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A Dissertation On " Comparitive Analysis Of Epidural Bupivacaine Versus Bupivacaine With Dexmedetomidine For Lower Abdominal Surgeries"

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I. Introduction

Epidural anaesthesia is the most commonly used technique for providing not only surgical anaesthesia but also postoperative analgesia in surgical patients.[1] Early postoperative mobilization, rehabilitation, minimal pain & discomfort are the most desirable features of modern surgery.[2,3,4] Local anaesthetic agents like bupivacaine , lignocaine with or without adrenaline are in use and are the gold standard drugs.[5,6] Opioids like fentanyl , morphine ,buprenorphine are used traditionally as an adjuvant, but come with the side effects such as pruritis, urinary retention , nausea , vomiting and respiratory depression.[7,8,9] Many new adjuvants to local anaesthetics are being tried and alpha- 2 agonists are one of them. The anaesthetic and analgesic requirement get reduced to a huge extent by use of these adjuvants because of their analgesic properties as well as augmentation of local anaesthetics mediated by hyperpolarization of nerve tissues by altering transmembrane potential and ion conductance at the local coerulus in the brainstem. Prolonged duration of surgery and positional changes make patients uncomfortable. At this stage giving large doses of intravenous sedation defeats the very purpose of giving regional block. [10]Alpha-2 agonists are the drugs , which have sedative and analgesic properties. The stable hemodynamic provided by these drugs makes them the desirable choice of adjuvant.

Dexmedetomidine is highly selective alpha-2 adrenergic agonist with an affinity 8 times more than clonidine.[10] It acts on both pre and post-synaptic sympathetic nerve terminals and central nervous system thereby decreasing the sympathetic outflow and nor epinephrine release causing sedative, anti-anxiety, analgesic, sympathetic and hemodynamic effects.[11,12,13] Dexmedetomidine causes dose dependent bradycardia , hypotension so in this prospective study we have used minimum doses, that is, 0.5µg/kg along with the local anaesthetic agent bupivacaine as it is easily available and routinely practiced since many years so that we can study the properties of the new drug like dexmedetomidine.

HISTORY OF EPIDURAL ANAESTHESIA AND ANALGESIA

- Jean Enthuse Sicard (1872-1929) and Fernand Cathelin (1873-1945) introduced cocaine through the sacral hiatus in 1901 , thereby becoming the first practitioners of caudal anesthesia.
- Sicard – neurologist, used the technique to treat sciatica ant tabes while Cathelin used the technique for surgical anesthesia
- Arthur Lawen(1876-1958) successfully used caudal anesthesia with large volumes of procaine for pelvic surgery
- Heile –published an extensive study of the epidural space in 1913, he approached the epidural space through the intervertebral foramina.
- Fidel pages -a Spanish military surgeon in 1921 devised a technique to introduce epidural procaine at all levels of the neuraxis, he used a blunt needle and then feel and hear the entry of the needle through the ligamentum flavum.
- Dogliotti" s method of identification of the epidural space was an important innovation. He used continouos pressure on the plunger of a saline filled syringe as the needle is advanced through the ligamentous structures.
- Gutierrez of Argentina illustrated the " hanging drop " sign, which is one method still widely used.
- T.Lemmon (1896-1974) used a 17 gauge , malleable , silver needle that was connected through a hole in the operating room table to rubber tubing and a syringe.

- Edward B.Tuohy (1908-1959) used a ureteral catheter threaded through a large Huber-tipped spinal needle to provide continouos spinal anesthesia .
- Behar in 1979 first reported the use of morphine in epidural for the treatment of pain.
- Robecchi and Capra in 1952 used periradicular hydrocortisone for treating radiculopathy. It is the first documented use of epidural steroids.

ANATOMY OF EPIDURAL SPACE

The vertebral column is made up of 24 individual vertebrae comprising 7 cervical, 12 thoracic and 5 lumbar while 5 sacral vertebrae are fused and the 3-5 coccygeal bones, though fused, remain rudimentary. These vertebrae house the epidural and the subarachnoid space.

Measurement of the epidural space

The epidural space is most roomy at the upper thoracic levels. The epidural space at the posterior space in the adult measures about 0.4 mm at C7-T1, 7.5 mm in the upper thoracic region, 4.1 mm at T11-12 region and 4-7 mm in the lumbar region, (Nickallis & Kokri, 1986). The space is far greater than that of the subarachnoid space at the same level. It takes about 1.5 – 2.0 ml of a local anesthetic to block a spinal segment in the epidural space while the volume (0.3 ml) is far less in the subarachnoid space for a similar block. It has been shown (Macintosh and Lee, 1973) that the paravertebral spaces, both serially and contralaterally, communicate with each other in the epidural space.

Epidural Space

The epidural space extends from the foramen magnum to the sacral hiatus. It is segmented, not uniform in distribution. The epidural space surrounds the dura mater anteriorly, laterally, and posteriorly.

Boundaries of the epidural space are as follows:
anterior- posterior longitudinal ligaments
lateral- pedicles and intervertebral foramina
posterior- ligamentum flavum and vertebral laminae

Contents The epidural space contains the following structures:

- fat
- nerve roots
- areolar tissue
- lymphatics and blood vessels.

As patients age, adipose tissue in the epidural space diminishes, and intervertebral foramina decrease in size. A decrease in adipose tissue results in decreased local anesthetic requirements in the elderly. Posterior to the epidural space is the ligamentum flavum, which extends from the foramen magnum to the sacral hiatus. The ligamentum flavum is not one continuous ligament. It is composed of a right and left ligamenta flava which meet in the middle, forming an acute angle with a vertebral opening. The two ligamenta flava may or may not be fused in the middle at variable levels within the same patient. The ligamentum flavum varies in respect to thickness, distance to dura, skin to surface distance, and the size of the vertebral canal. The ligamentum flavum also varies in thickness from cephalad to caudad. It is thicker in the lumbar region compared to the thoracic region

Anatomical structures located posterior to the ligamentum flavum are the:

- lamina and spinous processes
- interspinous ligament
- supraspinous ligament

Identification of the epidural space

Identification of the epidural space is of crucial importance as it is technically demanding. The first demonstration of this space was about 83 years ago (Dogliotti, 1933). The accuracy in the location of the space however, determines the functionality of the epidural analgesia. The epidural needle, if inserted in the midline, pierces the skin and traverses the subcutaneous tissue, supraspinous ligament, interspinous ligament and through the ligamentum flavum to reach the space. The depth of the epidural space has been defined as the distance from overlying skin to the tip of the needle just penetrating into the epidural space . The depth can pose some difficulties during the location of the epidural space particularly in the obese patient.

Methods of identification

Various methods have been used in identifying the epidural space. Most of these traditional methods of locating the epidural space depend on the negative pressure exhibited during the introduction of the epidural needle into the space. Any techniques identifying the epidural space should be simple and straightforward, effective, safe, and reliable to minimize the number of complications associated with it.

One of the most reliable methods in identifying the space depends on loss of resistance (LOR). This method of identification uses either air or a liquid such as saline or a local anesthetic to achieve it. The technique applies continuous or intermittent pressure on the piston of an epidural glass or plastic syringe towards the barrel, and the loss of resistance is where it becomes possible to inject through the syringe attached to the epidural needle, so the piston can easily move into the barrel. This technique works because the ligamentum flavum is extremely dense, and injection into it is almost impossible. The syringe may contain air or saline. The principles are the same, but the specifics of the technique are different due to the greater compressibility of air with respect to saline or lidocaine.

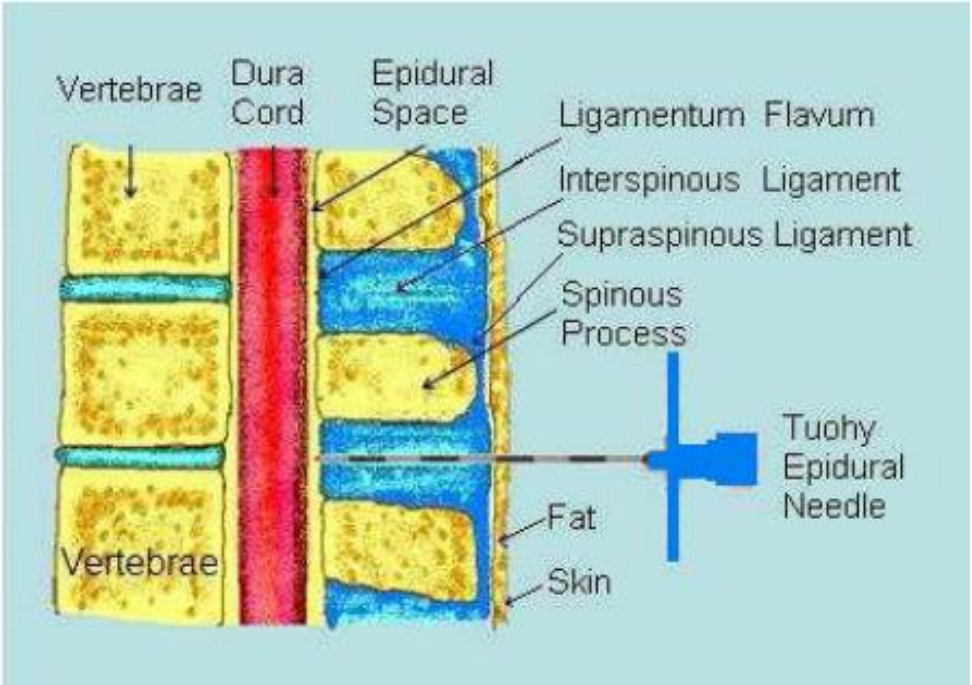
Epidural space:

It is the potential space within the bony cavity of the spinal canal and outside the dural sac. The bodies of the vertebrae, the intervertebral discs and the posterior longitudinal ligament covering them bound it anteriorly. Posteriorly it is bounded by the anterior surface of the vertebral laminae and the ligamentum flava. Superiorly it is closed by the fusion of the dura and periostium at the foramen magnum. Inferiorly the sacro coccygeal ligament at the sacral hiatus, laterally by the pedicles of the vertebrae and the intervertebral foramina.

The shape of the epidural space in cross section is nearly circular in the cervical and thoracic regions, but becomes triangular in the lumbar regions. The depth of the epidural space is greatest in the midline in the lumbar region where it is said to be 5to6 mm in adult male. [Change 1963, Bromage 1978) for this reason midline approach is advocated for entering the lumbar epidural space.

Epidural space communicates via the intervertebral foramina, with paravertebral spaces. The paravertebral spaces in the thoracic region lie between the heads of the ribs and are in direct contact with pleura. The negative intrathoracic pressure is thus conducted via the paravertebral spaces to the thoracic epidural space

Figure 3: Layers pierced by epidural needle



Contents of the epidural space:

Dural space:

It extends from the foramen magnum to the lower border of secondsacral vertebra. The dural tube tends to hug the anterior wall of the spinal canal, sothat the epidural space is narrow anteriorly and wider posteriorly.

Spinal nerve roots:

Along with their dural cuffs, they traverse the epidural space on their way to their respective intervertebral foramina. In the cervical region these travelalmost horizontally but lower down they become more inclined owing to the discrepancy between the length of the spinal cord and the spinal canal, until the lower lumbar and sacral roots are almost vertical.The roots vary greatly in size and thickness, the thoracic roots are thin white the cervical and lumbosacral roots subserving the limbs are thick. The great differences in size and neural population with in the roots are interrelated. The very large diameter and high neural populations of the dorsal and ventral roots of the first sacral segment are associated with great resistance to epidural blockade. Prolonged latency and poor analgesia of spinal segments are due to poor penetration of local anaesthetics to the deeply placed fibers at the core of the root.

The root sleeves deserve a special mention, as they have an important role in the mechanism of the action of epidural anaesthesia. In the region of the "dural cuff the arachnoid villi and granulations invaginate the epidural veins and drain the CSF from the subarachnoid space, into the blood stream. Those villi, which are not with the vessels, drain the CSF into the epidural fat, from where it is drained by lymphatics .

Epidural vessels:

The branches of the subclavian, aortic and iliac arteries cross theepidural space and enter the subarachnoid space in the region of the dural cuffs. These branches provide blood supply for the spinal roots. Apart from the cervical region, theentire blood supply to the spinal cord passes through the epidural space. The epiduralveins are arranged in the mid line. They drain the spinal cord, vertebral canal and CSFfrom the subarachnoid space. They do not possess valves. These veins although divided into anatomical groups, all are interconnected and form a series of horizontalsegmental anastamosis. They connect with the intervertebral foramina andcommunicate with the vertebral, ascending cervical, deep vertical, intercostal,iliolumbar and lateral sacral veins. As the epidural veins have no valves, they afford aconnection between the pelvic veins below and the intercostal veins above.The epidural veins become distended during coughing and straining and alsowhen the inferior vena cava is obstructed by large abdominal tumors or in late pregnancy. This distension of epidural veins diminish the effective volume of the epidural space. Under these circumstances, the requirement of the local anaesthetic ismarkedly decreased, as a small volume of drug tend to spread over a wide area of epidural space.

