 :SHOWING COMPARISON OF VARIOUS VARIABLES IN ALL THREE GROUPS

variables	Group A	Group B	Group C	Total	P value
Weight (kg)	62.8±10.21	69.07±9.19	63.17±9.06	65.01±9.83	0.020*
Onset of Sensory Block	14.12±6.18	4.63±1.22	5.75±1.71	8.17±5.65	<0.001**
Onset of Motor Block	17.17±2.01	7.02±1.70	8.10±2.05	10.76±4.96	<0.001**
Time to achieve T6level	13.22±1.43	4.73±1.32	5.82±1.72	7.92±4.07	<0.001**
Duration of Surgery	85.50±21.24	85.43±21.29	74.33±21.51	81.76±21.76	0.071+
Time for Two segment regression	86.77±3.60	106.4±8.01	102.7±8.05	98.62±10.94	<0.001**
Recovery from Motor block	97.77±5.03	121.6±8.42	119.87±10.01	113.08±13.53	<0.001**
Time to first Analgesic request	1.90±0.28	3.18±0.83	4.08±0.95	3.06±1.16	<0.001**

Time taken for sensory block in group A was 14.12±6.18, in group B it was 4.63±1.22 and in group C it was 5.75±1.71, which signifies that time for onset of sensory block was seen early in group B.

Time for complete motor blockade in group A was 17.17±2.01, in group B it was 7.02±1.70 and in group C it was 8.10±2.05, which signifies that early onset of motor blockade was seen in group B.

Time taken to achieve T6 level in group A was 13.22±1.43, in group B it was 4.73±1.32 and in group C it was 5.82±1.72, which imparts that time to achieve T6 level was seen early in group B

Time for two segment regression in group A was 86.77±3.60, it was 106.4±8.01 in group B and it was 102.7±8.05 in group C , which signifies that early two segment regression seen in group A, where as longer time for two segment regression was seen in group B

Time for recovery from motor blockade in group A was 102.7±8.05, in group B it was 121.6±8.42 and in group C it was 119.87±10.01 which signifies that time for regression of motor blockade in longer in group B when compared to other two groups.

Time taken for first analgesic request in group A was 1.90±0.28 hours, in group B it was 3.18±0.83hours and in group C it was 4.08±0.95hours, which signifies that analgesics during post operative period was better with group C, that is magnesium sulphate.

Average time taken for surgeries in group A was 85.50±21.24, in group B was 85.43±21.29 and in group C it was 74.33±21.51.

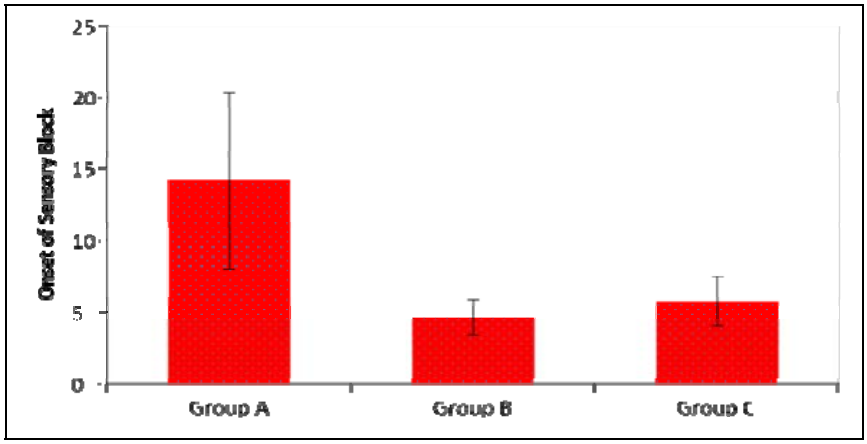


FIGURE NO 15: BAR DIAGRAM SHOWING DURATION OF THE ONSET OF SENSORY BLOCK IN THREE GROUPS

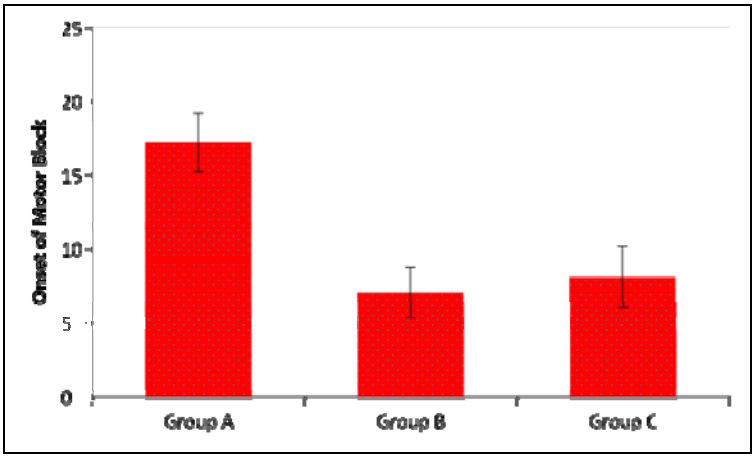


FIGURE NO 16: BAR DIAGRAM SHOWING THE DURATION OF ONSET OF MOTOR BLOCKADE IN THREE GROUPS

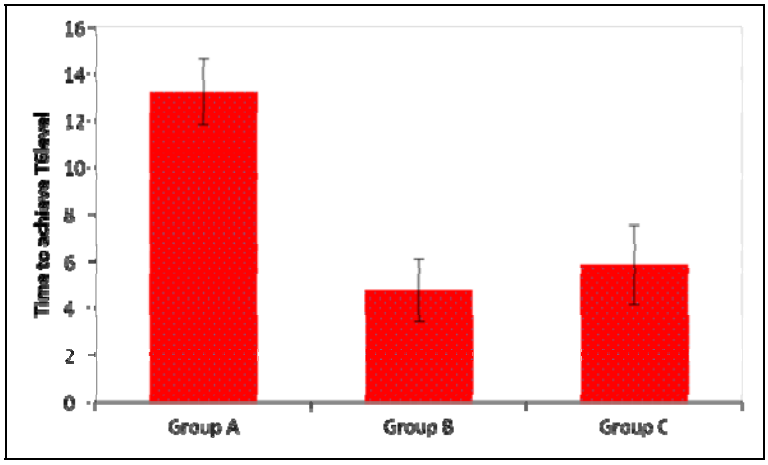


FIGURE NO 17: BAR DIAGRAM SHOWS THE DURATION OF TIME TO ACHIEVE T6 LEVEL IN THREE GROUPS

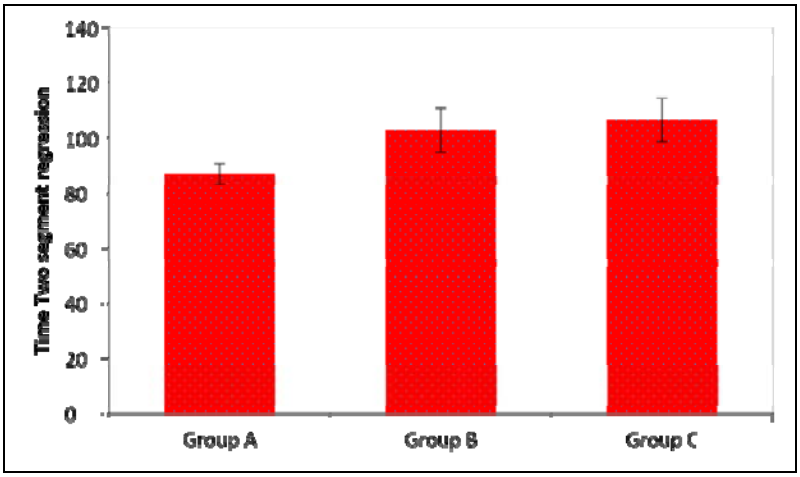


FIGURE NO 18: BAR DIAGRAM SHOWS THE TIME FOR TWO SEGMENT REGRESSION IN THREE GROUPS

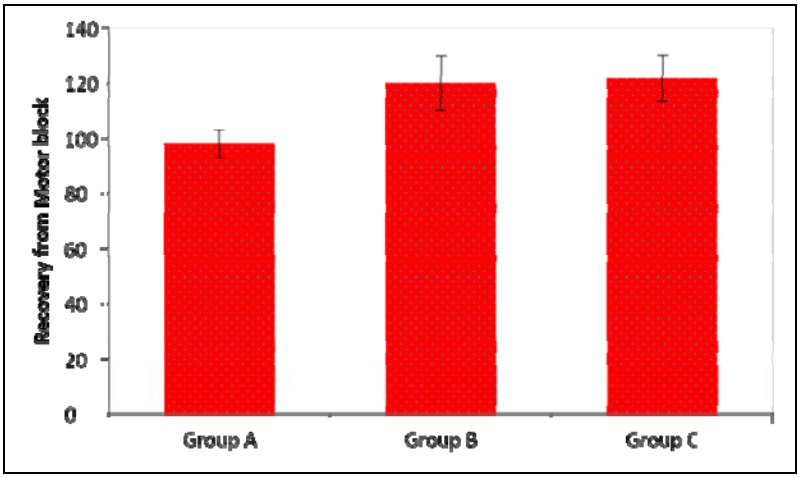


FIGURE NO 19: BAR DIAGRAM SHOWS THE TIME FOR RECOVERY FROM MOTOR BLOCKADE IN ALL THREE GROUPS

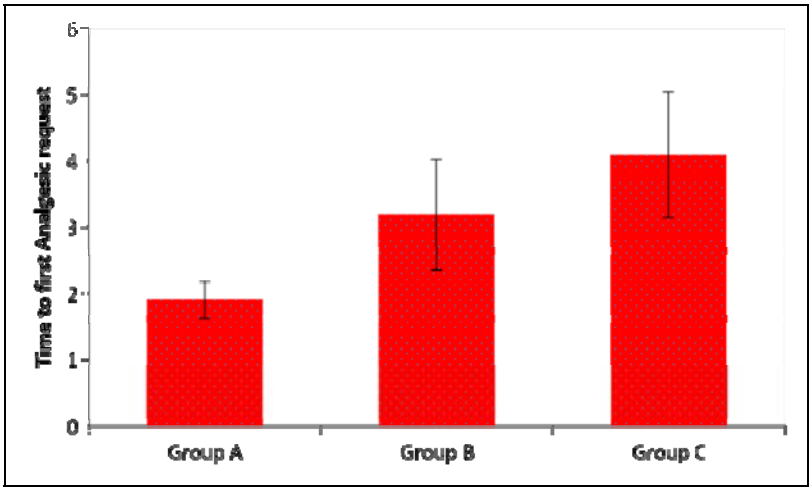


FIGURE NO 20: BAR DIAGRAM SHOWS THE TIME FOR FIRST ANALGESIC REQUIREMENT IN ALL THREE GROUPS

TABLE NO 10:

VAS SCORE IN THREE GROUPS

variables	Group A	Group B	Group C	Total	P value
VAS First Analgesic	6.47± 0.63	4.83± 0.75	5.00± 0.95	5.43±1.07	<0.001**
VAS 6hrs	6.30±0.65	4.70±1.21	4.47±1.04	5.16±1.28	<0.001**
VAS 12hrs	6.30±0.75	4.77±1.5	4.23±1.19	5.10±1.47	<0.001**
VAS 24hrs	6.13±0.57	4.93±1.31	4.03±1.19	5.03±1.37	<0.001**

VAS score in all three groups postoperatively in 24hours shown, where it was less in group C after 6hours post operatively, which signifies that post operative analgesic effect is better with group C.

