A Dissertation on

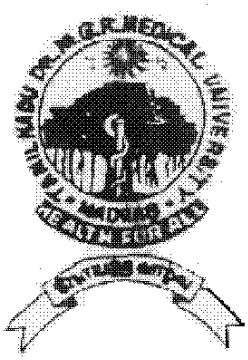
COMPARATIVE EVALUATION OF SUBARACHNOID BLOCK WITH LOW DOSE BUPIVACAINE AND FENTANYL VS. LOW DOSE BUPIVACAINE AND SUFENTANIL IN PATIENTS UNDERGOING INGUINAL SURGERIES

Dissertation Submitted in partial fulfillment of

M.D. DEGREE EXAMINATION

BRANCH X- ANAESTHESIOLOGY

MADRAS MEDICAL COLLEGE, CHENNAI



THE TAMILNADU Dr. M.G.R. MEDICAL UNIVERSITY

CHENNAI , TAMILNADU

February 2007

DECLARATION

I hereby declare that dissertation entitled **"Comparative Evaluation of Subarachnoid block with Low dose Bupivacaine and Fentanyl vs. Low dose Bupivacaine and sufentanil in patients undergoing inguinal surgeries"** has been prepared by me under the guidance of **PROF. DR. G. SIVARAJAN, M.D., D.A.,** Professor and Head of Department of Anaesthesiology, Madras Medical College, Chennai in partial fulfillment of the of the regulations for the award of the degree of M.D. [Anaesthesiology], examination to be held in March 2007.

This study was conducted at Madras Medical College and Government General Hospital, Chennai.

I have not submitted this dissertation previously to any university for the award of any degree or diploma.

Date:

Place: Chennai **Dr. V. Hari Babu**

CERTIFICATE

This is to certify that the dissertation **"Comparative Evaluation of Subarachnoid block with Low dose Bupivacaine and Fentanyl vs. Low dose Bupivacaine and sufentanil in patients undergoing inguinal surgeries"** presented herein by **Dr. V. Hari Babu,** is an original work done in the Department of Anaesthesiology, Madras Medical College and Government General Hospital, Chennai for the award of Degree of M.D. [Branch X] Anaesthesiology under my guidance and supervision during the academic period of 2004-2007.

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INTRODUCTION

"For all the happiness mankind can gain is not in pleasure but in rest from pain"

—John Dryden

Spinal anaesthesia is widely used for surgeries involving the lower limb, perineum and inguinal region. The duration of spinal anaesthesia that is timed according to the duration of surgery may help prevent complications associated with prolonged immobilization especially in elderly patients.

Recently there has been an interest in using analgesics and local anaesthetics in an attempt to decrease the local anaesthetic dose enabling faster recovery while improving anaesthetic success and providing effective post operative analgesia. The use of intrathecal lignocaine for spinal anaesthesia has been questioned because of the frequent occurrence of Transient Neurological Symptoms. An increasing number of surgeries being performed in the ambulatory setting under spinal anaesthesia has generated interest in finding alternative drugs that would provide adequate surgical anaesthesia while having quick recovery profile and low side effect profile.

The discovery of opioid receptors has opened new horizons in pain management. Since their introduction into clinical practice in 1979, spinal opioids have achieved great international popularity in a variety of clinical settings either as sole analgesic agents or in combination with low-dose local anesthetic agents. By bypassing blood and the blood-brain barrier, small doses of opioids administered in either the subarachnoid or epidural spaces provide

profound and prolonged segmental analgesia. Numerous studies have shown that spinal opioids can provide profound postoperative analgesia with less central and systemic adverse effects than can opioids administered systematically. Several reviews have appeared in the literature.

The rationale for the combination technique is that opioids and local agents eliminate pain by acting at two distinct sites—the local anaesthetic at the nerve axon and the opioid at the receptor site in the spinal cord. If even an extremely low concentration of local anaesthetic is added to the opioid, the quality of analgesia may be far superior. This study thus was designed to test the hypothesis that adding an opioid to the local anaesthetic in the subarachnoid space provides great advantages as has been reported extensively in literature.

AIM OF THE STUDY

To study the effect of

Low dose Hyperbaric Bupivacaine 10 mg

with 5 μg of Sufentanil

Vs.

Low dose Hyperbaric Bupivacaine 10 mg

with 50 μg of Fentanyl

on

1. Block characteristics
2. Hemodynamic changes

SPINAL ANAESTHESIA

Spinal (subarachnoid/intrathecal) anaesthesia is a form of central neuraxial block in which a temporary interruption of nerve transmission is achieved following injection of local anaesthetic and/or adjuvant solutions into the subarachnoid space.

Spinal anaesthesia is one of the most frequently employed methods of regional anaesthesia.

Anatomy

The vertebral canal extends from the foramen magnum to the sacral hiatus. It is formed by the dorsal spine, pedicles and laminae of successive vertebrae (7 cervical, 12 thoracic, 5 lumbar and 5 sacral). The vertebrae are held together by a series of overlapping ligaments namely anterior and posterior longitudinal ligaments, ligamentum flavum, interspinous ligament, supraspinous ligament and the intervertebral discs.

The spinal cord, a direct continuation of the medulla oblongata begins at the upper border of the atlas and terminates distally in the conus medullaris. The distal termination, because of the differential growth rates between the bony vertebral canal and central nervous system varies from L3 in the infant, to the lower border of L1 in the adult.

Surrounding the spinal cord in the bony vertebral column are three membranes (from within to the periphery); the pia mater, arachnoid mater and dura mater. The pia mater is a highly vascular membrane that closely invests

the spinal cord. The arachnoid mater is a delicate nonvascular membrance closely attached to the outermost dura mater. Between the two innermost membranes is the subarachnoid space. In this space are the cerebrospinal fluid (CSF), spinal nerves, blood vessels that supply the spinal cord the dentate ligaments. Although the spinal cord ends at the lower border of L1 in adults, the subarachnoid space continues to S2. The outer membrane in the spinal canal is the longitudinally organized fibroelastic membrane, the dura mater. This layer is the direct extension of the cranial dura mater and extends as the spinal dura mater from the foramen magnum to S2, where the filum terminale (an extension of the pia mater beginning at the conus medullaris) blends with the periosteum of the coccyx. There is a potential space between the dura mater and arachnoid, the subdural space which contains only small amounts of serous fluid to allow the dura and arachnoid move over each other. Surrounding the dura mater is the epidural space which extends from the foramen magnum to the sacral hiatus. Posterior to the epidural space is the ligamentum flavum which extends from the foramen magnum to the sacral hiatus. Immediately posterior to the ligamentum flavum is the interspinous ligament, extending from the external occipital protuberance to the coccyx, posterior to these structures is the supraspinous ligament.

Lumbar puncture is routinely done below the L2 vertebra down to the L5-S1 interspace to avoid damaging the spinal cord which ends at the lower border of L1 vertebra in adults.

Physiology of Subarachnoid Block Cerebrospinal Fluid

The cerebrospinal fluid (CSF) is an ultrafiltrate of blood plasma with

which it is in hydrostatic and osmotic equilibrium. It is a clear, colourless fluid found in the spinal and cranial subarachnoid space and in the ventricles of the brain. The average volume in the adult ranges from 120-150ml of which 35ml is in the ventricles, 25ml is in the cerebral subarachnoid space and 75 ml is in the spinal subarachnoid space. It is secreted by the choroids plexus at a rate of 0.3 – 0.4 ml/minute.

Physical characteristics of Cerebrospinal Fluid

pH	7.4
Specific gravity	referred to H_2O
at body temperature	.007
at 4^0C	.0003
Density	1.0003 g/ml
Baricity	1.000
Pressure	8-12mm Hg/70-80mm H_20
Cells	3-5/cu.mm
Proteins	20 mg/dl
Glucose	45-80 mg/dl

The cerebrospinal fluid plays an important role in spinal anaesthesia as media for dispersion of the local anaesthetic drug to the spinal nerve. An important factor determining the spread of drugs in the subarachnoid space is

the specific gravity of the injected solution compared with that of CSF.