Fat:

The content of the spinal canal lie cushioned in a packing of semifluid, lobulatedfat. Solutions injected into the epidural space, track up and down between the fattytissues. The epidural fat consists an important pharmacological space and depot forinjected local anaesthetics and other drugs and it is one of the three compitators for itsshare of the drug. The other two compitators being nervous tissue of spinal roots and cord and blood vessels with in the spinal canal. Drug with high lipid solubility and hypoprotein binding characteristics will tend to enter the fat phase and remain there fora period of time depending on their pharmacodynamics and on the briskness of the local blood flow competing for uptake. The compliance of the epidural fat varies from person to person and with age, in children and young adults it offers very little resistance.

Lymphatics

Lymphatics draining the dural sac and its surroundings run anteriorlyfrom each intervertebral foramen and empty into the longitudinal channels in front of the vertebral column.

Applied aspects of anatomy of epidural blockade

The epidural space is not as voluminous as the subarachnoid space; nevertheless, it extends from the base of the skull to the sacrococcygeal membrane and has direct communications with the paravertebral space and indirect communications with the cerebrospinal fluid. It also leads directly to the vascular system by way of its large epidural veins,this is a potential direct route to the brain for drugs, air or other material inadvertently injected into an epidural vein. Within the cranium there is no epidural space, as meningeal dura and endosteal dura are closely adherent, except where they separate to formvenous sinuses. At the foramen magnum these two layer separate, the former becoming the spinal dura and later the periosteum of the spinal canal Thus although -local anaesthetics cannot enter between the endosteal and meningeal layer of thecerebral dura. They can diffuse across the spinal dura at the base of the brain into the cerebrospinal fluid and then to the brain. Between the spinal dura and the spinal periosteum lies the epidural space.The ligamentum flavum completes the posterior wall in direct continuity with the periosteum of the spinal canal. Since the spinal canal is approximately triangular in cross section and articular processes indent the triangle. The epidural space narrows posteriorly and then widens again laterally towards the intervertefaral foramina. Thus the safest point of entry into the epidural space is the mid line.

Size of the epidural space:

The distance across the circular peridural space is variable. It is negligible oralmost non-existent in the anterior region. It is more and readily measurable in the posterior region, especially in the midline

Table 1: Epidural space and thickness

	Epidural Space (mm)	Thickness of Dura (mm)
Cervical	1.0 – 1.5	2.0 – 1.5
Upper Thoracic	2.5 – 3.0	1.0
Lower Thoracic	4.0 – 5.0	1.0
Lumbar	5.0 – 6.0	0.66 – 0.33

Physiological Aspects :

Haldt and Moloney were the first to describe negative pressure in the epidural space in 1928. This negative pressure is maximum at points of firm attachments. It is maximum in the thoracic region, less in the lumbar regions and least or absent in the sacral region

Lower Lumbar - 0.5 cm H2O

Upper Lumbar - 1.0 cm H2O

Thoracic - 1.0 to 3.0 cm H2O

(Average 20 cm of H2O)

Identification of epidural space:

There are several methods to identify the epidural space. These methods take advantage of the potential negative pressure or use of the sudden disappearance of resistance when the ligamentum flavum is penetrated.

Negative pressure technique:

1) Hanging drop sign (Gutiriez sign)
2) Capillary tube method
3) Manometer technique

Loss of resistance technique:

1) Syringe technique
2) Spring loaded syringe
3) Balloon technique (Macintosh's extradural space indicator)
4) Brooks device
5) Vertical tube of Dawkins

Others:

- Ultrasonic localization- Oxford epidural space indicator

Negative pressure in the epidural space:

Originally, Heldt and Maloney described a negative extradural pressure in1828. It is greatest in the thoracic region since the intra thoracic pressure istransmitted via paravertebral space less in the lumbar and least or absent in the sacralregion. In the lower lumbar region it amounts to about 0.5cm of water. In the upper lumbar region it about -1.0 cm of water and in the thoracic region it varies from -1.0to -3.9 cm of water.There are three theories explaining this negative pressure.

1) The transmission theory:

Negative pressure in the epidural space is caused by the transmission of the intrapleural negative pressure through the intervertebral foramina (mountos in BeyerSmith 1947). It varies with the depth of respiration i.e. clinically this negative pressure will be diminished or absent if the patient is not relaxed and if there is straining. Marked flexion at the spinal column increases the negative pressure and is more in young people. A rise in negative pressure may favour the spread of localanaesthetic solution in the epidural space.

2) Cone theory:

This says that the epidural needle introduced depresses the dura, thus creating a large space, it is thus an artefact caused by the indentation of dura by the advancing needle (Janzen 1926).

3) Flexion theory:

This theory says that, more the flexion of spine, the greater the negative pressure (Oden 1938).Thus a good knowledge of the anatomy of the epidural space, the nearby structures, factors influencing the negative pressure, along with precision adequate timing, proper positioning of the patient and careful identification of the epidural space goes a long way in proper performance of the technique of epidural block.

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Local anaesthetic injected into the epidural space acts on the dorsal root ganglia and spinal roots with their dural cuffs in the extradural space.

- Leakage by vascular absorption
- Leakage through intertebral foramina
- Diffusion through dural root sleeves.
- Diffusion through dura mater

Epidural Anaesthesia has the advantage of:

1.Widespread use
2.Familiar technique
3.Indwelling catheter allows top up doses, modification and extension of block
4.Less dramatic and slower onset of hypotension compared to subarachnoid anaesthesia
5.Absence of PDPH unless accidental dural tap.

The Disadvantages are of epidural Anaesthesia are:

1. Slow establishment of block
2. May be patchy or asymmetrical
3. Large volumes of local anaesthetic required
4. Some nerve roots are difficult to block

PHYSIOLOGICAL EFFECTS OF EPIDURAL BLOCKADE

The segmental nerves in the thoracic and lumbar region contain somatic sensory, motor and autonomic (sympathetic) nerve fibres. Sensory and autonomic fibres have a smaller diameter and are more easily blocked than larger, more rapidly-conducting motor fibres. The relationship between sensory and autonomic outflow is complex, but sympathetic block usually extends 1-2 levels higher than sensory block.

Effects on organ systems

Cardiovascular system.

Vasodilatation of resistance and capacitance vessels occurs, causing relative hypovolaemia and tachycardia, with a resultant drop in blood pressure. This is exacerbated by blockade of the sympathetic nerve supply to the adrenal glands, preventing the release of catecholamines. If blockade is as high as T2, sympathetic supply to the heart (T2-5) is also interrupted and may lead to bradycardia. The overall result may be inadequate perfusion of vital organs and measures are required to restore the blood pressure and cardiac output, such as fluid administration and the use of vasoconstrictors. Sympathetic outflow extends from T1 - L2 and blockade of nerve roots below this level, as with, for example, knee surgery, is less likely to cause significant sympathetic blockade, compared with procedures requiring blockade above the umbilicus.

Respiratory system.

Usually unaffected unless blockade is high enough to affect intercostal muscle nerve supply (thoracic nerve roots) leading to reliance on diaphragmatic breathing alone. This is likely to cause distress to the patient, as they may feel unable to breathe adequately.

Gastrointestinal system.

Blockade of sympathetic outflow (T5-L1) to the GI tract leads to predominance of parasympathetic (vagus and sacral parasympathetic outflow), leading to active peristalsis and relaxed sphincters, and a small, contracted gut, which enhances surgical access. Splenic enlargement (2-3 fold) occurs.

Endocrine system.

Nerve supply to the adrenals is blocked leading to a reduction in the release of catecholamines.

Genitourinary tract.

Urinary retention is a common problem with epidural anaesthesia. A severe drop in blood pressure may affect glomerular filtration in the kidney if sympathetic blockade extends high enough to cause significant vasodilatation.

Indications

Indications for epidural nerve block can be divided into the following categories:

- Sole epidural anesthetic
  - Orthopedics - Surgeries of lower limbs, including hip, knee, and pelvic areas
  - Vascular surgery - Lower limbs, amputations
  - Obstetrics - Cesarean delivery
  - Gynecology - Surgeries of female pelvic organs
  - Urology - Prostate and bladder surgeries
  - General surgery - Lower abdominal surgeries, including appendectomy, bowel surgeries, hernia repair
- Epidural anesthetic in combination with spinal anesthetic
  - This combination is referred to as combined spinal epidural (CSE).
  - All of the indications noted above for sole epidural anesthetic may also be performed with CSE.
- Epidural anesthetic in combination with general anesthetic
  - All of the indications noted above for sole epidural anesthetic may also be performed with CSE.
  - Pediatric surgery - Penile procedures, inguinal hernia repair, lower limb orthopedic procedures

Thoracic surgery -thoracotomy cardiac bypass, other cardiac surgeries

- Epidural analgesia combined with general anesthesia reduces the incidence of postoperative pneumonia in patients with chronic obstructive pulmonary disease who are undergoing major abdominal surgery

Contraindications

Absolute contraindications

- Patient refusal
- Uncorrected hypovolemia
- Severe hypotension
- Cougulopathy or other bleeding diasthesis
- Increased intracranial pressure
- Infection at the site
- Allergy to local anesthetic
- Severe stenotic valvular heart lesion with low fixed cardiac output

Relative contraindications

- Patients on anticoagulants
- Pre-existing neurological disease
- Uncooperative patient
- Severe spinal deformities
- Sepsis

EPIDURAL BLOCKADE AND MOTOR FUNCTION:

The degree of motor blockade increases as the dose of the drug increases. Motor blockade in lower limbs is assessed by bromage scale.

Table 2 : Bromage scale

Grade	Criteria	Degree of block
I	Full flexion of knees and feet	Nil (0%)
II	Just able to flex knees , still full flexion of feet possible	Partial (33%)
III	Unable to flex knees, still flexion of feet	Almost complete (66%)
IV	Unable to move legs or feet	Complete (100%)

PHARMACOLOGICAL REVIEW

PHARMACOLOGY OF BUPIVACAINE:

Bupivacaine was synthesized by Ekenstam in 1957 and used clinically in 1963

It is a synthetic long acting amide local anaesthetic.

Structure:

It is a 2-piperidine carboxamide 1- Butyl N (2, 6, di methyl, phenyl)mono hydrochloride, monohydrate

Figure 4: Structural formula of bupivacaine

FDA Approved; October 1972.

Potency: four times that of lidocaine, mepivacaine , prilocaine.

Toxicity : less than four times that of lidocaine, mepivacaine.

Metabolism : metabolished in the liver by amidases.

Excretion : via the kidney; 16 % unchanged from human urine.

pKa : 8.1

Molecular weight : 288

pH of plain solution; 4.5 to 6.0

Onset of Action : slower onset time than other commonly used local anesthetics (eg 6 to 8 minutes)

Anesthetic half life : 2.7 hours

Pregnancy Classification : C

Pharmacokinetic Properties:

Absorption: The absorption is related to

The site of injection (Intercostal >Epidural > Brachial plexus >Subcutaneous).

A linear relationship exists between the total dose and the peak blood concentration achieved

The drug is highly lipid soluble and therefore uptake into fat is rapid and the drug has a direct vasodilator effect.

Distribution:

95% of the drug is bound to alpha- 1- acid- glycoprotein in the plasma The VD is 4L and the Foeto / maternal ratio is 0.2 to 0.4.

Metabolism:

It is metabolized in the liver by N-dealkylation and is conjugatedwith glucuronic acid to 2, 6, pipecolyloxylidine. N-desbutyl bupivacaine and 4-hydroxy bupivacaine are also formed. Hepatic disease potentiates its toxicity.

Excretion:

5% of the dose is excreted in the urine as pipcolyloxylidine; 16% isexcreted unchanged. The clearance is 0.47 L / min.

Presentation:

Vials of 20ml containing a clear colourless solution of 0.25% / 0.5%Bupivacaine hydrochloride.Vials containing 0.75% of Bupivacaine are also available (presently not in India).20 ml vials of 0.25% - 0.5% Bupivacaine without preservative are also available.Ampules containing 4ml of 0.5% (heavy) solution with dextrose for spinal anaesthesia.