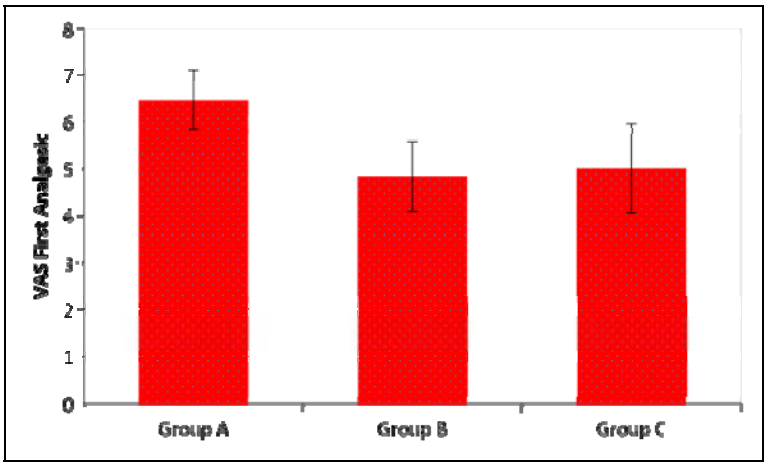


FIGURE NO 21: BAR DIAGRAM SHOWING VAS SCORE DURING THEIR FIRST ANALGESIC REQUEST IN ALL THREE GROUPS

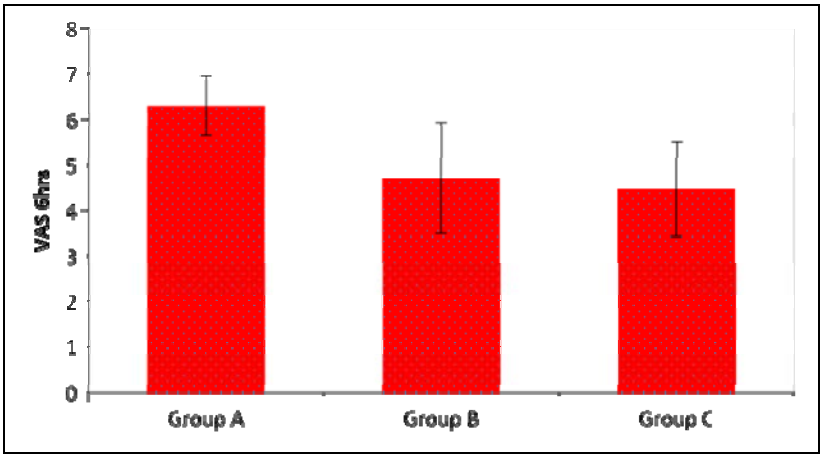


FIGURE NO 22: BAR DIAGRAM SHOWING VAS SCORE AFTER 6 HOURS POST OPERATIVELY IN ALL THREE GROUPS

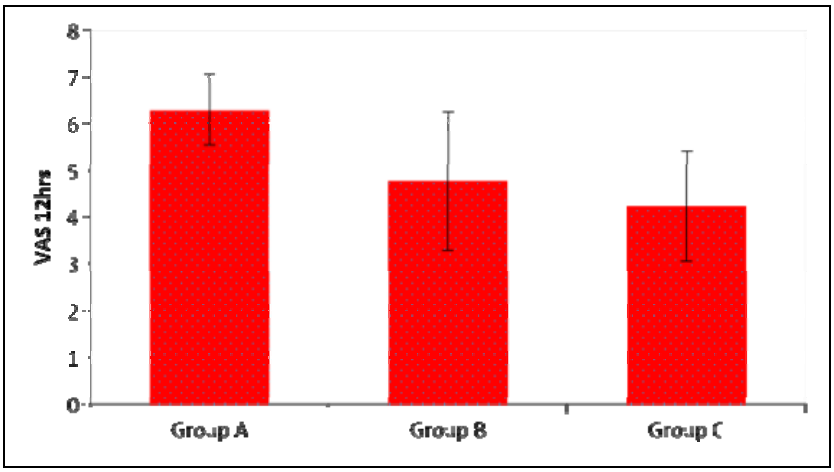


FIGURE NO 23: BAR DIAGRAM SHOWING VAS SCORE AFTER 12 HOURS POST OPERATIVELY IN ALL THREE GROUPS

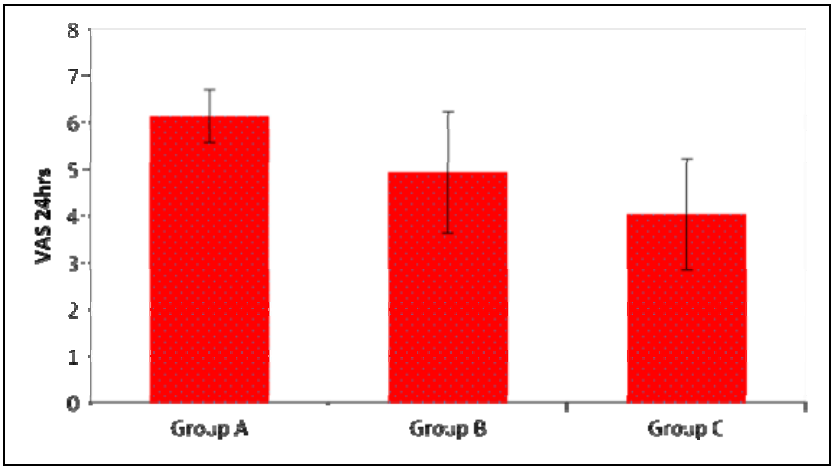


FIGURE NO 24: BAR DIAGRAM SHOWING VAS SCORE AFTER 24 HOURS POST OPERATIVELY IN ALL THREE GROUPS

TABLE NO 11:

TABLE SHOWING TOTAL ANALGESIC REQUIREMENT IN 24 HOURS POST OPERATIVELY

Total Dose Analgesic	Group A	Group B	Group C	Total
1	0(0%)	4(13.3%)	14(46.7%)	18(20%)
2	0(0%)	12(40%)	13(43.3%)	25(27.8%)
3	10(33.3%)	14(46.7%)	3(10%)	27(30%)
4	17(56.7%)	0(0%)	0(0%)	17(18.9%)
5	3(10%)	0(0%)	0(0%)	3(3.3%)
Total	**30(100%)**	**30(100%)**	**30(100%)**	**90(100%)**

The table shows the no. of analgesic requests in all three groups which was maximum in group A and minimum in group C, which indicates that group C had better analgesic effect. In group A 10 required 3 doses of top up requirement in 24hours, 17 required 4 doses of top ups. In group C only 3 required 3 doses of top ups, 14 required only one dose and 13 required 2 doses.

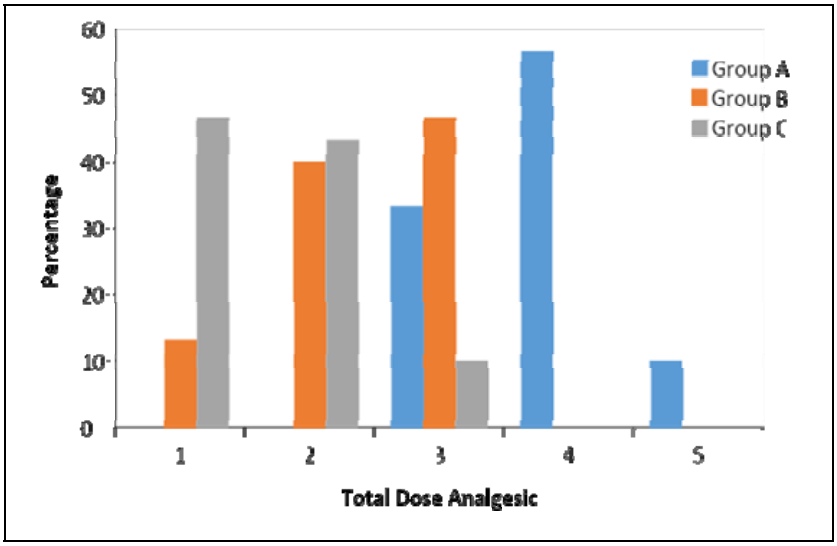


FIGURE NO 25: BAR DIAGRAM SHOWING TOTAL DOSE OF ANALGESIC REQUEST IN 24 HOURS POST OPERATIVELY IN THREE GROUPS

TABLE NO 12:

COMPLICATIONS AND SIDE EFFECTS

Complications	Group A	Group B	Group C	Total
No	29(96.7%)	26(86.7%)	30(100%)	85(94.4%)
Hypotension	0(0%)	3(10%)	0(0%)	3(3.3%)
Shivering	1(3.3%)	0(0%)	0(0%)	1(1.1%)
Vomiting	0(0%)	1(3.3%)	0(0%)	1(1.1%)
Total	30(100%)	30(100%)	30(100%)	90(100%)

This table shows the complication in three group's intra operatively and post operative period of first 24hours, where 3 in group B had hypotension and one had vomit. 1 had shivering in group A and no complication was seen in group C.