Mechanics of Spinal Anaesthesia

Injection of local anaesthetics into the spinal CSF allows access to sites of action both within the spinal cord and the peripheral nerve roots. The nerve roots leaving the spinal canal are not covered by epineurium and are readily exposed to the local anaesthetic within the CSF.Therefore afferent impulses entering the central nervous system via the dorsal nerve roots and efferent impulses leaving via the ventral nerve roots are blocked during spinal anaesthesia. Spinal local anaesthetics block sodium channels and electrical conduction in spinal nerve roots. Local anaesthetics can exert sodium channel block within the dorsal and ventral horns, inhibiting generation and propagation of electricity activity. The order in which the nerve fibres are blocked in-spinal anaesthesia is preganglionic sympathetic B fibres followed by temperature fibres (cold before warmth), fibres carrying pin-prick sensation, touch, deep pressure, somatic motor sensation and lastly fibres conveying vibration sense and priprioceptive impulses. Recovery is roughly in the reverse order.

Spread of Local Anaesthetics in Subrachnoid Space

The local anaesthetic solution is diluted by CSF and therefore its original concentration is of less importance than the actual mass of drug injected. Spread is also determined by the baricity of the injected solution. Baricity is a ratio comparing the density of a local anaesthetic solution at a specified temperature to the density of CSF at the same temperature. A hypobaric solution has a baricity less than 1.0000 or specific gravity less than 1.0069 (the mean value of CSF specific gravity). A hyperbaric solution has a baricity greater than 1.0000 or specific gravity more than 1.0069. Hypobaric and hyperbaric solutions are prepared from isobaric solutions by addition of various amounts of sterile distilled water and dextrose respectively. Isobaric

solutions do not move under the influence of gravity in the CSF, therefore spread of isobaric solutions and consequently height of block is not influenced by position of patient and is somewhat and is unpredictable. Hyperbaric solutions, being heavier than CSF, settle to the most dependent aspect of the subarachnoid space, which is determined by the position of the patient. In supine patients, hyperbaric solutions gravitate to the thoracic kyphosis and Hypobaric solution float's up.

The major factors affecting height of subarachnoid block are the baricity of the local anaesthetic solution and the dosage (mass) of drug injected.

Fate of Local Anaesthetics in the Subarachnoid Space

Following injection of local anaesthetic solution into subarachnoid space, its concentration falls rapidly. The initial steep fall is due to mixing with CSF and subsequent absorption into nerve roots and spinal cord. The egress of local anaesthetics following subarachnoid injection is primarily by vascular absorption with no hydrolysis or degradation taking place in the CSF. Depending on the type of drug used, it is metabolized in plasma by pseudocholinesterase or in the liver. As duration of anaesthesia is in part, a result of the rate of absorption from the subarachnoid space, the addition of a vasconconstrictor to the local anaesthetic solution will retard absorption of the drug and thus increase the duration of anaesthesia.

Indications for Subarachnoid Block

Spinal anaesthesia can be administered whenever a surgical procedure can be done with a sensory level of anaesthesia that does not produce adverse patient outcome. Such procedures include:

- Lower abdominal surgeries
- Lower limb surgeries

- Urological procedures
- Gynecological surgeries
- Perineal and rectal surgeries

Contraindications for Subarachnoid Block

An absolute contraindication for subarachnoid block is patient refusal.

Other contraindications are:

- Local sepsis
- Uncorrected coagulopathy
- uncontrolled blood loss / shock
- fixed cardiac output states
- documented allergy to local anaesthetics
- raised intracranial pressure
- neurological disease
- major spine deformities/previous surgery on the spine
- severe cardiac disease

METHODS OF PAIN MEASUREMENT

Pain is a personal, subjective experience influenced by cultural learning, the meaning of the situation, attention and other psychological variables. Melzack[30] suggested a three dimensional view of pain which comprises of sensory-discriminative, motivational-affective, cognitive–evaluative components.

Methods of Pain Measurement include

1. Verbal rating scale
2. Visual analogue pain scale
3. . Mc Gill pain Questionnaire
4. . The Descriptor Differential Scale

Visual Analogue Pain Scale

Advantages

1. Simple, efficient, minimally intrusive measure of pain intensity
2. Widely used in clinical as well as research settings
3. Provided that adequate clear instructions are given to the patient, its conceptual simplicity.

Disadvantages

1. Bias of expectancy for change and reliance on memory

2 It is assumption that pain is a unidimensional experience

INTRATHECAL OPIOIDS

History

Opiate receptors were first identified in the central nervous system in 1973 by **Pert CB** and **Snyder SH**[34]. Subsequently, large populations of these receptors were localized in the dorsal horn of the spinal cord. In 1976, **Yaksh TL** and **Rudy TA**[49] performed animal studies and demonstrated the ability of intrathecal opioids to produce analgesia. In 1979, **Wang**[45] and colleagues reported pain relief using intrathecal morphine in cancer patients and in the same year, **Behar et al**.[4] achieved the same result injecting the drug into the epidural space.

Neuraxial opioids

Placement of opioids in the epidural or sub arachnoid space to manage acute or chronic pain is based on the knowledge that opioid receptors [principally mu receptors] are present in the substantia gelatinosa of the spinal cord [**Cousins** and **Mather**,[8] 1984]. Analgesia produced by neuraxial opioids, in contrast to intravenous [IV] administration of opioids or regional anaesthesia with local anaesthetics, is not associated with sympathetic nervous system denervation, skeletal muscle weakness, or loss of proprioception. Analgesia is dose related.

Spinal opioid receptors – location

Opioid receptors are synthesized in the cell body of the sensory neuron and are transported in both the central and peripheral directions. In the spinal

cord, opioid receptors are found in the dorsal horn in the terminal zones of C fibers primarily in laimna I of the substantia gelatinosa. Spinal opioid receptors are 70% mu, 24% delta and 6% kappa.

Mechanism of Action

Opioids act as agonists at stereospecific opioid receptors at pre synaptic and post synaptic sites in the central nervous system (principally the brain and spinal cord) and outside the CNS, in peripheral tissues.

The principal effect of opioid receptor activation is a decrease in neurotransmission by presynaptic inhibition of neurotransmitter (acetylcholine, dopamine, norepinephrine, substance P) release, although post synaptic inhibition of evoked activity also occur. The biochemical events following opioid receptor activation are characterized by increased potassium conductance (leading to hyperepolarisation), calcium channel activation, or both, which produced an immediate decrease in neurotransmitter release.

Activation of opioid receptors in the primary afferent neurons may either directly decrease neurotransmission or inhibit the release of excitatory neurotransmitters such as substance P.

Opioid Receptors

	Mu_1	**Mu_2**	**Kappa**	**Delta**
Effect	Analgesia (supra spinal and spinal) Euphoria Low abuse potential Miosis Bradycardia Hypothermia Urinary retension	Analgesia (Spinal) Depression of Ventilation Physical dependence Constipation (marked)	Analgesia (Supraspinal and spinal) Dysphoria Sedation Low abuse potential Miosis Diuresis	Analgesia (supraspinal and spinal) Depression of ventilation Physical dependence Constipation (minimal) Urinary retension
Agonists	Endorphins Morphine Synthesic opioids	Endorphins Morphine Synthesic opioids	Dynorphine	Enkephalins
Antagonists	Naloxone Naltrexone Nalmefene	Naloxone Naltrexone Nalmefene	Naloxone Naltrexone Nalmefene	Naloxone Naltrexone Nalmefene

Neuraxial Opioids

Based on the knowledge that opioid receptors (principally mu receptors) are present in the substantia gelatinosa of the spinal cord.

In contrast to intravenous administration of opioids (or) regional anaesthesia with local anaesthetics, analgesia produced by neuraxial opioids is not associated with sympathetic nervous system denervation, skeletal muscle

weakness or loss of proprioception. Analgesia is dose related and is specific for visceral rather than somatic pain and it decreases the minimum alveolar concentration (MAC) of the volatile anaesthetics.

