COMPARATIVE EVALUATION OF THORACIC PARAVERTEBRAL BLOCK WITH THORACIC EPIDURAL IN PATIENTS UNDERGOING THORACOTOMY

A STUDY OF 60 CASES

DISSERTATION SUBMITTED FOR THE DEGREE OF

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BRANCH – X (ANAESTHESIOLOGY)

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CHENNAI,

TAMILNADU

BONAFIDE CERTIFICATE

This is to certify that the study entitled **"COMPARATIVE EVALUATION OF THORACIC PARAVERTEBRAL BLOCK WITH THORACIC EPIDURAL IN PATIENTS UNDERGOING THORACOTOMY"** is a bonfide record work done by Dr.G.N.JEEVANANDAM under my direct supervision and guidance, submitted to the Tamilnadu Dr. M.G.R.Medical University in partial fulfillment of University regulation for MD, Branch X-Anaesthesiology

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DECLARATION

I **Dr.G.N.JEEVANANDAM** solemnly declare that this dissertation titled "**COMPARATIVE EVALUATION OF THORACIC PARAVERTEBRAL BLOCK WITH THORACIC EPIDURAL IN PATIENTS UNDERGOING THORACOTOMY"** has been done by me. I also declare that this bonafide work or a part of this work was not submitted by me, or any other, for any award, degree, diploma, to any other University, or board, either in India or abroad.

This is submitted to The Tamilnadu Dr.M.G.R.Medical University, Chennai in partial fulfillment of the rules and regulation for the award of Doctor of Medicine degree Branch-X (Anaesthesiology) to be held in April 2012.

Place: Madurai

Date: Dr.G.N.JEEVANANDAM

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INTRODUCTION

In modern medicine, postoperative analgesia is considered an integral part of the anaesthetic management. Pain after thoracotomy is very severe, probably the most severe pain experienced after surgery. The nociceptive pathways that are responsible for post thoracotomy pain are still poorly understood. Possible sources of nociceptive input that may contribute to postoperative pain following thoracic surgery are multiple and include the site of the surgical incision, disruption of the intercostal nerves, inflammation of the chest wall structures adjacent to the incision, pulmonary parenchyma or pleura, and thoracostomy drainage tubes. If pain is poorly controlled in the postoperative period, respiratory excursions, movements, and coughing may result in muscle splinting. This splinting of respiratory muscles may result in inability to clear secretions by effective coughing, with resulting pneumonia, respiratory failure, and facilitation of the often incapacitating chronic pain, the post-thoracotomy pain syndrome. This postoperative decline in lung function is primarily due to the incisional pain and preventable by effective analgesia.

Analgesic treatment in thoracotomised patients is the most important factor in preventing the onset of major complications that may negatively influence the results of the surgery. Therefore, various methods have been used for the treatment of these post-surgical discomforts.

The options for pain management include various modalities which include systemic analgesics, neuraxial opioids and local anesthetics, regional anesthetic techniques like the Paravertebral nerve blocks with catheters, Intercostal nerve blocks with catheters, Intrapleural catheters.

Although there are various techniques for postoperative pain control after thoracotomy surgeries, it is uncertain which method has better pain control and fewer adverse effects.

Effective postoperative pain relief after elective thoracic surgeries can be obtained with intravenous analgesia using opioids. However, these commonly used systemic opioids are a potential cause of ventilatory depression, oversedation, nausea, vomiting, ileus, biliary spasms, the potential for abuse, etc. This has provided the impetus to search for better postoperative pain controlling methods with the emphasis on optimizing the respiratory function.

Epidural analgesia is extensively employed as a means to control post-thoracotomy pain. Thoracic epidural analgesia has greatly improved the pain experience and its consequences. It has been considered the 'gold standard' for pain management after thoracotomy (Wildsmith et al 1989). A survey of analgesic techniques after thoracotomy, in Australian hospitals showed that 79% of respondents regarded epidural blockade as the best available technique (Cook et al 1997). A similar survey of UK practice, after upper abdominal surgery, found that 80% of anaesthetists considered epidural analgesia to be the best mode of pain relief (Cook et al 1997).

Epidural blockade reduces the stress response associated with surgical stimuli. This is mediated primarily by the blockade of the sympathetic system outflow. Increased sympathetic system activity causes myocardial oxygen demand supply mismatch leading on to the risk of development of ischemia. Blockade of such responses has protective effects on the heart. Because of the superior analgesia it provides, epidural block has shown to reduce the incidence of postoperative pulmonary complications. Epidural blockade also has possible beneficial effects on gastrointestinal, metabolic and immune function. But epidural blockade in itself possess the side effects like hypotension, bradycardia, urinary retention, intravascular spread, intrathecal spread resulting in unexpected high level of blockade, epidural hematoma, epidural abscess, cord compression and its sequlae, etc. Also performance of the thoracic epidural is relatively difficult when compared with lumbar epidural. Procedure related complications like dural puncture, cord injury, failure to perform the block can occur. These complications have led to the search of techniques with similar analgesic quality with minimal complications.

Paravertebral blocks with its recent resurgence, is being considered as an alternative to thoracic epidural. Paravertebral blocks as the name goes, is a technique of depositing the drug in the paravertebral space providing unilateral blockade, unlike epidural that causes bilateral blockade. Since there is only unilateral blockade of sympathetic chain hypotension is uncommon. It also avoids most of the complications of the neuraxial techniques mentioned above. This technique also has its disadvantages like pleural puncture, vascular puncture, and difficulty in threading the catheter. The dose requirements are also high on a segment basis when compared with epidural technique.

In this study the thoracic paravertebral block was compared with thoracic epidural for the purpose of providing postoperative analgesia in patients undergoing thoracotomy. The main objective of the study was to measure the hemodynamic alteration in both groups. In addition the success and failure rate of both the techniques, and the complications were compared.

AIM OF THE STUDY

To compare Thoracic paravertebral block with Thoracic epidural in patients undergoing thoracotomy, for postoperative analgesia.

Following parameters are observed and compared in the study

- Total duration of analgesia
- Incidence of Hypotension
- Incidence of Bradycardia
- Technique failure rate
- Complications associated with the procedures

HISTORY

Fundamental to the modern neural blockade and regional anaesthesia is the concept that sensory block is accomplished by pharmacologically interrupting specific nerve fibers amenable, in principle, to modulation or interruption along nerve's pathway. **Descartes** matured the concept of a neural connection from periphery to brain. Attempts to influence neuralgic pain by applying a drug to the transmitting nerve was published first by **Francis Rynd** (1801 – 1862). Rynd's idea foreshadowed both nerve block and regional analgesia. **William Stewart Halstead** (1852 - 1922), **Richard John Hall** (1856 – 1897), most clearly saw the possibilities of conduction block, and were the true progenitors of conduction anaesthesia.

Spinal anaesthesia was first performed in the year 1885 by **James Leonard Corning** (1855 – 1923) which was regarded as the first epidural blockade. **Fernand Cathelin** (1873 – 1945) in 1901 demonstrated the feasibility of injecting a local anaesthetic by the caudal route. **Jean Anthanase Sicard** (1872 – 1929) also did lot of research to achieve analgesia via the epidural route. Continuous epidural anaesthesia through the caudal route was first described by **Eugen Bogdan Aburel** (1899 - 1975). Use of flexible catheters was popularized by the year 1943. **Fidel Pages** used the term “metameric anaesthesia” in 1921 for epidural anaesthesia. **Achile Mario Dogliotti** (1897 – 1966) who is considered as the father of lumbar epidural anaesthesia popularized epidural technique which he called segmental peridural spinal anaesthesia. He also described the fact of loss of resistance, when ligamentum flavum was pierced and the epidural space was entered.

Hugo Sellheim of Leipzig (1871–1936) was the originator of paravertebral block, who was able to perform abdominal operations successfully by injecting close to the posterior roots of T8-T12. **Arthur Lawen** refined Sellheim’s technique in 1911 and called it “Paravertebral conduction anesthesia”. **Kappis** further developed the technique of paravertebral anaesthesia and was able to produce anaesthesia for abdominal surgery by blocking thoracic and lumbar nerves by the paravertebral approach. After its initial popularity, paravertebral block was neglected until 1979, when **Eason and Wyatt** “revisited” paravertebral block and rekindled interest by describing a catheter technique. Sabanathan, Richardson and Lonnqvist are the three researchers who recently have contributed substantially to improving our understanding of this technique.

EPIDURAL BLOCKADE

Epidural blockade is the technique of injecting drugs in the epidural space with the intension of blocking the spinal nerve roots at the point of exit from the vertebral canal. With this technique segmental blockade of the dermatomes are possible where both the upper limit and lower limit of the block can be controlled. Epidural blockade is used extensively in each field of surgical anaesthesia, obstetric anaesthesia, and diagnosis and management of pain.

ANATOMY

Epidural space is a potential space that lies between the dura and the periosteum lining the inside of the vertebral canal. It extends from the foramen magnum to the sacral hiatus. The anterior and posterior nerve roots in their dural covering pass across this potential space to unite in the intervertebral foramen to form segmental nerves. The epidural space is limited superiorly by the fusion of the spinal and periosteal layers of duramater at the foramen magnum, inferiorly by the Sacrococcygeal membrane. The boundaries are anteriorly by the posterior longitudinal ligament covering the vertebral bodies, vertebral bodies and the intervertebral discs, posteriorly by the laminae and articular processes, their connecting ligaments, capsule of facet joints, the periosteum of the root of the spines, and the interlaminar spaces filled by the ligamentum flavum, and laterally by the periosteum of the vertebral pedicles and intervertebral foraminae.

Contents of the epidural space

The distribution of the epidural contents is highly nonuniform. Epidural space is empty in large areas, where the dura contacts the bone and the ligaments. Separated by these empty areas the epidural contents occur as a series of circumferentially discontinuous compartments. The dura is not adherent to the canal wall in the empty areas and solutions and catheters may still pass through them. The epidural space contains loose areolar connective tissue, semiliquid fat, lymphatics, arteries, extensive plexus of valveless veins, spinal nerve roots as they exit the dural sac and pass through intervertebral foramina.

The epidural space is divided into three compartments namely the posterior epidural compartment, lateral epidural compartment, and anterior epidural compartment.

Posterior epidural compartment

This compartment is larger at the midlumbar level, with progressive decrease in anterior-posterior dimension at thoracic levels. This compartment is filled with fat that is triangular in axial section. This fat facilitates the movement of the dura within the canal wall. The pad of fat has its point of attachment to the vascular pedicle that enters through the gap between the right and left ligamentum flava. Cranial to the C7 level, the posterior epidural space vanishes and the dura lies entirely in contact with the ligamentum flavum and laminar bone. The cleft like space between the epidural fat and canal wall allows passage of catheter and injected fluids, with only a minor impediment in the posterior midline. This arrangement of apposing, non adherent tissue planes is ideally designed to demonstrate the sub atmospheric pressure within tissue generated by the action of lymphatics, and balance of osmotic and hydrostatic forces across capillary endothelium. This produces the force that aspirates a hanging drop.

The triangular arrangement of the posterior pad of fat dictates that the needle must travel after entering the epidural space before contacting the dura when the epidural space is approached by the midline approach. As the posterior epidural fat thin out laterally when the epidural space is approached away from the midline the dura is encountered with no further advancement.

Lateral epidural compartment

This compartment is occupied by segmental nerves and vessels and fat. These segmental nerves exit through the intervertebral foramen and it is one of the sites of action of local anaesthetics injected into the epidural space.

Anterior epidural compartment

This compartment is occupied by confluent internal vertebral plexus from which the midline basivertebral vein originates. Fascia of the posterior longitudinal ligament is a fine membrane that stretches laterally from the posterior longitudinal ligament and separates the anterior epidural compartment from the other compartments. This membrane blocks the spread of the injected solutions anterior to the plane of the posterior longitudinal ligament and funnels solution towards the spinal nerves.

Site of action of local anaesthetics

The primary site of action of the local anaesthetics administered epidural is principally on the nerve roots at the location where they leave the subarachnoid space and enter the nerve root sheath. Other mechanisms of action like the diffusion of the local anaesthetic across the dura in to the subarachnoid space, acting on the nerve roots, or on the cord itself, or the diffusion of the local anaesthetics in to the paravertebral space through the intervertebral foramen and blocking the nerves distal to their dural sheath similar to bilateral paravertebral block, had been postulated.

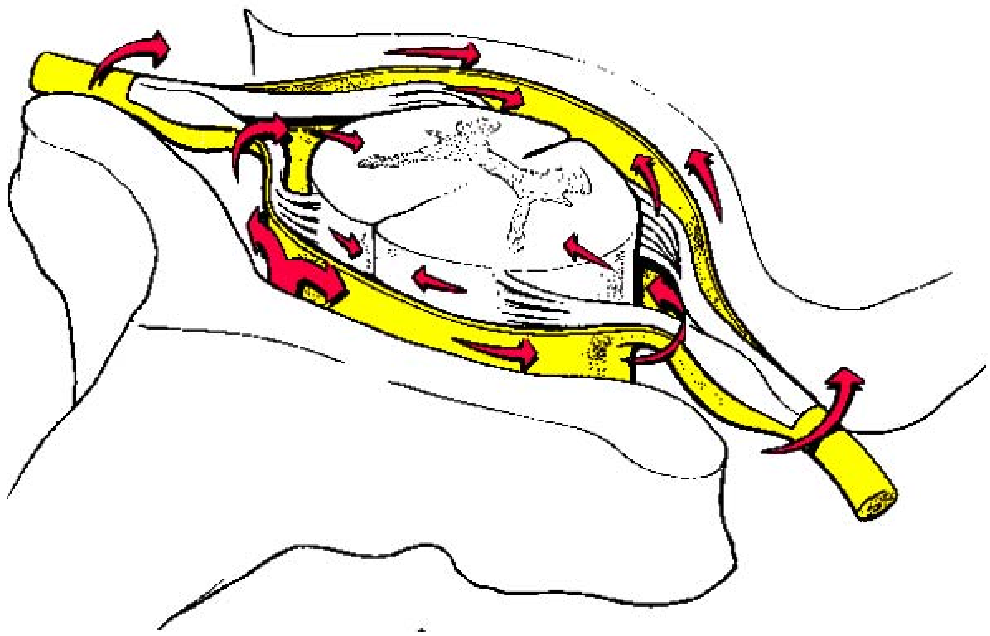
APPROACHES TO EPIDURAL SPACE

There are two approaches to reach the epidural space. They are the midline approach, and the Paraspinous or Para median or lateral approach. The epidural space is identified by the loss of resistance technique with air or saline, or by the Gutierrez Hanging drop technique.

Midline approach

In this approach the epidural needle (Tuohy) is inserted in the midline in between the spinous process of the adjacent vertebra at the intended level. The structures encountered are skin, subcutaneous tissue, supraspinous

Schematic representation of distribution of local anaesthetic into the epidural space



ligament, interspinous ligament, ligamentum flavum. At the thoracic level there is extreme downward slope of the spinous process necessitating extreme angulation of the needle, the spinous processes are close, causing difficulty in identifying the interspinous ligament. These make the performance of the epidural block at the thoracic level difficult. Other consideration at the thoracic level is, the laminae that are broader than lumbar lamina, but shorter in vertical dimension, so there is large area for location of depth of ligamentum flavum with less fear of injuring the dura. The thoracic epidural space is 3-5mm in the midline narrowing laterally.

Paraspinous / para median / lateral approach

In the thoracic region, the point of entry is 1centimeter lateral to the caudad tip of the spinous process cephalad to the intended level of needle insertion. The needle is advanced with an angulation of 55 to 60 degrees to the long axis of the spine with an inward angulation of 10 to 15 degrees. In this approach the supraspinous and the interspinous ligaments are not encountered. The first resistance to be encountered is the ligamentum flavum. The Crawford needle with the straight tip is preferred for this approach than the Tuohy needle with Huber tip, which may permit easier threading of the catheter.

In both the techniques threading catheter only to a depth of 3-4 centimeter reduces the incidence of curling up of catheter and catheter malfunction.