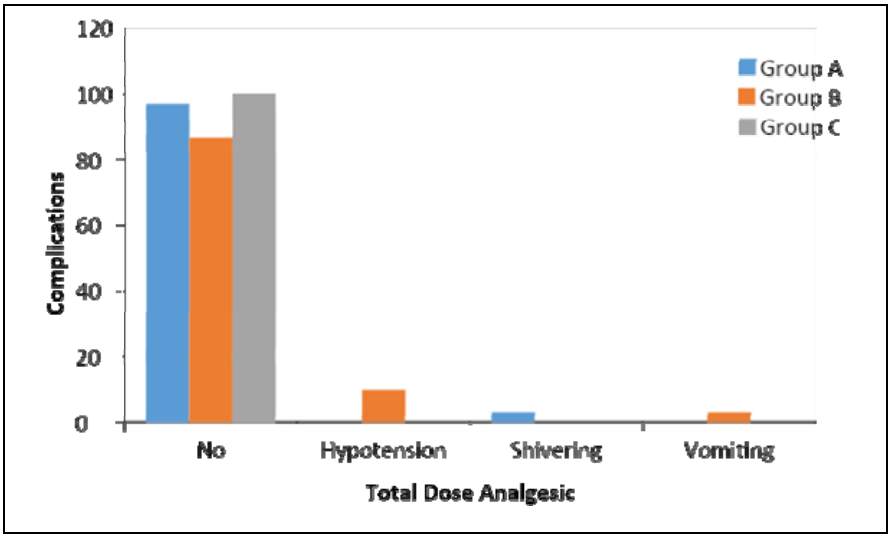


FIGURE NO 26: BAR DIAGRAM SHOWING COMPLICATION IN ALL THREE GROUPS

Significant figures

+ Suggestive significance (P value: 0.05<P<0.10)

* Moderately significant (P value: 0.01<P ≤ 0.05)

** Strongly significant (P value: P≤0.01)

DISCUSSION

Central neuraxial blockade is standard and widely practiced technique popular in many surgical procedures. Bupivacaine is commonly used local anaesthetic drug both in intrathecal and epidural anaesthesia. A variety of drugs been used to potentiate the effect and quality of analgesia of bupivacaine during neuraxial blockade. Epidural opioids, midazolam and ketamine have all been used for this purpose[48,49]. The use of opioid drug associated with the occurrence of undesirable side effects such as pruritus, nausea, vomiting, respiratory depression, urinary retention and somnolence. So the search for an effective analgesic with no or low incidence of side effects is continuing. Various options including alpha 2 agonists are extensively being evaluated as an alternative.

The pharmacological properties of alpha 2 agonist have been largely studied and been employed clinically to achieve desired effects in regional anaesthesia. Epidural administration of these drugs is associated with sedation, analgesia, anxiolysis, hypnosis and sympatholysis[50]. Introduction of dexmedetomidine, a newer prototype of alpha 2 agonist has widened the scope in regional anaesthesia. It was introduced in clinical practice in 1999[51]. Epidural bupivacaine in a dose of 2mcg/kg given along with intrathecal bupivacaine causes significant prolongation in the duration of analgesia. The number of administered rescue analgesic doses are significantly less in patients receiving epidural dexmedetomidine. The faster onset of action of local anaesthetics, rapid establishment of both sensory and motor blockade, prolonged duration of analgesia in the postoperative period, dose sparing action of local anaesthetics and stable cardiorespiratory parameters make alpha 2 agonist an effective adjuvant in regional anaesthesia[2].

Parenteral magnesium, used for many years as an antiarrhythmic agent and for prophylaxis in seizures in pre eclampsia. Noxious stimulation leads to release of neurotransmitters, which bind to various subclasses of excitatory amino acid receptors, including NMDA receptors[52]. NMDA receptor signalling may be important in determining the duration of acute pain[53]. Magnesium blocks calcium influx and non competitively antagonizes NMDA receptor channels[54]. Magnesium can prevent the induction of central sensitization at the spinal action by blocking NMDA receptors in a voltage dependent manner. With same mechanism of action when small doses of magnesium was added to local anaesthetics for spinal anaesthesia the duration of action of spinal anaesthesia was prolonged and analgesic requirement postoperatively was reduced and side effects of high doses of local anesthetics and opioids were reduced[55].

This was double blinded randomized control prospective study carried out at R.L.Jalappa Hospital and Research, Tamaka, Kolar, from Jan 2019 to June 2020. Ninety patients of age group 18 – 65 years with ASA grade I, II of either sex undergoing lower abdominal and lower limb surgeries under epidural anaesthesia and fulfilling the inclusion criteria were segregated into three groups based on computer generated randomisation as follows

GROUP A (control group) received epidural bupivacaine 0.5 %(17 ml) + 1ml 0.9% normal saline.

GROUP B received epidural Bupivacaine 0.5 %(17 ml) + 1ml 0.5mcg per kg dexmedetomidine.

GROUP C received epidural Bupivacaine 0.5 %(17 ml) + 1ml 50mg magnesium sulphate.

Baseline HR, NIBP, ECG, SPO2were recorded. Following parameters of blockade characteristics and hemodynamic parameters were noted.

I. SENSORY BLOCKADE:

i) Onset of sensory blockade

ii) Time to achieve T6 level

iii) Quality and extent of sensory blockade

II. MOTOR BLOCKADE:

i) Onset of motor blockade

ii) Quality of motor blockade

III. Two segment regression

IV. Time for first epidural top up

V. Hemodynamic stability

VI. Side effects and complications

Demographic data:

The demographic parameters of age, sex were comparable between three groups. The demographic profile in the study were comparable to similar other studies and did not show any significant differences on statistical comparison.

Duration of surgery:

Mean duration of surgery in group A was 85.50±21.24, in group B ws 85.43±21.29 and in group C it was 74.33±21.51 and it was not clinically significant.

Onset of sensory blockade:

Mean time taken for sensory blockade in group A was 14.12±6.18 and in group B it was 4.63±1.22 and in group C it was 5.75±1.71. Time to achieve T6 level in group A was13.22±1.43, in group B it was 4.73±1.32 and in group C it was 5.82±1.72. Time for two segment regression in group A was 86.77±3.60, in group B it was 106.4±8.01 and in group C was 102.7±8.05, which shows that group B has better onset of sensory blockade when compared to other three groups.

Onset of motor blockade

The mean time taken to achieve motor block in group A was 17.17±2.01, in group B it was 7.02±1.70 and in group C it was 8.10±2.05. And the time for recovery from motor blockade in group A was 97.77±5.03 and in group B was 121.6±8.42 and in group C was 119.87±10.01. This shows that Group B has faster onset of motor blockade when compare to other two groups

Time for first epidural to up and total number of rescue analgesia

The mean time to first analgesic request in group A was 1.90±0.28 hours and in group B was 3.18±0.83 hours and in group C it was 4.08±0.95 hours. VAS score at 6 and 24 hours in group A was 6.30±0.65 and 6.13±0.57 respectively, in group B was 4.70±1.21 and 4.93±1.31 respectively, in group C it was 4.47±1.04 and 4.03±1.19 respectively. The number of rescue analgesics in group A, 10 required 3 doses of top up requirement in 24hours, 17 required 4 doses of top ups. In group B 4 required single dose, 12 required two doses and 14 required 3doses. In group C only 3 required 3 doses of top ups, 14 required only one dose and 13 required 2 doses. This shows group C has better post operative analgesic effect when compared to other two groups.

Hemodynamic stability:

Baseline HR (bpm) were compared in three groups, which were 86.43±8.98, 81.57±9.96 and 79.47±8.96 in group A, group B and group C respectively.

In group A there were no significant difference in PR, even after 30 minutes of epidural bupivacaine it remained at 83.97±9.96 and there was increased PR seen after 1hour of epidural bupivacaine with normal saline, it was 101.17±10.3 after 120min of epidural.

In group B after 10minutes of epidural bupivacaine with dexmedetomidine PR dropped to 64.87±8.25 and it remained on lower side all though the procedure without tremendous increase in PR. It was 63.5±4.32 even after 120minutes of epidural

In group C, PR remained the same all through the procedure, after 30minutes of epidural bupivacaine with magnesium sulphate it was 75±11.91 and it was 86±7.21 after 120minutes of epidural.

Baseline SBP in all the three groups were 133.63±13.16, 129.6±14.11 and 125.13±11.26 in group A, group B and group C respectively.

In group A there was fall in SBP only after 40minutes of epidural which was 124.97±27.39 and was gradually increasing as the time proceeded, it was 146±7.27 after 120 minutes of epidural.

In group B there was significant fall in SBP after 10minutes of epidural which was 107.3±11.88 and it remained on lower side all through the procedure , it was 108±3.46 after 120 minutes of epidural.

In group C there was fall in blood pressure after 10minutes of epidural but it was not significant when compared to group B which was 115.6±15.62, and there was no much change thereafter, it was 127.87±18.52 after 120minutes of epidural.

Baseline DBP in all three groups were 86.13±11.21, 80.97±10.13 and 82.30±9.07 in group A, group B and group C respectively.

In group A there were no much in fall in DBP after 40minutes of epidural it was 81.07±12.31 and it remained the same all throughout the procedure and started increasing as time proceeded, it was 94.67±8.41after 120minutes of epidural.

In group B there were a significant reduction in DBP after 20minutes of epidural it was 61.03±10.95 and it was on the lower side thereafter, it was 65.33±3.88 after 120minutes of epidural.

In group C there were no much reduction in DBP, it was 73.60±10.60 after 30minutes of epidural and there was no much change thereafter. It was 90.67±2.08 after 120minutes of epidural.

Baseline MAP in all three groups were 101.90±11.35, 97.17±10.66 and 96.60±9.51 in group A, group B and group C respectively.

In group A MAP remains constant and there is no much fall in MAP, it was 95.70±14.79 after 40minutes of epidural, and it was 111.83±7.65 after 120minutes of epidural.

In group B significant reduction of MAP was seen after 30minutes of epidural and it was 74.93±9.51, it was stable all through the procedure and it was 79.67±2.16 after 120minutes of epidural.

In group C MAP remains constant without increase or decrease from its basal value, it was 79.67±2.16 after 30minutes of epidural, and it was 104.33±2.08 after 120minutes of epidural.

By this data it was concluded that group B has better hemodynamic stability when compared to other two groups.

Complications and side effects:

Complications in three groups intra operatively and post operative period in the first 24hrs were noted, 3 in group B had hypotension and one had vomit. 1 had shivering in group A and no complication was seen in group C.

To conclude when epidural dexmedetomidine when added as adjuvant to bupivacaine has fast onset of motor and sensory blockade and better hemodynamic stability. Magnesium has good postoperative analgesic property with no side effects when added as adjuvant to epidural bupivacaine not associated with any complications.