Mode of action:

Bupivacaine diffuses in its uncharged base form through neural sheathsand the axonal membrane to the internal surface of cell membrane sodium ionchannels where it combines with hydrogen ions to form a cationic specieswhich enters the internal opening of the sodium ion channel and combines witha receptor. This produces blockade of the sodium ion channel, therebydecreasing sodium ion conductance and preventing depolarization of the cellmembrane. Thus it blocks the generation and conduction of nerve impulses by increasing the threshold of electrical excitation in the nerve, by slowing the propagation of nerve impulse and by reducing the rate of rise of action potential. At blood concentrations of 1 -2 mcg/ml achieved with therapeutic doses, no systemic side effects are seen.

Routes of administration and dose:

Bupivacaine can be administered topically, by infiltration, intrathecally or epidurally.

Toxic dose is 2 mg / kg

It is used in varying concentrations:

For spinal anesthesia it is used in the concentration of 0.5% with a duration of 75 – 150 min.

For epidural it is used in the concentration of 0.5% to 0.375%.Onset of action is 10 – 20 min and duration 180 – 300 min.For infiltration- - 0.5% - 0.25%.
Onset of action is rapid and duration is200 min.
For peripheral nerve blocks – 0.25% - 0.5%.
Onset of action is 10 – 20min and duration of action is 400 min
In obstetric analgesia it is used in concentrations of as less as 0.0625%to 0.25%. At concentrations of 0.125% to 0.0625% sensory blockade predominates and at concentrations above 0.25% motor blockade is seen.
It should not be used in IVRA

PHARMACOLOGY OF DEXMEDETOMIDINE:

Dexmedetomidine is a highly specific agonist of the alpha – 2 receptor that has sympatholytic, analgesic, hypnotic, sedative, and anxiolytic properties. It was first licensed for the use of sedation in mechanically ventilated adult intensive care patients for up to 24 hours. [19]

In 2008 it was labelled for use as a sedative in non - intubated adult patients before surgical, diagnostic and therapeutic procedures.
Dexmedetomidine is not approved for use in any paediatric setting.
Despite these licensing restrictions, dexmedetomidine has been used extensively throughout the hospital setting for numerous off-label applications including,

1) Management of postoperative pain,
2) As an adjunct to anaesthesia in adult and paediatric patients[20],
3) Used in intensive care and procedural sedations for both adults and children,
4) Treatment of cyclic vomiting syndrome,
5) Treatment of shivering after anaesthesia,
6) Withdrawal / Detoxification amelioration in adult and paediatric patients[21]

Table 3: Physicochemical characteristics of dexmedetomidine

Chemical description	(+) – 4 - (S) - [1 - (2, 3 – dimethylphenyl) ethyl] – 1 H - imidazole Monohydrochloride[21]
	S enantiomer of medetomidine
Subclass	Imidazole
Molecular weight	236.7
Solubility	Readily soluble in water
Empirical formula	C13H16N2.HCl

AVAILABILITY :
Dexmedetomidine is available in the form of 2-mL vials containing 100 µg /mL or 50 µg / ml or 50 µg / 0.5 ml solution. For adult patients :

Table 4: Loading and maintenance dose of dexmedetomidine

Loading dose	1 mcg / kg given over a period of ten minutes
Maintainence dose	0.2 - 0.7 mcg / kg / hour

Table 5: Metabolism and pharmacokinetics of dexmedetomidine

Distribution	Rapidly distributed
Protein binding	94 %
Metabolism	Liver
	Hydroxylation n-methylation (21%) conjugation (41%),
Excretion	Urine and faeces.

Having profound effects on cardiovascular variables, it may alter its own pharmacokinetics[22]. With large doses, there is marked vasoconstriction, which probably reduces the volume of distribution. In essence, Dexmedetomidine displays nonlinear pharmacokinetics. Dyck and collegues found that its pharmacokinetics in volunteers is best described by a three compartment model.[23]

Table 6: Elimination and clearance of dexmedetomidine

Elimination	Elimination Half-Life(hr)	Clearance (mL/kg/min)	VdSS (L / kg)
Dexmedetomidine	2 - 3	10 - 30	2-3

These pharmacokinetic parameters apparently are unaltered by age , weight or renal failure, but clearance is a function of height. Postoperative patients sedated with Dexmedetomidine displayed pharmacokinetics similar to the pharmacokinetics seen in volunteers.

PHARMACOLOGY

Dexmedetomidine has a high specificity for the alpha 2 adrenergic receptor with the ratio between alpha 2: alpha 1 being 1600: 1. Clonidine which is also an alpha - 2 adrenergic receptor exhibits a ratio between alpha 2: alpha 1as 200: 1. Moreover, dexmedetomidine has a shorter half life of about two to three hours whereas clonidine has a long half life of about twelve to twenty four hours[24].

Dexmedetomidine exerts its physiologic actions through potentiation of the postsynaptically situated alpha - 2 adrenergic receptors which causes activation of G proteins leading onto a negative feedback effect and less release of adenylyl cyclase[21]. This causes a decrease in the activity of the cyclic adenosine monophosphate (cAMP) that is situated intracellularly following which the ion transmission channels get dephosphorylated . This contributes to the reduced activity of the nervous system leading onto the sedative and hypnotic effects of dexmedetomidine.[21,22] .

The alpha – 2 adrenergic receptors are classified into three subtypes in human beings:

Table 7: Classification of alpha-2 receptors

SUBTYPE	LOCATION
Alpha 2 A	Periphery
Alpha 2 B	Brain, spinal cord
Alpha 2 C	Brain, spinal cord

The postsynaptic alpha - 2 adrenoreceptors that are located in the peripheral blood vessels produce vasoconstriction, whereas the central action is through the activation of presynaptic alpha – 2 receptors in the medulla, which results in reduction of the norepinephrine turn over and suppression of the sympathetic discharge. Other actions include potentiation of the parasympathetic discharge and suppression of sympathetic discharge from the locus ceruleus. This action on locus ceruleus (LC) contributes to the sedative and anxiolytic properties of dexmedetomidine[26].

The stimulation of alpha – 2 adrenoreceptors which are situated in the posterior horn of the spinal tract causes inhibition of substance P, thereby exhibiting the analgesic properties of dexmedetomidine[27].

EFFECTS ON THE CENTRAL NERVOUS SYSTEM

SEDATION

Dexmedetomidine exerts the properties of anxiolysis and sedation by stimulation of the alpha - 2 adrenergic receptors which are situated in the locus ceruleus (LC) of the central nervous system.

The locus ceruleus plays a major role in a wide range of activities in the central nervous system, which includes somnolence, wakefulness, apprehension and syndromes that occur due to the withdrawal of drugs like central nervous system depressing agents and opiates .The sedation produced by these alpha - 2 adrenergic agonists are different from the sedation that is induced by drugs like propofol or benzodiazepines and does not seem to involve the cerebral cortex[28]. The sedative effect exhibited by dexmedetomidine is usually smooth and the patient responds to commands. The patient can be made to exhibit activities from somnolence to awakefullness and they can even perform work and they may become somnolent again once the stimulation is withdrawn.

The alpha 2 agonistic agents exert their action through specific pathways which are situated endogenously and stimulate sleep. This leads to a decrease in the activity of the projections of the locus ceruleus to the ventrolateral preoptic nucleus. This increases GABA and galanin release in the tuberomammillary nucleus, producing a decrease in the histamine release in cortical and subcortical projections[29]. The sleep state that is produced by dexmedetomidine is similar to the natural sleep and hence, it is utilised in sedating ICU patients.

Similar to other adrenergic receptors, the alpha - 2 agonists also exhibit tolerance after prolonged administration. Dexmedetomidine can be employed for addiction treatment like cocaine withdrawal, rapid opioid detoxification, and iatrogenic induced benzodiazepine and opioid tolerance after prolonged sedation.

ANALGESIA

Dexmedetomidine produces analgesia by acting on the alpha - 2 receptors that are located in the central nervous system. The exact process by which dexmedetomidine produces analgesia is not yet studied completely. Brain tissue, spinal cord and other mechanisms seem to play a role in analgesia [30].

The main site which induces analgesia is found to be the spinal cord. Here, the stimulation of alpha - 2 C adrenergic receptor subtype is found to potentiate the analgesic effect of opioid drugs thereby decreasing the transmission of pain signals to brain centres[31].

Alpha - 2 agonistic agents do not exhibit analgesia when administered through the epidural or subarachnoid pathway. Clonidine injected in the neural axis helps with short term pain, cancer pain, and neuropathic pain. Systemic use of Dexmedetomidine also have demonstrated a narcotic sparing effect.

EFFECTS ON THE RESPIRATORY SYSTEM

Alpha - 2 agonistic agents exerts less influence on the respiratory system. It is found that dexmedetomidine when administered to the normal individuals or in the patients perioperatively, has not caused depression in the respiratory activity. It was observed that there is no variation between placebo and dexmedetomidine in the functions of respiratory system in the ICU patients[32]. Dexmedetomidine has not caused depression of the respiratory system even when administered in doses greater than the recommended levels[33].

EFFECTS ON THE CARDIOVASCULAR SYSTEM

The alpha – 2 B receptors are situated in the smooth muscle of the vascular wall and they cause constriction of the blood vessels[34].

In the central nervous system, activation of the alpha - 2 adrenergic receptors results in a decrease in the discharge of the sympathetic signals[26] and a rise in the parasympathetic activity. Dexmedetomidine also blocks the ganglionic receptors that are situated in the periphery, and hence results in further accentuation of the parasympathetic activity. All these changes result in a predominant decrease in the catecholamine levels, and hence, a fall in the heart rate and a modest decrease in arterial blood pressure occurs[27].

Dexmedetomidine when administered as a bolus dose in human beings have exhibited a biphasic action. An acute intravenous administration of 2 mcg / kg has caused a transient rise in arterial blood pressure by 22% and a fall in heart rate by 27% from the baseline after about five minutes following intravenous injection. This transient rise in blood pressure is caused by the vasoconstricting property of dexmedetomidine due to the stimulation of the peripherally situated alpha 2 receptors[28]. Following a transient fall, the heart rate returns to its baseline value after about fifteen minutes, and the blood pressure slowly decreases and reaches a value that is less than 15 % from the baseline value at the end of one hour.

When dexmedetomidine is administered intramuscularly, transient rise in blood pressure did not occur and there was less than ten percent fall in blood pressure and heart rate. Bradycardia was also reported, mainly in young individuals who have a predominant vagal activity. It was found that beta blockers do not potentiate the effects of bradycardia[35].

Dexmedetomidine has been found to cause hypotension when administered to patients who are volume depleted. This can be minimized by omission of the initial loading infusion and not administering a dose greater than 0.4 mcg / kg. The hypertension which occurred transiently during the initial period can also be minimized by administering the initial dose of drug slowly over a period of twenty minutes.

In several studies after intramuscular and intravenous administration, dexmedetomidine caused in a small percentage of patients, profound bradycardia (< 40 beats / min) and occasionally sinus arrest[36]. Generally, these episodes of bradycardia resolved spontaneously or were readily treated by anticholinergic agents without adverse outcome. It would be expected from its profile that dexmedetomidine would be beneficial to the ischemic myocardium. In animal models, dexmedetomidine showed some beneficial effects on the ischemic heart through decreased oxygen consumption and redistribution of coronary flow from non ischemic zones to ischemic zones after acute brief occlusion. No rebound effects have been found when discontinuing dexmedetomidine drips, even when it is given for more than 24 hours[37].

RENAL AND ENDOCRINE EFFECTS:

The alpha - 2 agonistic agents have a property of decreasing the neurohumoral stress responses[38]. It is observed that these agents when used for a period less than twenty four hours has not caused significant changes in the level of cortisol in the serum. In addition, dexmedetomidine has been shown to suppress antidiuretic hormone and thereby causing natriuresis[39]. In resting volunteers, dexmedetomidine increased growth hormone secretion in a dose - dependent manner, but it had no effect on other pituitary hormones.

OTHER EFFECTS:

GASTROINTESTINAL SYSTEM:

During the intraoperative and postoperative period, the motility of the gastrointestinal system gets altered leading onto a delay in the emptying of the gastric contents. These factors have to be kept in mind while administering drugs for sedation and analgesia to the patients. It was observed that dexmedetomidine inhibits the emptying of gastric contents to a much lesser extent[40] when compared with that of morphine.

IMMUNE SYSTEM:

Studies have shown that many of the anaesthetic drugs that we use were found to inhibit the leukocytes. It is observed that dexmedetomidine does not alter the leukocyte function and hence can be used safely during acute inflammatory and infectious periods[41].