FACTORS AFFECTING EPIDURAL BLOCKADE

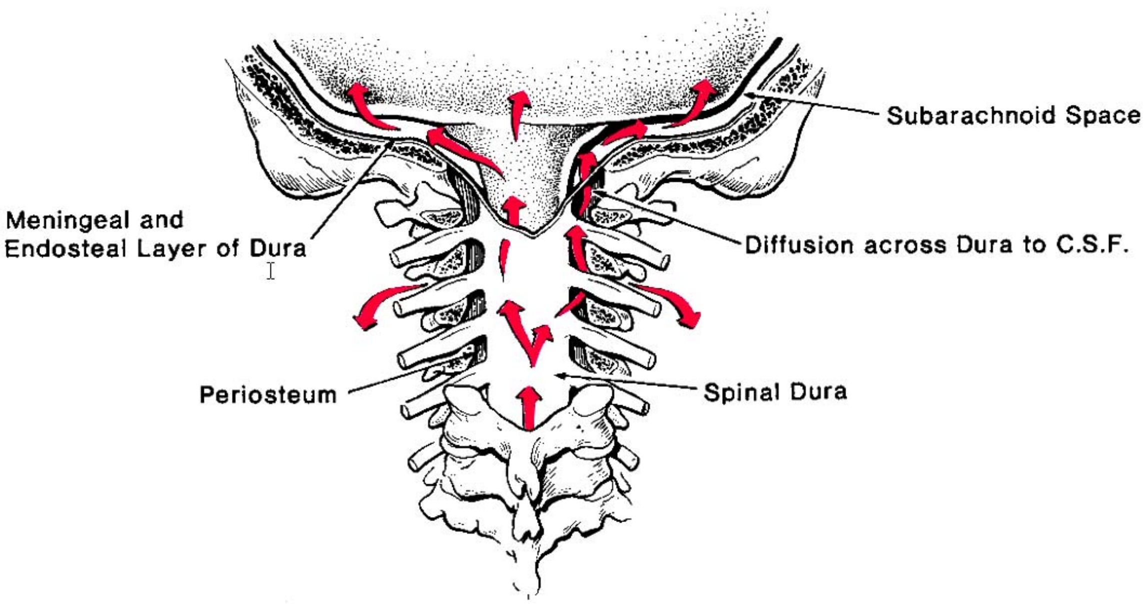
a. Site of injection and nerve root size

Block is more intense and has the most rapid onset close to the site of injection. In thoracic epidural injection, blockade spread quite evenly from the point of injection. The upper thoracic segments are resistant to blockade, because of large size of the nerve roots and large number of nerve fibres within them.

b. Age

With aging the intervertebral foramen is narrowed and sealed preventing drug migration through the foramen. With aging the dura becomes more permeable, the epidural space compliance is reduced the neural population of the cord decreases, and also the conduction velocity in the nerves decreases. All these changes make aged patients more susceptible to the blockade causing more rapid onset of the block, intense motor block, and higher levels of block. They are more prone to develop hemodynamic and thermoregulatory disturbances.

Schematic representation of longitudinal spread of drugs injected into the epidural space.



Spread superiorly to base of skull, with diffusion into the cerebrospinal fluid by diffusion across dura, including the region of the dural cuffs at the origins of the spinal nerves.

c. Position

In sitting position the caudad spread of block is favored in comparison to the lateral position, but the difference is small. The lateral position favors spread of analgesia on the dependent side.

d. Speed of injection

Increasing the speed of injection has no effect on bulk flow of solutions in epidural space. Rapid injection of large volumes may compromise spinal cord blood flow and cause spinal stroke.

e. Dose of the drug

Dose (volume × concentration) determine the spread of blockade. With regard to motor blockade dosage becomes less important when dilute solutions are used. Increasing concentration results in a reduction in onset time and intensity of motor blockade. Increasing dose results in a linear increase in degree and duration of block.

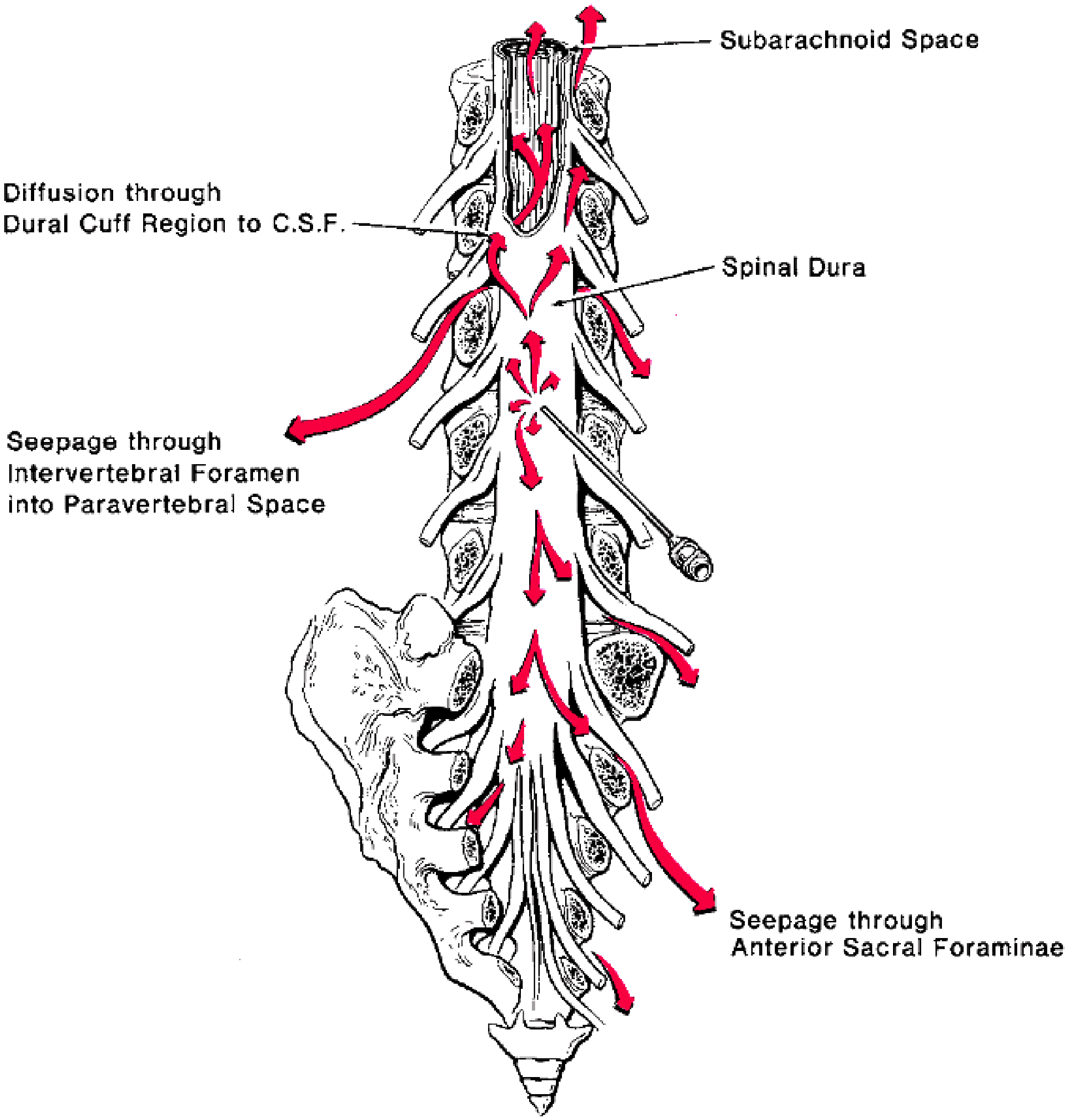
f. Adjuvants

Use of adjuvants like epinephrine, opioids, clonidine, significantly alter the block characteristics.

g. Weight and height

Have no correlation with spread of analgesia in adults.

Schematic representation of longitudinal spread of drugs Injected into the epidural space.



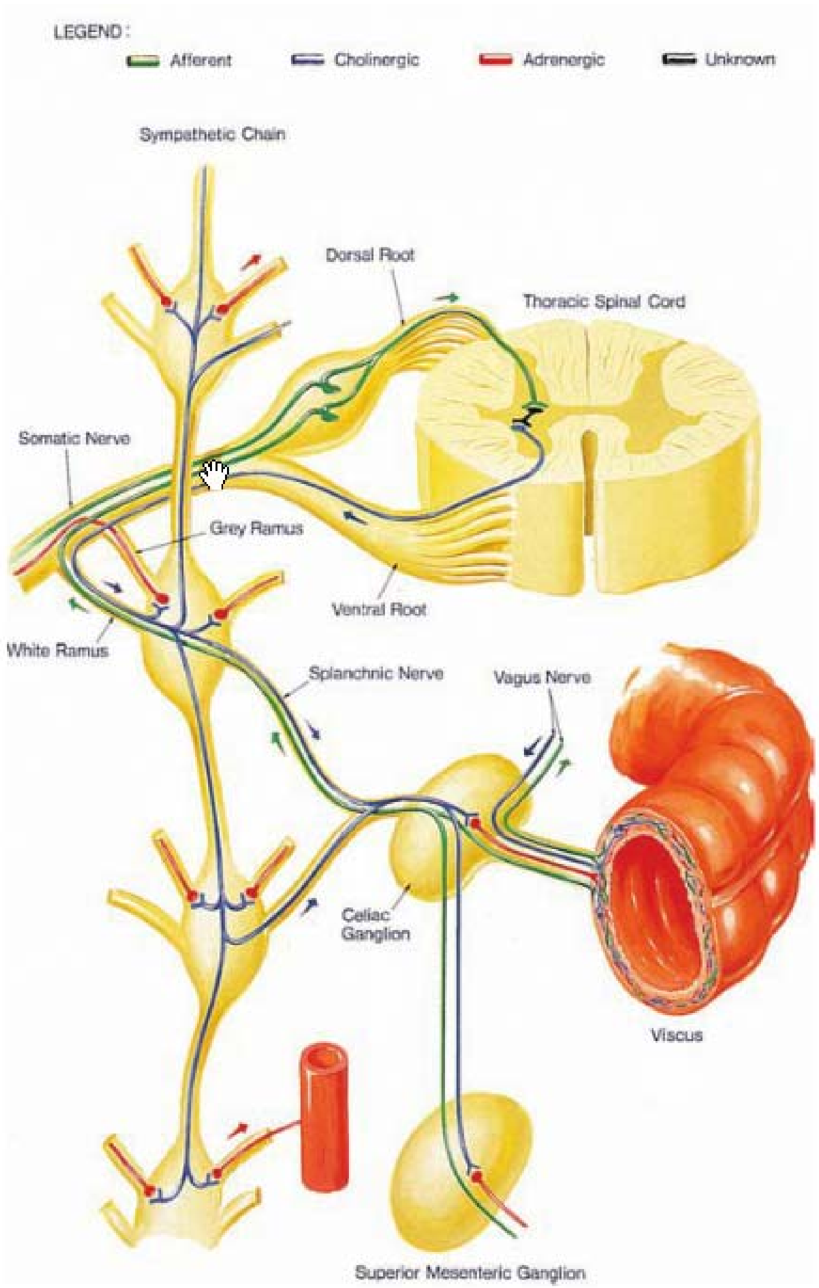
Spread inferiorly to caudal canal with seepage by way of anterior sacral foramina. Seepage also occurs through the intervertebral foramina into the paravertebral space.

SYMATHETIC NERVOUS SYSTEM

Sympathetic blockade is produced together with motor and sensory blockade during spinal and epidural anaesthesia which is the cause of the hemodynamic alterations produced by the block. It is also the reason for the relief of visceral pain following these neuraxial techniques.

The peripheral sympathetic system begins as efferent preganglionic fibres from the neurons in the intermediolateral column of the spinal cord from T1- L2 segments. These fibres pass in the ventral root of the spinal nerve as white rami communicans, to the paravertebral sympathetic ganglia located alongside the vertebral bodies, or to remotely located ganglia like the celiac ganglion. In the thoracic region, these ganglia are present in a segmental fashion and are located adjacent to the neck of the ribs, relatively close to the somatic roots. There are three cervical ganglia, four to five lumbar ganglia, four sacral ganglia, and one unpaired coccygeal ganglia. From each ganglion they give rise to adrenergic fibres to supply viscera or to join the somatic nerves by the grey rami communicans to supply efferent fibres to the limbs (sudomotor and vasomotor effects). Afferent fibres travel by the way of ganglia without synapsing and reach the cell bodies in the dorsal root ganglia. These afferent fibres carry pain from the viscera.

Sympathetic pathways



PHYSIOLOGICAL EFFECTS OF EPIDURAL BLOCKADE

Epidural blockade implies not only somatic blockade but also blockade of sympathetic nervous system outflow. The somatic blockade can be in form of a combined sensory and motor blockade, or just the sensory blockade.

Effects on the cardiovascular system

The cardiovascular responses to epidural anaesthesia are mainly due to the blockade of the sympathetic innervations of heart and vascular system. The post ganglionic sympathetic nerves are important in controlling the cardiac function and vascular tone. Cardiac sympathetic denervation results in predominance of the parasympathetic cardiovascular responses like the baroreceptor reflex, bezold jarisch reflex, responses to mesenteric traction etc. Vasoconstrictor nerve blockade results in hypotension due to decrease in preload and afterload. The decrease in preload is due to the increase in the venous capacitance of the splanchnic venous bed, resulting in pooling of blood in gut and abdominal viscera. The decrease in afterload is due to the reduction in systemic vascular resistance due to the vasodilation. These result in redistribution of blood in affected dilated vascular bed. The hypotension is further aggravated by the loss of chronotropic and inotropic drive to the myocardium as a result of the blockade. The decrease in venous return to the heart is sensed by the mechanoreceptors in the ventricles. This activates the bezold- jarisch reflex causing intense vagal activity resulting in bradycardia, and sometimes asystole in volume depleted patients.

Epidural blockade, though it causes hypotension and bradycardia, thoracic epidural blockade has its protective effects on heart. In patients in coronary artery disease high thoracic epidural anaesthesia improves global and regional left ventricular function. The diastoloic function is also improved. It increases the endocardial to epicardial blood flow ratio which may cause a decrease in ischemic injury.

Absorption of the local anaesthetic and vasoconstrictors injected in the epidural space, into the vascular system is more because of the high volume used and the proximity of the epidural veins. These absorbed local anaesthetics and vasoconstrictors may cause significant hemodynamic changes in addition to that caused by the sympathetic blockade.

Effects on respiratory system

Effects on respiratory system by the epidural blockade is due to the afferent sensory neural blockade that reduces the noniceptive afferent drive to the respiratory center, efferent motor neural blockade of the intercostal muscles, abdominal muscles, and rarely diaphragm, and sympathetic neural blockade with resultant changes in the pulmonary blood flow and cardiac output.

Thoracic epidural anaesthesia caused rib cage distortion by impaired contraction of the respiratory and parasternal muscles. Ventilatory response to carbon dioxide was reduced because of decreased contribution of rib cage to tidal breathing. However by attenuating the postoperative pain, it improves the diaphragmatic function, increases the ability of the patient to cough and breathe deeply, thereby preventing respiratory failure due to pain.

Respiratory arrest encountered during epidural block is not due to the afferent and efferent blockade but rather due to the hypoxic injury to central nervous system due to the reduced cardiac output, leading to reduced oxygen delivery to the central nervous system. Thoracic epidural anaesthesia does not alter airway resistance.

Effects on GastroIntestinal system

Preganglionic fibres from T_5-L_1 are inhibitory to gut. So because of the sympathetic blockade the small intestine contracts with relaxed sphincters and peristalsis remains normal. Handling of viscera causes discomfort and bradycardia since vagus is not blocked.

Effects on GenitoUrinary system

Renal blood flow is not altered significantly because it is auto regulated. Important is the urinary retention produced when there is blockade of the lower lumbar and sacral dermatomes that supply the urinary bladder.

Thermoregulation

Hypothermia is common with epidural due to heat lost to the environment. This is due to sympathectomy induced vasodilation.

Metabolic and Hormonal effect

Epidural anaesthesia blocks the hormonal and metabolic responses to noniceptive stimuli arising from the operative site. It minimizes the rise, cortisol, renin, and aldosterone release associated with postoperative stress. The hyperglycemic response to surgery is reduced, and by preserving the insulin sensitivity it also reverses the postoperative impaired glucose tolerance. Epidural anaesthesia blocks the perioperative increase in coagulation proteins and platelets and preserves the fibrinolytic activity reducing the incidence of postoperative thrombotic events. It also reduces the protein catabolism in the perioperative period.

CONTRAINDICATIONS and COMPLICATIONS

Contraindications

Absolute contraindications include patient refusal, infection at the site of injection, dermatologic conditions that preclude aseptic preparation, increased intracranial pressure, and coagulopathy. Relative contraindications include preexisting disease of spinal cord, sepsis, tattoo on the back, chronic headache or backache, hypovolemia, and deformities of the spinal cord.

Complications

The various complications of epidural block can be attributed either to the physiologic effects of the block or to the performance of the procedure. Complications attributable to the physiologic effects include hypotension, bradycardia, urinary retention, shivering, etc. those attributable to the procedure include dural puncture resulting in development of posture dependent postdural puncture head ache (PDPPH), inadvertent high level of block due to intrathecal injection of the drugs either due to migration of the catheter to the intrathecal space, or due to accidental dural penetration during injection. Vascular puncture may lead to development of epidural hematoma which may lead to cord compression and its sequlae. Patients may develop local anaesthetic toxicity due to accidental intravascular injection commonly due to catheter migration. Symptoms usually follow a sequence of light-headedness, tinnitus, circumoral tingling or numbness and a feeling of anxiety, followed by confusion, tremor, convulsions, coma and cardio-respiratory arrest. Other complications are development of epidural abscess, meningitis etc.