CONCLUSION

From our study we conclude that when dexmedetomidine added as an adjuvant to epidural bupivacaine it provides fast onset of motor and sensory blockade with better hemodynamic stability. And magnesium when added as adjuvant to epidural bupivacaine it provides better post operative analgesics not associated with any complications.

SUMMARY

It was a double blinded randomized control prospective study carried out at R.L.Jalappa Hospital and Research, Tamaka, Kolar, from Jan 2019 to June 2020. Ninety patients of age group 18 – 65 years with ASA grade I, II of either sex undergoing lower abdominal and lower limb surgeries under epidural anaesthesia and fulfilling the inclusion criteria were segregated into three groups based on computer generated randomisation as follows

GROUP A (control group) received epidural bupivacaine 0.5 %(17 ml) + 1ml 0.9% normal saline.

GROUP B received epidural Bupivacaine 0.5 %(17 ml) + 1ml 0.5mcg per kg dexmedetomidine.

GROUP C received epidural Bupivacaine 0.5 %(17 ml) + 1ml 50mg magnesium sulphate.

Baseline HR, NIBP, ECG, SPO2were recorded. Following parameters of blockade characteristics and hemodynamic parameters were noted

I .SENSORY BLOCKADE:

i) Onset of sensory blockade

ii) Time to achieve T6 level

iii) Quality and extent of sensory blockade

II .MOTOR BLOCKADE:

i) Onset of motor blockade

ii) Quality of motor blockade

III. Two segment regression

IV .Time for first epidural top up

V .Hemodynamic stability

VI .Side effects and complications

In the study, three groups were comparable with respect to age, sex, and ASA physical status grading and showed no statistical differences.

There was a significant difference in mean heart rate between three groups at any intervals.

There was a significant difference in mean systolic blood pressure, diastolic blood pressure, and mean arterial pressure among three groups at any intervals.

There was a significant difference in onset of motor and sensory blockade and also post operative analgesics among three groups.

We conclude that when dexmedetomidine added as an adjuvant to epidural bupivacaine it provides fast onset of motor and sensory blockade with better hemodynamic stability. And magnesium when added as adjuvant to epidural bupivacaine it provides better post operative analgesia not associated with any complications.

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ANNEXURES

ANNEXURE - I

PROFORMA

INVESTIGATORS: Dr. Manjula Devi S & Dr. Ravi M, Professor & HOD

DIAGNOSIS:

PROCEDURE:

Name: Age :

Sex : Weight:

Hospital No: ASA Grade:

PRE-ANAESTHETIC EVALUATION:

General examination:

PR: BP:

Pallor/Icterus/Clubbing/Cyanosis/Lymphadenopathy/Edema:

Systemic examination:

Respiratory system -

Cardiovascular system -

Central nervous system -

Per abdomen -

Investigations:

Haemoglobin -

Total leukocyte count -

Platelet count -

Blood grouping -

Blood urea -

Serum creatinine -

Serum sodium -

Serum potassium -

Bleeding time -

Clotting time -

HIV -

HBsAg -

Groups:

GROUP A (control group) will receive epidural bupivacaine 0.5 %(17 ml) + 1ml 0.9% normal saline.

GROUP B will receive epidural Bupivacaine 0.5 %(17 ml) + 1ml 0.5mcg per kg dexmedetomidine.

GROUP C will receive epidural Bupivacaine 0.5 %(17 ml) + 1ml 50mg magnesium sulphate.

Baselines:

- Heart rate -
- Systolic blood pressure -
- Diastolic blood pressure -
- Mean arterial pressure -
- Oxygen saturation-

Regional anaesthesia:

Procedure -

Posture -

Space -

Drug -

Level of blockade -

INTRAOPERATIVE VITALS

	0 MIN	3	5	10	20	30	40	50	60	90	120
PR											
NIBP											
SPO_2											

Total duration of surgery:

Duration of sensory regression by two segments:

Recovery from motor block:

Time of first analgesia request:

Total analgesic use in 24hours:

VAS - VISUAL ANALOGUE SCALE (for pain)

0 - No pain

1-3 - mild pain

4-6 - moderate pain

7-10 - severe pain

TIME	VAS (FOR PAIN)
First analgesia request	
6th hour	
12th hour	
18th hour	
24th hour	

Any significant side effects

1) Hypotension-

2) Bradycardia-

3) Vomiting-

4) Shivering-

5) Pruritis-

6) Others

ANNEXURE - II

PATIENT INFORMATION SHEET

Title of the study: STUDY TO EVALUATE USEFULNESS OF MAGNESIUM SULPHATE AND DEXMEDETOMIDINE AS ADJUVANT TO BUPIVACAINE FOR LOWER LIMB AND ABDOMINAL SURGERIES UNDER EPIDURAL ANAESTHESIA

The main objective of the study is to compare the efficacy of magnesium sulphate and dexmedetomidine as an adjuvant to bupivacaine for lower limb and lower abdominal surgeries under epidural anaesthesia.

Purpose of the research: Opioids, midazolam, ketamine are used as adjuvant to bupivacaine in lower abdominal and lower limb surgeries which may cause various side effects like nausea, vomiting, pruritis , respiratory depression, urinary retention in order to avoid these side effects, I use and compare the efficacy dexmedetomidine and magnesium sulphate as an adjuvant to bupivacaine under epidural anaesthesia. Magnesium sulphate added as an adjuvant to bupivacaine shortens the onset of sensory and motor blockade and helps in prolonging post operative analgesia without any significant side effects.

Dexmedetomidine added as adjuvant significantly produces increased duration of motor and sensory blockade, it also reduces number of rescue analgesia with better hemodynamic stability.

Procedures and Protocol:

This is a randomized double blind prospective study. 90 patients undergoing lower abdominal and lower limb surgeries at R. L. Jalappa Hospital and Research Centre, Tamaka , Kolar, during the period from January 2019 to June 2020 will be included in the study.

After obtaining informed consent, 90 patients will be randomly divided into 3 groups of 30 each. Randomization will be done by computer generated table.

GROUP A (control group) will receive epidural bupivacaine 0.5 %(17 ml) + 1ml 0.9% normal saline.

GROUP B will receive epidural Bupivacaine 0.5 %(17 ml) + 1ml 0.5mcg per kg dexmedetomidine.

GROUP C will receive epidural Bupivacaine 0.5 %(17 ml) + 1ml 50mg magnesium sulphate.

Reimbursements: You will not be given money or gifts to take part in this research.

Confidentiality: We will not be sharing the identity of the participant. The information we collect from you will be kept confidential and only researchers involved in this project will have access to it.

Right to Refuse or Withdrawal: You do not have to take part in this research if you do not wish to do so and you can refuse to participate.

Whom to Contact: If you have any questions you may ask us now or later, even after the study has started, you may contact the following person:

For more information:

DR. MANJULA DEVI S

Post Graduate in Anaesthesiology

Sri Devaraj Urs Medical College, Tamaka, Kolar.

Mobile- 9597138951

Email – manjuselva47@gmail.com

Dr. RAVI M

Professor and H.O.D of Anaesthesiology

Sri Devaraj Urs Medical College, Tamaka, Kolar.

Mobile – 9845287591

Email - ravijaggu@gmail.com

ANNEXURE - III

INFORMED CONSENT FORM

Name of the institution: SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH.

Title of the project: STUDY TO EVALUATE USEFULNESS OF MAGNESIUM SULPHATE AND DEXMEDETOMIDINE AS ADJUVANT TO BUPIVACAINE FOR LOWER LIMB AND ABDOMINAL SURGERIES UNDER EPIDURAL ANAESTHESIA

Name of the principal investigator: Dr. Manjula Devi S

Name of the guide: Dr. Ravi M

Name of the co guide: Dr Dinesh K

Name of the subject/participant:

I, _____ aged _____ ,after being explained in my own vernacular language about the purpose of the study and the risks and complications of the procedure, hereby give my valid written informed consent without any force or prejudice for taking magnesium sulphate, dexmedetomidine as adjuvant to bupivacaine in epidural anaesthesia for the purpose of prolonging anaesthetic and analgesic effect. The nature and risks involved have been explained to me to my satisfaction. I have been explained in detail about the study being conducted. I have read the patient information sheet and I have had the opportunity to ask any question. Any question

that I have asked, have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research. I here by give consent to provide my history, undergo physical examination, undergo the procedure, undergo investigations and provide its results and documents etc to the doctor / institute etc. All the data may be published or used for any academic purpose. I will not hold the doctors / institute etc responsible for any untoward consequences during the procedure / study. A copy of this Informed Consent Form and Patient Information Sheet has been provided to the participant.

_____ _____

(Signature & Name of Pt. Attendant) (Signature & Name of Pt)

(Relation with patient)

DATE:

Investigator signature

KEY TO MASTER CHART

M	: Male
F	: Female
Kgs	: Kilogram
ASA PS	: American Society of Anaesthesiologists physical Status
HR	: Heart rate
SBP	: Systolic blood pressure
DBP	: Diastolic blood pressure
MAP	: Mean arterial pressure
mmHg	: Millimetre of mercury
SPO2	: Peripheral capillary oxygen saturation
VAS	: Visual analogue scale
Mins	: Minutes
Secs	: Seconds
L	: Left
R	: Right
ORIF	: Open reduction with internal fixation
#	: Fracture
IT	: Intertrochanteric
IMIL	: Intramedullary Interlocking
NVD	: Neuro vascular deficit
DNVD	: Distal neuro vascular deficit
AUB	:Abnormal uterine bleeding