Spinal Opioid Receptors – Location

Opioid receptors are synthesized in the cell body of the sensory neuron and are transported in both the central and peripheral directions. In the spinal cord, opioid receptors are found in the dorsal horn in the terminal zones of C fibers primarily in lamina I of the substantia gelatinosa. Spinal opioid receptors are 70% mu, 24% delta and 6% kappa.

Mechanism of Action

Spinal opioids act at nerve synapses either presynaptically [as neuromodulators] or postsynaptically [as neurotransmitter]. Stimulation of presynaptic receptors is associated with hyperpolarization of the terminal and reduced substance P release. This relates primarily to inhibition of voltage gated calcium channels. Postsynaptic membrances contain opioid receptors linked to potassium channels. Stimulation of these receptors enhances outward flow of potassium thereby stabilizing the membrane, making it less sensitive to neurotransmitters. These actions are carried out by second messengers [G proteins].

With the injection of an opioid into the CSF, a reservoir of drug is created that passively diffuses into the dorsal horn of the spinal cord where it exerts its action by binding to opioid receptors.

Pharmacokinetics

The onset of analgesic effect following intrathecal administration of an opioid is directly proportional to the lipid solubility of the drug, whereas the duration of effect is longer with more hydrophilic compounds. Opioids placed in the epidural space undergo significant systemic absorption and passage into the subarachnoid space. Vascular absorption after intrathecal administration of opioids is insignificant. Cephalad movement of opioids in the CSF is dependent on lipid solubility. Lipid soluble opioids like fentanyl are limited in the cephalad migration by uptake into the spinal cord, while hydrophilic opioids like morphine remain in the CSF for transfer to more cephalad locations.

Loss of analgesia after intraspinal injection primarily results from clearance of drug from the site of action. Intrathecal opioids are eliminated by diffusion along the neuraxis and vascular absorption. It is not yet established what role metabolism plays in the termination of action of intrathecal opioids.

Tolerance

Decrease in effect over time to a given dose of drugs has been demonstrated with intrathecal opioids. There is good evidence in support of the glutatmate receptor of the NMDA type to be involved in the mechanism of tolerance.

Benefits

- Long lasting post operative analgesia after a single injection
- Precise and reliable placement of low concentration of drug near its site of action.

The principle disadvantage is its lack of titrability and need to either

repeat the injection or consider other options when the analgesic effect of the initial dose wanes. Nevertheless, it is common clinical experience that after the analgesic effect of the initial intrathecal dose wanes, the intensity of post operative pain is greatly diminished and can be satisfactorily managed by other modalities.

Side Effects

1. Pruritus

Pruritus is the most common side effect and is more likely to be localized to the face, neck or upper thorax, often elicited only after direct questioning, particularly in obstetric patients, due to the interaction of estrogen with opioid receptors. It is due to cephalad migration of the opioid in CSF and subsequent interaction with opioid receptors in the trigeminal nucleus. Naloxone, an opioid antagonist is effective in relieving pruritus.

2. Urinary Retention

More common in young males and with epidural administration than after IM or IV administration.

It is most likely due to interaction with opioid receptors located in sacral segment of the spinal cord and inhibition of sacral parasympathetic nervous system outflow, which causes detrusor muscle relaxation and increase in bladder capacity, leading to urinary retention and is readily reversed with Naloxone.

3. Depression of ventilation

This is the most serious side effect of neuraxial opioids which may occur within one minute or may be delayed for hours, requiring intervention.

Early depression of ventilation occurs within 2 hours of neuraxial injection of opioid and results from systemic absorption of the lipid soluble opioids. Eg. Fentanyl, Sufentanil.

Delayed depression of ventilation occurs more than 2 hours and reflects cephalad migration of the opioid in the CSF and subsequent interaction with the opioid receptors in the ventral medulla. Eg. Morphine.

Factors that increase the risk of depression of ventilation.

High opioid dose

Low lipid solubility of opioids

Concomitant administration of parenteral opioids

Lack of opioid tolerance

Advanced age

4. **Sedation –** Dose related particularly with Sufentanil.

5. CNS excitation

Tonic skeletal muscle rigidity resembling seizure activity occur following large IV doses of opioids but rarely with neuraxial administration. Cephald migration in the CSF and interaction with non-opioid receptors in the brain stem (or) basal ganglia is the most likely explanation, inhibition of the inhibitory neurotransmitters.

6. Viral reactivation

Reactivation of herpes simplex labialis may occur 2 – 5 days after epidural administration.

7. Neurotoxicity

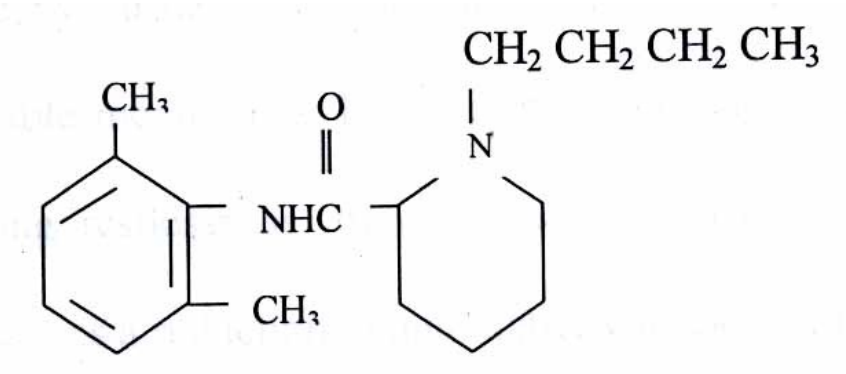
Animal and human studies have not demonstrated neurotoxicity with any of the commercially available preservative free opioid agents administered by the subarachnoid route.

PHARMACOLOGY OF BUPIVACAINE

Bupivacaine is an amide local anaeshetic, synthesized by A.F. Ekenstam in 1957 and brought into clinical use in 1963.

It is produced for clinical use in a racemic mixture, containing equal proportions of the 'S' and 'R' enantiomers. It is supplied for clinical use as a hydrochloride salt.

Chemical Structure



Description: 1– Butyl-N-(2,6-dimethylphenyl)-2-piperidine Decarboxamide Hydrochloride monohydrate

Physico-Chemical Profile

Molecular Weight (base)	288
pKa	8.1
Solubility in Alcohol	1 in 8
Water	1 in 25
Octanol/water partition coefficient	High

Lipid solubility	28
Plasma Protein Binding	95%

Mechanism of Action

Bupivacaine exerts its effect by inhibition of sodium channels. It acts to block conduction in the nerves by decreasing or preventing the large transient increases in permeability of the cell membrane to sodium ions that follows depolarization of the membrane. Bupivacaine also reduces the permeability of the resting nerve membrane to potassium as well as sodium ions.

Pharmacodynamics

Bupivacaine by virtue of its pharmacological effects, has a stabilizing action on all excitable membranes. In the central nervous system, stimulation can occur producing restlessness, tremors and convulsions in over dosage. Bupivacaine also causes a reduction of automaticity in the heart.

The clinical profile of nerve blockade produced by Bupivacaine differs from that of Lignocane. It is 4 times more potent than Lignocaine, but the onset of action is slower. The duration of action is considerably longer. The sensory block produced by Bupivacaine tends to be more marked than the motor block.

Pharmacokinetics

Bupivacaine is rapidly absorbed from the site of injection. The rate of rise in plasma Bupivacaine concentration and the peak plasma concentrations obtained depend on the route of administration. There is also some inter-individual variation and peak systemic concentrations may occur between 5

and 30 minutes after administration. The addition of a vasoconstrictor delays absorption and results in lower plasma concentrations of Bupivacaine.

Pharmacokinetic Profile

Volume of distribution at steady state (Vdss)	72 litres
Clearance	0.47 l/mm
t ½ α	2.7 mm
t ½ β	28 mm
t ½ γ	3.5 hrs

Metabolism

Possible pathways for metabolism of Bupivacaine include aromatic hydroxylation, N-dealkylation, amide hydrolysis and conjugation. Only the N dealkylated metabolite, N-desmethylbupivacaine has been measured in blood and urine after epidural and spinal administration. The degradation of Bupivacaine takes place in the liver. Renal disease is unlikely to alter the kinetics of Bupivacaine to any great extent. Less than 10% of the drug is excrete unchanged in urine.