THORACIC PARAVERTEBRAL BLOCK

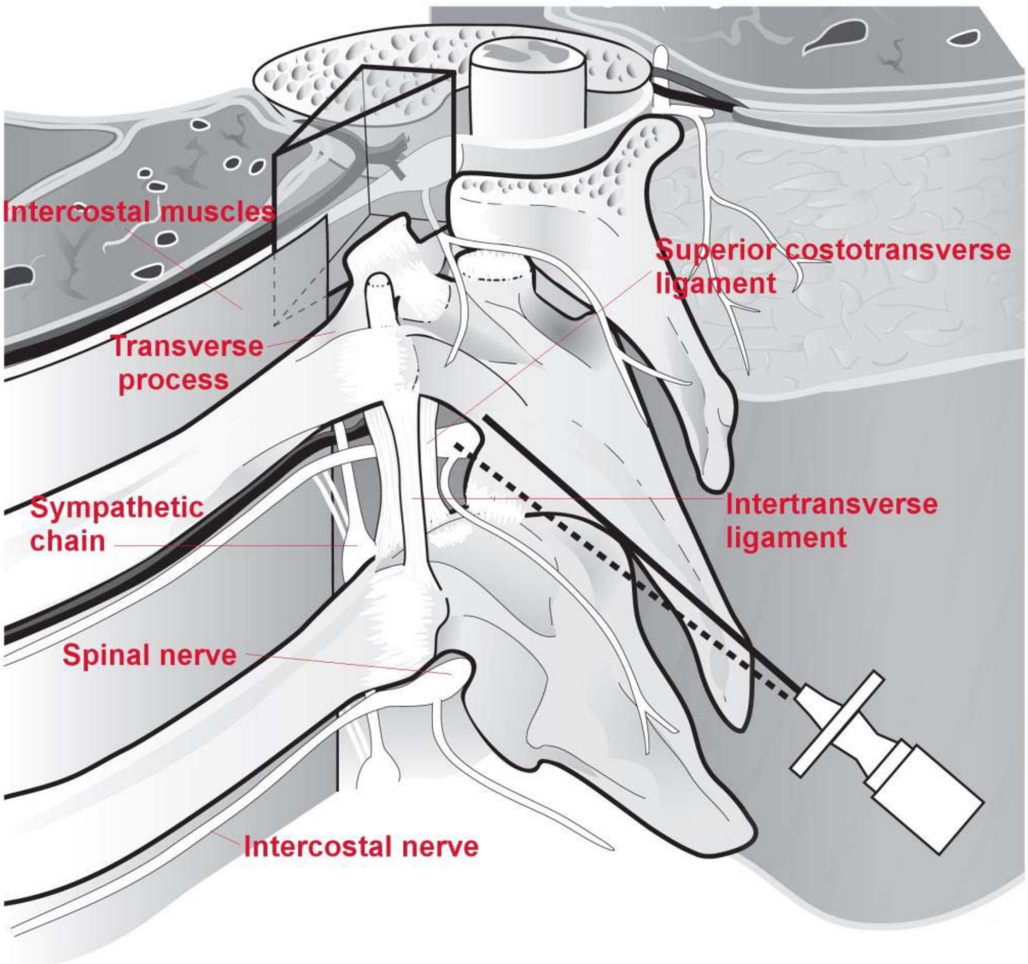
Paravertebral nerve block produces ipsilateral analgesia through injection of local anaesthetic alongside the vertebral column. The thoracic paravertebral block was first described in the treatment of chronic pain. More recently, the technique has also been used to provide surgical analgesia. It is advocated predominantly for unilateral surgery, like thoracic surgeries, breast surgeries, general surgical procedures like open cholecystectomy, herniorrhaphy, etc and in trauma for fractured ribs.

ANATOMY

The thoracic paravertebral space is a triangular wedge shaped area sandwiched between the head and neck of ribs. This space is found on either side of the thoracic vertebrae from T1-T12. It is bonded posteriorly by the superior costotransverse ligament, further laterally the posterior intercostal membrane, anteriorly by the parietal pleura, medially by the posterolateral aspect of the vertebra, intervertebral disc, intervertebral foramen, and laterally he space is continuous with the intercostal space.

Interposed between the parietal pleura and the superior costotransverse ligament is a fibroelastic structure, the endothoracic fascia. The endothoracic

THORACIC PARAVERTEBRAL SPACE



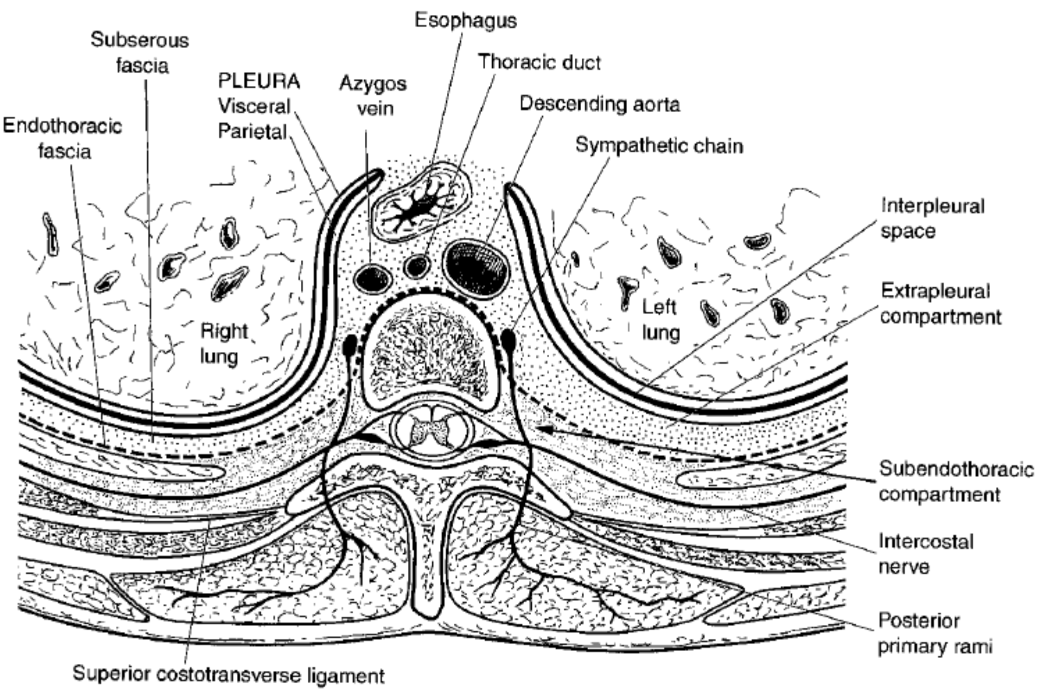
Drawing of the thoracic paravertebral space.

The boundary of the space is depicted by a transparent wedge.

fascia is the deep fascia of thorax that lines the inside of the thoracic cage. An intervening layer of loose connective tissue, the subserous fascia, is found between the parietal pleura and the endothoracic fascia. The endothoracic fascia thus divides the thoracic paravertebral space into two potential fascial compartments, anterior extrapleural paravertebral compartment and posterior subendothoracic paravertebral compartment

The cranial extent of the thoracic paravertebral space is not well defined. Paravertebral space does exist in the cervical region, but it is not clear as to whether there is communication between the thoracic and cervical paravertebral space. There is disagreement regarding the caudal limit of the thoracic paravertebral space. The origin of the poses major muscle forms the caudal boundary and inferior (lumbar) spread through the thoracic paravertebral space is thought to be unlikely. Still an injection made into the lower thoracic paravertebral space can cause blockade of the lumbar segments. This is because of the endothoracic fascia that continues inferiorly with the fascia transversalis of the abdomen dorsal to the diaphragm through the medial and lateral arcuate ligaments and the aortic hiatus. So injection in the lower thoracic paravertebral space posterior to the endothoracic fascia, can spread inferiorly through the medial and lateral arcuate ligaments to the

ANATOMY OF PARAVERTEBRAL SPACE



retroperitoneal space behind the fascia transversalis, where the lumbar spinal nerves lie.

Communications of the Thoracic Paravertebral Space

Above and below, the space communicates freely with adjacent levels. The paravertebral space is also in communication with the vertebral foramina. It is continuous with the intercostal space laterally, the epidural space medially through the intervertebral foramen, and the contralateral paravertebral space through the prevertebral space. The local anaesthetics introduced into this space, produces predominantly unilateral sensory, motor, and sympathetic blockade over several dermatomes. Though the paravertebral space is continuous with the epidural space and the contralateral paravertebral space, bilateral blockade and contralateral spread of blockade is rare.

Contents of the Thoracic Paravertebral Space

The contents of the thoracic paravertebral space include anterior ramus of the intercostal nerve, posterior ramus of the intercostal nerve, inercostal vessels, sympathetic chain located laterally or anterolaterally to vertebral body, gray and white rami communicantes, sinu-vertebral nerve. The intercostal nerve and vessels are located behind the endothoracic fascia, while the sympathetic trunk is located anterior to it in the thoracic paravertebral space. The spinal nerves in the thoracic paravertebral space are segmented into small bundles lying freely among the fat and devoid of a fascial sheath, which makes them exceptionally susceptible to local anesthetic block.

PARAVERTEBRAL BLOCKADE TECHNIQUES

Patient position

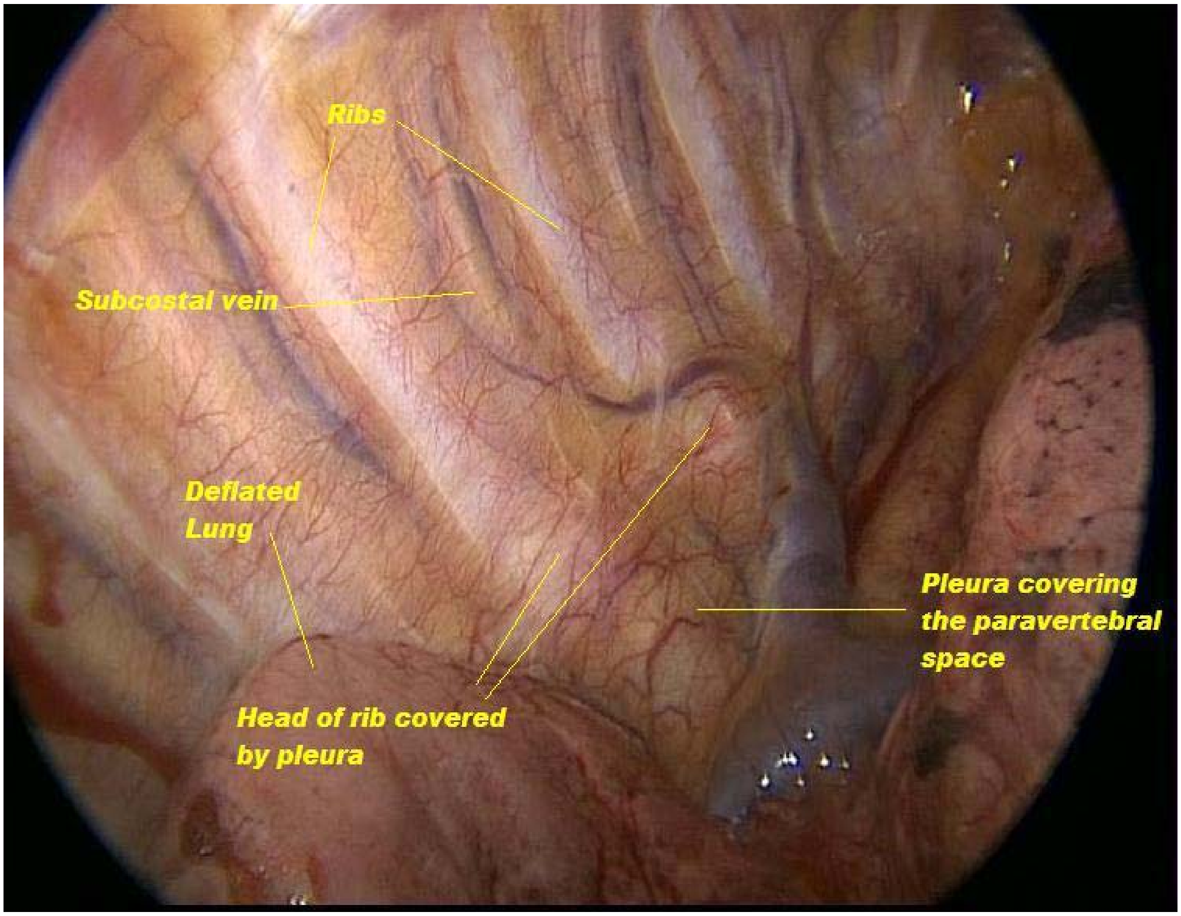
Thoracic paravertebral block can be performed with the patient sitting, shoulders and head relaxed and leaning forward, or with the patient lying in the lateral position with the side to be operated on uppermost. The lateral position is convenient for patients under general anaesthesia and this position commonly matches that for surgery.

Landmarks

The spines of the thoracic vertebrae are angled caudally such that the superior aspect of the tip of the spine lies adjacent to the transverse process of the vertebra immediately below. The tip of the spine of T5 is adjacent to the transverse process of T6. So using T5 spine as the landmark will actually lead to the T5-T6 interspace in the paravertebral region. The superior aspect of vertebral foramen, nerve bundle, or lung parenchyma. The pleura lies deep to the needle tip as it enters the thoracic paravertebral space and will be breached if the needle is advanced too far. A more lateral approach meets the intercostal space, rib or pleura and medially the intervertebral foramen may be entered.

2. Loss of resistance technique (LRT)

The Loss of resistance technique technique is employed using an epidural needle. After the needle is walked off the superior border of the transverse process while performing thoracic paravertebral block or the inferior border while performing lumbar paravertebral block a loss of resistance syringe is connected to the needle hub. Saline or air may be used. Resistance to the syringe is provided by the superior costotransverse ligament. The needle is carefully advanced in the same manner as for an epidural technique. Loss of resistance should be found after approximately 1centimeter. If not, the needle should be withdrawn to the skin and the process repeated again after checking the landmarks and patient position. If the needle is inserted too laterally the costotransverse ligament is missed and the first loss of resistance may be the pleural space. This should be suspected if the patient coughs or reports pain. Care should be taken to advance the

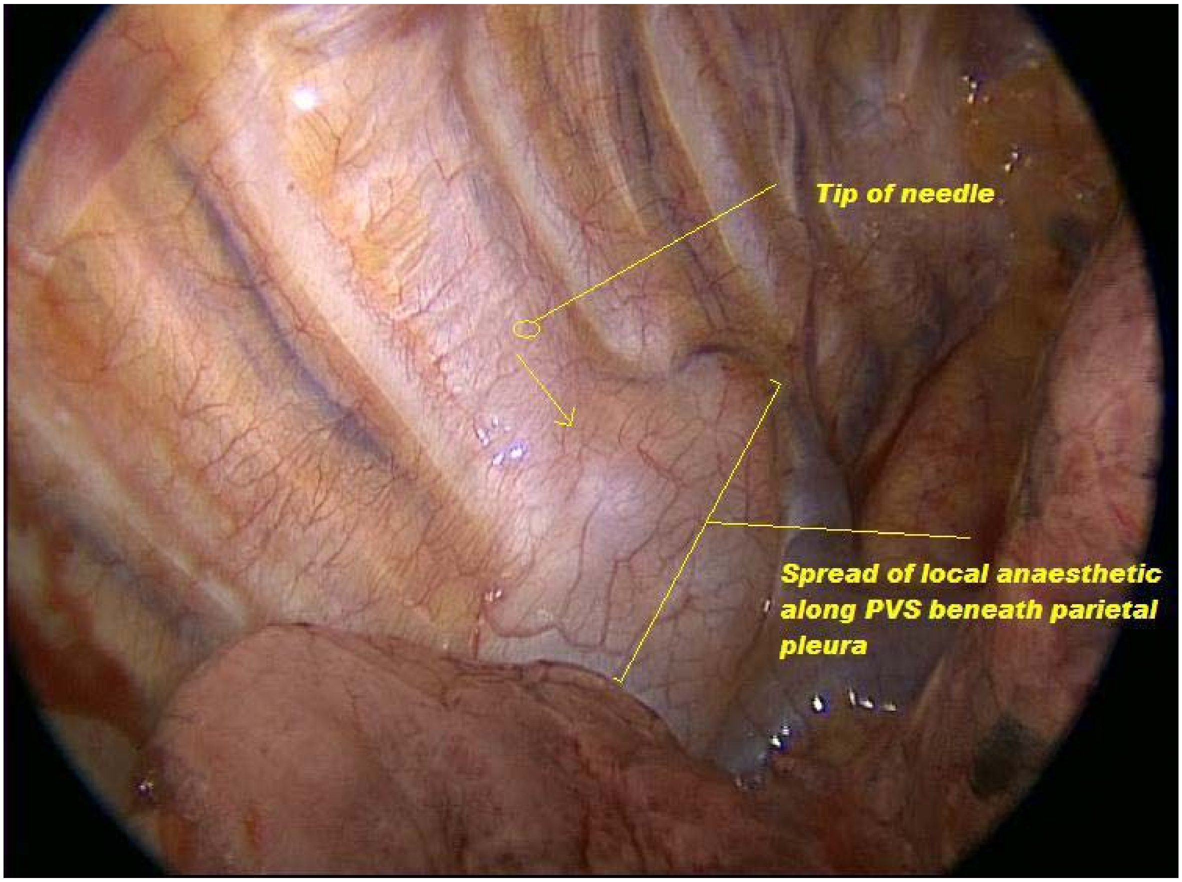


View of the paravertebral space before percutaneous
PVB under direct vision.

each spine is marked. A parasagittal line, parallel and 2.5centimeter lateral to the midline is drawn on the side to be anaesthetized. Point is marked on the parasagittal line corresponding to the superior aspect of the spinous process. The transverse process lies deep to each parasagittal mark.