MASTER CHART

SI.NO	GROUP	UHID	SEX	AGE (yrs)	DIAGNOSIS	PROCEDURE	ASA	WEIGHT	ONSET OF SENSORY BLOCK (mins)	ONSET OF MOTOR BLOCK (mins)	TIME TO ACHIEVE T6 LEVEL (mins)	DURATION OF SURGERY (mins)	TIME FOR TWO SEGMENT REGRESSION (mins)	RECOVERY FROM MOTOR BLOCK (mins)	TIME FOR FIRST ANALGESIC REQUEST (hours)	VAS SCORE (1-10): At the time of first analgesic request a1	6 hours after surgery a2	12hours after surgery a3	24hours after surgery a4	TOTAL DOSE OF ANALGESIC GIVEN IN 24 HOURS	PRE OPERATIVE VITALS: PR (BPM) a1	SBP (mmHg) b1	dbp c1	d1	SPO2% e1
1	A	629984	M	28	Closed R femur #	CRIF with IMIL nailing	I	67	12.5	15	12.5	85	96	108	2	6	7	7	6	4	82	130	80	96.7	100
2	A	623907	F	57	Closed displaced # of R both bones	ORIF with IMIL nailing R tibia	II	62	12.5	15	12.5	86	88	93	1.5	6	6	7	6	3	92	150	100	117	100
3	A	627568	M	58	Closed displaced # of neck of L femur	L bipolar hemiarthroplasty	I	63	12	15	12	95	89	100	1.5	6	7	6	6	4	106	144	92	109	97
4	A	832241	M	18	Recurrent appendicitis	Open appendicectomy	I	48	13	18	13	60	88	93	2	6	7	7	6	4	84	110	70	83.3	100
5	A	838412	M	58	Schwanomma over medial aspect of R leg	Excision	I	69	15	19	15	120	82	109	2	6	6	7	5	4	85	140	100	113	99
6	A	615450	M	20	Polytrauma with R tibia exposure with implant insitu	Wound debridement and transposition of flap	I	55	11	14	14	65	85	98	1.5	6	6	7	7	4	86	118	76	90	100
7	A	832922	M	48	R inguinal hernia	R Hernioplasty	I	72	13.5	17	13.5	85	89	98	2	6	6	5	6	4	89	150	100	117	100
8	A	840267	F	28	Umblical hernia	Hernioplasty	I	68	13	19	13	60	84	92	1.5	6	5	6	6	4	89	120	90	100	100
9	A	320236	F	41	Varicose vein of L lower limb	Trendelenberg procedure with stripping of veins	I	66	12	18	12	75	83	96	1.5	7	5	6	6	4	75	120	80	93.3	99
10	A	828659	F	55	Paraumblical hernia	Mesh repair	I	42	11	15	11	68	84	92	1.5	7	6	5	6	4	94	130	80	96.7	100
11	A	710496	M	25	Closed R bimalleolar #	ORIF with CC screw for R medial malleolus with plating for R lateral	I	79	14.5	20	14.5	100	85	102	2	6	6	6	5	3	98	140	100	113	100
12	A	765851	F	27	UMblical hernia	Mesh repair	I	64	14.5	18.5	14.5	70	85	99	2	6	7	7	7	4	87	120	70	86.7	100
13	A	628570	M	27	Closed Gillin type IV IT # with open type II both bone # distal one third	ORIF with variable locking plate with LCP	I	70	12	14	12	120	93	104	2	6	7	7	6	5	89	138	79	98.7	100
14	A	837971	M	45	Umblical hernia	Hernioplasty	I	71	14	18	14	80	89	94	2	7	6	5	6	4	94	130	90	103	100
15	A	629568	M	19	Closed # both bones at middle third	CRIF with nailing of R tibia	I	49	11	16	11	72	80	92	2	7	6	6	7	4	67	108	64	78.7	98
16	A	614555	M	60	Post op case of wound debridement and spanning Ex fix application for R	Ex fix removal and ORIF with distal femurLCP fpr R femur with wound	I	76	13	16	13	129	83	101	1.5	6	6	5	6	5	92	144	88	107	98
17	A	821391	M	50	Necrotising fascitis of R lower limb	Fasciotomy and wound debridement	II	55	14	20	14	70	86	102	2	6	7	7	6	3	58	90	60	70	98
18	A	846740	F	52	L leg bimalleolar #	ORIF with TBW for medial malleoli	I	69	13.5	17	13.5	85	88	101	2	6	5	7	7	4	84	130	70	90	98
19	A	825458	M	49	Varicose vein of R lower limb	Trendelenberg procedure with stripping of veins	I	75	13	18	13	90	88	94	2	6	6	6	5	3	78	130	80	96.7	100
20	A	623550	M	38	# of L proximal femur	CRIF with IMIL nailing	I	56	11	14	11	85	86	94	2.5	7	7	7	6	3	84	154	101	119	98
21	A	819623	F	34	Umblical hernia	Mesh repair	I	69	12	16	12	85	90	98	2	7	6	6	6	4	88	130	90	103	100
22	A	879415	F	49	UV prolapse	Vaginal hysterectomy	II	42	11	16	11	120	88	104	2	8	6	6	6	4	70	110	60	76.7	99
23	A	708740	F	33	Paraumblical hernia	Hernioplasty	I	74	12	16	12	65	87	99	2	6	7	6	6	3	87	120	90	100	98
24	A	628067	M	30	4.5 months old uniting both bone # of L leg with antibiotic coated nail	Exfix removal with exchange of K nail and orthofix	I	50	46	21	16	120	94	106	1.5	8	7	8	7	5	97	130	90	103	100
25	A	357305	M	16	#years old united R femur shaft # with IMIL nail insitu	IMplant removal	I	58	13	16	13	70	88	96	2	7	7	6	6	3	82	134	83	100	99
26	A	818002	M	43	L inguinal hernia	L hernioplasty	I	58	15	19	15	60	82	94	2	7	6	6	6	3	84	130	90	103	100
27	A	698272	M	36	R sided hydrocele with bilateral inguinal hernia	Jobouleys procedure with R hernioplasty	I	74	15	20	15	120	87	96	2	7	7	6	6	4	87	130	90	103	100
28	A	866638	M	35	Open type II b # of distal third of R tibia	CRIF with IMIL nailing	I	69	16	19	16	75	88	94	2.5	6	6	7	7	3	92	130	100	110	100
29	A	801546	F	48	R adnexal mass	Total abdominal hysterectomy with bilateral	II	62	13.5	16.5	13.5	90	83	92	2	6	6	6	7	4	92	150	90	110	100
30	A	848213	M	47	Closed R shaft of femur #	CRIF with IMIL nailing	I	52	14	19	14	60	85	92	2	7	7	6	6	3	88	130	70	90	99
31	B	447914	M	37	14months old united R femur # and united R tibial # with IMIL nail insitu	Implant removal	I	69	3	5	3	50	117	90	1.5	4	5	5	6	3	68	109	74	85.7	97
32	B	795946	M	38	Open type IIIB communited # of both bones of distal 3rd of L leg	ORIF with external fixation	I	70	4	6.5	4	90	109	113	3.5	4	3	3	4	2	108	110	68	82	100
33	B	795092	M	35	Closed undisplaced R lateral femoral condyle # with extension of R	closed reduction and internal fixation with CC screw fixation with	I	78	4	6	4	90	98	122	2.5	4	6	7	7	3	84	120	70	86.7	100
34	B	785908	F	65	Closed L leg both bone # at proximal end, Neck of fibula # and tibial #	Closed reduction and and spanning external fixation	I	63	7	10	6	120	101	119	3	5	4	3	4	2	78	120	70	86.7	98
35	B	784709	M	40	closed 5month old L tibia #	Osteotomy with CRIF	II	74	4	8	8	118	122	133	4	4	5	6	6	3	72	162	89	113	100
36	B	782775	M	24	Closed displaced # of Lfemur	CRIF with long PFN for femur	I	50	5	7	5	112	108	126	2.5	4	6	6	7	3	102	141	72	95	100
37	B	790759	F	38	Unicarmel cyst of R acetabulum	Surgical dislocation of R hip with bone grafting and currettage	I	63	4	6	4	122	118	138	3	6	6	5	5	3	97	120	70	86.7	100
38	B	584953	M	49	1.5 year old post op R IT # with broken implant insitu	IMplant removal with CRIF and PFN fixation	II	78	6	12	6	119	105	112	3	4	5	4	4	2	82	130	83	98.7	100
39	B	621710	M	23	Partial L ACL tear of R knee	Arthroscopic reconstruction	I	67	6	8.5	6	80	92	113	3.5	5	4	3	3	1	84	126	82	96.7	99
40	B	629570	M	55	Spiral # of L tibia middle one third	CRIF with IMIL nailing of L tibia	I	72	4.5	7	4.5	78	101	129	2.5	5	6	5	5	2	88	146	92	110	99
41	B	629550	F	35	Open type II communited dispalced # of shaft of R femur at middle one third	CRIF with IMIL nailing of R femur	I	68	3.5	6.5	3.5	90	108	126	2	6	5	6	6	3	84	139	84	102	100
42	B	628115	F	60	IT # of R femur with open type II communited # of distal third of femur with	CRIF with DHS for R IT # and knee spanning Ex fix for # of distal one of	II	58	6	8	6	99	91	108	3.5	4	3	3	4	2	89	134	82	99.3	97
43	B	628678	M	22	Open type II middle one third of tibia # of L leg without NVD	CRIF with IMIL nailing of L tibia	I	64	3	4.5	3	68	98	126	3	5	6	6	7	3	68	101	64	76.3	98
44	B	619171	F	52	closed L hoffas #	CC screw fixation for L hoffas #	II	60	6	8	6	70	91	112	3.5	4	4	3	4	2	88	162	89	113	98
45	B	627622	M	58	Closed comminuted # mid shaft of R tibia without NVD	CRIF with IMIL nailing R tibia	II	76	5	9	5	86	104	116	4.5	5	4	3	3	2	82	128	88	101	99
46	B	511764	M	42	10 months old united # of midshaft of R femur with IMIL nail insitu with	Exchange nailing with bone grafting	I	78	3.5	6	3.5	96	108	121	2.5	5	6	7	6	3	78	120	84	96	99
47	B	618860	M	30	#L femur distal one third without DVND	CRIF with IMIL nailing	I	79	6.5	8	6.5	80	94	109	4.5	5	4	3	4	2	94	134	80	98	99
48	B	620976	M	38	United # both bones L leg middle one third with infected IMIL nail in situ	Implant removal	I	64	3.5	6	3.5	55	106	128	3.5	5	6	7	5	2	83	110	70	83.3	99
49	B	623857	M	45	Closed displaced # of L femur without NVND	CRIF with IMIL nailing	I	61	5.5	8	5.5	75	98	118	4.5	5	3	4	3	2	66	126	74	91.3	98
50	B	622978	M	28	Closed communited # of mid shaft of L femur	ORIF with IMIL nailing	I	73	4	5	4	90	104	128	3	6	7	6	6	3	84	134	78	96.7	99
51	B	622976	M	60	Closed# of both bones R leg and tibial # at middles one third	Closed reduction with IMIL nailing of tibia	II	64	6	7.5	6	60	98	116	3.5	5	4	3	4	1	56	130	70	90	99
52	B	626222	F	35	5years old operated L tibia # with IMIL nail in situ	Implant removal	I	59	3	4.5	3	50	103	126	3	6	5	7	6	2	82	128	74	92	99
53	B	828659	F	55	Paraumblical hernia	Mesh repair	II	64	3	6	3	60	108	131	2.5	5	4	5	6	3	72	140	90	107	99
54	B	849904	M	25	Closed displaced # of L femur middle one third	CRIF with IMIL nailing	I	84	4	6	4	90	98	123	3.5	5	4	6	5	3	76	120	80	93.3	100