The onset of action of Bupivacaine occurs 20-30 minutes after peripheral nerve block and duration lasts for 8-9 hours.

Clinical Applications

- Infiltration anaesthesia
- Peripheral nerve blocks
- Central neuraxial blocks (intrathecal, epidural and caudal)

Contraindications

- Paracervical block (in obstetrics)
- Known hypersensitivity to amide local anaesthetics
- Intravenous regional anaesthesia (IVRA)

Preparations Available

0.25%, 0.5% solutions in 10 ml and 20 ml vials.

5mg/ml (0.5%) Bupivacaine and 80 mg dextrose in 4 ml ampoules for intrathecal injection (Baricity 1.027).

Recommended safe dose

Concentration used	**Maximum permitted dose**
0.125% - 0.5%	2mg/kg body weight
0.75% (not to be used in obstetric epidurals)	Max. over 4 hours – 150 mg Max. during 24 hours – 400 mg
0.5% plain / hyperbaric solution (intrathecal use)	20 mg

Adverse Reactions

Adverse reactions are associated mainly with excess plasma levels of the drug, which may be due to over dosage, unintentional intravascular injection or slow metabolic degradation.

CNS Reactions

Excitation characterized by restlessness, anxiety, dizziness, tinnitus,

blurred vision or tremors were possible proceeding to convulsions, followed by drowsiness, unconsciousness and cardiac arrest.

Cardiovascular System Effects

Bupivacaine appears to be more cardiotoxic than Lidocaine and this relates to the action of Bupivacaine on cardiac sodium channels (fast in, slow out agent) and physico-chemical properties like high lipid solubility and high protein binding, particularly at low pH. Accidental intravenous injection of Bupivacaine causes dysrhythmias, atrioventricular block, ventricular tachycardia and ventricular fibrillation. Pregnancy increases the sensitivity to cardiotoxic effects of Bupivacaine.

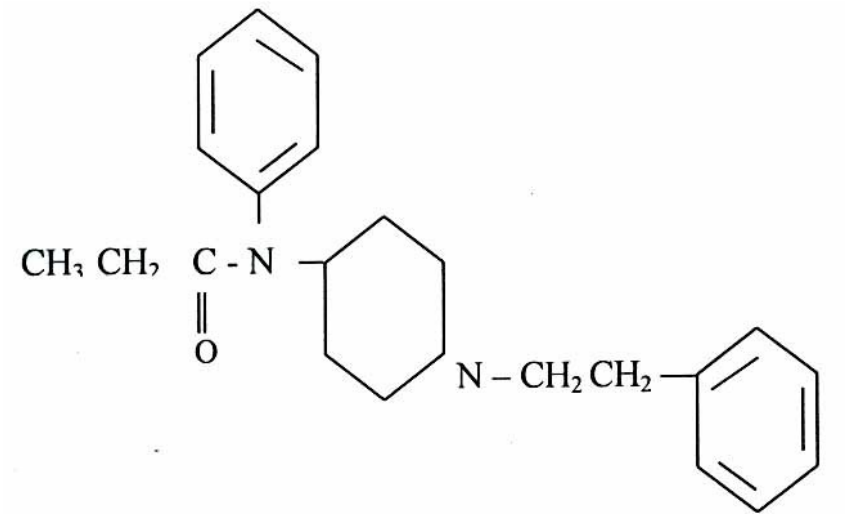
Allergic Reactions

Manifests as urticaria, pruritis, angioneurotic edema etc. Cross sensitivity among members of amide type local anaesthetics has been reported.

PHARMACOLOGY OF FENTANYL

Fentanyl is a Phenylpiperidine – derivative, synthetic opioid agonist that is structurally related to Meperidine. As an analgesic, Fentanyl is 75 to 125 times more potent than Morphine.

Chemical structure



Pharmacokinetics and physico-chemical properties

Fentanyl has a more rapid onset and shorter duration of action than Morphine. Effect – Site equilibration time between blood and the brain for Fentanyl is 6.4 min. The greater potency and more rapid onset of action reflects the greater lipid solubility of Fentanyl compared with that of Morphine. Short duration of action of a single dose reflects its rapid redistribution to inactive tissues such as fat, skeletal muscle and lungs. Duration of analgesia is prolonged following multiple IV doses or following continuous infusion.

pKa – 8.4

% Un ionized at pH 7.4 - < 10

Octanol / water partition coefficient – 813

% Bound to plasma protein – 84

Diffusible fraction (%) – 1.5

t ½ α, (min) 1 – 2

t ½ β, (min) 10 – 30

t ½ γ, (h) 2 – 4

Vde (L/kg) 0.4 – 1.0

Vdss (L/kg) 3 – 5

Clearance (ml/kg/mt) 10 – 20

Hepatic extraction ratio 0.8 – 1.0

Metabolism

Fentanyl is extensively metabolized by N – demethylation producing Norfentanyl, which is structurally similar to Normeperidine. It is excreted by the kidneys and can be detected in the urine for 72 hours after a single IV dose of Fentanyl.[40]

Routes of Administration

Oral, parenteral (IV / IM), transmucosal transdermal, neuraxial (subarachnoid / epidural).

Clinical Uses

Intravenous Fentanyl

- Low doses of Fentanyl 1 to 2 μgm/kg IV, are injected to provide analgesia.
- Fentanyl 2 to 20 μgm/kg IV, administered as an adjuvant to inhaled anaesthetics in an attempt to blunt circulatory responses to,Direct laryngoscopy for intubation of trachea

- Sudden changes in the level of surgical stimulation

- Large doses of Fentanyl, 50 to 150 μgm/kg IV, have been used alone to produce surgical anaesthesia. It has the advantage of stable haemodynamics due to the (a) lack of direct myocardial depressant effect, (b) absence of histamine release, and (c) suppression of stress responses to surgery.

Disadvantages

(a) Failure to prevent sympathetic nervous system responses to painful surgical stimulation at any dose, (b) possible patient awareness, (c) postoperative depression of ventilation.

Transmucosal Fentanyl

Administered as a transmucosal preparation in a delivery device (lozenge mounted on a handle) designed to deliver 5 to 20 μg/kg of Fentanyl to decrease preoperative anxiety and to facilitate induction of anaesthesia, especially in children.

In children 2 to 8 years of age, preoperative administration of oral Transmucosal Fentanyl, 15 to 20 μgm/kg 45 minutes before the induction of anaesthesia, reliably induces preoperative sedation and facilitate induction of inhalation anaesthesia.

Transdermal Fentanyl

Preparations delivering 75 to 100 μgm/hr result in peak plasma Fentanyl concentrations in about 18 hours that tend to remain stable during the presence

of the patch, followed by a decreasing plasma concentration for several hours after the removal of the delivering system, reflecting continued absorption from the cutaneous depot. Transdermal system decrease the amount of parenteral opioids required for postoperative analgesia.

Side Effects:

Respiratory system: Persistent or recurrent depression of ventilation is a potential postoperative problem. Secondary peaks in plasma concentrations of Fentanyl from sequesterated sites have been attributed.

Cardiovascular system: Markedly depresses carotid sinus baroreceptor reflex control of heart rate in neonate with 10 μgm/kg IV. Care should be taken in neonates because cardiac output is primarily heart rate dependent.

Seizure activity following rapid administration

Changes in somatosensory evoked potentials and electroencephalogram with doses > 30 μgm/kg IV.

Intracranial Pressure – modest increase (6 to 9 mm Hg) in ICP despite maintenance of an unchanged PaCo2 in head injury patients accompanied by decrease in mean arterial pressure and cerebral perfusion pressure.