1. Landmark technique:

When placing an indwelling catheter a Tuohy epidural kit may be used. A wheal of local anaesthetic is raised at each point marked on the parasagittal line. The needle is advanced through the wheal perpendicular to the skin in all planes until the bony resistance of the transverse process is met. This depth varies. It is deepest in the higher thoracic area (6-8centimeter at T1-2) and shallowest at mid thoracic levels (2-4centimeter at T5-10). The distance from the skin to transverse process is measured. The needle is walked off the superior border of the transverse process while performing thoracic paravertebral block and the inferior border while performing lumbar paravertebral block. The needle is further advanced by approximately 1centimeter above the previous measurement. After gentle aspiration to check for blood, CSF, pleural effusion and air, the local anaesthetic is injected slowly. Little resistance should be felt. Resistance to injection may indicate the tip of the needle is within the costotransverse ligament, the



An epidural needle is inserted percutaneously from the posterior thoracic wall to tent the pleura. The tip is seen to tent the pleura lateral to the PVS in the medial aspect of the intercostal space. The arrow shows medial spread of anaesthetic from the tip into the PVS. The PVS is seen to fill beneath the pleura spreading caudally and cranially needle no more than 1centimeter past the transverse process while remaining perpendicular to the skin.

3. Nerve Stimulation

The landmark technique is carried out as described above. Before insertion the stimulating needle is connected to a nerve stimulator and set to deliver 2.5mA at 2-5Hz. The return of a train-of-four following muscle relaxation must be confirmed with a peripheral nerve stimulator before starting the procedure if the procedure performed after general anaesthesia. The paraspinal muscles are seen to contract as the needle is advanced past the skin. As the needle tip enters the superior costotransverse ligament the muscle contraction ceases. Almost immediately on entering the thoracic paravertebral space the somatic nerve is stimulated. The electrical current should be reduced slowly and the needle tip repositioned to provide a muscle contraction at 0.5mA. Corresponding intercostal or abdominal wall contraction will be seen and will disappear on injection of the local anaesthetic.

4. Ultrasound guided

The use of ultrasound to guide the needle tip into the thoracic paravertebral space has been described recently with low levels of complications and high rates of therapeutic success.

5. Surgical Placement

During thoracotomy or thoracoscopy a paravertebral block may be reliably placed under direct vision by the surgeon. The percutaneous approach uses the landmark technique to place an epidural needle in the paravertebral space. From within the thorax the needle tip can be seen to appear in the paravertebral space as it tents the parietal pleura. 10-20ml of local anaesthetic is injected and an indwelling catheter then placed under direct vision. An alternative method is for the surgeon to make a small incision through the parietal pleura from within the thorax. A sub pleural pocket is dissected and local anaesthetic placed within the pocket. No indwelling catheter is used. The pocket is then closed with suture.

CONTRAINDICATIONS and COMPLICATIONS

Contraindications

The absolute contraindications are cellulitis or cutaneous infection at site of needle puncture, empyema, tumor occupying the paravertebral space, allergy to local anaesthetic drugs. The relative contraindications are coagulopathy, kyphoscoliosis deformity that may predispose to pleural puncture, previous thoracotomy which causes scaring and adhesions making identification of the space difficult.

Complications

Complications include vascular puncture and hematoma formation, epidural injection, subarachnoid injection, pneumothorax due to the pleural puncture. Pleural puncture can be identified by ‘Pop’ sensation, irritating cough, sharp pain in chest or shoulder, aspiration of air. Sympathetic blockade and hypotension is uncommon. Others include Horner’s syndrome due to the blockade of cervical sympathetic chain.

REVIEW OF LITERATURE

1. **Mathews et al (1989)** compared continuous thoracic paravertebral block with thoracic epidural. 40 patients included in the study with 20 in each group. Both groups had similar pain scores. Six out of 20 patients in epidural anaesthesia group had hypotension and urinary retention. They concluded that epidural was associated with high incidence of hypotension and urinary retention because of bilateral sympathetic blockade. In the first 24 hours the patients with epidural analgesia required larger volumes of intravenous colloid to maintain a normal arterial pressure. Paravertebral blockade is predominantly unilateral and had lower incidence of side effects. (British Journal of Anaesthesia (1989), 62, 204-205)
2. **Sabanathan et al (1995)** compared paravertebral analgesic technique with intrapleural analgesic technique in thoracic surgery. They found that FVC (forced vital capacity) and FEV1 (forced expiratory volume in first second) were better in paravertebral block. They concluded that bupivacaine deposited in the paravertebral space produced greater elevation of lung function and fewer side effects (British journal of anaesthesia 1995;75;405-408).

3. **Richardson et al (1999)** studied the effect of preoperative and continuous balanced epidural or paravertebral bupivacaine on post thoracotomy pain, pulmonary function and stress response. This was a randomized study done in 100 patients undergoing posterolateral thoracotomy. Patients in the paravertebral group had significantly lower visual analogue score both at rest and on coughing. Cumulative morphine consumption in the 24 hour period was significantly higher in the epidural group when compared to paravertebral group. Pulmonary function was also better preserved in paravertebral group. The lowest PEFR (peak expiratory flow rate) obtained as a fraction of preoperative period was 0.73 in the paravertebral group and in the epidural group it was 0.54. Plasma concentration of cortisol and glucose increased in both the groups but the increase was significantly less in the paravertebral group. Postoperative hypotension, nausea, vomiting, urinary retention occurred predominantly in the epidural group. Follow up of the patients for 6 month revealed that 10 patients in the epidural group had persistent chest pain compared to one patient in the paravertebral group. They found that paravertebral analgesia was superior in terms of analgesia, pulmonary

function, neuroendocrine stress response, side effects and postoperative respiratory morbidity.(British journal of anaesthesia 83(3):387-92)

4. **Naja et al** (2001) recorded the failure rate and complications following thoracic and lumbar paravertebral blocks performed in 620 adults and 42 children. The technique failure rate in adults was 6.1%. No failures occurred in children. The complications recorded were, inadvertent vascular puncture (6.8%), hypotension (4.0%), hematoma (2.4%), pain at site of skin puncture (1.3%), signs of epidural or intrathecal spread (1.0%), pleural puncture (0.8%), pneumothorax (0.5%). No complications were noted in the children. The use of a bilateral paravertebral technique was found approximately to double the likelihood of inadvertent vascular puncture (9% vs. 5%) and to cause an eight-fold increase in pleural puncture and pneumothorax (3% vs. 0.4%), when compared with unilateral blocks. The incidence of other complications was similar between bilateral and unilateral blocks. They concluded that the paravertebral technique was associated with a 94% overall success rate and was associated with an acceptable incidence of side-effects and complications. (Anaesthesia 2001; 56;1181-1201.)

5. **Pintaric et al (2011)** compared thoracic epidural with paravertebral block on perioperative analgesia. This randomized prospective study assessed the effects of epidural and paravertebral analgesia on hemodynamics during thoracotomy. Thirty-two patients were randomized to receive either epidural analgesia or paravertebral block. The groups did not differ significantly in heart rate, mean arterial blood pressure, or systemic vascular resistance indices. However, to maintain the oxygen delivery index of 500ml/minute per square meter or higher, the volume of colloid infusion required in the epidural group was 554±50ml and in the paravertebral group was 196±75mL. The difference was significant with a 'p' value of 0.04. The dose of phenylephrine required to maintain the targeted oxygen delivery index was 40±10µg in the epidural group and 17±4µg in the paravertebral group. The difference was significant with a 'p' value of 0.04. The epidural group required higher volume of colloid infusion and greater dose of phenylephrine. Pain intensity before and after respiratory physiotherapy was similar in the epidural and the paravertebral groups ('p'=0.14). Systolic blood pressure was lower in the epidural group. They concluded that continuous paravertebral block resulted in similar analgesia but greater hemodynamic stability than

epidural analgesia in patients having thoracotomy. (Regional Anesthesia & Pain Medicine: May/June 2011 - Volume 36 - Issue 3 - pg 256-260).

6. **Oguzhan Cucu et al (2004)** compared continuous epidural anesthesia with paravertebral nerve block in patients undergoing thoracotomy. 50 patients were included in the study. Catheter placement was successful in all the patients in the paravertebral block with no procedural complications. The mean pain scores were 52.40±21.50mm and 44.40±19.40mm in epidural and paravertebral groups respectively in the immediate postoperative period at rest, and whereas at the 4^{th} hour they were decreased to 30±14.10mm and 27.20±13.40mm. There were no statistically significant differences between the groups in morphine consumption, 37.56±25.93mg and 36.78±18.58mg for epidural and paravertebral groups respectively. FEV1, FVC, FEF25-75, and mean arterial pressure decreased significantly in both groups compared to basal values. When compared between the two groups these variables were comparable with insignificant 'p' values. None of the patients in the study developed hypotension. Heart rate and MAP were significantly lower in epidural group at postoperative 6 th,12th and 24 hours as compared to paravertebral group ($p<0.01$). Respiratory frequency was similar in both

groups. Arterial partial pressure of oxygen (PaO2) was similar in both groups. No patient had hypercapnia. There was no evidence of contralateral blockade from paravertebral injection. They concluded that paravertebral block appears like an effective and easy method for the relief of post thoracotomy pain and should be considered as an alternative to thoracic epidural anaesthesia.

7. **Vogt et al (2005)** studied the effect of single shot thoracic paravertebral block for postoperative pain management after thoracoscopic surgery. The main outcomes recorded during 48 h after surgery was pain scores using the visual analogue scale (VAS). Half an hour and 24 h after surgery, median (25^{th} –75^{th} percentiles) VAS on coughing in the paravertebral group was 31.0 mm (20.0–55.0) and 30.5mm (17.5–40.0) respectively and in the control group it was 70.0mm (30.0–100.0) and 50.0mm (25.0–75.0) respectively which was statistically significant. They conclude that single shot paravertebral block is an effective procedure to improve pain treatment after thoracoscopic surgery. (British Journal of Anaesthesia 95 (6): 816–21 2005)

8. **Emmanuel marret et al (2005)** conducted a randomized controlled trial to evaluate the effectiveness of multimodal approach pertaining to pain

treatment after thoracic surgery including a continuous thoracic paravertebral block. This study demonstrated the analgesic effect of continuous thoracic paravertebral block mainly supported by lower VAS pain scores at rest and coughing. Combination of continuous thoracic paravertebral block with non opioid analgesics provided effective analgesia after thoracic surgery. They concluded that thoracic paravertebral approach may avoid major complication associated with epidural analgesia such as epidural hematoma, epidural abscess, or spinal cord injury this multimodal analgesic technique including paravertebral block could be considered as an alternative to thoracic epidural analgesia. (annals of thorac surgery ; 2005;79:2109 – 14)

9. **R.G.davies (2006)** et al did a systematic review and meta analysis of studies comparing paravertebral block with epidural blockade. They found out that there was no significant difference between paravertebral block and epidural in the level of analgesia provided and the pain score between two groups were comparable. Pulmonary complication occurred less often with paravertebral block. Urinary retention, nausea, vomiting, and hypotension were less common with paravertebral block. Rates of failed block were lower in paravertebral block. Both techniques provided

comparable pain relief after thoracic surgery. They concluded that paravertebral block is advantageous and can be recommended for major thoracic surgery.(British journal of anaesthesia 96(4):418-26)

10. **Hee Cheol Jin et al (2007)** studied about varied concentrations of bupivacaine for continuous paravertebral block for pain control after thoracotomy. 0.5% and 0.25% bupivacaine showed lower VAS score and cumulative dose of fentanyl, than 0.125%. There was no difference in the satisfaction scale between the 3 groups. There was no difference between the 0.5% and 0.25% bupivacaine in other parameters measured. They concluded that 0.25% bupivacaine used for thoracic paravertebral block is more effective when used for pain control after a thoracotomy (Korean Journal of Anesthesiology 2007 Aug; 53(2):212-216).
11. **Yati Mehta et al (2008)** compared continuous paravertebral block with continuous epidural for postoperative analgesia after robotic assisted coronary artery bypass surgery. This was a prospective randomized study. The results of the study revealed no significant differences with regard to demographics, hemodynamics, and arterial blood gases. Pulmonary function tests were better maintained in paravertebral block group post operatively. The quality of analgesia was also comparable in both groups.

They concluded that paravertebral block is safe and effective technique for postoperative analgesia and is comparable to thoracic epidural analgesia with regard to quality of analgesia. (annals of cardiac anaesthesia, vol 11.2, july-dec 2008).

12. **Mohta, Medha et al (2009)** compared continuous thoracic epidural and thoracic paravertebral infusion in patients with unilateral multiple fractured ribs. This was a prospective randomized study involving thirty patients having three or more unilateral fractured ribs. Both thoracic epidural analgesia and thoracic paravertebral block provided good pain relief and improved respiratory function, as evident by improvement in Visual analogue scale scores at rest and on coughing, respiratory rate, and peak expiratory flow rate. There were no significant intergroup differences. Incidence of pulmonary complications was also similar in the two groups. Incidence of hypotension was more in thoracic epidural analgesia group. They concluded that continuous infusion through thoracic paravertebral block is as effective as through thoracic epidural analgesia for pain management in patients with unilateral fractured ribs and the outcome after two techniques is comparable. (Journal of Trauma. 2009 Apr;66(4):1096-101).

13. **Stephen M. Klein et al (2000)** studied the effectiveness of paravertebral block for breast surgery. This study demonstrated improved postoperative analgesia from paravertebral block. In addition there was a trend of less postoperative nausea in those treated with paravertebral block. Despite the additional time required, the technique offers patients postoperative benefits that may justify the increased effort. They concluded that paravertebral block is an alternative technique for cosmetic breast surgery that may offer superior pain relief and decreased nausea than general anaesthesia alone. (anaesthesia analgesia 2000;90:1402- 5).

14. **Gulbahar et al (2010)** compared epidural and paravertebral catheterization techniques in post thoracotomy pain management. This was a randomized study involving 50 patients. In this study there was no difference between the visual analogue score (VAS) between the two groups in the post in the postoperative period. Pulmonary function as measured by FEV1 (forced expiratory volume in first second), PEFR (peak expiratory flow rate) and oxygen saturation were found to be similar in the postoperative period in both the groups with insignificant 'p' values. No side effects were noted in the paravertebral group. In the epidural group 4 patients had urinary retention, 5 patients had nausea and

vomiting, 4 patients had hypotension, which was statistically significant. They concluded that though both epidural and paravertebral techniques are quite effective in managing post thoracotomy pain, continuous paravertebral technique should probably be preferred due to its ability to be applied at the desired anatomical locations in a shorter time and due to the lower adverse effects and complications compared with the epidural technique.(European Journal of Cardiothoracic Surgery 2010 ; 37: 467-472)

15. **Lonnqvist et al (2011)** in their review of bilateral thoracic paravertebral block technique recommended that this technique can provide excellent intraoperative and postoperative analgesic conditions with less adverse effects and fewer contraindications than central neural blocks. Bilateral paravertebral block has also been used successfully in the thoracic, abdominal and pelvic regions, sometimes obviating general anaesthesia. Despite the need for relatively large doses of local anaesthetics, there are no reports of systemic toxicity. The incidence of complications like pneumothorax and hypotension is low.(British journal of anaesthesia 106(2):164 – 71)

MATERIALS AND METHODS

After getting the approval from the ethical committee, the study was conducted in 60 patients who all underwent thoracotomy. After getting consent and explaining the procedure details to the patients the anaesthetic technique was performed.

Selection of patients

The patients selected for this study were of ASA Risk III who underwent thoracotomy for closed mitral commisurotomy for mitral stenosis.

Patients having atrial fibrillation, cardiac failure, severe pulmonary hypertension, coagulopathy, local sepsis, raised intracranial pressure, allergy to local anaesthetics, spinal deformities like kyphoscoliosis , and those who had undergone thoracotomy in the past, were excluded from the study.

Age group

Age of the patients ranged from 18 to 60 years

Preoperative preparation

Preoperative assessment of the patients included, history regarding the symptoms and their severity, other associated systemic illness, and history of previous surgery. A systematic examination of the cardiovascular and respiratory systems was done to assess the severity of the disease and to find out the patients in cardiac failure, or atrial fibrillation. The spine of the patient was examined for spinal deformities and assessment of the airway was done. Apart from the basic preoperative investigations like blood hemoglobin, sugar, urea, creatinine, specific investigations like serum electrolytes, chest X-ray, electrocardiogram, and echocardiography were done for the patient. Patients were assessed under ASA III. On the day of surgery patients were given their regular cardiac drugs orally with sips of water in the morning. 30 minutes before arrival into the operation theatre all the patients were premedicated with Morphine 0.1mg/kg and Promethazine 0.5mg/kg intramuscularly.