INTRA OPERATIVE VITALS

SI.NO	PR(BPM) (mins) 0 a2	3 a3	5 a4	10 a5	20 a6	30 a7	40 a8	50 a9	60 a10	90 a11	120 a12	SYSTOLIC BLOOD PRESSURE(mmHg) (mins) 0 b2	3 b3	5 b4	10 b5	20 b6	30 b7	40 b8	50 b9	60 b10	90 b11	120 b12
1	84	82	87	84	80	78	82	86	88	10000	1000	131	133	130	129	134	139	136	131	134	1000	1000
2	92	96	90	88	91	86	89	83	86	92		148	142	141	139	136	135	143	144	141	150	
3	103	104	94	98	102	96	92	94	98	103		144	134	139	131	129	133	138	128	141	144	
4	85	87	80	78	74	75	72	70	76			118	117	112	111	108	109	110	115	114		
5	85	84	83	89	85	91	85	86	92	94	101	144	146	138	142	135	132	144	149	146	153	156
6	89	84	82	89	91	89	93	96	104			120	126	118	129	131	138	139	141	136		
7	85	86	84	88	89	79	75	85	82			154	147	145	139	142	146	136	144	149		
8	89	87	85	85	88	86	88	89	92			131	129	126	134	127	131	128	125	129		
9	75	74	72	78	76	74	75	71	75			128	114	118	119	112	116	114	124	127		
10	94	92	88	89	87	85	91	92	95			133	128	124	119	134	137	136	128	132		
11	98	95	88	91	83	97	92	91	105	102		142	138	132	137	129	136	139	142	144	146	
12	86	87	89	82	84	86	89	88	81			128	122	124	127	131	129	134	137	129		
13	89	84	88	91	94	93	90	86	89	83	89	142	139	132	129	131	128	132	136	129	138	141
14	98	97	92	88	86	84	87	88	89			136	129	124	138	141	146	148	139	142		
15	67	69	63	59	61	69	74	81	86			110	112	106	104	109	98	99	124	128		
16	94	93	88	86	89	91	94	93	104	116	108	143	139	144	149	136	142	139	141	143	151	149
17	59	56	54	52	56	57	58	54	52			93	98	96	91	97	94	92	95	91		
18	84	86	82	88	86	91	89	87	92			134	131	128	126	129	132	129	128	135		
19	78	75	78	74	73	79	82	85	88	92		130	128	126	129	127	123	3	130	135	136	
20	89	84	86	88	86	83	78	74	83			153	149	145	149	139	141	149	139	141	143	
21	86	84	82	87	86	85	84	83	84			132	129	131	127	129	125	124	128	129		
22	74	70	68	65	71	73	75	78	79	81	89	115	118	116	112	103	104	108	125	127	131	135
23	84	85	81	86	82	87	84	86	89			128	121	123	125	128	132	127	125	126		
24	91	92	97	94	98	107	103	104	108	111	114	138	132	139	130	128	135	134	139	144	147	149
25	86	89	87	85	84	89	83	84				136	131	129	127	134	139	141	138	136		
26	86	84	85	88	82	81	83	80	87			136	127	123	125	128	126	127	129	133		
27	89	85	87	89	82	91	92	93	99	104	106	135	131	127	135	128	136	134	140	143	145	146
28	94	92	90	88	86	84	82	91	92			135	139	131	128	126	134	137	136	129		
29	91	85	87	81	86	87	84	91	97	99		154	150	147	135	134	138	132	140	145	149	
30	89	85	82	72	78	66	64	63	64			138	122	117	112	104	102	97	99	97		
31	68	63	64	74	68	69	66	67				101	108	113	108	94	99	97	99			
32	92	87	80	75	74	72	61	64	67	60	61	120	110	118	109	105	104	104	121	120	123	113
33	91	79	73	63	64	60	61	59	62	67		126	123	110	105	103	107	104	105	107	109	
34	78	76	66	64	55	56	52	58	63	59	60	120	80	90	90	100	90	100	90	90	80	110
35	77	74	88	68	64	66	62	61	60	64	69	160	154	140	117	123	118	113	110	102	108	107
36	101	90	82	64	60	61	65	68	60	62		141	131	126	110	100	116	105	121	118	104	
37	97	82	78	72	71	69	65	64	65	68	62	120	102	106	96	101	112	98	99	103	107	109
38	83	86	87	88	87	72	64	68	66	67	69	140	144	132	129	118	107	109	111	104	102	103
39	82	78	74	76	72	69	64	60	74			126	124	129	121	117	102	104	109	114		
40	84	79	66	62	58	54	52	55				140	123	109	86	94	85	94	96	99		
41	84	74	68	66	62	61	59	62	64			139	118	108	101	103	102	94	96	100	98	
42	89	83	84	78	75	65	61	66	60	62		134	127	122	116	114	105	103	107	101	99	
43	68	62	60	59	48	43	42	40				101	96	90	94	93	96	99	104	108		
44	89	86	72	70	71	75	77	71	68			166	142	132	126	116	107	101	110	117		
45	84	86	88	74	72	74	76	78	74	70		131	126	121	126	118	138	129	130	128	131	
46	72	70	74	66	65	53	51	54	56	53		128	121	118	109	103	101	110	101	99	98	
47	98	86	78	65	69	68	74	70	72			134	119	111	120	109	108	116	121	119		
48	80	74	73	63	68	61	66	67				110	103	108	94	96	99	98	103			
49	68	64	62	58	64	68	68	65	61			128	118	120	109	107	112	111	107	109		
50	84	82	78	74	71	63	60	61	54	68		138	131	124	118	108	106	109	103	104	103	
51	56	58	61	63	64	59	64	68	68			138	129	118	119	131	116	114	117	119		
52	84	83	68	64	63	61	62	61				125	108	90	86	84	89	96	99			
53	78	72	69	66	64	62	59	58	60			132	129	114	104	99	97	94	92	90		
54	78	72	71	68	66	64	63	61	59	60		123	117	106	103	98	97	95	92	90	92	

SI.NO	DIASTOLIC BLOOD PRESSURE(mmHg) (mins) 0 c2	3 c3	5 c4	10 c5	20 c6	30 c7	40 c8	50 c9	60 c10	90 c11	120 c12	MEAN ARTERIAL BLOOD PRESSURE (mm Hg) (mins) 0 d2	3 d3	5 d4	10 d5	20 d6	30 d7	40 d8	50 d9	60 d10	90 d11	120 d12
1	86	78	76	78	81	84	82	79	81	1000	1000	101	96	94	95	99	102	100	96	99	1000	1000
2	99	84	83	81	83	84	83	79	81	86		115	103	102	100	101	101	103	101	101	107	
3	86	82	81	84	79	82	86	76	89	88		105	99	100	100	96	99	103	93	106	107	
4	70	74	68	64	67	64	65	66	69			86	88	83	80	81	79	80	82	84		
5	104	102	97	2	96	84	92	93	97	96	103	117	117	111	49	109	100	109	112	113	115	121
6	71	80	74	79	82	85	87	86	89			87	95	89	96	98	103	104	104	105		
7	101	98	96	85	86	91	87	92	86			119	114	112	103	105	109	103	109	107		
8	88	82	81	79	83	85	84	83	85			102	98	96	97	98	100	99	97	100		
9	82	86	84	81	79	75	76	78	79			97	95	95	94	90	89	89	93	95		
10	87	82	84	83	85	87	85	87	82			102	97	97	95	101	104	102	101	99		
11	98	92	84	86	94	92	86	84	97	92		113	107	100	103	106	107	104	103	113	110	
12	82	83	87	78	79	82	87	81	83			97	96	99	94	96	98	103	100	98		
13	82	92	84	81	84	79	84	86	84	78	84	102	108	100	97	100	95	100	103	99	98	103
14	88	86	81	76	92	91	89	90	87	89		104	100	95	97	108	109	109	106	105	59	
15	68	61	59	66	62	54	47	78	76			82	78	75	79	78	69	64	93	93		
16	81	74	86	82	84	85	83	81	86	92	89	102	96	105	104	101	104	102	101	105	112	109
17	58	54	51	53	48	49	46	45	51			70	69	66	66	64	64	61	62	64		
18	82	81	79	75	76	84	81	82				99	98	95	92	94	100	97	97	45		
19	88	85	81	87	86	84	82	89	88			102	99	96	101	100	97	56	103	104	45	
20	99	98	92	96	89	84	86	84	89	88		117	115	110	114	106	103	107	102	106	106	
21	92	90	88	86	84	87	83	89	84			105	103	102	100	99	100	97	102	99		
22	68	64	61	70	75	74	78	79	85	86	89	84	82	79	84	84	84	88	94	99	101	104
23	89	87	80	83	81	86	84	85	89			102	98	94	97	97	101	98	98	101		
24	85	87	91	96	92	88	97	98	99	101	104	103	102	107	107	104	104	109	112	114	116	119
25	82	84	81	79	84	91	81	79	81			100	100	97	95	101	107	101	99	99		
26	85	81	79	72	78	74	76	72	81	83		102	96	94	90	95	91	93	91	98	55	
27	92	94	90	93	87	85	92	90	97	96	99	106	106	102	107	101	102	106	107	112	112	115
28	104	98	95	91	84	86	89	94	97			114	112	107	103	98	102	105	108	108		
29	99	95	91	88	87	92	97	94	101	99		117	113	110	104	103	107	109	109	116	116	
30	88	72	70	68	57	58	57	52	49			105	89	86	83	73	73	70	68	65		
31	68	74	68	64	58	54	51	59				79	85	83	79	70	69	66	72			
32	70	65	71	69	58	58	54	69	69	70	66	87	80	87	82	74	73	71	86	86	88	82
33	72	72	60	59	56	55	57	57	56	62		90	89	77	74	72	72	73	73	73	78	
34	70	50	40	60	60	60	60	60	60	50	60	87	60	57	70	73	70	73	70	70	60	77
35	98	84	78	63	64	62	60	66	64	63	68	119	107	99	81	84	81	78	81	77	78	81
36	72	60	66	62	71	47	53	62	58	62		95	84	86	78	81	70	70	82	78	76	
37	71	68	64	58	52	51	54	56	62	53	61	87	79	78	71	68	71	69	70	76	71	77
38	82	81	74	72	68	60	65	66	63	61	68	101	102	93	91	85	76	80	81	77	75	80
39	82	84	78	81	82	79	74	72	71			97	97	95	94	94	87	84	84	85		
40	92	84	74	47	42	41	52	50	61			108	97	86	60	59	56	66	65	74		
41	86	71	64	59	51	54	51	50	51	55		104	87	79	73	68	70	65	65	67	69	
42	82	66	62	61	60	54	57	56	52	50		99	86	82	79	78	71	72	73	68	66	
43	64	52	51	48	46	43	55	61	67			76	67	64	63	62	61	70	75	81		
44	89	74	71	80	69	86	76	74	72			115	97	91	95	85	93	84	86	87		
45	89	84	78	72	64	78	71	79	79	81		103	98	92	90	82	98	90	96	95	98	
46	79	73	71	64	59	61	59	64	58	62		95	89	87	79	74	74	76	76	72	74	
47	83	71	84	71	79	74	73	71	68			100	87	93	87	89	85	87	88	85		
48	72	61	64	61	52	62	71	68				85	75	79	72	67	74	80	80			
49	78	61	73	75	63	64	61	67	66			95	80	89	86	78	80	78	80	80		
50	84	74	68	63	51	54	51	54	58	64		102	93	87	81	70	71	70	70	73	77	
51	84	76	72	71	81	76	79	74	70			102	94	87	87	98	89	91	88	86		
52	82	71	53	49	41	52	64	68				96	83	65	61	55	64	75	78			
53	92	86	76	69	64	58	56	52	48			105	100	89	81	76	71	69	65	62		
54	81	80	76	64	62	61	59	52	50			95	92	86	77	74	73	71	65	63	31	