DEXMEDETOMIDINE CLINICAL APPLICATIONS

USES

Dexmedetomidine is found to have a wide range of clinical applications like sedation, anxiolysis, sympatholysis and analgesia with less depression of the respiratory system[26]. Hence, it is widely used in many clinical situations.

PREMEDICATION:

Many patients are prone for stress during the preoperative, intraoperative and postoperative period. Dexmedetomidine has been used successfully as an adjuvant to premedication because of its anxiolytic, sedative, analgesic, sympatholytic, and stable hemodynamic profile[26]. Dexmedetomidine also reduces the consumption of oxygen in the perioperative period. The premedication dose is 0.33 to 0.67 mg / kg intravenously given fifteen minutes before surgery and this dose minimizes the side effects of hypotension and bradycardia. In view of absent respiratory depression, it can be continued during extubation period unlike other drugs.

Dexmedetomidine potentiates the anaesthetic effect of all the anaesthetic agents irrespective of the mode of administration (intravenous, inhalation, regional block). Intraoperative administration of dexmedetomidine in lower concentrations has decreased the requirement of other anaesthetic drugs[42]. But, side effects like bradycardia and hypotension are the limitations to its use necessitating the need for pharmacological rescue therapy. These effects can be accounted to the co – administered volatile anaesthetic agents which causes depression in myocardial contractility and vasodilatation. Dexmedetomidine when administered in high concentrations may cause increase in the systemic and pulmonary arterial pressure[43] due to the direct vascular changes that occur in the periphery and it may also cause a decrease in the contraction of the myocardium.

LOCOREGIONAL ANALGESIA

Dexmedetomidine is highly lipophilic in nature and hence, it readily crosses the brain blood barrier and is rapidly absorbed in the central nervous system. It binds to the alpha – 2 adrenoreceptors that are distributed in the spinal cord and exerts its analgesic action. It prolongs the duration of both sensory and motor blockade[45] caused by the local anaesthetic agents regardless of the way through which theses drugs are administered, for example, subarachnoid, caudal or epidural route. Dexmedetomidine enhances both the central and peripheral neural blockade caused by local anaesthetics; however, the peripheral neural blockade is due to its binding to alpha 2A – adrenoreceptor.

Dexmedetomidine has been successfully used in brachial plexus block, intravenous regional anesthesia (IVRA), and intra articularly. 0.5 mcg/ kg dexmedetomidine, when added to lignocaine has been found to improve the intensity and duration of the anaesthetic blockade. Addition of dexmedetomidine to levobupivacaine in brachial plexus blocks[46] has decreased the onset of action and enhanced the duration of the nerve blockade and provided better pain relief postoperatively. Intra articular administration of dexmedetomidine to patients undergoing arthroscopic knee surgery has been found to improve the intensity and quality of pain relief perioperatively[47].

For ICU sedation, dexmedetomidine has become a popular sedative agent because of its ability to produce cooperative sedation, i.e., patients remain awake, calm, and are able to communicate their needs. It does not interfere with the respiratory drive or produce any agitation, hence facilitating early weaning from the ventilator, thereby reducing overall ICU stay costs. Since dexmedetomidine maintains a sleep state that is similar to that of the natural sleep, it hastens the recovery in ICU patients. Dexmedetomidine, on comparison with the conventional opiates and sedatives, is found to have better analgesic and sedative properties, produces less delirium and has caused less depression of the respiratory system and also has a favourable outcome in the cardiovascular system.

PROCEDURAL SEDATION

Dexmedetomidine is an attractive agent for short term procedural sedation and has been safely used in elective awake fiberoptic intubation, transesophageal echocardiography, awake carotid endarterectomy, colonoscopy, vitreoretinal surgery, shockwave lithotripsy, pediatric MRI[48] and in paediatric patients undergoing tonsillectomy. The loading dose of dexmedetomidine for procedural sedation is 1 mcg / kg and the dose for maintainence is 0.2 mcg / kg / hour. The onset time for its action is about five minutes and reaches the peak in

about fifteen minutes. Atipamezole is the antagonist of choice for the alpha - 2 adrenoreceptor agents and hence it reverses the pharmacologic actions of dexmedetomidine.

CONTROLLED HYPOTENSION

Dexmedetomidine is a safe and an effective agent for controlled hypotension which is mediated by its central and peripheral sympatholytic action. Spinal fusion surgery for idiopathic scoliosis, tympanoplasty and septoplasty[49] operations and maxillofacial surgery have been safely done with dexmedetomidine -controlled hypotension.

Dexmedetomidine has a significant opioid sparing effect and is useful in intractable neuropathic pain. In cardiac surgeries, dexmedetomidine apart from attenuating the stress responses during intubation of trachea, has also contributed to a decrease in the area of myocardial ischemia.

NEUROSURGERY:

Dexmedetomidine provides a consistent cerebral hemodynamic effect without causing a sudden rise in intracranial tension during endotracheal intubation, extubation, and insertion of the head pin. It attenuates the neurocognitive impairment (delirium and agitation) thereby, allowing immediate postoperative neurological evaluation[50]. Dexmedetomidine provides neuroprotection through various methods of action which makes it, a promising drug in neurosurgery. It does not interfere with neurological monitors and has an upcoming role in "functional" neurosurgical procedures like awake craniotomy which involves resecting the tumours of the brain and also in the surgical management of Parkinson's disease.

OBESITY

Dexmedetomidine does not cause respiratory depression and has been infused at the rate of 0.7 mcg/ kg intraoperatively to avoid respiratory depression due to narcotic usage in morbidly obese patients.

OBSTETRICS

Dexmedetomidine is being used effectively as an adjunctive agent in parturients who are in labour and in whom epidural analgesia was not effective. It provides anxiolysis, stable hemodynamics and also stimulates the contractility of the uterus. It is retained in placental tissue and passes less readily into the fetal circulation than clonidine because of its high lipophilicity and thereby has less susceptibility to cause fetal bradycardia.

PEDIATRICS

Dexmedetomidine is not approved yet for use in the paediatric population. Yet, it has been used successfully in inducing somnolence in the paediatric patients in the ICU[51] and also for diagnostic and therapeutic radiological imaging techniques[48].

OTHER USES:

- Dexmedetomidine is found to be effective in the management of withdrawal symptoms associated with alcohol[52], opioids, benzodiazepines and other addicting drugs.
- As an adjunct in otorhinolaryngology anesthesia for rhinoplasty and in surgeries involving the middle ear.
- As an adjunctive agent in aneurysmal repair surgeries.
- As an antishivering agent.
- Dexmedetomidine is effective in preventing ethanol induced neurodegeneration.

DRUG INTERACTIONS

Dexmedetomidine when administered with other anaesthetic agents or sedatives is found to exhibit a drug interaction which results in the potentiation of the overall sedative effect. This adjunct effect often decreases the reliance on other agents. Concurrent administration of dexmedetomidine and digoxin may result in a decrease in the heart rate, possibly through an additive increase in vagal tone.

ADVERSE EFFECTS

Dexmedetomidine is associated with many adverse effects. This includes bradycardia, hypertension, hypotension, dry mouth, nausea, vomiting, atrial fibrillation, pyrexia, chills, pleural effusion, atelectasis, pulmonary edema, hyperglycemia, hypocalcemia, acidosis, etc. Rapid administration of dexmedetomidine infusion at the rate of 1 mcg / kg / hour if administerd in less than ten minutes may cause transient hypertension mediated by peripheral alpha 2B - adrenoreceptor vasoconstriction. But hypotension and bradycardia[53] may occur with ongoing therapy which is mediated by central alpha 2A – adrenoreceptor thereby causing decreased release of noradrenaline from the sympathetic nervous system. Long term use of

dexmedetomidine leads to supersensitization and upregulation of the receptors; so, with abrupt discontinuation, a withdrawal syndrome of nervousness, agitation, headaches, and hypertensive crisis can occur

II. Aims And Objectives Of The Study

To study the effects of epidural dexmedetomidine on quality and efficacy of epidural bupivacaine 0.5% for lower abdominal surgeries, by studying :

- The onset and duration of sensory and motor blockade.
- Highest dermatomal level achieved
- The Intraoperative and post operative hemodynamic effects.
- The sedation levels
- The study of intraoperative and postoperative anaesthesia and analgesia.
- The adverse effects of epidural dexmedetomidine added to bupivacaine in lower abdominal surgeries.

III. Review Of Literature

Coskuner et al in 2007 did a study to examine the effects of intravenous dexmedetomidine on the duration of bupivacaine-induced epidural anaesthesia and level of wakefulness and the respective side-effects.Sixty ASA I–II patients were included in the study. Consecutive patients were allocated to groups according to the last digit (odd/even) of their admission numbers. All patients had epidural anaesthesia with bupivacaine 0.5% performed by the same experienced anaesthesiologist. In the first group, the patients were administered intravenous dexmedetomidine infusion just after the epidural block and continued during the operation, while those in the second group were administered physiologic saline infusion at the same amount and duration.The recovery time of sensory block was significantly longer in the first group. The bispectral index values were lower in the first group than in the second. Also, heart rate was significantly lower in Group I than in Group II. Regarding side-effects, shivering was significantly less frequent in the first group, whereas there was a significant increase in the requirement of atropine in the first group as dexmedetomidine caused bradycardia.Intravenous administration of dexmedetomidine prolonged the duration of epidural anaesthesia, provided sedation and had few side-effects.

Sudheesh et al in 2011 did a detailed study about wonder drug dexmedetomedine in anaesthesia practice. Dexmedetomidine has become of the frequently used drugs in anaesthetic armamentarium, along with routine anaesthetic drugs, due to its haemodynamic, sedative, anxiolytic, analgesic, neuroprotective and anaesthetic sparing effects. Other claimed advantages include minimal respiratory depression with cardioprotection, neuroprotection and renoprotection, thus making it useful at various situations including offsite procedures.[1] α-1 to α-2 ratio of 1:1600 makes it a highly selective α-2 agonist compared to clonidine, thus reducing the unwanted side effects involving α-1 receptors.

High selectivity of dexmedetomidine to α-2A receptors (which mediate analgesia and sedation) has been exploited by various authors in regional anaesthesia practice.

Due to its central sympatholytic effect, dexmedetomidine is useful in blunting haemodynamic responses in perioperative period. It is successfully used in intravenous doses varying from 0.25 to 1 mcg/kg for attenuating intubation response.[2–5] Optimal dose for attenuating pressor response seems to be 1 mcg/kg with lesser doses not being effective.[5] Infusion continued into the postoperative period has been associated with reduced haemodynamic fluctuations and decrease in plasma catecholamines.[3] Doses in the range of 0.5 mcg/kg not only blunted the extubation response but also reduced the emergence reaction and analgesic requirement to extubation following rhinoplasty and neurosurgery. There was no delay in recovery or prolonged sedation when boluses were administered before induction or before extubation. Similar was the observation when duration of infusion was within 2 hrs.[6,7] Bradycardia and hypotension are the major side effects observed following dexmedetomidine infusion. Bradycardia is attributed to reflex response for transient hypertension during initial part of infusion. Subsequent decrease in heart rate is due to decrease in central sympathetic outflow. Hypotension is attributed to decreased central sympathetic outflow. Transient hypertensive response has been observed with higher doses (1–4 mcg/kg). This is attributed to initial stimulation of α-2B receptors present in vascular smooth muscles. This hypertensive episode settles once there is decrease in central sympathetic outflow. Mason *et al*. observed increased incidence of hypertension in children less than 1 year, undergoing magnetic resonance imaging (MRI) under dexmedetomidine sedation, and observed that younger children and multiple bolus therapies are highly significant predictors of the occurrence of hypertension.[8]

The highly selective effect of dexmedetomidine promotes its use for intensive care unit (ICU) sedation. Reduced ICU stay, decreased duration of ventilation, haemodynamic stability and reduced agitation are claimed

advantages. However, a meta-analysis by Tan[9] did not find any significant advantage with regards to duration of mechanical ventilation. It was further suggested that the risk of bradycardia was significantly higher when both a loading dose and high maintenance doses (more than 0.7 mcg/kg/hr) were used. Jones *et al.* retrospectively analysed different doses of dexmedetomidine for ICU sedation and noted that doses greater than 0.7 mcg/kg/hr did not enhance sedation or incidence of side effects.[10] This is further endorsed by the meta-analysis by Tan where it was observed that incidence of bradycardia requiring intervention increased in studies that used both a loading dose and maintenance doses of dexmedetomidine in excess of 0.7 mcg/kg/hr.[9]