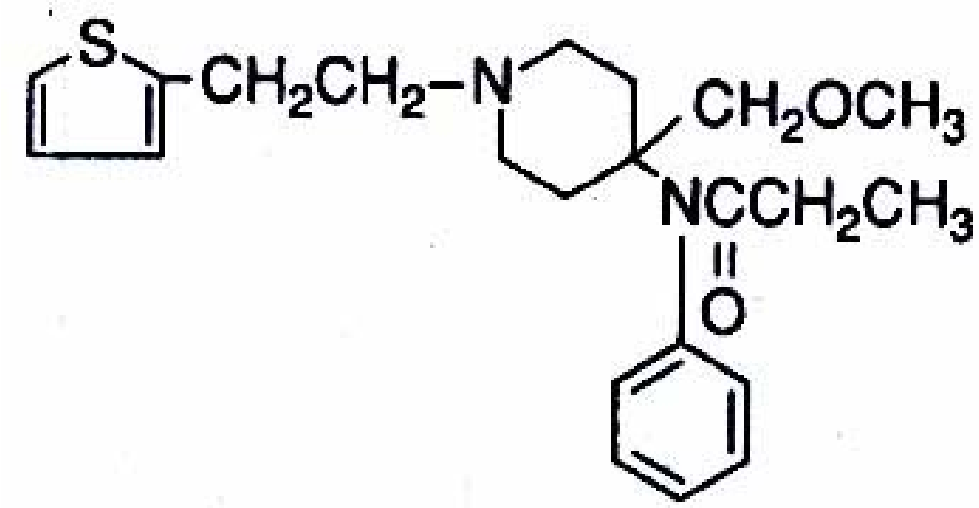
Drug Interactions

Potentiates the effect of Midazolam and decrease the dose requirements of Propofol. The Opioid – Benzodiazepine combination displays marked synergism with respect to hypnosis and depression of ventilation.

PHARMACOLOGY OF SUFENTANIL

Sufentanil is a semisynthetic thienyl analogue fentanyl with analgesic potency 5 to 10 times more than that of fentanyl.

Structure / Chemistry



Pharmacological properties

Sufentanil's greater potency when compared to fentanyl is due to its greater affinity for opioid receptors. EC_{50} (plasma concentration necessary to cause 50% of maximum slowing of EEG) is 12 times more potent than fentanyl. An important distinction from fentanyl 1000-fold difference analgesic dose of sufentanil and the dose that produces seizures in animals. This difference is 160-fold for fentanyl and may be important when large doses are used to produce anaesthesia.

Pharmacokinetics

The elimination half-time of sufentanil is intermediate between that of fentanyl and alfentanyl (2.2 to 4.6 hours). A single IV dose has a similar elimination half-time in patients with or without cirrhosis of liver. The volume of distribution and elimination half-time of sufentanil is increased in obese patients reflecting the high degree of liquid solubility of this drug.[41] The high tissue affinity is consistent with the lipophilic nature of sufentanil which permits rapid penetration of the blood brain barrier and onset of CNS effects (effect site equilibration time of 6.2 minutes similar to that of 6.8 minutes for fentanyl). Cumulation occurs with the large doses. It undergoes significant first pass pulmonary uptake (approximately 60 per cent). Extensive protein binding (92.5%) compared to that of fentanyl (79 to 87%) contributes to smaller volume of distribution characteristic of sufentanil. It is predominantly bound to alpha 1 acid glycoprotein whose levels are increased after surgery.[6] Low levels of this protein in the pediatric age-group accounts for more free fraction of the drug resulting in a greater incidence of respiratory depression.

pk	8.0
% non-ionised (pH 7.4)	20
Protein binding (%)	93
Clearance (ml per minute)	900
Volume of distribution (litres)	123
Partition co-efficient	1727
Elimination half-time (hours)	2.2 to 4.6
Context sensitive half-time: 4 hours infusion (in minutes)	30
Efflect-site (blood brain) equilibration (in minutes)	6.2

Metabolism

It is rapidly metabolized N-dealkalyation and O-demethylation. O-demethylated product dis methyl sufentanil has a good 10% activity of sufentanil less than 1% of the administered drug appears unchanged in urine resulting from maximal tubular reabsorption of the free drug. Its action gets prolonged in chronic renal failure. It undergoes high hepatic extraction, hence its clearance is sensitive to hepatic blood flow.

Context sensitive half-time

It is less than that for alfentanyl. After termination of sufentanil infusion the decrease in plasma drug concentration is accelerated not only by metabolism also by continued distribution to the peripheral compartment. Compared to alfentanyl as a more favourable recovery profile when used for a longer period of time.

Preparation

Sufentanil citrate equivalent to sufentanil 0.050 mg/ml.

Dosage

Analgesic dose:

I.V. (bolus) 0.3 to 2 mcg/kg

Epidural 15-30 mcg

Labor pain (I.V.) 10 mcg

Clinical Uses

A single dose of sufentanil 0.1 to 0.4 mcg/kg I.V. produces a longer period of analgesia and less depression on ventilation than does a comparable dose of fentanyl 0.1 to 0.4 mcg/kg I.V. In large doses used for rapid induction of anaesthesia earlier emergence and earlier tracheal extubation.[42] Like other opioids it decreases the cerebral metabolic oxygen requirement with bradycardic effect is sufficient to produce a decrease in cardiac output.

Adverse effect

As observed with fentanyl delayed depression on ventilation has been described. Large doses used for I.V. induction results in muscle rigidity making positive pressure ventilation difficult. Transient skeletal muscle spasm has been described after large doses (40 mcg) of accidental intrathecal injection suggesting a irritative effect of this drug.[22]

REVIEW OF LITERATURE

Identification of opiate receptors in the brain and spinal cord and the role of morphinomimetic substances in the mechanisms of pain perception have led to the use of intrathecal opioid in animals and man for the relief of pain.

Intrathecal Opioids

Pert CB and Sinder SH [1973][34] demonstrated the presence of opioid receptors ion high density in the dorsal horn of the spinal cord.

Yaksh TL and Rudy TA [1976][49] published a study on the effectiveness of intrathecal morphine for relief of experimental pain in rats. This report initiated a series of trails in main.

Behar M et al [1979][4] reported the first effective use of epidural opioids in human while **Wang JK** et al [1979][45] reported the first controlled study of intrathecal opioids in human. They demonstrated that small doses of morphine given intrathecally or extradurally produced long lasting relief of chronic and post operative pain in man. The use of these methods spread rapidly and became clinically accepted long before data from controlled studies were published.

Crawford JS [1980][10] claimed that spinal opioids act predominantly on the brain.

Willer JC and **Bussel B**[48] [1980] and **Maruyama Y** et al [1980] suggested a selective spinal analgesic effect in humans. Willer JC and Bussel B [1980] and Yaksh TL [1981] suggested that opioids act on presynaptic and

postsynaptic receptors in the substantia gelatinosa of spinal cord dorsal where they inhibit neurone cell excitation.

Nicol et al [1991][32] studied densities of various drugs used intrathecally. They used 5% glucose as a vehicle for use as a hyperbaric solution along with opioids. They concluded that all drugs dissolved in 5% glucose were hyperbaric in comparison with CSF at room and body temperature.

Complications

Glynn CG et al [1979][16] and **Davies GK** et al [1980] reported respiratory depression following spinal morphine.

Glynn CG et al[16] [1979] reported a respiratory depression with rostral spread of spinal opioids. He noted a delay of upto 11 hours before onset of respiratory depression following spinal morphine.

Jones RDM[24] [1980] reported that naloxone was effective for reversing such respiratory depression without reversing analgesia.

Reiz and Westberg [1980] and Yaksh TL [1981] and Samii J, Chanin M and Viars P [1981] reported adverse reactions such as pruritus and urinary retention after intrathecal administration of opioids.

Oyama T [1980][33] observed that pruritus did not occur following intrathecal β-endorphin.

Bromage PR et al [1982][7] suggested that pruritus may be due to alterations in sensory modulations following opioid spread over the spinal cord to the brain. They also found naloxone to be effective in the control of pruritus

in some cases.

Roscow CE et al [1982][37] reported pruritus associated with spinal opioids but was a opinion that it was unlikely to be due to histamine release since pruritus occurred with fentanyl which does not cause systemic release of histamine.