SI.NO	SPO2(%)(mins) 0 e2	3 e3	5 e4	10 e5	20 e6	30 e7	40 e8	50 e9	60 e10	90 e11	120 e12	COMPLICATIONS
1	99	99	98	99	98	99	98	99	100	###	###	No
2	100	100	100	100	99	100	100	100	99	99		No
3	98	97	98	98	98	98	98	98	98	98		No
4	100	100	100	100	100	100	100	100	100			no
5	100	99	99	99	99	99	99	99	99	99	99	no
6	100	100	99	99	99	98	99	100	100			Shivering
7	100	99	99	99	99	99	99	99	100			no
8	100	100	100	100	100	100	100	100	100			no
9	100	100	100	98	100	100	100	99	99			no
10	98	99	99	97	99	98	98	99	100			no
11	100	100	100	100	99	98	99	98	99	100		NO
12	99	100	99	98	99	100	99	100	100			NO
13	100	100	100	100	99	99	100	100	100	100	100	No
14	100	100	99	99	100	100	100	100	100			no
15	100	99	99	99	99	98	99	99	99			no
16	100	99	100	100	100	99	99	99	100	99	100	no
17	99	98	99	98	99	99	99	99	98			NO
18	99	99	98	100	99	99	99	99	99			no
19	99	99	99	99	100	100	100	100	100	100		no
20	100	99	99	99	98	99	98	99	99	99		no
21	100	99	100	100	100	100	99	100	100			no
22	100	99	97	97	99	99	99	98	98	99	100	NO
23	99	99	99	97	98	99	97	98	99			NO
24	100	97	96	98	96	97	99	98	99	99	99	NO
25	100	99	98	98	98	98	99	98	99			no
26	100	99	99	99	99	98	99	99	99			no
27	99	99	99	97	98	100	98	99	97	99	100	NO
28	99	99	99	99	100	99	100	99	100			NO
29	100	100	100	100	99	100	100	99	100	99		NO
30	99	98	97	98	99	98	96	98	97			NO
31	99	100	99	100	98	98	98	98				no
32	100	99	100	100	100	99	99	99	99	99	100	No
33	99	98	99	99	99	100	100	100	100	100		No
34	98	98	100	100	100	100	100	100	100	97	99	No
35	100	100	99	100	99	100	100	100	100	100	100	No
36	100	100	100	99	100	100	100	100	100	99		No
37	100	100	100	100	100	100	100	100	100	100	100	No
38	100	100	100	100	100	100	100	100	100	100	100	No
39	100	100	100	99	98	99	100	100	100			No
40	100	100	99	98	98	98	98	98	99			Hypotension
41	100	98	96	98	96	99	98	99	99	99		No
42	100	99	99	98	99	99	99	99	100	100		no
43	100	99	98	98	99	99	99	99	99			no
44	100	100	99	99	100	100	100	99	100			no
45	100	99	99	99	98	99	98	100	99	100		no
46	100	99	99	98	99	99	99	99	99	99		no
47	100	99	99	99	99	99	99	99	99			no
48	100	99	99	99	99	99	99	98				no
49	100	99	98	99	99	99	99	98	100			no
50	98	98	98	87	98	98	98	99	100	99		no
51	99	99	98	100	99	98	99	99	99			no
52	99	99	99	99	99	99	99	99				Hypotension
53	99	100	100	100	99	98	99	99	99			no
54	99	99	99	100	100	100	98	99	99	99		no

MASTER CHART

55	B	850504	M	55	Closed # of tibia middle one third	CRIF with IMIL nailing	I	78	6	8	6	70	94	106	3	4	4	3	3	1	94	130	100	110	100
56	B	852198	M	60	R neck of femur #	R bipoloar hemiarthroplasty	II	61	4.5	7	4.5	120	106	126	3	6	5	6	6	3	86	140	100	113	99
57	B	837573	M	20	Acute appendicitis	Open appendicectomy	I	54	3.5	5	3.5	70	102	125	3	5	4	5	6	3	73	110	70	83.3	100
58	B	834974	F	53	Incisional hernia	Mesh repair	II	83	6	9	6	90	96	114	2.5	4	3	4	4	2	72	130	90	103	100
59	B	759471	M	48	R inguinal hernia	R Hernioplasty	I	86	3.5	5.5	3.5	90	111	131	2.5	6	7	6	6	3	79	130	100	110	100
60	B	983021	M	59	R inguinal hernia	R Hernioplasty	II	74	5.5	7	5.5	75	92	111	5.5	4	3	3	3	1	82	120	60	80	100
61	C	815680	M	21	Acute appendicitis	Open appendicectomy	I	58	3.5	4.5	3.5	65	108	122	2.5	6	5	6	6	3	79	120	90	100	100
62	C	827924	M	30	R sided varicocele	Varicocelectomy	I	62	8	7	9	60	97	115	4.5	5	4	5	5	2	69	100	60	73.3	100
63	C	828519	M	60	Varicose vein of R lower limb	Trendelenberg procedure with stripping of veins	II	58	4.5	6	4.5	90	103	132	3	6	6	5	5	2	83	120	90	100	100
64	C	828738	M	38	Incisional hernia	Mesh repair	I	66	6.5	8.5	6.5	78	94	113	5.5	4	4	3	3	1	74	120	70	86.7	100
65	C	814340	M	37	R inguinal hernia	R Hernioplasty	I	74	3.5	6	3.5	70	109	122	3.5	6	6	5	5	3	85	120	90	100	100
66	C	841492	M	30	Acute appendicitis	Open appendicectomy	I	58	6	8	6	50	95	109	4.5	4	4	3	3	1	85	120	90	100	100
67	C	840445	M	58	Non healing ulcer with osteomyelitis of first, second, third toes ofR leg	Transmetatarsal amputation	II	52	4	6	4	80	105	132	2.5	6	5	5	5	2	89	130	90	103	100
68	C	814408	F	36	Umblical hernia	Hernioplasty	I	64	4	8	4	62	118	134	3	6	6	5	4	2	75	120	80	93.3	100
69	C	834059	M	22	Bilateral psoas abcess	Incision and drainage	I	57	6	9	6	90	101	116	4.5	4	3	3	3	2	89	120	90	100	100
70	C	835077	M	33	Acute appendicitis	Open appendicectomy	I	52	4	6	4	60	114	127	3	6	5	6	6	2	76	120	60	80	100
71	C	756943	F	60	Post hartmanns procedure end colostomy	Revision stoma	II	46	3.5	7	4.5	45	118	136	3	6	6	5	5	2	70	130	80	96.7	100
72	C	833771	M	38	R Periurethral abscess	Incision and drainage	I	78	7	10	7	50	104	115	5.5	4	3	3	3	1	78	110	70	83.3	100
73	C	822754	M	60	Wet gangrene over R leg	R above knee amputation	I	52	4	7	4	90	114	128	3.5	6	6	6	5	2	84	130	100	110	100
74	C	438976	M	29	Healing ulcer over L leg	Split skin grafting	I	74	6	8	6	60	97	113	4	5	3	3	3	1	84	130	90	103	99
75	C	392406	F	45	UMblical hernia	Mesh repair	I	61	5	8	5	70	117	123	3	6	5	5	5	2	74	110	90	96.7	98
76	C	820913	F	46	Recurrent appendicitis	Open appendicectomy	I	67	8	10	8	50	92	109	3.5	6	4	3	3	1	60	100	50	66.7	97
77	C	803591	F	48	AUB-F	Total Abdominal hysterectomy	I	65	6	9	6	60	101	118	4	5	4	3	3	1	76	130	90	103	100
78	C	831496	F	60	AUB-F	Total Abdominal hysterectomy	I	54	3.5	5	3.5	90	102	112	4.5	5	4	4	3	1	54	90	50	63.3	100
79	C	748370	M	59	Non healing ulcer with osteomyelitis of R tibia	Below knee amputation	II	52	4.5	6	4.5	90	113	133	3	4	3	3	3	2	92	140	90	107	100
80	C	706974	M	60	Heal defect	Transposition of flap and SSG	I	72	7.5	10.5	7.5	120	118	121	4	4	4	4	3	2	78	120	90	100	100
81	C	719608	M	31	R inguinal hernia	Hernioplasty	I	67	4	6	4	75	109	134	4	6	6	5	6	3	87	130	70	90	100
82	C	696746	M	32	Giant cell tumour of R tibia and fibula	Enblock tumor excision	I	61	6.5	9	6.5	125	102	117	5	4	4	4	3	1	64	110	70	83.3	99
83	C	692954	M	25	Post traumatic raw area over R foot	Split skin grafting	I	54	5.5	6.5	5.5	60	118	135	4.5	6	6	7	6	2	87	130	80	96.7	99
84	C	695983	M	35	Incisional hernia	Meshplasty	I	76	8	11	8	65	107	119	5.5	4	4	3	3	1	86	120	90	100	100
85	C	776910	F	45	AUB with umblical hernia	Total Abdominal hysterectomy with mesh repair	I	69	8	11	8	130	107	127	5	4	4	3	3	1	88	130	80	96.7	100
86	C	800161	F	45	AUB	Total abdominal hysterectomy with bilateral	I	71	7.5	10	7.5	70	105	113	4.5	4	4	3	3	1	89	140	100	113	100
87	C	851725	M	30	Closed both bone # of R leg	ORIF with IMIL nailing of R tibia	I	79	8.5	11	8.5	70	96	116	4.5	4	3	3	3	1	78	110	70	83.3	100
88	C	713019	M	43	L patella closed transverse #	ORIF with TBW of L patella	I	76	4.5	6.5	4.5	80	118	125	4	6	5	5	5	2	79	120	80	93.3	100
89	**C**	117497	F	54	L IT # with DHS insitu	DHS implant removal	II	57	8	11.5	8	65	106	119	5.5	4	4	4	3	1	82	110	70	83.3	100
90	C	426367	M	40	2years old united # of L tibia with implant insitu	Implant removal	I	63	7	11	7	60	104	113	5.5	4	4	5	5	1	88	120	90	100	100