By virtue of its effect on spinal α-2 receptors, dexmedetomidine mediates its analgesic effects. Dexmedetomidine has been found to prolong analgesia when used as an adjuvant to local anaesthetics for subarachnoid block, epidural and caudal epidural blocks. However, there is no proper consensus regarding the dose of drug to be used for neuraxial blocks. Doses varying from 3 to 15 mcg have been used as adjuvant to bupivacaine for spinal anaesthesia. There has been dose-dependant prolongation of analgesia. However, the incidence of side effects due to dexmedetomidine alone is difficult to assess as different doses of bupivacaine were used in different studies.[11–13] Addition of dexmedetomidine 2 mcg/kg to caudal bupivacaine 0.25% at 1 ml/kg significantly promoted analgesia after anaesthetic recovery in children aged 6 months to 6 years, without increasing the incidence of side effects.[14]

Animal studies have shown dose-dependant reduction in minimum alveolar concentration (MAC) of isoflurane following epidural administration of dexmedetomidine in dogs at 2 hrs and 4.5 hrs.[15] However, Konacki *et al*., in their study on rabbits, noted no sensory or motor effects of epidural dexmedetomidine when administered without local anaesthetic, but for its potential to neurotoxicity. Following epidural anaesthesia in rabbits, they found evidence of demyelinisation of the oligodendrocytes in the white matter in dexmedetomidine group which was significantly higher than when only lignocaine was used.[16] In a recent study conducted on patients undergoing thoracic surgery under combined epidural and general anaesthesia, dexmedetomidine administered via epidural route provided good postoperative analgesia with reduction in anaesthetic requirements.[17] Dexmedetomidine has been successfully used in children as adjuvant in caudal epidural. 1–2 mcg/kg dexmedetomidine used along with bupivacaine provided prolonged analgesia without significant side effects.[18,19] However, its superiority against clonidine is yet to be fully established.[19]Dexmedetomidine is finding its way into every segment of anaesthesia practice, and barring few animal study reports, no significant side effects so far being described, this drug may stay put firmly in anaesthetist's armamentarium.

Seema Shreepad Karhade et al in 2015 compared epidural bupivacaine with epidural bupivacaine with dexmedetomidine similar to our study.Selection of the exclusive epidural route during this study was done deliberately to avoid the spinal anesthesia induced sudden hypotension, to provide the post-operative pain relief and to study the analgesic, anesthetic potency, safety of the dexmedetomidine. This study directly shows the effects of the epidural dexmedetomidine.To provide sedation, stable hemodynamics and prolonged postoperative analgesia are the main desirable qualities of an adjuvant used in epidural anesthesia.[14] The demographic profile in the present study was comparable to other studies and did not show any statistical difference.

In the present study, the dexmedetomidine showed an earlier onset of sensory and motor blockade. Postoperatively number of the top ups were less with the bupivacaine dexmedetomidine group as compared to bupivacaine alone.

Sukhminder Bajwa *et al*.[10] also found the early onset of analgesia and motor blockade in epidural dexmedetomidine when used with ropivacaine. Gupta *et al*.[15] found similar results with epidural dexmedetomidine when used with levobupivacaine in doses comparable to our study.

Sedation score was 2 on Ramsey sedation scale throughout the surgery and up to 2 h in post-operative room with the dexmedetomidine group, whereas in group I patients were given midazolam for the same effects. All these results show the analgesic, anesthetic and sedative properties of the dexmedetomidine.

In the present study, baseline heart rate was between 80 and 90/min. Heart rate dropped down to 56 and 70/min in six patients in epidural dexmedetomidine group. None of the patients needed atropine. Similarly, mean arterial pressure decreased from baseline in both the groups and comparable, but it never went below 70 mm of Hg. The decrease in the heart rate caused by alpha-two agonist can be explained on the basis of their central action where they decrease the sympathetic outflow and nor epinephrine release.[11,12,13] The stable hemodynamics can possibly be explained on the basis of lower volumes of the local anesthetic agent used, the lower doses of the adjuvant used.

Dry mouth, shivering was observed in five patients from dexmedetomidine group but was mildly discomforting to the patients and did not need any treatment. None of the patients in the present study had episodes of the respiratory depression.

Safiya I Shaikh et al in 2016 analysed the efficacy and safety of epidural dexmedetomidine with bupivacaine.Epidural analgesia offers superior pain relief and early mobilization especially when local anesthetic dose is combined with an adjuvant.[1] Epidural anesthesia is popular and offers several benefits to the

patients but at the same time it is linked with drawbacks like pain at the puncture site, fear of needles, and recall of the procedure.[13,14,15,16]. These factors stress the importance of sedation that offers analgesia, anxiolysis, and amnesia. Sedation is known to increase patient's acceptance of regional anesthesia and to greatly improve patient wellbeing during the surgical procedure.[17]

Alpha 2-agonists have evolved as a panacea for various applications/procedures with multiple promising delivery routes. Epidural administration of these drugs is associated with sedation, analgesia, anxiolysis, hypnosis and sympatholysis.[18,19] α-2 agonists may provide an attractive alternative to anesthetic adjunctive agents now in use because of their anesthetic-sparing and hemodynamic-stabilizing effects.[20,21] α-2 adrenoreceptor agonists produce analgesia by depressing release of C - Fiber transmitters and by hyperpolarization of postsynaptic dorsal horn neurons.[22,23,24] The complementary action of local anesthetics and α-2 adrenoreceptor agonists accounts for their profound analgesic properties. The prolongation of the motor block of local anesthetics may be the result of binding of α-2 adrenoreceptor agonists to the motor neurons in the dorsal horn.[4,5] Dexmedetomidine is eight times more specific and highly selective α-2 adrenoreceptor agonist compared to clonidine.[20,25]

This study was undertaken to compare the analgesic efficacy, and sedative effects of two α-2 agonists when administered epidurally along with bupivacaine.

Dexmedetomidine provided a smooth intra-operative analgesia as compared to clonidine which is evident from the results. Addition of either 1 μg/kg dexmedetomidine or 2 μg/kg clonidine as adjuvant to epidural bupivacaine leads to early[3,5,26,27] onset of analgesia, faster achievement of maximum sensory level and motor blockade. It not only prolonged the duration of analgesia but also provided a good sedation level during the surgical procedure without significant hemodynamic effects. Our data support previous studies that used dexmedetomidine and clonidine as additive to regional anesthetics.[5,26,27]

We found no statistical significance in the peak levels of analgesia provided by both drugs. Our findings were in concordance with Salgado *et al*.[27] Unlike our study Bajwa *et al*.[5] found that dexmedetomidine provided a significantly higher dermatomal spread compared to clonidine when added as adjuvant to epidural ropivacaine. This is probably due to the lesser amount of dexmedetomidine (1 μg/kg) used in our study.

The hypnotic and supraspinal analgesic effects of dexmedetomidine are mediated by the hyperpolarization of noradrenergic neurons, which suppresses neuronal firing in the locus coeruleus along with inhibition of norepinephrine release and activity in the descending medullospinal noradrenergic pathway.[28,29,30]

The results of our study clearly indicate the effectiveness of epidural dexmedetomidine as adjuvant to bupivacaine in providing sedation, more patients in Group A had sedation score 3 and were arousable by gentle tactile stimulation as compared to Group B. Similar results were seen in study done by.[5,11,26]

The cardio-respiratory parameters, as evident from [Figures [Figures33–5] remained stable throughout the study period which reaffirms the established effects of α-2 agonists in providing a hemodynamically stable peri-operative and postoperative period. The requirement of vasopressors for the maintenance of stable hemodynamic parameters did not reveal significant differences between the both groups on statistical comparison. Similarly, comparable cardio-respiratory parameters were also observed by.[26,27,31]

Avoidance of respiratory depression in the patients who were administered dexmedetomidine and clonidine was one of the most remarkable observation in our study [Figure 5] and the evidence is similar to the earlier studies where researchers have found complete absence of clinically detectable respiratory depression in the previous multiple human studies.[32,33,34]

The dexmedetomidine group showed visible superiority over clonidine group in various postoperative block characteristics like the weaning of sensory and motor block, prolonged postoperative analgesia. Similar to this study, Bajwa *et al*. found significant prolongation of time to two segmental dermatomal regression and regression to Bromage 1 in dexmedetomidine group when compared to clonidine group. Salgado *et al*. found the duration of motor block was significantly higher in the dexmedetomidine group ($P > 0.05$), being on average 30% higher than that observed in the control bupivacaine group.

Intensity of postoperative pain and quality of relief of pain was assessed using VRS and analgesia was provided when VRS was >4. We found significantly higher verbal analogue scores in clonidine group at 220, 250, 310 and 340 min. Our results were similar to studies conducted by Saravana Babu *et al*., Schnaider *et al*., El-Hennawy *et al*. who found significant differences in the visual analog scores in clonidine group compared to dexmedetomidine group. Unlike this study, Salgado *et al*. found no difference in the scores of pain, assessed in the postanesthesia care unit.

The incidence of side-effects like vomiting, headache, shivering and dizziness were comparable in both the groups and statistically nonsignificant. The incidence of nausea (four patients in Group A and three patients in Group B) and dry mouth (six patients in Group A and seven patients in Group B) was significantly higher in both the groups but it was statistically nonsignificant on comparison. Prevention of shivering in patients with

dexmedetomidine (1 of 30) and clonidine (2 of 30) was seen. Similar to this study, Bajwa *et al*. and El-Hennawy *et al*. also found the incidence side-effects to be statistically nonsignificant on comparison. Clonidine and dexmedetomidine acts on central thermoregulatory system to reduce the vasoconstriction threshold and the shivering threshold and prevents postoperative shivering.[35,36]

Most of the previous studies have used a higher dexmedetomidine dose and found superior results to clonidine.[5,26,27] This study clearly shows the superiority of lower dose of dexmedetomidine (1 μg/kg) when compared to clonidine (2 μg/kg).

IV. Materials And Methods

SETTING

The study is to be done in Coimbatore Medical College Hospital between July 2016 to September 2017 in the Department of Anaesthesiology.

STUDY ON POPULATION :

Data will be collected from patients posted for lower abdominal surgeries in Department of Anaesthesiology, Pain and Critical Care, Coimbatore Medical College Hospital.

TYPE OF STUDY:

Prospective Randomized Controlled Study.

SAMPLE SIZE :

60 patients will be enrolled in this study 30 in each group with below mentioned inclusion and exclusion criteria

Case selection will be done as follows:

INCLUSION CRITERIA:

1) American Society of Anesthesiologists Grade 1 and 2 patients.
2) Age 20-60 years
3) Patients undergoing lower abdominal surgeries.

EXCLUSION CRITERIA:

1) American Society of Anesthesiologists Grade 3 and 4 patients
2) Patients with known contraindications for epidural anesthesia.
3) Patients with hemodynamic instability
4) Patients with cardiac and respiratory dysfunction.
5) Patients allergic to amide group of local anaesthetic agents.

MATERIALS USED:

- 16 Gauge Tuohy needle
- 18 Gauge epidural catheter
- Loss of resistance syringe
- 10 ml syringe , 2 ml syringe
- Local anaesthetic solution (3 ml of 1.5% lignocaine with epinephrine 1 in 2,00,000 dilution) for test dose.
- 0.5 % bupivacaine
- Inj. Dexmedetomidine
- 22 G needle for pin prick test
- Tuberculin syringe

METHODOLOGY:

Following detailed pre-anesthetic check up, Informed written consent is obtained from patients fulfilling the required criteria. Patients are randomly divided into two groups namely group I and group II.

Group I : Control group receiving epidural 0.5% bupivacaine 15 – 20 ml only.

Group II : Group receiving epidural 0.5% bupivacaine 15 – 20 ml with dexmedetomidine 0.5μg/kg.

In the preoperative room, venous access achieved with the 18 gauge vasofix. After taking the patient into the operative room, monitor attached to and baseline value of pulse rate (PR),non invasive blood pressure (NIBP), pulse oximetry (SpO2), respiratory rate noted. All the patients coloaded with 500 ml of lactated Ringer solution.

After taking all aseptic precautions, the lumbar epidural block induced using 16 gauge tuohy needle , in sitting position. After skin infiltration with 2% lignocaine in the L2-L3 interspace ,the epidural needle inserted , and epidural space identified by loss of resistance to air technique.An epidural catheter inserted and

kept 5 cm in the epidural space and then fixed on the back of the patient. Test dose of 3ml 1.5% lignocaine with adrenaline given through the catheter after changing to supine position. After ruling out intradural and intravascular placement of the catheter, the study drug given epidurally, prepared by anaesthesia technician unaware of the study design.