Lam et al [1983][27] reported that delayed respiratory depression does not occur after epidural fentanyl which has lipophilic properties similar to pethidine.

Cousins MJ and **Mather LE** al [1984][8] suggested that the pruritus was unlikely to be due to the preservatives in the opioid since it occurs also with preservative free preparations.

Roxane Fournier[38] et al in a study of on 42 geriatric patients scheduled for elective total hip replacement surgery where randomized and double blinded. One group received 7.5 μg with 2 ml of hyperbaric bupivacaine intrathecally and other group received 40 μg fentanyl with 2 ml hyperbaric bupivacaine on comparing between sufentanil and fentanyl time to onset of sensory block was 9 min vs. 11 min and the time to first systemic analgesic intervention was 241 vs. 214 min. He concluded that both lipid soluble opioids produced excellent analgesia both comparable onset, duration and low incidence of side effects.

DeBalli P[14] et al studied the synergesic effect of intrathecal opioids of combined spinal epidural anaelgesia during labour. They observed that an intrathecally administered opioid provides rapid onset of labour analgesia

without motor block or significant haemodynamic pertubation.

WC Lau et al[28] in his randomized prospective double blinded study designed to examine post operative recovery with two anaesthetic techniques for unilateral ESWL i.e., intrathecal sufentanil versus intrathecal 5% lignocaine. Patients were randomized to receive either intrathecal sufentanil 20 μg plus saline or intrathecal 5% lignocaine. Patients who received intrathecal sufentanil ambulated [79 min vs. 146 min], voided [80 min vs. 152 min] and were discharged home [98 min vs. 166 min] sooner than the other group.

BBEN David et al[5] showed the synergism between intrathecal opioids and local anaesthetics in providing reliable spinal anaesthesia with minimal hypertension. 20 patients aged more than 70 years undergoing surgical repair of hip fracture were randomized into two groups of 10 patients each. Group A received bupivacaine 4 mg plus fentanyl 20 μg. Group B received 10 mg bupivacaine. All patients had satisfactory anaesthesia. One of the 10 patients in Group A required ephedrine. 9 of the 10 patients in Group B required an average 35 mg ephedrine and 2 patients required phenylpephrine, showing that mini-dose combination of local anaesthetic opioid cost dramatically less hypotension than large dose conventional local anaesthetics.

Herman et al[19] compared the analgesic and untoward effects of intrathecal fentanyl versus sufentanil at equipotent doses for labor. 40 healthy pregnant partiurients were recruited for the study after randomization. One group received 17.5 μg of fentanyl and other group received 9 μg of sufentanil. Pain was assisted with vast scale, in addition oxygen saturation, respiratory ETCO2 analgesic success was 91% and 95% in the fentanyl group compared to

sufentanil. The analgesic duration with fentanyl and sufentanil was 76 min vs. 101 min. Incidence of pruritis was more in the patients receiving sufentanil.

Jiri Malek et al[22] studied the efficacy and safety of intrathecal fentanyl and sufentanil added to bupivacaine for surgical repair for hip fractures in patients above 60 years. After standard premedication group C was administered 0.5% bupivacaine 3 ml with one ml saline. Group F 3 ml of 0.5% bupivacaine with fentanyl 50 μg and groups bupivacaine 0.5% 3 ml with 5 mcg sufentanil. Duration of analgesia was longer in both opioid groups compared to control [5.4 h] and longer in S [9.5 h] than in F [8.1 h]. There was no difference in bradycardia, hypotension, oxygen saturation and pruritis among the groups. Sufentanil appears to be more convenient because of longer analgesia and less post operative nausea and vomiting.

Ben David et al.[5] studies the synergism between intrathecal opioids and local anaesthetic on pain relief without prolonging recovery. Fifty patients undergoing ambulatory surgical arthroscopy were randomized into two groups receiving spinal anaesthesia with 3 ml of 0.17% bupivcaine [Group I] or with [Group II] the addition of 10 mg fentanyl. It was concluded that addition of 10 μg Fentanyl to spinal anaesthesia with small dose bupivacaine intensified and increased the duration of sensory blockade without increasing the intensity of motor blockade or prolonging recovery to micturation or home readiness.

DW Cooper et al[9] studied the effect of intrathecal dimorphine or intrathecal fentanyl to supplement spinal anesthesia as post caesarean section analgesia. 50 patients received 2 ml of bupivacaine with 50 μg of fentanyl versus 50 patients receiving dimorphine with bupivacaine. Final results showed

fentanyl group had good analgesia, better haemodynamic stability and lesser side effects.

Bogra et al[21] studied the synergistic effect of intrathecal fentanyl and bupivacaine in spinal anaesthesia. This study was performed on 120 caesearean section partiurients divided into six groups B8, B10, B12.5 receiving 8, 10, and 12.5 mg of bupivacine respectively and the groups FB8, FB10 and FB12.5 receiving the same dose of above but in combination with 12.5 μg fentanyl. On the onset of sensory block occurred faster in bupivacaine in fentanyl groups. Lower concentrations of bupivacaine alone could not completely remove visceral pain. It was concluded bupivacaine fentanyl combination leads to abolishment of visceral pain increased haemodynamic stability and increased duration of post op analgesia.

Fauzio Bano et al[3] conducted a prospective randomized study on the role of intrathecal fentanyl as an adjunct to hyperbaric bupivacaine in spinal anaesthesia for caesaearan section. 60 young adult females undergoing elective and emergency LSCS where randomly allocated to receive spinal anaesthesia either by using 0.75% hyperbaric bupivacaine 1.5 ml with 0.25 ml normal saline or 0.75% bupivacaine with 0.25 ml fentanyl. Comparing the bupivacaine group time to achieve highest sensory level for significant shorter in the fentanyl group while the duration of complete analgesia lasted significantly more longer in the fentanyl group than bupivacaine group [184 min vs. 126 min].

Karim Asehounne[25] et al conducted a prospective randomized study in patients undergoing lower abdominal and neurological surgeries under spinal

anesthesia. Patients received 5 μg sufentanil with 7.5 mg of hyperbaric bupivacaine. They recorded cardiac output by impedance, cardiography, arterial blood pressure and heart rate. They demonstrated that sufentanil with low dose bupivacaine provided successful anaesthesia prolongation of analgesia and better cardiac stability.

S K K Ngiam[31] et al studied the effect of adding intrathecal sufentanil and fentanyl to bupivacaine in emergency LSCS. One group received 15 μg fentanyl added to 7.5 mg of bupivacaine and other received 10 μg of fentanyl with 7.5 mg of bupivacaine. They demonstrated increase in effective analgesia time with 358% in sufentanyl group and 256% in fentanyl group. There was increased incidence of desaturation 45% versus 56% and pruritis 35% versus 27.8% in the sufentanil group.

Anchalae Techanivate[2] et al assessed the effectiveness of administration of fentanyl in spinal anaesthesia for appendisectomy. 40 patients randomized and double blind where recruited to receive either 4 ml of 0.5% of hyperbaric bupivacaine with 20 μg of fentanyl [Group F] for 4 ml of 0.5% hyperbaric bupivacaine with 0.4% normal saline [Group S]. The time to first requirement of post operative analgesia in Group F of significantly higher than in group S [13.6 vs. 6.3 hours]. There was no significant differences in the incidence of nausea, vomiting, hypotension and urinary retension.

Gupta[18] et al studied the role of low dose bupivacaine plus fentanyl for intrathecally during ambulatory inguinal herrhaphy. 40 patients randomly divided and double blinded into two groups. Group L received bupivacaine 6 μg and group H bupivacaine 7.5 μg. In both the groups fentanyl 25 μg was

added to the spinal anaesthetic. They concluded no difference in the spread duration and regression of sensory blocks between the groups.