Patients were randomly divided into two groups, 30 patients in each group.

GROUP **TPB :** THORACIC PARAVERTEBRAL BLOCK

GROUP **TEB :** THORACIC EPIDURAL BLOCK

Procedure details

After arrival into the operation theatre pre induction monitors like non invasive blood pressure monitor, Electrocardiography, Pulse oxymetry were connected and the base line readings were noted down. Intravenous cannula was secured. Patients were induced with Thiopentone sodium 5mg/kg, Fentanyl citrate 2μg/kg and Vecuronium bromide 0.1mg/kg. Lignocaine hydrochloride 1.5mg/kg was given 90 seconds before intubation for intubation stress attenuation. Anaesthesia was maintained with nitrous oxide and oxygen in the ratio 3 : 2. Vecuronium bromide and Fentanyl citrate were used in intermittent titrated doses as required. At the end of the procedure after the closure of the skin, patients were put in left lateral position. In Group TPB thoracic paravertebral block was performed with 18 gauge tuohy needle at the level of T5 spinous process using the loss of resistance technique. In group TEB thoracic epidural block was performed at the T5 – T6 inter space using the loss of resistance technique in a midline approach. In both the groups catheter were threaded for approximately 3 -4 centimeters. If there was any occurrence of vascular puncture or dural puncture the next adjacent space above was selected for the performance of the block. The hemodynamic parameters at the end of the procedure were noted down and were taken as the baseline value (0 minute) for further monitoring. After the procedure was performed patients were turned supine. Both the groups received Bupivacaine hydrochloride 0.25%, 8 ml through the catheter.

Residual neuromuscular blockade was reversed with Neostigmine 40µg/kg and Glycopyrrolate 10µg/kg. Patients were extubated.

In the postoperative period blood pressure and heart rate were noted down. When there was a fall of more than 30% from the baseline blood pressure or the systolic blood pressure less than 90mmhg, it was taken as hypotension and was treated with fluids, vasopressors as necessary. Fall of heart rate to less than 50/min was taken as bradycardia and was treated with atropine.

Observations

In the intra operative period, the total dose of intraperative opioid used, the complications of the procedure like vascular puncture, dural puncture, pleural puncture if occurred were noted down. The procedure was considered a failure if the block could not be performed within 3 attempts, or VAS (visual analogue score) was greater than 4 at initial assessment, or if three anaesthetic dermatomes cannot be demonstrated by pin prick method.

In the postoperative period, the total duration of analgesia was measured as the duration from time of administration of drug to the time when VAS (visual analogue score) was greater than 4. When patients had a Visual analogue score of greater than 4 the study was concluded and bupivacaine dose was repeated through the catheter for pain relief. Blood pressure and Heart rate was monitored every 15 min for the initial one hour, there after hourly blood pressure and heart rate was monitored until the conclusion of the study.

OBSERVATIONS and RESULTS

Group **TPB** : Thoracic paravertebral group

Group **TEB** : Thoracic epidural group

STATISTICAL TOOLS

The information collected regarding all the selected cases were recorded in a Master Chart. Data analysis was done with the help of computer using **Epidemiological Information Package (EPI 2010)** developed by Centre for Disease Control, Atlanta.

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

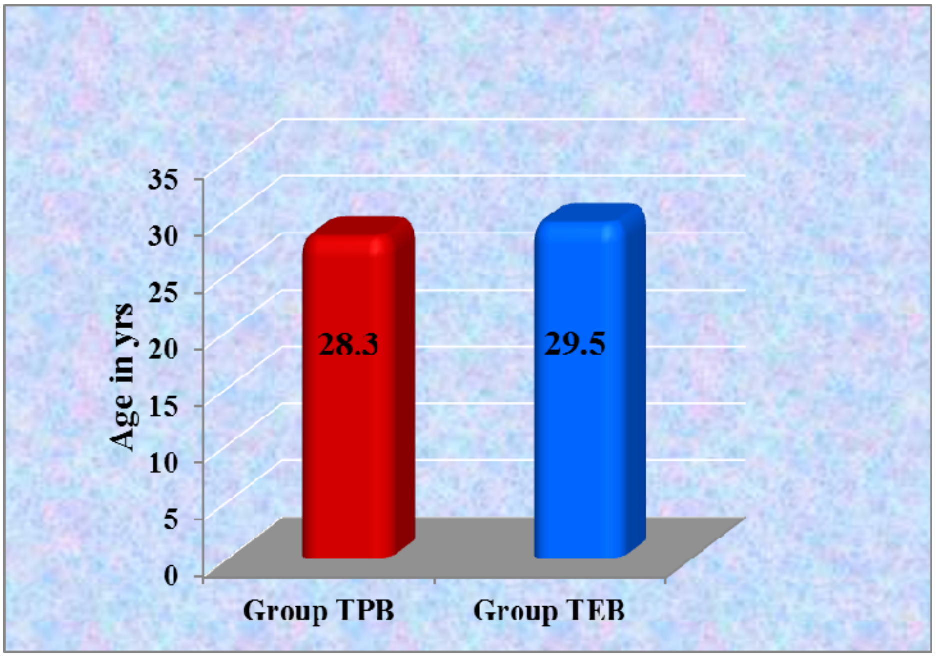
CHARACTERISTICS OF CASES STUDIED

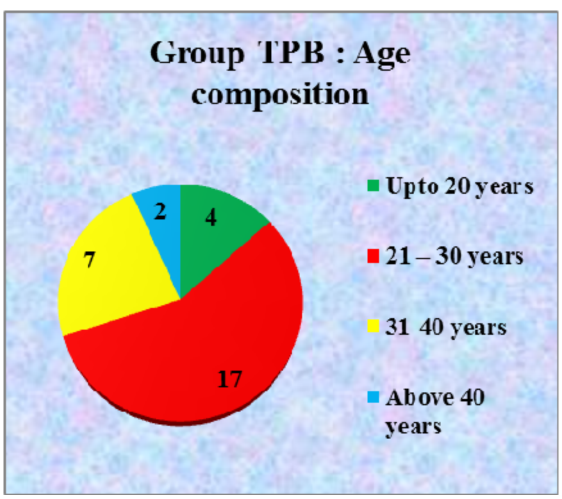
Table 1 : Age distribution

Age group	Group TPB		Group TEB	
	No	**%**	**No**	**%**
Up to 20 years	4	13.3	3	10
21 – 30 years	17	56.7	16	53.3
31-40 years	7	23.3	10	33.3
Above 40 years	2	6.7	1	3.3
Total	30	100	30	100
Range	19 – 48 years		18 – 48 years	
Mean	28.3 years		29.5 years	
SD	7.7 years		7.1 years	
'p'	0.3619 Not significant			

Nearly 80% of the cases belonged to 21-30 years age group. Group TPB had an age of 28.3 $\pm$ 7.7 years and Group TEB, 29.5 $\pm$7.1 years. The difference was not statistically significant.

AGE DISTRIBUTION





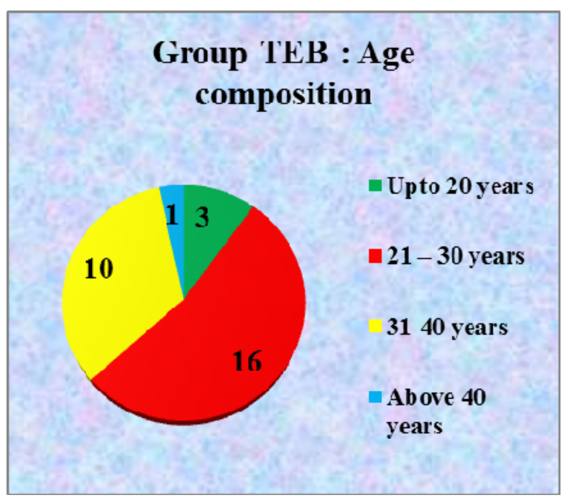


Table 2 : Sex distribution

Sex	Group TPB		Group TEB	
	No	%	No	%
Male	6	20	7	76.7
Female	24	80	23	23.3
Total	30	100	30	100
‘p’	1.0 Not significant			

Sex composition of both the groups did not have significant difference.

SEX DISTRIBUTION

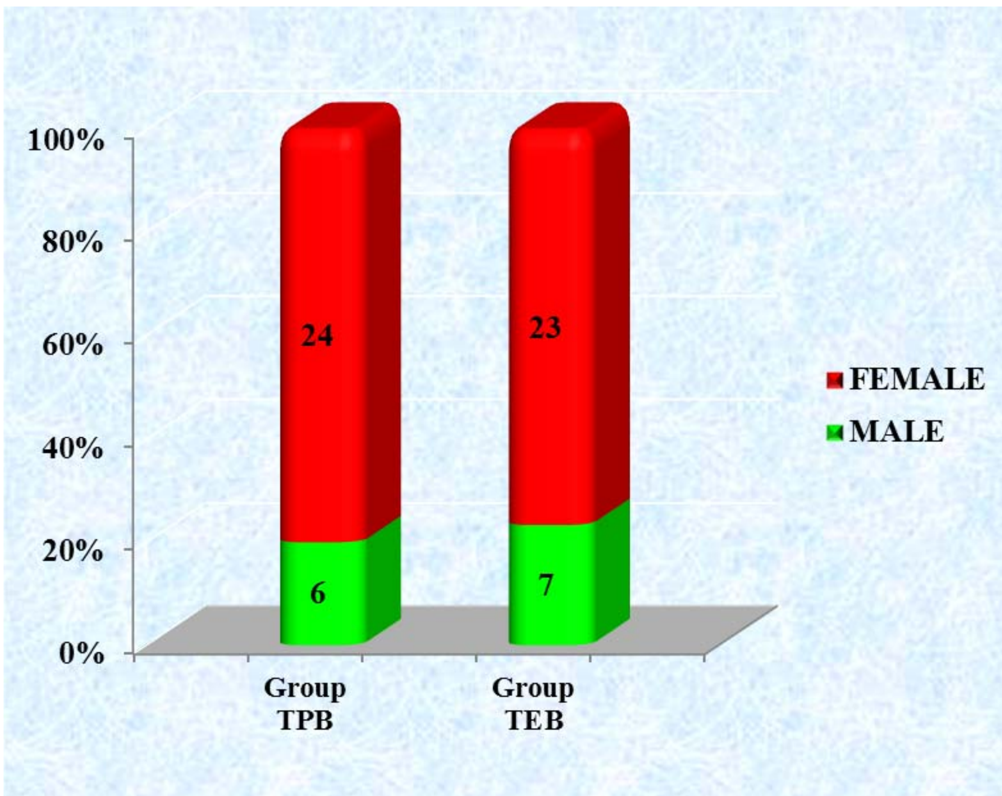


Table 3: Weight

Parameter	Weight (in kgs)	
	Group TPB	**Group TEB**
Range	40- 60	40-60
Mean	49.7	51.0
SD	6.0	4.7
'p'	0.461 Not significant	

Mean weight of the Group TPB was 49.7kgs and the Group TEB was 51.0kgs. There was no statistically significant difference('p' value 0.461).

WEIGHT

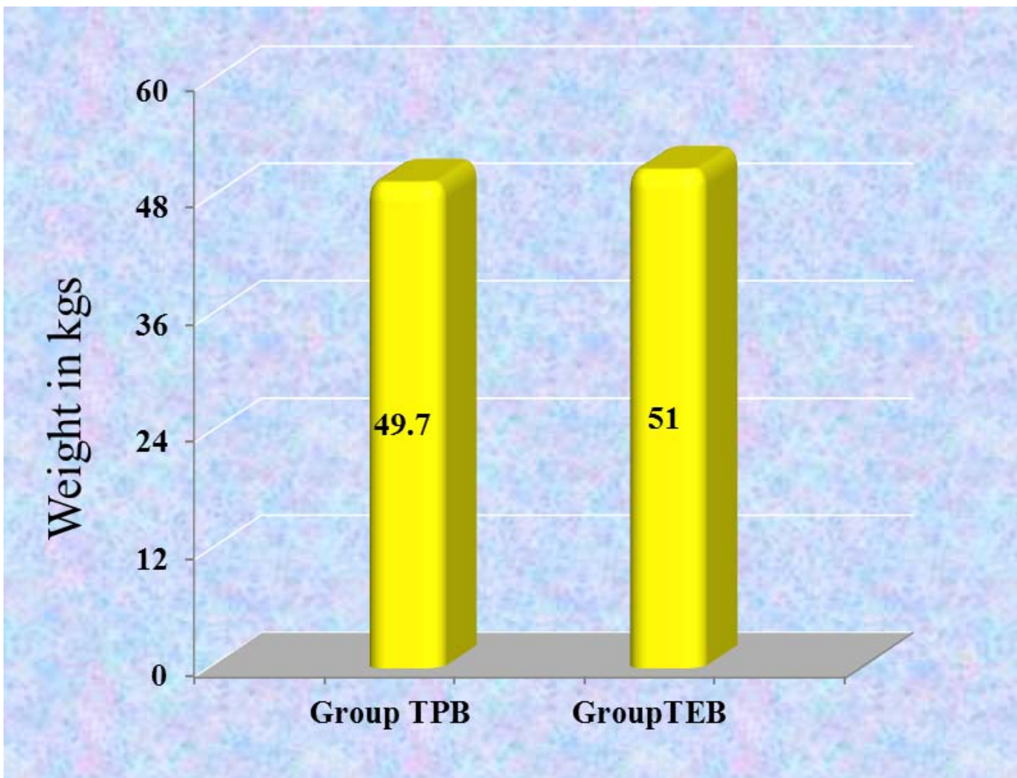


Table 4 : ASA

ASA	Group TPB		Group TEB	
	No	%	No	%
III	30	100	30	100
Others	-	-	-	-
Total	30	100	30	100

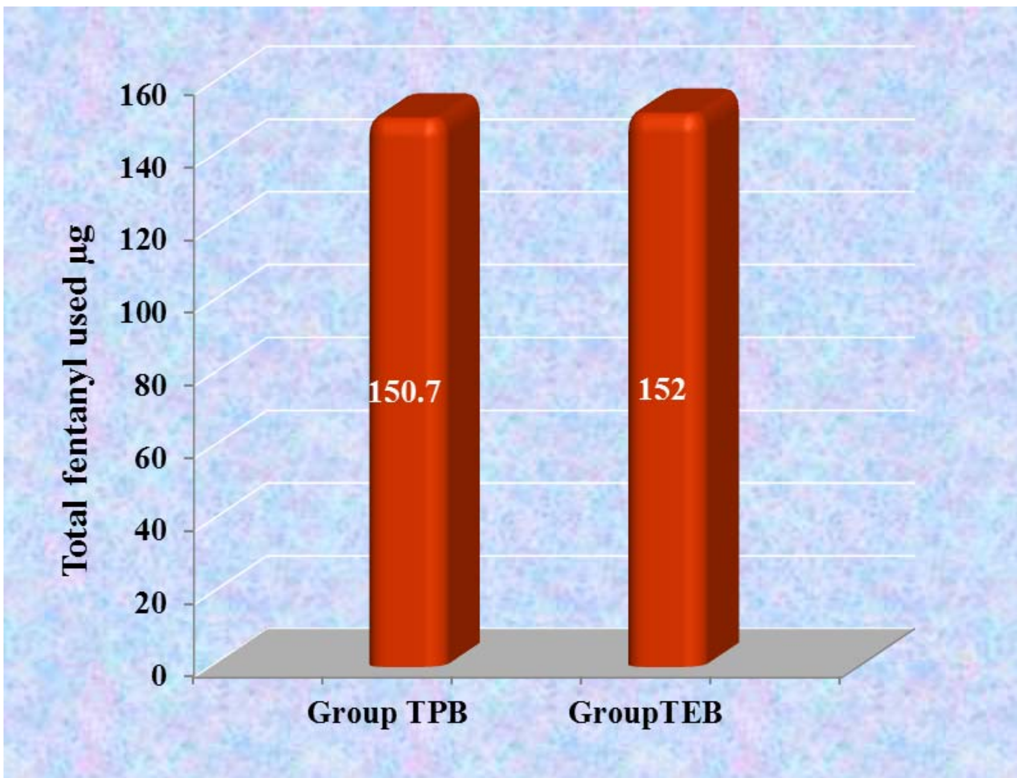
All the patients in the study belonged to ASA III.

Table 5 : Total fentanyl used

Parameter	Total fentanyl used µg	
	Group TPB	**Group TEB**
Range	130-170	140-170
Mean	150.7	152.3
S.D.	11.1	10.7
‘p’	0.6181 Not Significant	

Total fentanyl used in Group TPB was 150.7±11.1µg and in Group TEB, it was 152.3±10.7µg. The difference was not significant statistically (‘p’ value 0.6181).

TOTAL FENTANYL USED



COMPARATIVE EFFICACY

Table 6 : Duration of analgesia

Parameters	Duration of analgesia (in minutes)	
	Group TPB	Group TEB
Range	330-390	330-400
Mean	357.1	358.4
SD	19.0	16.0
‘p’	0.7792 Not significant	

Duration of analgesia in the Group TPB was 357.1±19 minutes. For the Group TEB, it was 358.4±16 minutes. There was no statistically significant difference (‘p’ = 0.7792). Both the techniques provide similar duration of analgesia.