The following solutions are randomly administered:

Group I : Received 15 ml of 0.5% bupivacaine.

Group II: Received 15 ml of 0.5% bupivacaine with 0.5µg/kg of dexmedetomidine .

Bilateral pin prick method is used to evaluate and check sensory level. Motor blockade assessed by modified Bromage scale (0= no block, 1= inability to raise extended leg, 2= inability to flex knee, 3= inability to flex ankle and foot). Sensory and motor block assessed every 5 minutes after giving the study drug for thirty minutes. Following parameters observed after the epidural block: Time of onset of the analgesia to T10 , maximum sensory level achieved, time for complete motor block (Bromage scale 3), time for two segmental dermatomal regression, regression to S1 dermatome, time for first rescue analgesic and total topups required during the study. Hemodynamic parameters – NIBP, PR, SpO2, ECG measured continuously and recordings made every 5 minutes till the completion of the surgery and every 15 minutes after the patients were shifted to the recovery unit.

Hypotension is defined as decrease in the systolic blood pressure more than 30 % of the baseline value and treated with ephedrine and bradycardia is defined as PR less than 50 / minute and treated with atropine 0.6 mg.

Grading of sedation evaluated by the Ramsay Sedation score

Score	**Responsiveness**
1	Patient is anxious and agitated or restless or both
2	Patient is co-operative, oriented and tranquil
3	Patients responds to commands only
4	Patient exhibits brisk response to light glabellar tap or loud auditory stimulus
5	Patient exhibits a sluggish response to light glabellar tap or loud auditory stimulus
6	Patient exhibits no response.

Sedation scores recorded just before surgery and thereafter every 20 minutes during the surgical procedure. Any untoward incident and side effects during the study period are carefully observed and managed symptomatically. Patient satisfaction score noted.

Parameters to be observed:

1.Demographic parameters
2.Baseline parameters
3. Duration of surgery
4. VAS score
5. Duration of analgesia
6. Time for first rescue topup
7. Incidence of side eff

V. Observation And Results

STATISTICAL TOOLS

The information gathered from the selected cases were noted in the master chart. The data are reported as the mean + / - SD or the median , depending on their distribution . Frequencies are expressed in percentages. The differences in quantitative variables between groups were assessed by means of the unpaired t test.The chi square test was used to assess differences in categoric variables between groups. A p value of < 0.05 using a two –tailed test was taken as test of significance for all statistical tests. All the data were analysed with a statistical software package.(SPSS ,version 16.0 for windows)

COMPARISON OF AGE:

Figure 8: Comparison of age

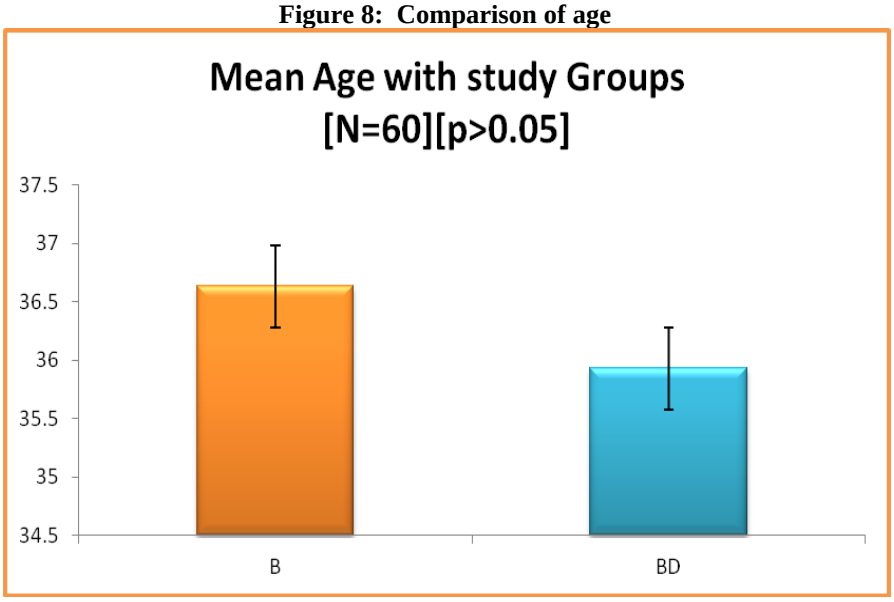

Table 8 : Comparison of age

Group	Mean	SD	95% CI for Mean		Minimum	Maximum	p value
			Lower	Upper			
B	36.63	9.593	33.05	40.22	22	55	
BD	35.93	9.476	32.4	39.47	22	55	
Total	36.28	9.46	33.84	38.73	22	55	>0.05

The mean age of group B and BD were 36.6 and 35.9 respectively. There was no statistically significant difference with the p value more than 0.05 between the mean age of two groups which shows that these two groups were similar with respect to age.

COMPARISON OF HEIGHT:

Figure 9 : Comparison of height

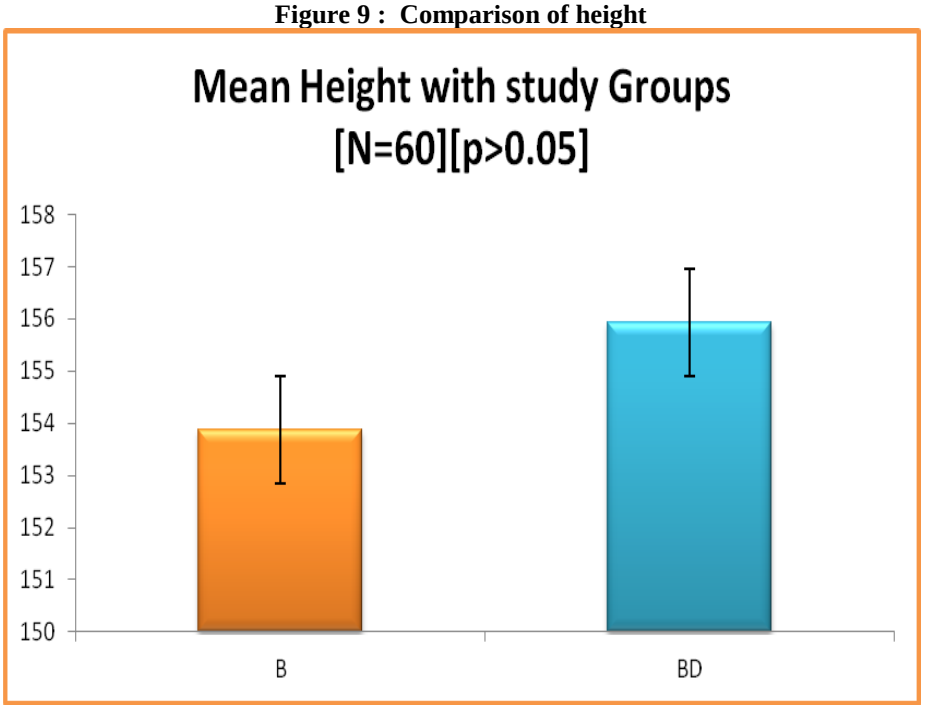

Table 9 : Comparison of height

		SD	Std. Error	95% CI for Mean		Minimum	Maximum	p value
Height[cm]	Mean			Lower	Upper			
B	153.87	4.023	0.735	152.36	155.37	148	168	>0.05
BD	155.93	4.299	0.785	154.33	157.54	149	168	
Total	154.9	4.257	0.55	153.8	156	148	168	

The mean height of groups B and BD were153.87 and 155.93 respectively. There is no statistically significant difference (p value more than 0.05) between these groups which shows that they are comparable with respect to height.

COMPARISON OF WEIGHT

Figure 10 : Comparison of weight

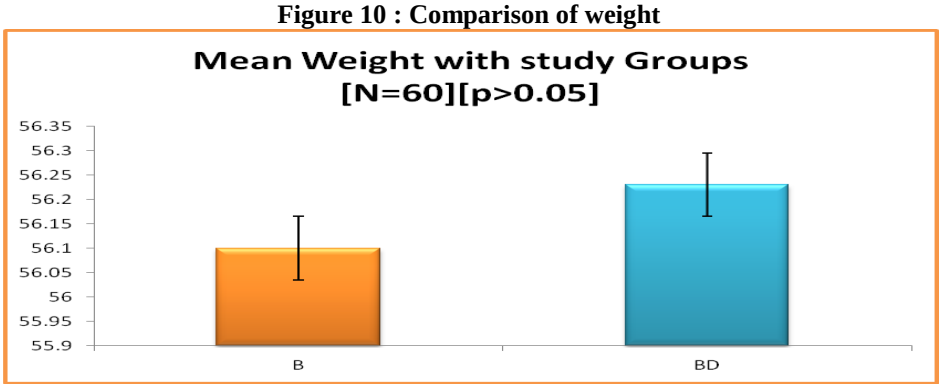

Table 10: Comparison of weight

Weight[kg]	Mean	SD	Std. Error	95% CI for Mean		Minimum	Maximum	p value
				Lower	Upper			
B	56.1	4.795	0.875	54.31	57.89	49	69	
BD	56.23	4.032	0.736	54.73	57.74	50	65	
Total	56.17	4.392	0.567	55.03	57.3	49	69	>0.05

The mean weight of the group B and BD were 56.10 and 56.23 respectively. There is no statistically significant difference (p value more than 0.05) between these groups which shows that they are comparable with respect to weight.

DURATION OF SURGERY

Figure 11 : Duration of surgery

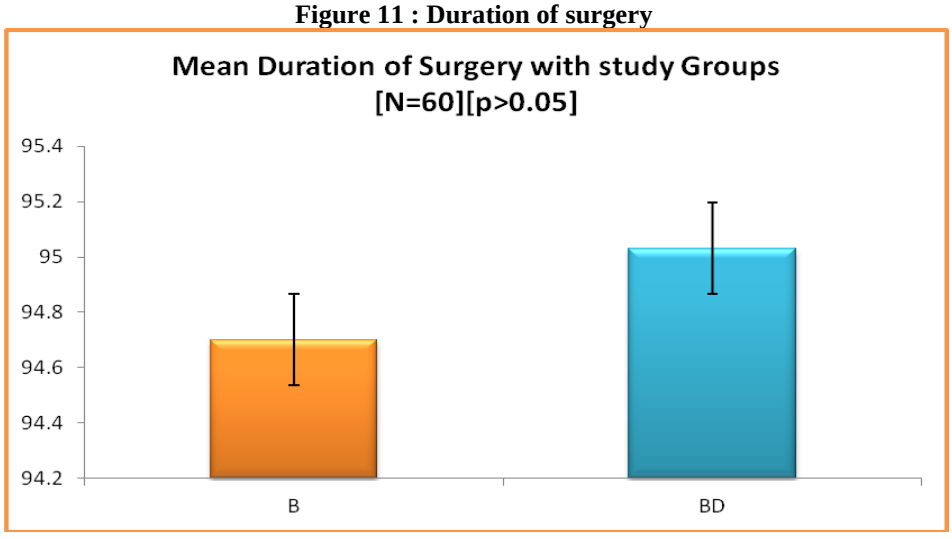

Table 11: Duration of surgery

	Mean	SD	Std. Error	95% CI for Mean		Minimum	Maximum	p value
				Lower	Upper			
B	94.7	7.111	1.298	92.04	97.36	84	108	
BD	95.03	8.938	1.632	91.7	98.37	64	108	>0.05

The mean duration of surgery in group B and BD were 94.70 minutes and 95.03 minutes respectively. p value is more than 0.05 which is not statistically significant and hence they are comparable with each other.