Singh Harbhej[39] et al. showed in his study intrathecal fentanyl prolonged sensory bupivacaine spinal block. Forty patients undergoing lower extremities or genitourinary surgery were enrolled to receive either 13.5 mg hyperbaric bupivacaine 0.75% with 0.5 ml is Sufentanil [Group I] or 13.5 mg hyperbaric bupivacaine 0.75% with 25 μg Fentanyl [Group G] according to a randomized assessor blind protocol. The onset and duration of sensory block onset and duration of motorblock was assessed. The time required for two sensory segment regression and sensory regression to L1 dermatome was 74 ± 18 and 110 ± 33min versus 93 ± 22 and 14 ± 37 min in Groups I and II respectively.They concluded that Fentanyl 25 μg prolonged the duration of bupivacaine induced sensory block by 28% and reduced the analgesic requirement in early postoperative period.

Goodzari M.[17] et al studies the effect of large dose of intrathecal opioids on the autonomic nervous system. They compared two groups of patients aged 10-16 years. Group one received intrathecal opioid. Group II [epidural group] received 0.5% bupivacaine intrathecal epidurally. The sympathetic effects of intrathecal opioid and epidural bupivacaine were monitored by the changes in toe relative to calf temperature and by the changes in pulse wave gradient with digital plethysmography. All patients demonstrated changes in their calf to the gradients after intrathecal and epidural injection [-3.2 ± 1.6]. Systolic blood pressure decreased from a area of 70 ± 15 mm Hg to 55 ± 10 mm Hg. They concluded that the increases in pulse wave, amplitude and decreases in calf-toe gradients indicate a sympatholytic effect after intrathecal opioid similar to that

of local anaesthetics.

Martor J.W. et al. studied the synergism between intrathecal opioids and local anaesthetics. They studied 40 elderly patients having either an injection of a dynamic hip screw or a hemiarthroplasty and compared 9 mg glucose free bupivacaine with added fentanyl 20 μg [Group BF] and 11 mg glucose free bupivacaine alone [Group B]. The incidence and frequency of hypotension in Group BF were less than in Group B. Similarly full in systolic, diastolic and mean blood pressure all less in Group BF than in Group B.

MATERIALS AND METHODS

This study was conducted at Government General Hospital, Madras Medical College and Research Institute, Chennai – 600 003 between July 2006 to August 2006 on 50 patients of ASA Physical Status I and II undergoing Inguinal and below Inguinal region surgeries. The study was done after getting institutional approval. Written informed consent was obtained from all patients included in the study.

Study Design: This study was done in a prospective double blind randomized manner. The patients were divided into two groups of twenty-five each . Patient meeting criteria incorporated into study, randomly allotted to either group by draw of lots.

Group F: Patients in this group received 10 mg of 0.5% hyperbaric bupivacaine with 50 μg of Fentanyl added to a total volume of 3 ml.

Group S: Patients in this group received 2 ml [10 mg] of 0.5% hyperbaric bupivacaine with sufentanil 5 μg [diluted with 5% dextrose] and volume made to 3 ml.

The final volume of injected solutions was 3 ml in both the groups.

In the study 0.5% Bupivacaine in 8% dextrose manufactured by **SPM** Drugs, Fentanyl citrate [Free] manufactured by **PHARMACHEMICO** laboratories, sufentanil manufactured by **CORE HEALTH** and the dilutent 5% dextrose prepared by **IVES DRUG INDIA LTD** was used.

All solutions were prepared under aseptic precaution by the operation

theatre incharge anaesthesiologist uninvolved in the administration of subarachnoid block or in the observation of patients.

The specific gravity of the injected solution 1.008 and this was hyperbaric related to cerebrospinal fluid [1.006].

Selection of Cases

Inclusion Criteria

Male and female patients in age group of 20-60 years undergoing elective Inguinal and below Inguinal region surgeries.

ASA I and II

Exclusion Criteria

Patient's refusal

ASA physical status III, IV and V

Deformity of vertebral column

Neurological diseases

Local sepsis

Bleeding diathesis

Pre Anaesthesia Evaluation

History

Medical illness, previous surgery, anaesthetic and hospitalization, allergy to drugs and local anaesthetics.

Physical examination: General condition

Vital signs

Height and weight

Examination of CVS, RS, CNS and vertebral column

Airway Assessment

Investigations

Complete hemogram

Blood sugar

Blood urea

Serum creatinine

Bleeding time and clothing time

Urine analysis

Chest X-ray

Electro cardiogram

Patients who satisified the inclusion critieria were explained about the nature of the study and anaesthetic procedure. Written informed consent was obtained from all patients included in the study.

All patients were reviewed the day prior to surgery. The VAS [visual analogue scale] was explained to the patient. The patients were shown a 10 cm long scale marked 0-10 a blank paper and told 0 represents no pain and 10 represents worst possible pain. Patients were advised nil per oral 6 hours prior to surgery.

Premedication

In the pre medication room, pulse rate, blood pressure, respiratory rate and oxygen saturation were noted. No sedative premedication was given as it would interfere with the observations. An intravenous line was started with a 16 gauge intravenous canula and pre loading done with 10 ml/kg of 0.9% normal saline over 30 minutes.

Technique

In the operating room appropriate equipment for airway management and emergency drugs were kept ready. Patients were shifted from the premedication room to the operation theatre. The horizontal position of the operating table was checked. The patients were made to be supine with a pillow under head. Non invasive BP monitor, pulse oximeter and electrocardiogram leads were connected to the patient. Preoperative baseline systolic and diastolic blood pressure; pulse rate, respiratory rate and O_2 saturation were recorded. The anaesthesiologist unaware of the drug combination performed the sub arachnoid block and made the observations in all the patients involved in the study.

Patients were placed in the right lateral position. Skin over the back was prepared with antiseptic solution and draped with a sterile towel. The L3-L4 interspace was identified and 23 G Quicke-Babcock spinal needle was introduced in this space through a midline approach. Once the needle pierced the dura and was in the sub arachnoid space, the stylet was removed. Free flow of CSF at the hub of the needle was verified. The prepared solution was injected at a rate of 1 ml every 5 seconds without barbotage. The direction of

needle aperture was cephalad during drug administration. The total volume of injectate was 2 ml. The patients were made to be supine immediately after injection and the following parameters were observed.

Sensory Block

Assessed by loss of sharp sensation to pin prick using 23 G sterile needle bilaterally. The assessment was started immediately after turning the patient to supine position and continued every 20 seconds till loss of pin prick sensation at T12 level. Onset of sensory block was defined as the time taken from intrathecal injection to loss of pin prick sensation at T12 dermatome. At the 30 minute interval after SAB, the maximum dermatomal level of sensory block was noted. This was considered the maximum level of sensory block. Sensory block was checked every 15 min till 2 segment regression from the maximal level of sensory block occurred. The time to 2 segment regression was noted. The level of sensory block at end of surgery noted and thereafter assessment was carried out at 15 min intervals till return of pin prick sensation to T12 dermatome. Duration of sensory block was taken as time from sub arachnoid injection to return of pin prick sensation to T12.

Motor Block

Motor block was assessed bilaterally using modified Bromage scale.

Modified Bromage Scale

0	No block-able to raise extended leg against gravity
1	Unable raise extended leg but just able to flex knees
2	Unable to flex knee, but able to flex ankle
3	Total block-inability to flex ankle/move leg

Assessment of motor block was started immediately after turning the patient supine. It was tested every 20 seconds till a Bromage scale of 1 was reached. Onset of Motor block was taken as the time to achieve Bromage score of 1 from time of subarachnoid injection. The degree of motor block 30 min after intrathecal injection was noted and was considered as the maximum degree of motor block. Thereafter motor block was assessed every 15 minutes until complete resolution of motor block [Bromage 0]. Duration of motor block was taken as time from sub arachnoid injection to return of Bromage score 0.

Vital signs

Blood pressure, Pulse rate, respiratory rate and oxygen saturation were recorded every 5 minutes throughout the intraoperative period. The above vital signs at the completion of surgery were noted.

Evaluation of side effects and complications

1. Respiratory depression

Respiratory depression was defined as a respiratory rate < 8/min and/or oxygen saturation ≤ 85 mm Hg. This was planned to be managed with bag and mask ventilation or intubation and IPPV, if necessary. Naloxone 0.1 mg intravenously administered every 5-10 min till normal breathing pattern was established.