DURATION OF ANALGESIA

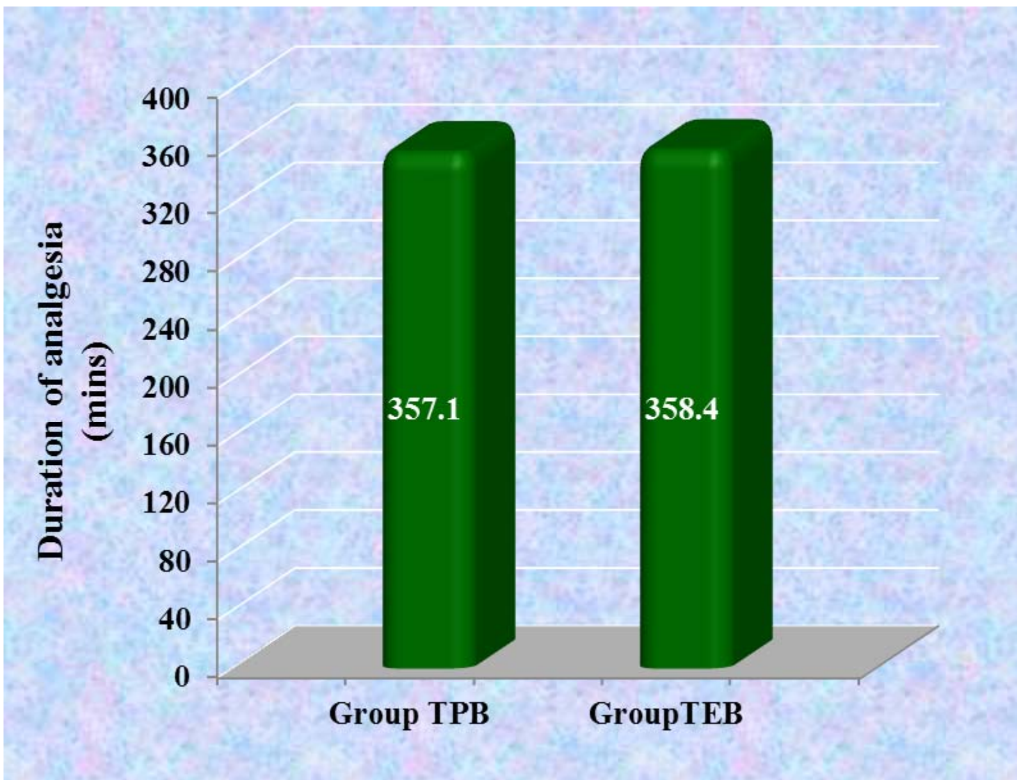


Table 7 : Mean Arterial pressure at various time intervals

MAP at	MAP value (Mean ±SD) for		'p'	Significance
	Group TPB	Group TEB		
Preoperative	83.4 ±5.3	83.4 ±5.1	0.9782	Not significant
At 0 minute	84.4 ±6.3	84.4 ±4.5	0.6203	Not significant
15 minutes	87.2 ±5.4	83.2 ±7.3	**0.0196**	**Significant**
30 minutes	86.3 ±5.1	83.0 ±6.3	**0.0262**	**Significant**
45 minutes	85.1 ±4.8	83.0 ±5.5	0.1226	Not significant
1 hour	85.0 ±4.6	84.1 ±4.5	0.384	Not significant
2 hours	85.0 ±4.8	84.4 ±4.2	0.7388	Not significant
3 hours	83.9 ±5.5	84.6 ±4.7	0.3991	Not significant
4 hours	84.6 ±5.8	85.0 ±4.7	0.687	Not significant
5 hours	84.9 ±4.7	84.6 ±4.6	0.9854	Not significant
6 hours	85.1 ±4.6	84.6 ±4.7	0.7623	Not significant

Mean arterial pressures in the preoperative period showed no statistically significant difference ('p' = 0.9782). During the postoperative period, Mean arterial pressure values were significantly different only at 15 minutes and at 30 minutes. At all the other times, there were no significant differences ('p'>0.05). Patients in the Group TEB had significantly low mean arterial pressure at 15 minutes and 30 minutes with a 'p' value of 0.0196 and 0.0262 respectively. Rest of the time the mean arterial pressures were comparable.

MEAN ARTERIAL PRESSURE

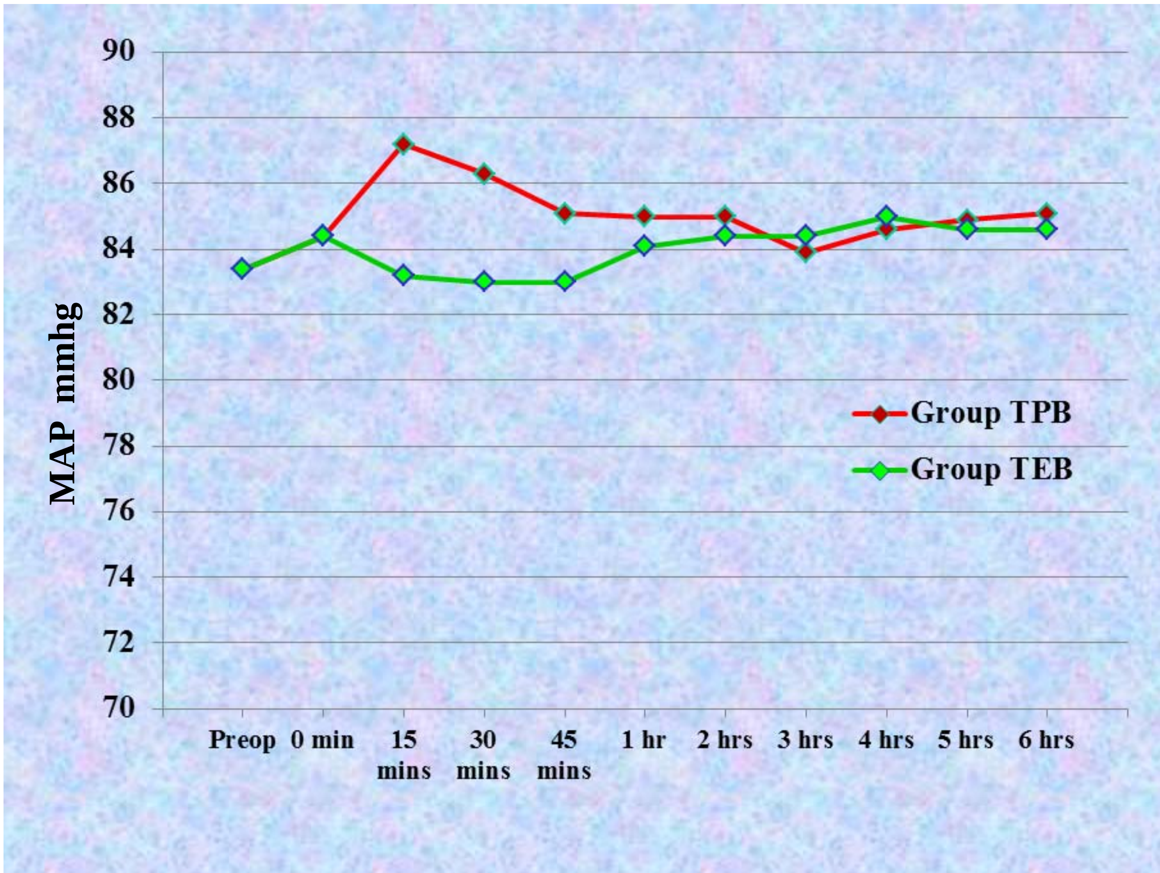


Table 8 : Incidence of Hypotension

Hypotension	No.of patients	Percentage
Group TPB	2	7.14%
Group TEB	5	19.23%

The failure rate in Group TPB was 7.14%. The failure rate in Group TEB was 19.23%.

INCIDENCE OF HYPOTENSION

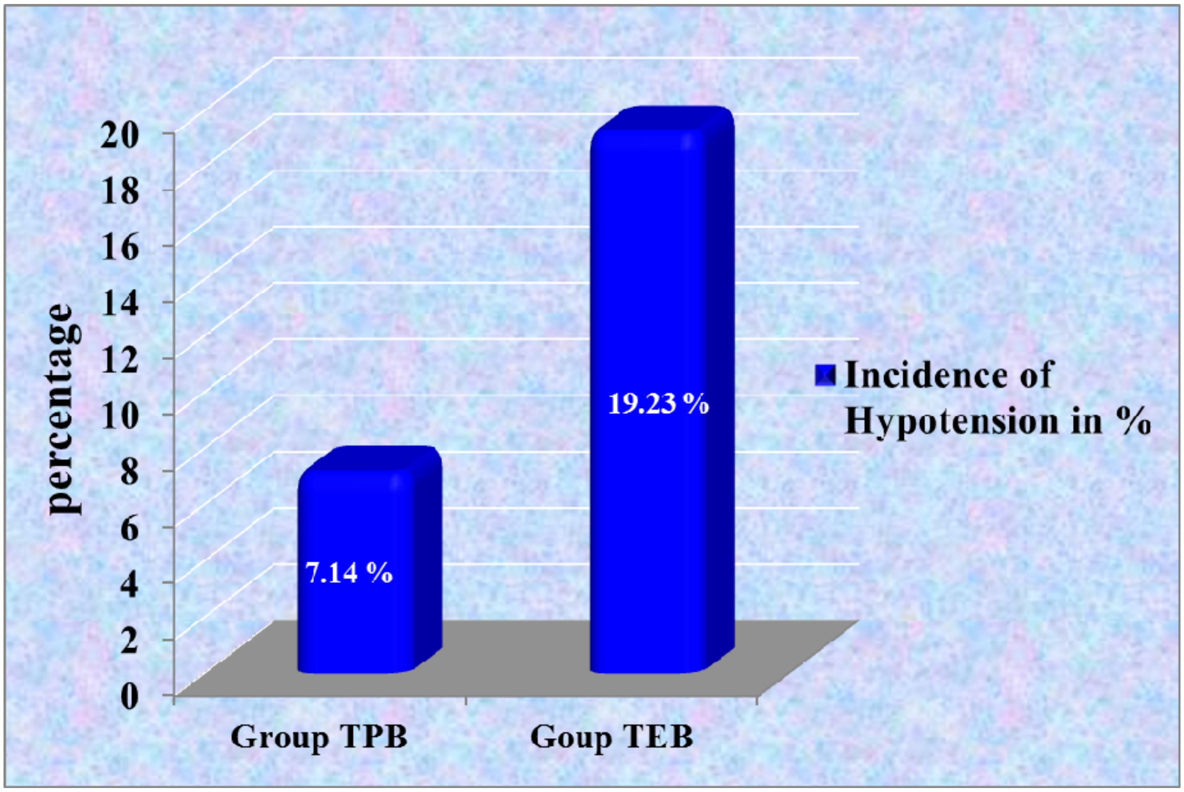
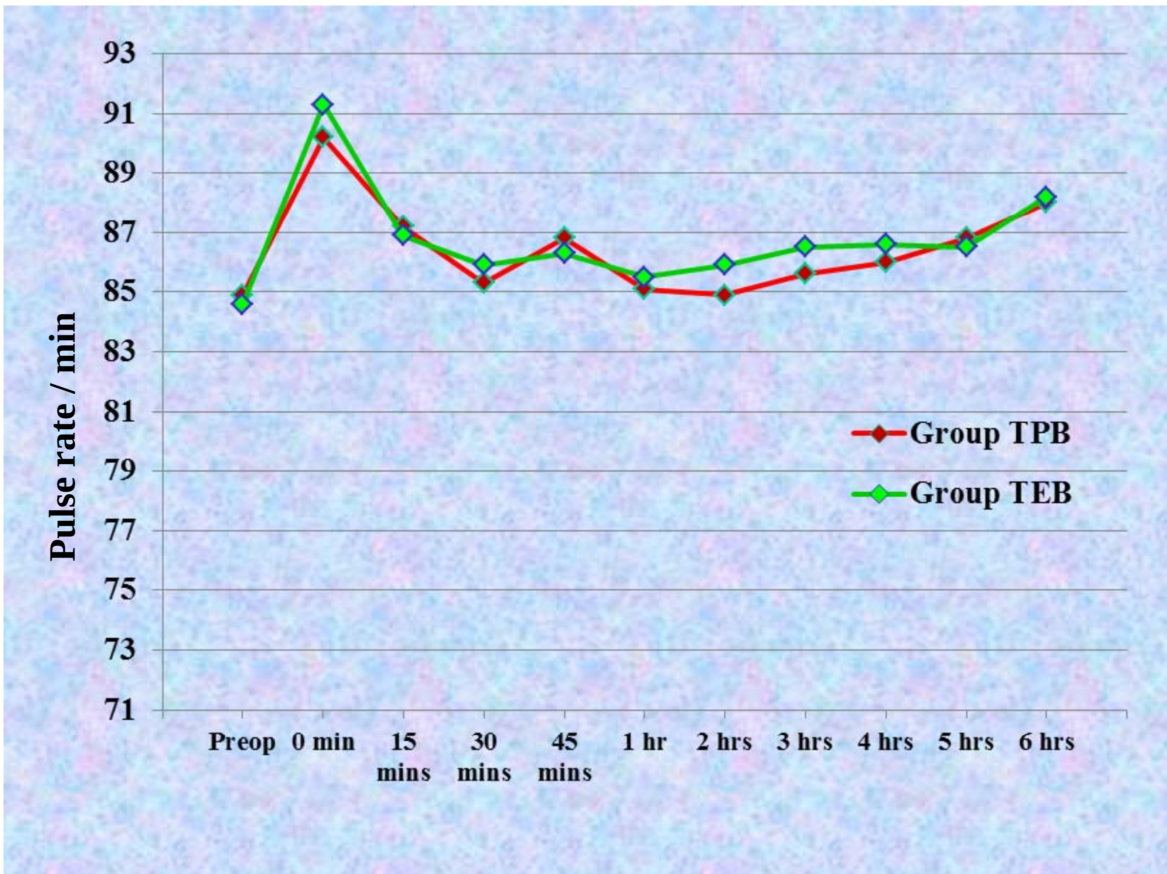


Table 9 : Pulse rate at various time intervals

Pulse rate	Pulse rate (Mean ±SD) for		'p'	Significance
	Group TPB	Group TEB		
Preoperative	84.9 ±10.1	84.6 ±9.8	0.9929	Not significant
At 0 minute	90.2 ±11.6	91.3 ±10.8	0.6165	Not significant
15 minutes	87.2 ±11.9	86.9 ±11.8	1.0	Not significant
30 minutes	85.3±8.4	85.9 ±9.2	0.5378	Not significant
45 minutes	86.8 ±9.4	86.3 ±10.3	0.7545	Not significant
1 hour	85.1 ±9.6	85.5 ±9.9	0.7266	Not significant
2 hours	84.9 ±8.4	85.9 ±9.2	0.5378	Not significant
3 hours	85.6 ±9.5	86.5 ±9.7	0.7009	Not significant
4 hours	86.0 ±7.2	86.6 ±8.7	0.9786	Not significant
5 hours	86.8 ±7.8	86.5 ±8.5	0.8933	Not significant
6 hours	88.0 ±7.2	88.2 ±8.9	0.9572	Not significant

Pulse rates did not have any statistically significant difference both pre operatively and post operatively at all time intervals ('p'> 0.05). In both groups the pulse rate at all the time intervals were comparable.

PULSE RATE



93
91
89
87
85
83
81
79
77
75
73
71
Pulse rate / min
Group TPB
Group TEB
Preop
0 min
15 mins
30 mins
45 mins
1 hr
2 hrs
3 hrs
4 hrs
5 hrs
6 hrs

Table 10 : Changes in MAP during postoperative period

Maximum deviation is calculated by noting down the highest mean arterial pressure attained by each patient during the entire monitoring period and then calculating their mean and standard deviation. Change in the mean arterial pressure is the mean of the difference between the highest mean arterial pressure attained in the monitoring period and the preoperative mean arterial pressure.

MAP at	Value (Mean ±SD) for		'p'	Significance
	Group TPB	Group TEB		
Preoperative	83.4 ±5.3	83.4 ±5.1	0.9782	Not significant
Maximum deviation	88.2 ±5.2	87.7± 5	0.6632	Not significant
Change in MAP	4.8 ±6.4	4.3 ±4.8	0.3186	Not significant
% of change in MAP	6.0 ±7.8	5.3 ±5.7	0.4858	Not significant

During the postoperative period, percentage of increase in MAP was 6±7.8mmhg for the thoracic paravertebral Group and 5.3±5.7mmhg for the thoracic epidural Group. The differences were not statistically significant ('p'> 0.05).