55	92	91	86	88	87	88	73	76	72			132	129	113	114	106	109	100	98	99		
56	84	81	76	71	72	73	68	65	61	62	60	138	127	113	102	106	101	118	109	112	107	106
57	73	69	64	63	61	62	60	59	58			112	106	95	94	93	85	84	82	95		
58	72	75	78	63	69	64	60	62	62	66		135	124	119	112	119	111	112	107	108	116	
59	78	74	71	65	69	62	61	63	61	62		130	128	114	103	104	98	102	97	96	94	
60	83	85	87	77	79	72	75	77	79			120	114	100	98	109	100	102	104	106		
61	78	74	76	79	74	73	76	70	18			128	118	106	102	98	92	94	97	98		
62	68	64	69	71	72	76	68	73	72			108	109	112	106	102	112	114	118	119		
63	83	79	74	75	71	78	81	85	86	88		128	115	112	104	101	98	99	102	100	101	
64	78	74	72	70	78	76	75	72	73			121	129	120	114	116	117	112	118	121		
65	88	86	72	70	85	82	81	80	86			123	114	112	105	112	119	124	118	117		
66	86	83	81	78	76	75	71	80				128	126	119	114	121	123	127	129			
67	88	78	74	71	82	84	88	89	91			133	120	121	117	113	119	125	128	138		
68	75	74	76	74	78	86	87	83	81			125	117	112	108	116	119	127	135	136		
69	87	84	80	75	71	74	76	75	78	82		122	118	115	124	123	125	128	127	123	124	
70	74	71	78	79	81	84	83	84	88			128	114	112	103	118	124	129	127	122		
71	72	77	74	76	74	78	84	81				134	121	114	128	123	121	135	138			
72	75	74	73	71	75	76	78	79				111	118	115	112	118	120	127	125			
73	84	81	74	72	71	64	85	86	81	80		134	128	114	105	102	98	99	95	102	98	
74	84	86	87	82	84	81	85	78	86			132	129	127	126	124	120	128	131	129		
75	76	75	71	76	87	84	86	82	83			112	114	108	102	97	99	95	94	92		
76	60	62	59	51	54	55	58	56				102	103	98	96	97	99	94	98			
77	78	75	72	74	79	76	71	72	75			136	128	131	124	129	125	126	127	134		
78	56	58	52	50	57	58	51	56	54	51		98	94	90	97	91	97	92	94	98	99	
79	94	85	81	78	74	75	64	68	62	60		142	135	124	114	116	108	115	118	112	119	
80	75	74	76	78	71	75	78	79	72	79	78	133	128	127	123	124	128	132	134	129	135	125
81	87	81	76	72	70	78	81	83	89			135	127	124	110	112	103	104	100	107		
82	66	68	64	67	68	62	69	75	76	78	88	112	118	110	117	114	116	122	128	134	127	130
83	85	81	76	74	82	85	87	89	82			135	128	123	114	108	107	98	97	96		
84	82	80	76	72	74	79	75	79	83			128	121	124	128	114	116	112	117	119		
85	87	82	84	86	89	92	87	88	84	87	92	138	131	127	126	128	134	126	134	127	129	139
86	89	84	83	87	89	85	86	89	92			142	135	131	128	134	129	137	126	124		
87	75	71	76	78	74	72	79	75	81			118	113	108	109	115	121	129	127	123		
88	78	74	68	64	62	60	58	56	57			128	127	114	116	104	109	98	94	99		
89	87	86	85	87	81	82	87	89	88			118	112	119	124	128	119	126	122	134		
90	89	82	84	87	83	80	85	87	89			122	127	111	113	118	114	122	128	134		

55	92	88	76	72	71	74	68	61				105	102	88	86	83	86	79	73	33			99	100	98	99	100	97	98	99	100			no
56	99	84	82	75	74	68	64	62	68	64	69	112	98	92	84	85	79	82	78	83	78	81	100	99	98	99	98	99	98	100	99	99	99	no
57	72	69	52	44	42	49	41	44	49			85	81	66	61	59	61	55	57	64			100	100	100	100	100	100	100	100	100			Hypotension
58	92	84	65	60	67	61	79	63	61	68		106	97	83	77	84	78	90	78	77	84		100	100	99	99	99	99	99	99	99	99		no
59	92	87	82	75	62	53	52	58	51	50		105	101	93	84	76	68	69	71	66	65		100	99	99	98	98	100	100	100	100	100		no
60	60	65	52	58	62	65	66	64	68			80	81	68	71	78	77	78	77	81			100	100	99	100	100	100	100	100	99			vomiting
61	87	75	62	60	56	52	51	50	54			101	89	77	74	70	65	65	66	69			99	99	98	98	100	100	100	100	100			no
62	64	61	68	64	68	71	72	78	81			79	77	83	78	79	85	86	91	94			100	100	100	100	98	98	98	99	100			no
63	85	79	74	72	68	61	58	57	54	59		99	91	87	83	79	73	72	72	69	73		100	100	98	100	100	99	100	100	100	100		no
64	82	84	78	74	76	72	79	81	82			95	99	92	87	89	87	90	93	95			99	100	100	100	98	100	100	100	100			no
65	82	76	74	70	64	61	74	72	71			96	89	87	82	80	80	91	87	86			100	100	100	100	99	99	100	100	100			no
66	88	85	84	86	85	84	87	82				101	99	96	95	97	97	100	98				99	99	98	99	100	100	100	100				no
67	88	85	74	74	76	81	79	84	87			103	97	90	88	88	94	94	99	104			100	99	98	98	98	99	100	100	100			no
68	82	78	71	72	74	72	80	81	85			96	91	85	84	88	88	96	99	102			100	99	100	100	99	98	99	100	98			no
69	87	84	86	82	81	78	75	81	83	80		99	95	96	96	95	94	93	96	96	95		100	99	100	100	100	100	100	100	100	100		no
70	82	75	72	73	64	71	78	74	74	73		97	88	85	83	82	89	95	92	90	49		100	100	99	99	99	99	99	99	99			no
71	84	74	76	85	88	82	82	84				101	90	89	99	100	95	100	102				100	100	100	100	100	100	100	100				no
72	72	70	75	74	76	72	78	72				85	86	88	87	90	88	94	90				100	99	99	99	98	100	100	100				no
73	98	91	85	74	71	65	62	64	67	60		110	103	95	84	81	76	74	74	79	73		99	98	100	99	99	99	99	99	100	100		no
74	84	81	74	7	79	71	72	75	74			100	97	92	47	94	87	91	94	92			98	99	99	97	97	97	98	98	99			no
75	78	76	72	64	61	58	54	52	50			89	89	84	77	73	72	68	66	64			99	98	97	98	99	98	99	99	99			no
76	62	58	54	52	57	59	53	52				75	73	69	67	70	72	67	67				100	100	100	99	99	99	99	99				no
77	91	87	85	87	81	82	89	85	91			106	101	100	99	97	96	101	99	105			99	100	99	99	99	99	99	99	99			NO
78	62	58	61	64	60	57	58	52	61	66		74	70	71	75	70	70	69	66	73	77		99	99	99	100	98	100	99	99	98	99		NO
79	92	90	85	87	84	82	86	81	76	78		109	105	98	96	95	91	96	93	88	92		98	97	97	100	100	100	100	99	98	99		NO
80	91	87	85	87	84	83	91	87	86	87	90	105	101	99	99	97	98	105	103	100	103	102	100	99	100	99	97	100	100	100	99	98	100	NO
81	81	79	75	72	74	78	68	61	67	68		99	95	91	85	87	86	80	74	80	45		100	99	98	99	99	100	99	99	99			NO
82	72	71	78	74	76	81	88	82	87	91	93	85	87	89	88	89	93	99	97	103	103	105	98	97	99	99	98	97	97	97	98	98	99	NO
83	88	75	72	65	61	62	54	52	50			104	93	89	81	77	77	69	67	65			100	99	98	99	98	99	100	99	100			NO
84	91	87	85	84	89	82	87	83	84			103	98	98	99	97	93	95	94	96			97	100	98	97	96	98	97	98	100			NO
85	82	86	87	82	89	91	90	85	87	93	89	101	101	100	97	102	105	102	101	100	105	106	100	99	98	99	97	97	99	97	98	99	100	NO
86	92	91	88	84	86	87	92	88	92			109	106	102	99	102	101	107	101	103			100	99	99	98	99	97	100	99	98			NO
87	81	80	76	74	72	78	71	70	79			93	91	87	86	86	92	90	89	94			99	99	99	99	99	99	98	100	99			NO
88	81	79	74	76	72	64	62	61	52			97	95	87	89	83	79	74	72	68			98	98	96	100	100	100	99	99	100			NO
89	71	16	68	75	81	84	86	79	81			87	48	85	91	97	96	99	93	99			99	98	100	100	99	98	99	98	99			NO
90	89	85	87	83	84	87	86	81	80			100	99	95	93	95	96	98	97	98			100	100	99	100	99	98	98	99	100			NO