ONSET OF SENSORY BLOCK AT T10 :

Figure 12 : Onset of sensory block at T10 (minutes)

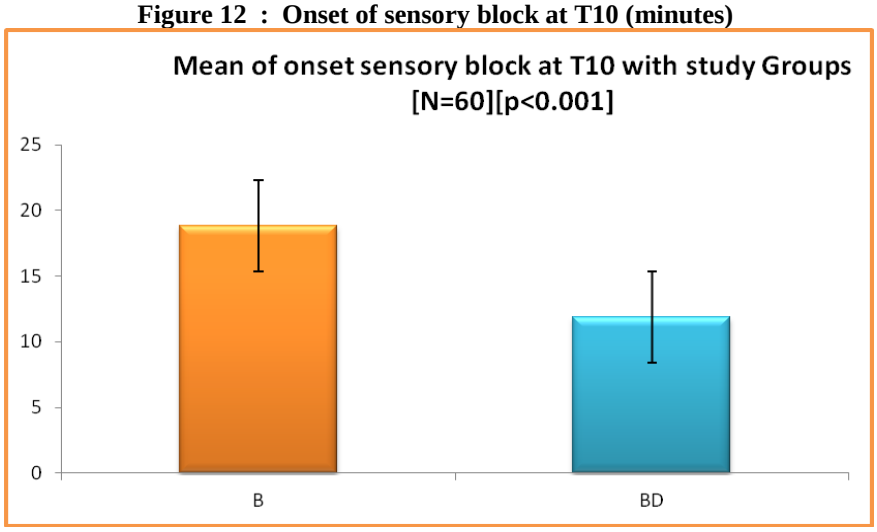

Table 12 : Onset of sensory block at T10 (minutes)

	Mean	SD	Std. Error	95% CI for Mean		Minimum	Maximum	p value
				Lower	Upper			
B	18.83	1.621	0.296	18.23	19.44	17	22	<0.001
BD	11.87	1.008	0.184	11.49	12.24	10	14	
Total	15.35	3.759	0.485	14.38	16.32	10	22	

The mean onset of sensory block at T10 in group B and BD were 18.83 minutes and 11.87 minutes respectively. p value is less than 0.001 which is statistically significant and hence the onset of analgesia at T10 dermatomal level was significantly earlier in group BD as compared to group B.

TIME FOR MAXIMUM SENSORY BLOCK

Figure 13 : Time for maximum sensory block (minutes)

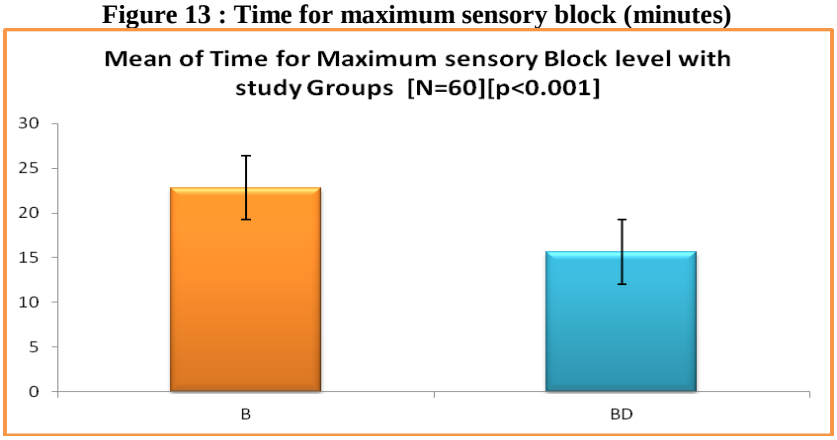

Table 13: Time for maximum sensory block (minutes)

	Mean	SD	Std. Error	95% CI for Mean		Minimum	Maximum	p value
				Lower	Upper			
B	22.8	1.584	0.289	22.21	23.39	20	25	
BD	15.63	0.999	0.182	15.26	16.01	14	18	<0.001
Total	19.22	3.845	0.496	18.22	20.21	14	25	

The mean of time for maximum sensory block in group B and BD were 22.80 minutes and 15.63 minutes respectively. p value is less than 0.001 which is statistically significant and hence time for maximum sensory block was significantly earlier in group BD as compared to group B.

TIME FOR COMPLETE MOTOR BLOCK

Figure 14 :Time for complete motor block (minutes)

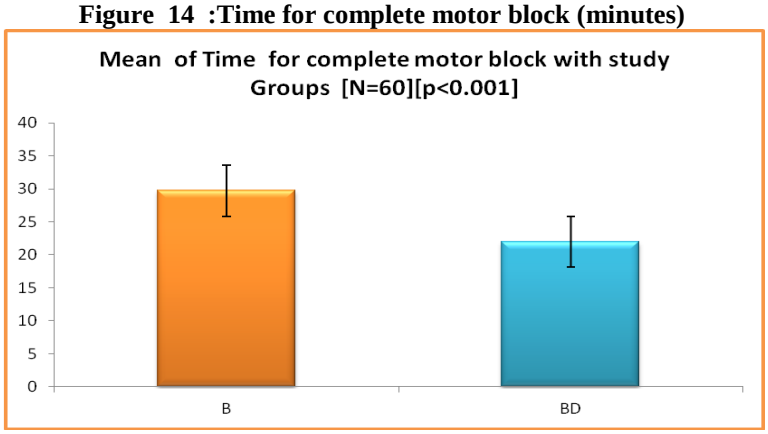

Table 14: Time for complete motor block (minutes)

	Mean	SD	Std. Error	95% CI for Mean		Minimum	Maximum	p value
				Lower	Upper			
B	29.73	1.596	0.291	29.14	30.33	27	33	
BD	22	1.509	0.275	21.44	22.56	20	25	
Total	25.87	4.192	0.541	24.78	26.95	20	33	<0.001

The mean of time for complete motor block in group B and BD were 29.73 minutes and 22 minutes respectively. p value is less than 0.001 which is statistically significant .Complete motor block was achieved quite earlier in group BD as compared to group B.

TIME TO TWO SEGMENTAL REGRESSION

Figure 15: Time to Two Segmental Regression (minutes)

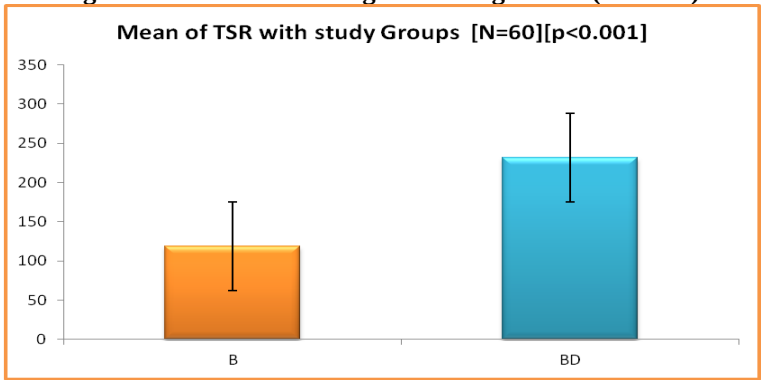

Table 15: Time to Two Segmental Regression (minutes)

	Mean	SD	Std. Error	95% CI for Mean		Minimum	Maximum	p value
				Lower	Upper			
B	118.93	4.456	0.814	117.27	120.6	110	126	
BD	231.73	39.935	7.291	216.82	246.65	22	250	<0.001
TOTAL	175.33	63.471	8.194	158.94	191.73	22	250	

The mean time to two segmental regression in group B and BD were 118.93 minutes and 231.73 minutes respectively. p value is less than 0.001 which is statistically significant and hence time to two segmental regression was significantly prolonged in group BD as compared to group B.

TIME FOR REGRESSION TO BROMAGE I

Figure 16: Time for regression to Bromage I (minutes)

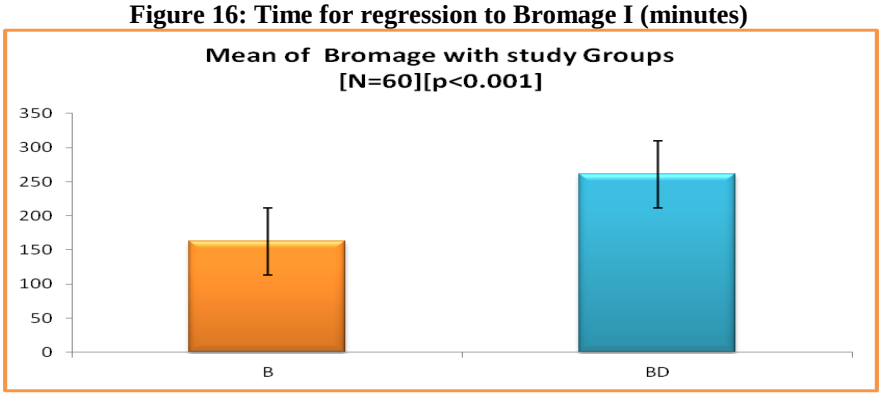

Table 16: Time for regression to Bromage I (minutes)

	Mean	SD	Std. Error	95% CI for Mean		Minimum	Maximum	p value
				Lower	Upper			
B	162.5	8.39	1.532	159.37	165.63	145	175	
BD	260.97	6.734	1.229	258.45	263.48	250	275	<0.001
Total	211.73	50.218	6.483	198.76	224.71	145	275	

The mean time for regression to bromage I in group B and BD were 162.50 minutes and 260.97 minutes respectively. p value is less than 0.001 which is statistically significant. Early return of motor power to bromage I was seen in group B as compared to group BD.

TIME TO RESCUE TOP-UP

Figure 17: Time to rescue top-up (minutes)

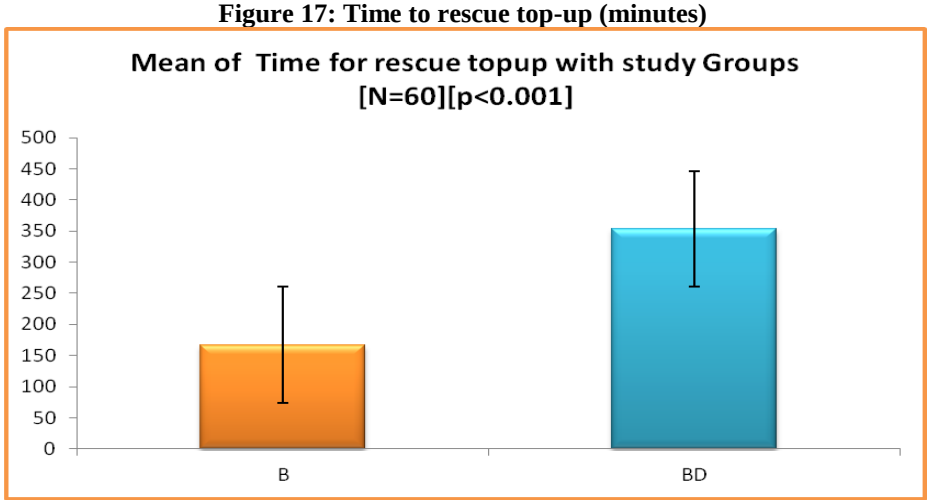

Table 17: Time to rescue top-up (minutes)

	Mean	SD	Std. Error	95% CI for Mean		Minimum	Maximum	p value
				Lower	Upper			
B	167.1	7.725	1.41	164.22	169.98	152	180	
BD	353.27	26.611	4.858	343.33	363.2	272	380	
Total	260.18	95.858	12.375	235.42	284.95	152	380	<0.001

The mean time to rescue top-up in group B and BD were 167.10 minutes and 353.27 minutes respectively. p value is less than 0.001 which is statistically significant .Early return of motor power to bromage I was seen in group B as compared to group BD. As a result , time for rescue analgesia was significantly shorter with group B as compared to group BD.

MEAN HEART RATE

Figure 18 : Heart rate

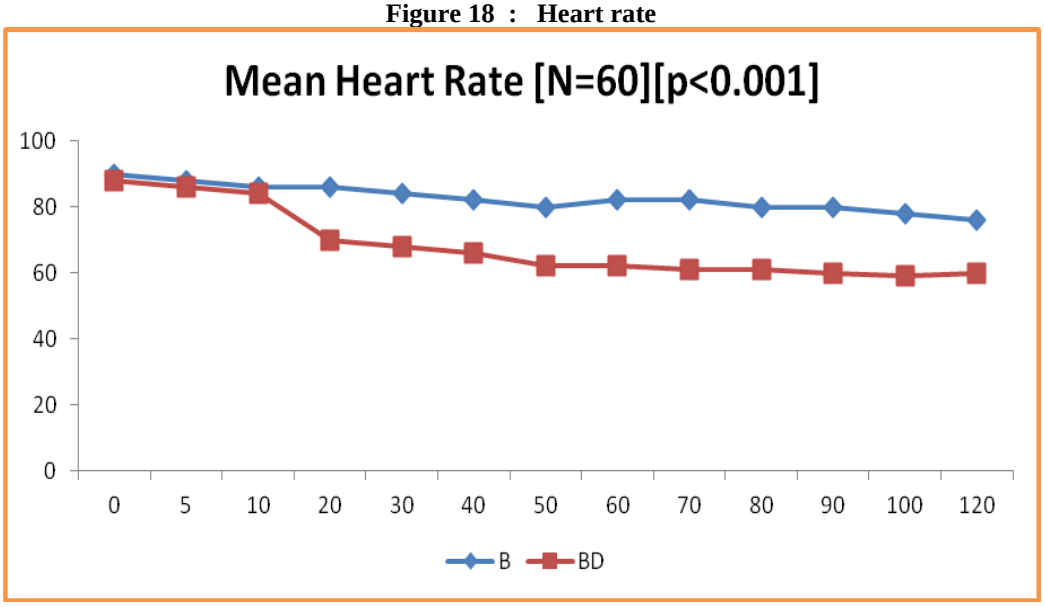

Table 18 : Heart rate

	Mean	SD	Std. Error	95% CI for Mean		Minimum	Maximum	p value
				Lower	Upper			
B	82.62	4.032	1.118	80.18	85.05	76	90	
BD	68.23	10.67	2.959	61.78	74.68	59	88	
Total	75.42	10.782	2.115	71.07	79.78	59	90	<0.001

The mean heart rate in group B and BD were 82.62 and 68.23 respectively. p value less than 0.001 which shows a statistically significant difference in the mean heart rate of both the groups. There was a fall in the mean heart rate in group BD but none of the patients needed injection atropine.