PERCENTAGE OF CHANGES IN MAP

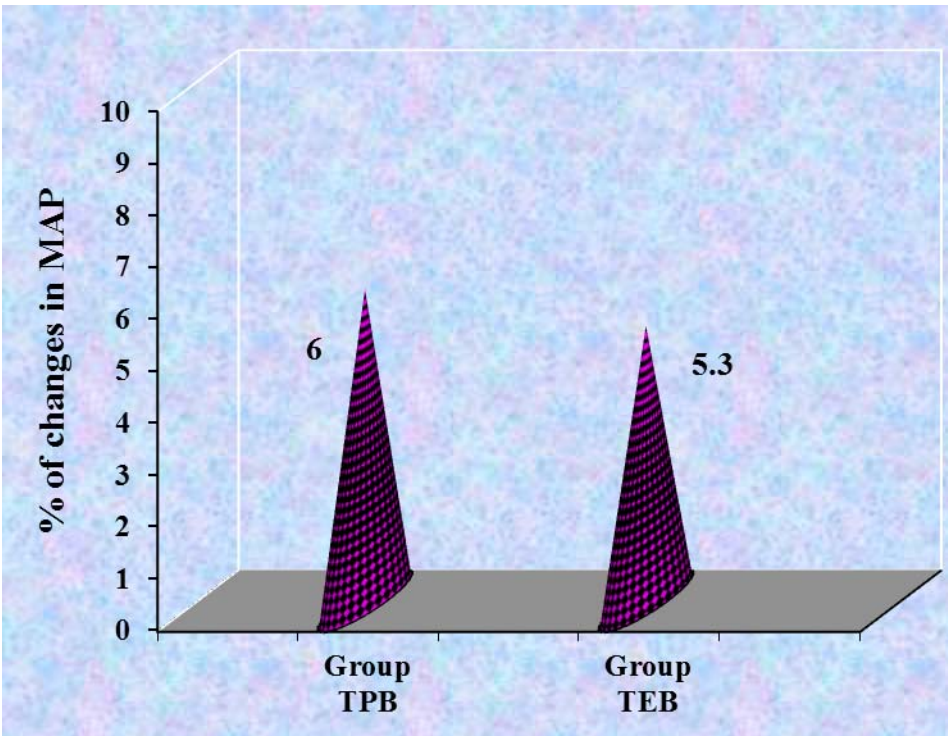


Table 11 : Changes in pulse rate during postoperative period

Maximum deviation is calculated by noting down the highest pulse rate attained by each patient during the entire monitoring period and then calculating their mean and standard deviation. Change in the pulse rate is the mean of the difference between the highest pulse rate attained in the monitoring period and the preoperative pulse rate.

Pulse rate/min	Value (Mean ±SD) for		'p'	Significance
	GroupTPB	Group TEB		
Preoperative	84.9 ±10.1	84.6 ±9.8	0.9929	Not significant
Maximum deviation	93.9 ±9.5	92.2 ±10.5	0.4575	Not significant
Change in PR	9.0 ±5.5	7.6 ±4.2	0.342	Not significant
% of change in PR	11.0 ±6.8	9.1 ±5.4	0.3312	Not significant

Percentage of increase in pulse rate was 11.0±6.8 and 9.1±5.4 for the two groups. There was no significant difference ('p'>0.05).

PERCENTAGE OF CHANGES IN PULSE RATE

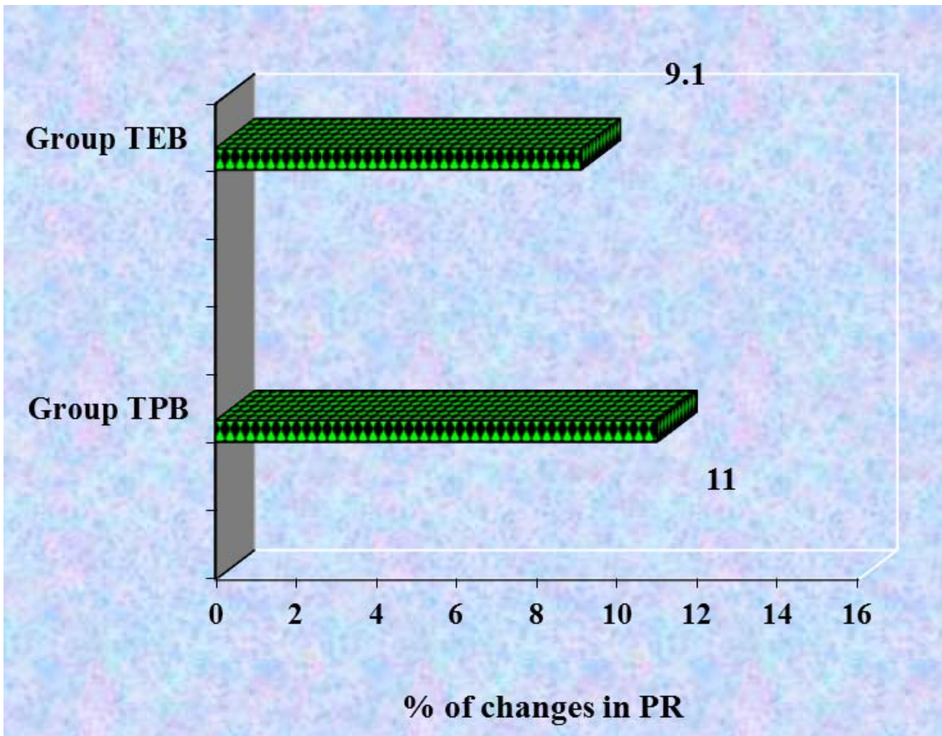
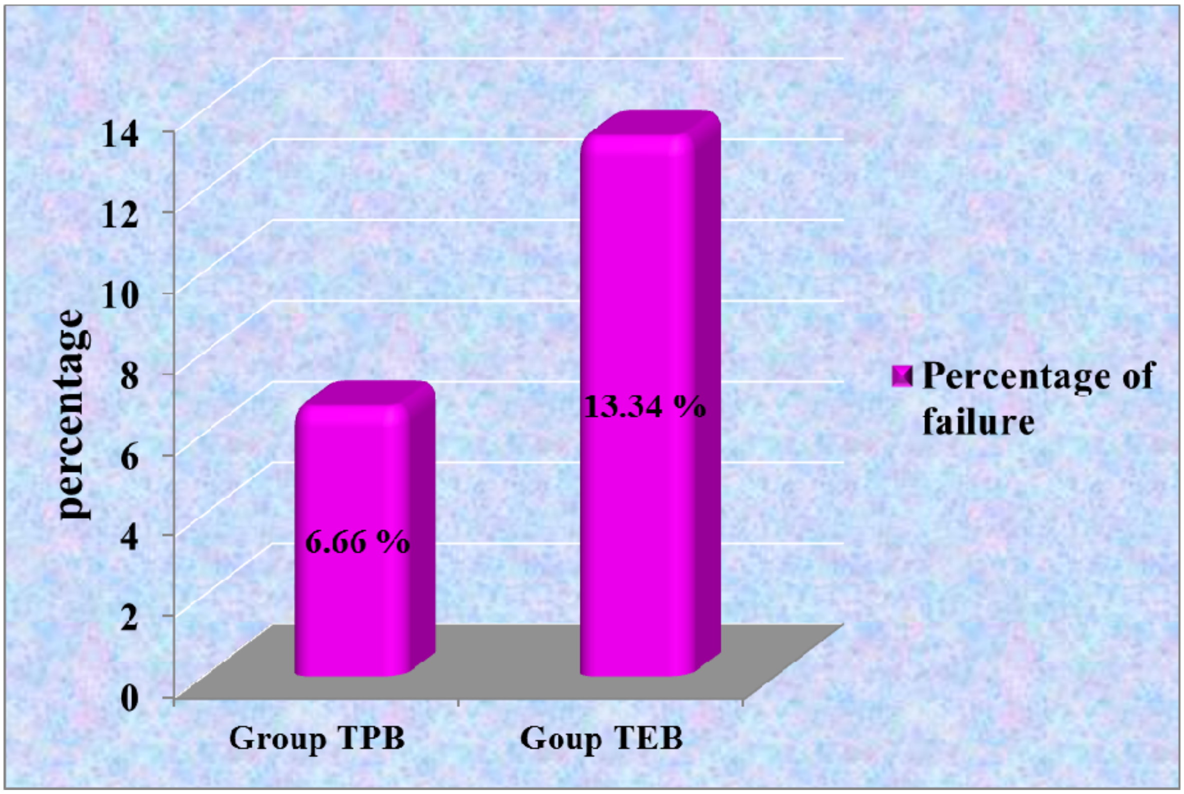


Table 12 : Failure rate

Failure rate	**No.of patients**	**Percentage**
Group TPB	2	6.66%
Group TEB	4	13.34%

The failure rate in Group TPB was 6.66%. The failure rate in Group TEB was 13.34%.

PERCENTAGE OF FAILURE



DISCUSSION

Postoperative pain relief has become an integral part of the anaesthesia practice. Inadequate treatment of postoperative pain has its own detrimental effects on the outcome of the patient. The acute effects are due to the increase in the catabolic hormones and catecholamine secretion. This also has its sequlae in the long term wellbeing of the patient. The extent of this response is in turn influenced by many factors including the intensity of the surgical injury, type of anaesthesia, etc[34].

Pain after thoracotomy is one among the most severe pain in the postoperative period. Such pain can result in splinting of the respiratory muscles causing decrease in pulmonary function. In the long term it can result in the development of post thoracotomy pain syndrome[6,15]. Multimodal approach to postoperative pain relief is being considered as the method of choice for treating postoperative pain. Regional techniques had always been the integral and major part of this approach. Considering the origin of the pain after thoracotomy, regional anaesthesia has been promising in providing better pain relief when compared to other techniques[6,18]. Various regional techniques like the thoracic epidural analgesia, intrapleural blocks, intercostal nerve blocks are being used. The newer addition to this list is the thoracic paravertebral block [6,18].

Thoracic epidural analgesia has been considered as the technique of choice for providing post thoracotomy pain relief[35,36]. Compared with systemic opioids epidural analgesia may confer several advantages including decrease in incidence of pulmonary dysfunction, early return of gastrointestinal motility, absence of respiratory depression, especially in high risk patients[3,4,34]. This sympathetic blockade is responsible for its adverse effects on the hemodynamic stability of the patient, manifesting as hypotension and bradycardia[3,4,37,39]. Performance of epidural block at the upper thoracic level is difficult due to the anatomical variation seen at this level of this vertebral column [34]. There are also other potential complications like dural puncture resulting in post dural puncture head ache, possibility of the spinal cord injury, accidental intrathecal and intravascular injections due to the migration of the catheter, epidural hematoma resulting in compression of the cord. There is possibility of introduction of infection in to the epidural space resulting in epidural abscess, and meningitis [3,4, 37].

Thoracic paravertebral block, which has recently gained popularity, is being considered as an alternative technique to thoracic epidural[19,24]. This technique is claimed to be associated with better hemodynamic stability[18,19,22]. Technically paravertebral block is relatively simple and easier to perform. This technique is devoid of various complications associated with thoracic epidural[6,19,22,24]. The main complication of thoracic paravertebral is the pleural puncture and development of pneumothorax[19,28,32,34,38] which is offset by the presence of intercostal drainage tube in thoracotomy.

In this study, duration of analgesia, blood pressure, pulse rate, were compared in the postoperative period. Failure rate and complications of the techniques were also compared.

Duration of analgesia

The duration of analgesia was measured as the duration until the patient had a visual analogue score less than or equal to 4. This study showed that both the thoracic paravertebral and thoracic epidural technique provided similar duration of analgesia. The duration of analgesia in paravertebral group (Group TPB) was 357.1$\pm$19 minutes. The duration of analgesia in epidural group (Group TEB) was about and 358.4$\pm$16. The ‘p’ value was 0.7792, which was statistically insignificant. Mathews et al, Pintaric et al, Oguzhan cucu et al, all had observed similar visual analogue scores in paravertebral and epidural techniques.

Hemodynamic parameters

Blood pressure

Blood pressure was compared in the form of mean arterial pressure in both the groups. On comparing both the paravertebral group (Group TPB) and epidural group (Group TEB), the mean arterial pressure was decreased in the thoracic epidural group (Group TEB) at 15minutes and 30 minutes after administration of the drug which was statistically significant (‘p’<0.05). At all other time intervals the mean arterial pressures in both the groups were comparable. The incidence of hypotension in paravertebral group (Group TPB) was 7.14% in this group. The incidence of hypotension in epidural group (Group TEB) was 19.23%. Naja et al had observed a 4% incidence of hypotension in the paravertebral block. Richardson et al, Gulbahar et al, R.G.Davies et al all observed higher incidence of hypotension and a low blood pressure in thoracic epidural technique when compared to thoracic paravertebral block. Oguzhan cucu et al had no incidence of hypotension but observed a low mean arterial pressure in patients receiving epidural block.

Pulse rate

Pulse rate measured in both the groups were comparable at all time intervals with statistically insignificance (‘p’ >0.05).

Thoracic paravertebral blockade is associated with a blockade which is predominantly unilateral in distribution. So the sympathetic blockade associated also follows the same pattern. In case of thoracic epidural the sympathetic blockade is bilateral in distribution. The bilateral sympathetic blockade perhaps might be the reason for the greater incidence of hypotension and low mean arterial pressure seen in patients receiving epidural. Since paravertebral block produced a unilateral sympathetic blockade there was less incidence of hypotension.

Complications during the procedure

The failure rate in thoracic paravertebral group (Group TPB) was 6.66%. Two patients in the paravertebral group were considered as failure. In one patient failure was due to the inability in identification of the paravertebral space, and in the other patient the initial VAS more than 4. Naja et al had a failure rate of 6.1% in thoracic paravertebral block.

The failure rate in thoracic epidural group (Group TEB) was 13.34%.Four patients in the thoracic epidural group were considered as failure. The failure was due to the inability to identify the space. Of these one patient in the thoracic epidural group had dural puncture. All these patients were excluded from the study. Gulbahar et al had a failure of 24% with thoracic epidural technique. Whereas Richardson et al had a failure of 10%. There was no incidence of pleural puncture in the paravertebral group. Since all the patients were catheterized incidence urinary retention could not be noted. None of the patients in both the groups developed vascular puncture, nausea, vomiting and local anaesthetic toxicity.

SUMMARY

The aim of this study was to prospectively compare thoracic epidural with thoracic paravertebral block for postoperative analgesia in patients undergoing thoracotomy for closed mitral commisurotomy. This study included 60 eligible patients who were divided into two groups of 30 each. Group TPB received thoracic paravertebral block and Group TEB received thoracic epidural block. The procedures were performed at the end of the intended surgery under general anaesthesia. Both the groups received 8ml 0.25% Bupivacaine through the threaded catheter. The base line hemodynamic parameters after the performance of the technique were noted. All the patients were extubated. There after the hemodynamic parameters were noted down in the postoperative ward at 0 minute, 15 minutes, 30 minutes, 45 minutes, 1 hour, thereafter at hourly intervals up to time when Visual analogue score was greater than 4 Duration of analgesia was noted as time for visual analogue score greater than 4. The failure rate and complications of the techniques, local anaesthetic toxicity were noted.

Of the two groups compared Group TEB had a failure rate of 13.34% which was higher than Group TPB in which the failure rate was 6.66%. One patient in Group TEB had dural puncture. The duration of

analgesia was similar in both the groups, which was statistically insignificant with a ‘p’ value of 0.7792. Incidence of hypotension in Group TEB was 19.23%. This was higher when compared to the Group TPB with incidence of 7.14%. The mean arterial pressure compared between the two groups showed lower mean arterial pressure in Group TEB at 15 minutes and 30 minutes which is statistically significant. The ‘p’ value was 0.0196 at 15 minutes and 0.0262 at 30 minutes. During all the other time intervals the difference between the mean arterial pressure were statistically insignificant (‘p’>0.05). The difference in the pulse rate at various time intervals between the two groups were statistically insignificant (‘p’>0.05). There was no incidence of bradycardia, vascular puncture, pleural puncture, or local anaesthetic toxicity in both the groups.

CONCLUSION

In conclusion, the data and the statistical analysis suggest that thoracic paravertebral block is a simple and easy to perform technique with a low failure rate, which provides duration of analgesia similar to thoracic epidural block but with better hemodynamic stability. Hence thoracic paravertebral block can be considered as an alternative technique to thoracic epidural blockade, for providing postoperative analgesia in patients undergoing thoracotomy.

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PROFORMA

Comparative evaluation of thoracic paravertebral block with thoracic epidural in patients undergoing thoracotomy with 0.25%bupivacaine

Name of the patient : IPNo : Date:

Age / Sex : M / F Weight : kgs Diagnosis :

Relevant positive history :

INVESTIGATIONS :

Blood : Hb % Sugar : mg% Urea : mg% Creatinine : mg%

Serum : Sodium meq/L Potassium : meq/L

ECG :

ECHO:

ASA : III

Preoperative hemodynamics

Pulse rate : /min Blood pressure : mmhg SPO2 : %

Premedication : Inj.Morphine 0.1mg/kg + Inj.Promethazine 0.5mg/kg

Level of thoracotomy :

Total intraoperative opioid used : microgram

Procedure performed : THORACIC PARAVERTEBRAL / EPIDURAL

No.of attempts :

Level of catheter insertion : Skin to space distance : centimeters

Level of catheter at skin: centimeters

Complications :

Dural puncture / Pleural puncture / Intravascular catheter insertion / Others

BASELINE HEMODYNAMICS (0 minute, After closure of skin and performing the block, before LA administration):

Pulse rate : /min Blood pressure : mmhg SPO2 : %

Local anaesthetic dose : 8ml 0.25% BUPIVACAINE through the catheter

Time of administration :

Hemodynamics after extubation and before shifting the patient:

Pulse rate : /min Blood pressure : mmhg SPO2 : %

MONITORING IN THE POSTOPERATIVE WARD

1. Failure of blockade : YES / NO

   (1hr VAS>4/failure to identify 3 anaesthetized dermatomes)

2. Time when VAS > 4 :
3. Total duration of Analgesia :

Postoperative monitoring:

	PR /min	BP mmhg	MAP mmhg	VAS (1-10)
15mins				
30 mins				
45 mins				
1hrs				
2 hrs				
3 hrs				
4 hrs				
5 hrs				
6 hrs				
7 hrs				
8 hrs				

Thoracic Epidural group

Sno	Name	Weight kg	Age yrs	Sex	sugar mg/dl	urea mg/dl	creatinine mg/dl	sodium meq/l	potassium meq/l	ASA	IPno.	Tot. fen. used	Dur.of anal min	MAP	
														Preop	0min
1	Krishnaveni	40	37	F	112	36	1.1	142	4.5	III	37708	150	380	83.3	83.3
2	Velusamy	60	35	M	98	42	0.9	144	3.9	III	35496	160	370	80	86.6
3	Jeyakodi	55	48	F	112	34	1.1	142	4.1	III	25396	140	350	83.3	86.6
4	Lakshmi	45	20	F	134	28	0.9	138	5.1	III	38150	140	360	76.6	80
5	Devi	48	23	F	120	39	1.2	135	4.3	III	39877	170	400	93.3	90
6	Kaleeswari	50	27	F	126	40	0.7	133	3.4	III	03678	140	340	76.6	80
7	Ambigai	52	28	F	136	38	0.9	142	4	III	47825	150	340	83.3	86.6
8	Chinnathai	48	33	F	100	44	1.2	139	4.2	III	86224	160	360	76.6	83.3
9	Nagaraj	54	27	M	84	30	0.8	140	3.7	III	91811	140	340	86.6	83.3
10	Jeyalakshm	50	35	F	98	37	0.9	136	3.2	III	43345	140	330	90	93.3
11	Petchiamal	58	38	F	110	41	1.3	141	3.3	III	2356	170	370	93.3	93.3
12	Karpagajothi	52	25	F	105	28	0.7	130	4.1	III	40433	160	360	83.3	80
13	Bharathi	52	34	F	115	35	0.9	138	4.5	III	74813	140	350	90	80
14	Usha	54	23	F	92	30	0.8	136	4.7	III	43522	150	360	86.6	83.3
15	Backialaksh	48	25	F	102	37	0.9	144	4.6	III	40967	160	360	76.6	76.6
16	Sahayamary	60	30	F	140	34	0.8	132	3.7	III	63789	140	370	83.3	86.6
17	Rabiyabegm	54	27	F	110	42	1.1	141	4.2	III	42356	160	340	80	83.3
18	Nagalaxmi	55	40	F	125	34	1	133	3.3	III	41633	170	360	86.6	83.3
19	Selvan	54	25	M	130	39	0.9	128	3.9	III	73017	170	370	83.3	93.3
20	Anandavali	50	30	F	105	28	0.8	139	4.7	III	64746	150	340	83.3	80
21	Karthick	45	23	M	98	32	0.7	136	4.4	III	67854	160	350	80	83.3
22	Selvam	48	25	M	84	38	0.9	132	3.5	III	70433	140	350	83.3	86.6
23	Lakshmi	54	20	F	108	44	4	130	4.5	III	83345	160	370	90	80
24	Rajendran	50	35	M	112	34	0.8	141	3.8	III	43522	150	380	80	83.3
25	manimegalai	50	23	F	120	44	1.2	144	4.1	III	90967	140	360	76.6	83.3
26	Eswari	44	27	F	124	36	0.8	135	3.9	III	82143	160	330	90	93.3
27	Sathya	52	18	F	106	34	0.7	137	4	III	34972	150			
28	Amutha	54	37	F	100	40	0.8	131	3.2	III	32391	150			
29	Guruvamal	45	40	F	94	39	1.1	144	3.3	III	93789	140			
30	Muthukumar	48	28	M	107	41	0.9	141	4.3	III	93268	160			

(GROUP TEB)

MAP									PR											
15 min	30 min	45 min	1hr	2hr	3hr	4hr	5hr	6hr	Pre op	0 min	15 min	30 min	45 min	1hr	2hr	3hr	4hr	5hr	6hr
76.6	76.6	80	80	83.3	83.3	83.3	83.3	86.6	84	88	90	86	88	82	82	84	84	86	90
90	90	86.6	86.6	83.3	83.3	86.6	86.6	86.6	78	80	84	80	80	82	83	86	84	86	86
80	76.6	76.6	76.6	83.3	93.3	93.3	93.3	93.3	80	78	80	70	74	78	82	78	80	80	76
83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	100	98	104	102	105	100	96	100	101	100	104
96.6	93.3	93.3	93.3	90	90	93.3	93.3	93.3	94	92	98	96	94	92	93	94	92	94	100
83.3	80	80	80	76.6	76.6	76.6	76.6	76.6	78	68	72	60	88	92	86	86	90	88	90
76.6	76.6	76.6	80	80	80	83.3	83.3	83.3	74	78	82	80	78	77	79	80	81	82	80
70	76.6	76.6	80	83.3	83.3	80	80	80	100	100	110	100	100	100	101	103	104	100	100
90	86.6	86.6	86.6	93.3	93.3	93.3	93.3	93.3	88	84	92	88	85	86	82	85	90	88	90
96.6	96.6	93.3	93.3	90	90	90	90	90	70	72	80	78	74	74	72	77	78	76	78
96.6	96.6	96.6	93.3	93.3	93.3	90	86.6	86.6	84	80	84	84	82	80	81	82	83	84	90
80	80	83.3	83.3	83.3	80	80	80	80	100	100	110	103	104	102	98	98	97	96	98
83.3	83.3	83.3	83.3	80	80	80	80	80	82	74	80	78	74	74	76	74	72	74	76
80	80	80	83.3	83.3	83.3	83.3	83.3	83.3	78	78	84	82	84	83	83	84	83	80	82
80	76.6	76.6	80	83.3	80	80	83.3	80	72	68	74	70	72	74	72	74	77	74	75
80	80	83.3	86.6	86.6	86.6	86.6	86.6	86.6	83	80	84	80	83	84	86	88	86	85	90
86.6	83.3	83.3	83.3	80	83.3	83.3	83.3	83.3	90	94	100	98	95	94	95	96	99	100	100
80	80	86.6	86.6	83.3	83.3	83.3	80	80	88	92	95	94	90	90	92	91	89	90	93
86.6	86.6	83.3	83.3	86.6	86.6	90	86.6	86.6	74	74	80	78	80	78	84	82	80	92	88
83.3	83.3	83.3	90	90	90	90	90	90	100	100	104	98	93	90	92	94	90	91	88
86.6	86.6	86.6	83.3	83.3	83.3	83.3	83.3	83.3	74	74	80	78	78	76	78	72	75	73	80
76.6	76.6	76.6	80	80	80	83.3	83.3	83.3	74	78	82	80	78	77	79	80	81	82	80
90	90	83.3	83.3	83.3	80	83.3	80	80	88	94	104	93	88	84	85	80	85	82	84
76.6	80	80	83.3	83.3	86.6	86.6	86.6	86.6	100	102	110	106	108	110	110	110	102	100	104
70	76.6	76.6	80	83.3	83.3	80	80	80	83	82	89	80	82	78	81	84	81	80	83
96.6	96.6	93.3	93.3	90	90	90	90	90	70	72	80	78	74	74	72	77	78	76	78

Thoracic Paravertebral group

Sno	Name	Weight kg	Age yrs	Sex	sugar mg/dl	urea mg/dl	creatinine mg/dl	sodium meq/l	potassium meq/l	ASA	IPno.	Tot. fen. used	Dur.of anal min	MAP	
														Preop	0min
1	Brindha	48	37	F	104	36	0.8	136	4.1	III	69280	150	360	83.3	93.3
2	Anusuya	55	48	F	98	42	1.1	140	3.7	III	30318	160	390	76.6	80
3	Prakash	54	27	M	140	30	0.9	133	3.2	III	32179	140	330	73.3	73.3
4	Amutha	50	37	F	98	28	1	134	3.5	III	32391	130	350	86.6	90
5	Pandiammal	45	27	F	84	37	0.8	129	3.9	III	26260	150	390	83.3	80
6	Valli	40	35	F	125	40	0.7	142	4.5	III	25140	160	340	80	83.3
7	Mookammal	48	45	F	130	46	1.2	137	5	III	32941	150	360	83.3	86.6
8	Alagumani	52	38	F	105	38	1.1	134	4.2	III	28835	140	370	80	83.3
9	Kuppamal	48	21	F	90	40	0.9	138	4.4	III	83224	160	340	83.3	93.3
10	Muthumari	45	29	F	110	37	0.8	132	3.8	III	67979	170	340	76.6	80
11	dhamar	40	23	M	138	38	0.7	130	3.4	III	90749	140	350	86.6	96.6
12	Velmurugan	54	32	F	120	37	1	136	4.2	III	70987	150	370	90	80
13	Selvakodi	48	27	F	84	44	1.2	140	4.7	III	48960	160	360	93.3	86.6
14	Petchiamma	52	30	F	120	40	1	133	4	III	57689	140	330	83.3	80
15	Velmurugan	54	26	M	93	28	0.9	137	3.4	III	4597	150	370	90	93.3
16	Kokila	40	20	F	74	35	1.1	130	3.7	III	41633	150	330	86.6	83.3
17	Usha rani	50	21	F	100	36	1.2	134	4	III	43017	140	350	76.6	76.6
18	Meena	58	29	F	104	37	1	141	3.2	III	34746	160	390	83.3	80
19	Pushparani	56	23	F	98	44	1.1	134	3.3	III	40177	150	340	80	83.3
20	Viji	60	37	F	110	34	0.9	141	4.7	III	3813	150	380	76.6	80
21	Veerammal	45	25	F	118	38	1	133	4.2	III	39475	140	370	83.3	86.6
22	Kannadasan	40	20	M	94	34	0.7	134	3.4	III	38765	160	370	90	93.3
23	Nadhiya	60	22	F	82	42	1.1	141	3.7	III	40177	170	380	80	80
24	Mareeswari	55	22	F	114	39	0.8	140	4.2	III	3813	140	350	83.3	80
25	Shanthi	45	36	F	143	33	1	129	4.4	III	40367	150	360	80	80
26	Selvam	48	23	M	130	28	0.9	144	4.3	III	43378	160	330	83.3	83.3
27	Shobana	50	20	F	112	41	1.2	137	4.1	III	43250	140	340	93.3	96.6
28	Nirmala	52	19	F	100	32	0.6	133	3.9	III	39475	130	360	90	80
29	Durairaj	56	26	M	150	36	1.1	139	3.1	III	45873	170			
30	Sathya	42	24	F	116	37	1	141	4	III	31117	160			

(GROUP TPB)

MAP									PR										
15 min	30 min	45 min	1hr	2hr	3hr	4hr	5hr	6hr	Pre op	0 min	15 min	30 min	45 min	1hr	2hr	3hr	4hr	5hr	6hr
93.3	90	90	90	91	90	80	80	83	78	82	76	74	80	84	80	86	87	90	90
90	83.3	83	83.3	83.3	83	80	80	80	80	84	80	80	87	78	88	94	94	94	94
73.3	83.3	83	76.6	76.6	77	77	87	87	82	70	70	85	86	70	74	74	80	76	74
93.3	93.3	93	93.3	83.3	83	83	83	83	78	74	80	84	92	90	90	90	88	92	92
83.3	86.6	87	86.6	80	80	80	80	80	110	104	110	102	102	92	84	90	82	84	88
76.6	80	80	83.3	80	80	83	83	83	94	102	110	106	108	110	110	110	102	100	104
86.6	90	83	83.3	83.3	77	77	80	80	84	78	84	86	78	78	80	80	84	78	86
80	80	80	83.3	83.3	83	83	83	83	82	82	88	80	82	84	90	88	86	90	92
86.6	86.6	83	83.3	86.6	87	90	87	87	74	74	80	78	80	78	84	82	80	92	88
83.3	76.6	77	76.6	83.3	80	77	80	80	100	100	104	98	96	100	94	100	102	104	100
93.3	93.3	93	93.3	90	90	93	90	90	94	94	88	86	86	84	80	82	88	90	86
90	80	80	80	83.3	80	83	83	83	70	70	80	78	74	78	80	78	82	80	82
90	90	87	86.6	93.3	93	93	93	93	84	84	88	86	84	80	84	86	84	88	90
83.3	83.3	83	90	90	90	90	90	90	100	100	104	98	93	90	92	94	90	91	88
96.6	93.3	93	90	93.3	93	93	93	93	82	82	89	80	82	78	81	84	81	80	83
86.6	83.3	83	80	80	80	80	80	83	78	70	84	76	75	77	78	79	81	82	79
80	80	83	83.3	83.3	77	77	83	83	72	70	78	79	80	74	77	72	74	75	79
90	90	83	83.3	83.3	80	83	80	80	88	94	104	93	88	84	85	80	85	82	84
86.6	86.6	87	83.3	83.3	83	83	83	83	74	74	80	78	78	76	78	72	75	73	80
86.6	86.6	83	83.3	83.3	83	87	87	87	80	84	90	84	88	82	82	83	90	92	94
90	90	87	86.6	93.3	93	93	93	93	82	84	88	86	84	80	84	86	84	88	90
86.6	86.6	87	86.6	80	80	80	80	80	94	104	110	102	102	92	84	90	82	84	88
90	80	80	80	83.3	80	83	83	83	76	70	80	78	74	78	80	78	82	80	82
83.3	80	80	83.3	80	80	83	83	83	102	102	110	106	108	110	110	110	102	100	104
86.6	86.6	83	83.3	83.3	83	87	87	87	80	84	90	84	88	82	82	83	90	92	94
93.3	93.3	93	90	93.3	93	93	93	93	78	82	89	80	82	78	81	84	81	80	83
93.3	93.3	93	93.3	90	90	93	90	90	94	94	88	86	86	84	80	82	88	90	86
90	90	83	83.3	83.3	80	83	80	80	88	94	104	93	88	84	85	80	85	82	84

COMPARATIVE EVALUATION OF THORACIC PARAVERTEBRAL BLOCK WITH THORACIC EPIDURAL IN PATIENTS UNDERGOING THORACOTOMY

ABSTRACT

BACKGROUND: This study was undertaken to compare the thoracic paravertebral block with thoracic epidural block, as a technique to provide postoperative analgesia in patients undergoing thoracotomy

PATIENTS and METHODS: This study was conducted in 60 patients scheduled to undergo thoracotomy for closed mitral commisurotomy who fulfilled the eligibility criteria for the study. The patients were divided into two groups Group TPB and Group TEB. Each group consisted of 30 patients. Group TPB received thoracic paravertebral block. Group TEB received thoracic epidural block. The techniques were performed at the end of the surgical procedure under general anaesthesia. In both the techniques catheter were threaded. Patients in both the groups received 8ml of bupivacaine 0.25% through the catheter. Then the patients were extubated. Pulse rate and mean arterial pressure measured at the end of the surgical procedure was taken as the baseline values. There after pulse rate and mean arterial pressure were measured 15minutes, 30minutes, 45minutes, 1hour and then at hourly intervals till the visual analogue score was greater than 4. Duration of analgesia was measured from the time of administration of the drug to the time when visual analogue score was greater than 4. The failure rate and complications of both the techniques were compared.

RESULTS: Both the paravertebral block and epidural block provided similar duration of analgesia 357.1$\pm$19minutes in group TPB and 358.4$\pm$16minutes in group TEB. Patients in the epidural group had a higher incidence of hypotension. Patients in the thoracic epidural group showed statistically significant decrease in the mean arterial pressure measured at 15minutes and 30minutes after the administration of the drug. At all other time the mean arterial pressure was comparable between both the groups. Pulse rate measured between both the groups did not show any significant difference. The overall Failure rate in the thoracic epidural group was 13.34% and in thoracic paravertebral group it was 6.66%.

CONCLUSION: This study showed that the thoracic paravertebral block provided similar duration of analgesia with better hemodynamic stability in patients undergoing thoracotomy. This technique has a low failure rate and can be considered as an alternative to thoracic epidural block for providing postoperative analgesia for patients undergoing thoracotomy

Keywords: Thoracic paravertebral block, Thoracic epidural block, Thoracotomy, Postoperative analgesia.