MEAN ARTERIAL PRESSURE

Figure 19: Mean Arterial Pressure

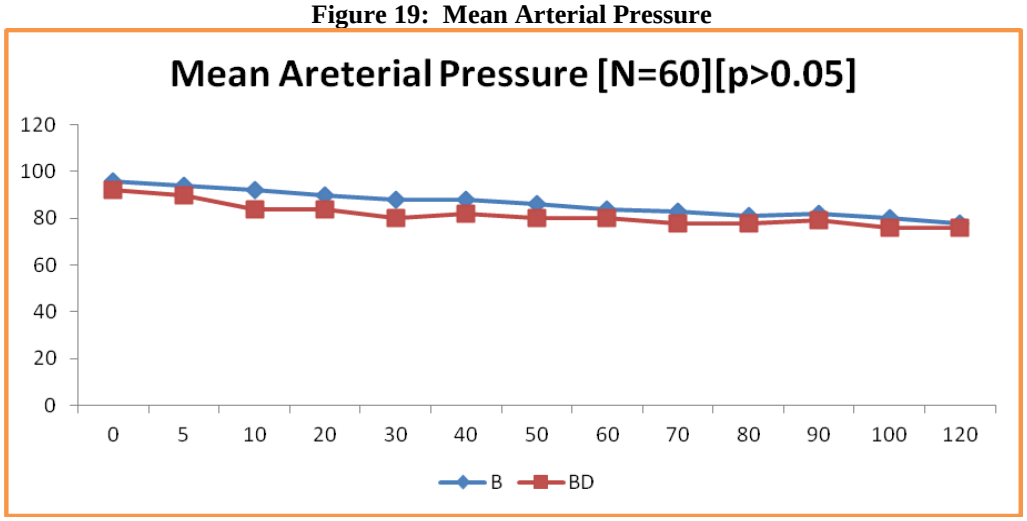

Table 19 : Mean Arterial Pressure

	Mean	SD	Std. Error	95% CI for Mean		Minimum	Maximum	p value
				Lower	Upper			
B	86.31	5.603	1.554	82.92	89.69	78	96	>0.05
BD	81.46	12.446	3.452	61.17	76.21	58	92	
Total	77.5	13.042	2.558	72.23	82.77	58	96	

The mean arterial pressure in group B and BD were 86.31 and 68.69 respectively. p value is more than 0.05 which shows there is no statistically significant difference in the mean arterial pressure of both the groups. The stable haemodynamics can possibly be explained on the basis of lower dose of adjuvant dexmedetomidine used.

SIDE EFFECTS

Figure 20 : Side effects

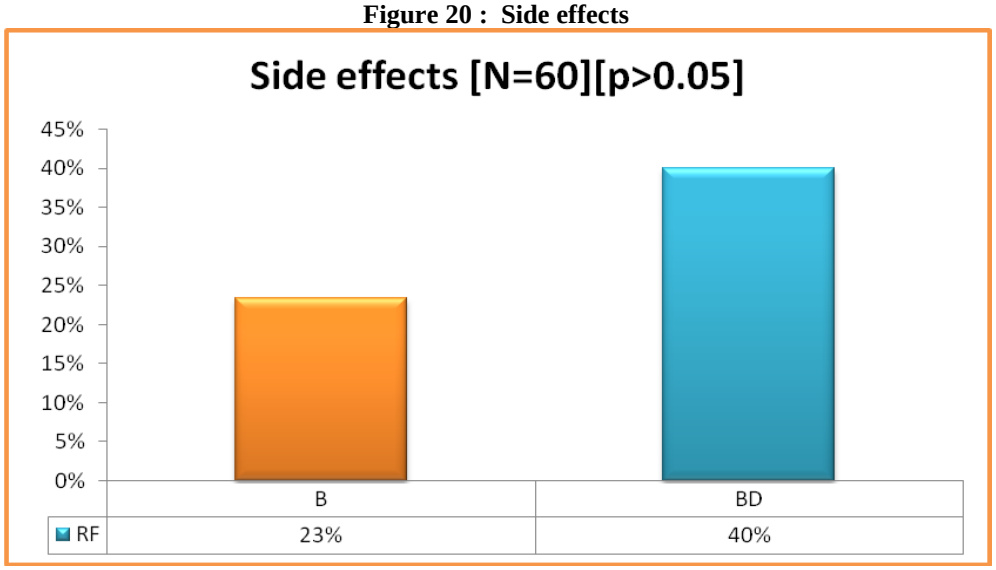

Table 20 : Side effects

Side Effects	Group		Total
	B	BD	
Nausea	1	2	3
HT	3	5	8
Shivering	1	1	2
Headache	0	0	0
Total	5	8	13

Hypotension was the most common side effect in both the groups. The incidence of side effects like nausea, vomiting, shivering , dizziness and dry mouth were comparable in both the groups and statistically nonsignificant.

VI. Discussion

Selection of the exclusive epidural route during this was done deliberately to avoid the spinal anaesthesia induced sudden hypotension, to provide postoperative pain relief and to study the analgesic, anaesthetic potency and the safety of dexmedetomidine. This study directly shows the effects of epidural dexmedetomidine.

To provide sedation , stable hemodynamics and prolonged postoperative analgesia are the main desirable qualities of adjuvant used in epidural anaesthesia. Lower doses of dexmedetomidine was preferred as higher doses results in more side effects such as bradycardia and hypotension.

A study entitled " A Comparitive study Of 0.5% epidural bupivacaine versus 0.5% bupivacaine with 0.5mcg/kg of dexmedetomidine for lower abdominal surgeries"

After getting informed consent from 60 patients of ASA 1 and ASA 2

Patients posted for various lower abdominal surgeries were randomly grouped into either bupivacaine alone(B) and bupivacaine with dexmedetomidine (BD) groups. Epidural space was identified by loss of resistance technique in the L2-L3 space with the patient in sitting position . An epidural catheter inserted and kept 5 cm in the epidural space and then fixed on the back of the patient. Epidural activation is done before skin incision . 0.5% bupivacaine 15ml plain or 0.5% bupivacaine 15ml with 0.5mcg/kg dexmedetomidine given as a single shot.

Based on the observations and results obtained in our study involving 30 patients in each group are discussed in detail by comparing with the available evidences in the literature. The analgesic efficacy of epidurally given 0.5% bupivacaine 15ml alone , 0.5% bupivacaine 15ml plus 0.5mcg/kg dexmedetomidine was studied.

All the demographic tools like age , height, weight were comparable to each other. There is no statistically significant difference between these parameters.

In the present study , the dexmedetomidine showed an earlier onset of sensory and motor blockade. Postoperatively number of topups were less with the bupivacaine with dexmedetomidine group as compared to bupivacaine alone.

Sukhminder bajwa et al also found the early onset of analgesia and motor blockade in epidural dexmedetomidine when used with ropivacaine. Gupta et al found similar results with levobupivacaine in doses comparable to our study.

Sedation score was 2 on ramsay sedation scale throughout the surgery and up to 2 hours in the postoperative room with the dexmedetomidine group where as there was no sedation in the group B . All these results show the analgesic, anaesthetic and sedative properties of the dexmedetomidine.

In the present study , heart rate reduced slightly but none of them needed atropine. Similarly mean arterial pressure decreased from baseline in both the groups and comparable but it never went below 65mm of Hg. The decrease in heart rate caused by alpha-two agonist can be explained on the basis of their central action where they decrease the sympathetic outflow and nor epinephrine release . The stable hemodynamics can possibly be explained on the basis of lower doses of the adjuvant used.

On comparing the time for first analgesic request postoperatively between the two groups , the patients in group B(167.10 mins) requested first analgesic dose earlier than the patients from group BD(353.27mins). This was statistically significant with the p value of < 0.001.

The onset of pain was earlier in the group B, when compared to group BD. This study confirmed that onset of pain is earlier with the local anaesthetic alone than with the combination of local anaesthetic and dexmedetomidine .

Dry mouth, shivering were observed in few patients from dexmedetomidine group but was mildly discomforting to the patients and did not need any treatment. None of the patients in the present study had episodes of respiratory depression.

Summary

After getting ethical committee approval the study was conducted in 60 patients undergoing lower abdominal surgeries belonging to ASA physical status I and II. The 60 patients enrolled in the study were divided into two groups.

The data were statistically analysed,compared and discussed. The results obtained are summarised below:

The demographic data like age, weight and height were comparable to each other in both the groups.

The time for maximum sensory block was significantly earlier in group BD patients (15.63 min) and it was delayed in group B patients (22.80 min)

The time for complete motor block was significantly earlier in group BD patients (22 min) when compared to group B patients (29.73 min)

The time to two segmental regression was significantly prolonged in group BD patients (231.73 min) and it was earlier in group B patients (118.93 min)

The time for first analgesic request was significantly earlier in group B patients (167.10 min) and it was delayed in group BD patients (353.27 min)

Hypotension was the most common side effect in both the groups. The incidence of side effects like nausea, vomiting, shivering , dizziness and dry mouth were comparable in both the groups and statistically nonsignificant.

VII. Conclusion

We conclude that epidural administration of dexmedetomidine – bupivacaine admixture resulted in faster onset of action of local anaesthetic agents,rapid establishment of both sensory and motor block,prolonged postoperative analgesia, stable haemodynamics when compared to other group. Dexmedetomidine reduces the dose of epidural bupivacaine, potentiates its action, provides adequate surgical anaesthesia and postoperative analgesia with a desirable level of sedation and minimal side effects. Hence we conclude that dexmedetomidine is a very effective adjuvant in epidural anesthesia.

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PROFORMA

Sl.No. Date of Admission
Name: IP No :
Age: Marital Status :
Sex: Occupation :
Address:
Diagnosis:
Surgery:
Weight :
Height : BMI:
ASA Status:
Informed Consent:
Group: I / II

HISTORY
General Examination
Systemic Examination
Investigations:
Haemogram : ECG:
Coagulation profile : Chest X-ray:
Blood Sugar :
Blood Urea Serum Creatinine:
Serum Electrolytes :
Blood Group:

PREOPERATIVE :

- Pulse :
- Blood Pressure : Pre-medication given :
- Resp Rate :
- SpO_2 :
- Preloading :

INTRAOPERATIVE RECORD

1. HAEMODYNAMIC VARIABLES :

MIN	5	10	15	20	25	30	35	40	45	50	55	60	70	80	90	100	110	120
HR																		
SBP																		
DBP																		
MBP																		

2. RESPIRATORY PARAMETERS

MIN	5	10	15	20	25	30	35	40	45	50	55	60	70	80	90	100	110	120
RR																		
SpO2																		

3. CHARACTERISTICS OF SENSORY BLOCK :

a) Highest sensory level :
b) Time from injection to highest sensory level (min) :
c) Time of two segments regression (min) :
d) Time of sensory regression to S1 (min) :

4. CHARACTERISTICS OF MOTOR BLOCK :

a) Onset to Bromage 3 (min) :
b) Regression to Bromage 0 (min) :

5. SEDATION SCORE:

ASSESSED BY RAMSAY SEDATION SCORE

MIN	0	15	30	45	60	75	90	115	120
SEDATION SCALE									

6. ADVERSE EFFECTS :

1) NAUSEA
2) VOMITING.
3) BRADYCARDIA
4) HYPOTENSION.
5) DESATURATION.
6) PRURITIS.
7) OTHERS.

Remarks :

7. ASSESSEMENT OF POST-OPERATIVE ANALGESIA :-

a) Pain intensity assessed by Visual Analogue Scale.
b) Time required for rescue analgesia

Dr. P. Suresh, M.D. Anaesthesiology. "A Dissertation On " Comparitive Analysis Of Epidural Bupivacaine Versus Bupivacaine With Dexmedetomidine For Lower Abdominal Surgeries." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 4, 2019, pp 25-53.