2. Nausea and vomiting

Patients were observed for nausea and vomiting. Vomiting was planned to be managed with Inj. Ondansetron 8 mg intravenously.

3. Pruritus

Distressing pruritus was planned to be treated with Pheniramine maleate 22.5 mg intravenously.

4. Hypotension

Hypotension was defined as systolic blood pressure <90 mm Hg or fall in systolic blood pressure > 30% from baseline. This was planned to be managed with intravenous ephedrine in increments of 6 mg.

5. Bradycardia

Bradycardia was defined as a Heart rate less than 60 beats per minute and this was planned to be managed with Atropine 0.01 mg/kg intravenously.

6. Urinary retention

Post operative urinary retention was watched for and was planned to be managed by bladder catheterization.

7. Sedation

The level of sedation was scored according to the six grade score devised by Ramsay and colleagues.

1	Anxious and agitated or restless or both
2	Co-operative, oriented, and tranquil
3	Responds to commands only
4	Asleep with brisk response to light glabellar tap or loud auditory stimulus
5	Asleep with sluggish response to stimulus
6	Asleep with no reponse to stimulus

A sedation score of greater than 4 was considered significant.

Quality of surgical anaesthesia

Surgical anaesthesia was graded 'Excellent' if there was no complaint of pain from the patients at any time during surgery. 'Good' if there was minimal pain or discomfort which was relieved by a small dose of IV Pentazocine 0.25 mg/kg and 'Poor' if general anaesthesia had to be administered.

Assessment in Post Anaesthesia Care Unit [PACU]

Patients were shifted to Post Anaesthesia Care unit after completion of surgery. The vital signs recorded every 15 minutes in the 1st hour after surgery and at 30 min intervals next two hours and thereafter every hourly for next three hours. Sensory and motor block assessments were done every 15 min till record of pin prick toT12 and Bromage score 0 respectively. Patients were shifted to post operative ward after complete resolution of motor blockade.

Assessment of pain and duration of analgesia

At the end of surgery, the degree of pain was assessed by visual analogue scale [VAS]. In the PACU VAS was done every 15 minutes till VAS score $\geq$ 4 was reached. The VAS was also noted whenever the patient complained of pain. Diclofenac sodium 75 mg was given intramuscularly, as the rescue analgesic. Duration of effective analgesia was defined as the time interval between administration of sub arachnoid block and time to reach VAS 4.

Patients were monitored for 24 hrs to detect the occurrence of side effects like respiratory depression, nausea, vomiting, pruritus and urinary retention.

Study material

A total of 25 cases each were randomly allocated to one of the following two groups of study viz. Group F - Fentanyl with Bupivacaine, Group S - Sufentanil with Bupivacaine.

Statistical method

The descriptive statistics of the variables studied are represented as two-way tables. The categorical factors are represented by the number and frequency (%) of cases. The continuous variables are represented by measures of central frequency (like mean, median & mode) and deviation (say, standard deviation and range). The differences in the proportions are tested for statistical significance using non-parametric Chi-Square test for variables measured on nominal scale. Fisher's exact probability test is employed whenever the expected frequencies were very small. For variables measured on a continuous scale, when testing for two groups, Student "t" test is used to test for statistical significance in the differences of the two means. Box plots are drawn to depict the summary statistics of continuous variables measured at a fixed one point in time. For continuous variables measured at different time points, line graphs are drawn to illustrate the trend of mean values at the respective time points.

OBSERVATION AND RESULTS

The study was conducted at Government General Hospital, Chennai. Fifty patients were included in this double blind randomized control study.

The patients were divided into two groups of twenty five each patients in Group F received intrathecal bupivacaine 0.5%.10 mg [2 ml] with 50 μg [1 ml] fentanyl. Group S patients received bupivacaine 0.5%. [2 ml] long with 5 μg sufentanil. Volume of injectate was 3 ml in both the groups.

Demographic Data:

Both the groups were comparable with respect to their age, height, weight, baseline pulse rate, systolic and diastolic blood pressure, respiratory rate and oxygen saturation. The duration of surgery was also comparable in the two groups. There was no statistically significant difference among the two groups in demographic aspect.

Table 1: Distribution of age of cases by groups[$]

Age	Gr. F	Gr. S	p-value
No. of cases	25	25	
Mean	30.2	28.5	
S.D.	6.38	5.73	0.33
Median	30	28	
Mode	30	25	
Range	20-45	21-45	

[$] *Not statistically significant*

The mean age was observed to be slightly higher in Group F than Group S but not statistically significant.

Table 2: Distribution of height of cases by groups[$]

Height	Gr. F	Gr. S	p-value
No. of cases	25	25	
Mean	163.7	163.8	
S.D.	5.18	3.71	0.95
Median	165	165	
Mode	165	165	
Range	161-170	160-170	

[$] *Not statistically significant*

The mean height was observed to be almost the same in Group F than Group S and not statistically significant.

Table 3: Distribution of weight of cases by groups[$]

Weight	Gr. F	Gr. S	p-value
No. of cases	25	25	
Mean	58.7	58.2	
S.D.	5.31	4.69	0.72
Median	58	57	
Mode	52	57	
Range	51-70	51-69	

[$] *Not statistically significant*

The distribution of cases by weight and the difference in the mean values are observed to be not statistically significant between Group F and Group S.

Block Characteristics

Onset of sensory block: The time taken to achieve a level of T12 from the time of administration of subarachnoid block was tested bilaterally by pin prick. The mean time taken for onset in Group F was 9.04 min and in Group S was 7.4 min. Statistically significant difference was observed in the onset of sensory block.

Table 4: Distribution of onset of sensory block by groups*

Time of onset of sensory block	Gr. F	Gr. S	p-value
No. of cases	25	25	
Mean	9.04	7.4	
S.D.	2.03	2.16	0.008
Median	9.0	7	
Mode	8.0	5	
Range	5-12	4-12	

** Statistically significant*

The mean time of onset of sensory block age was observed to be higher in Group F than Group S and is statistically significant.

Maximum level of sensory block

The range of maximum level of sensory block in Group F was T4-T8 with a maximum at T5 [52%]. The range in Group S was also T4-T8 and

maximum at T6 [40%]. The distribution of patients in each level of maximum sensory block is shown in.

Table 5: Distribution of maximal height of sensory block by groups[$]

Attempt	Gr. F (25)		Gr. S (25)		p-value
	No.	%	No.	%	
T4	4	16.0	6	24.0	
T5	13	52.0	6	24.0	0.21
T6	4	16.0	10	40.0	
T7	2	8.0	1	4.0	
T8	2	8.0	2	8.0	

[$] *Not statistically significant*

Time to two segment regression

The time to two segment regression in Group F was 39 min and in Groups was 42.2 mins which was not statistically significant.

Table 6: Distribution of two segmental regression values by groups[$]

Two segmental regression	Gr. F	Gr. S	p-value
No. of cases	25	25	
Mean	39.8	42.2	
S.D.	13.96	15.95	0.57
Median	40	40	
Mode	20	40	

Range	20-65	20-85	

[$]*Not Statistically significant*

The mean duration of two segmental regression values was observed to be higher in Group S than Group F but not statistically significant.

Duration of sensory block [surgical anaesthesia]

Duration of surgical anaesthesia in Group F was 142.8 min [mean] and the duration in Group S was 137.6 min [mean]. Though the mean duration of surgical anaesthesia was observed to be higher in Group F than Group S, but it was not statistically significant .

Table 7: Distribution of duration of surgical anaesthesia of cases by groups[$]

Duration of surgical anaesth	Gr. F	Gr. S	p-value
No. of cases	25	25	
Mean	142.8	137.6	
S.D.	26.30	19.43	0.43
Median	150	135	
Mode	150	135	
Range	90-180	105-180	

[$] *Not statistically significant*

The mean duration of surgical anaesthesia was observed to be higher in Group F than Group S but not statistically significant.

Quality of Surgical Anesthesia

Quality of Surgical anaesthesia was graded excellent in all but 2 patients one belonging to Group F and other to Group S, where the quality was rated good and had to be supplemented by narcotics.

Duration of effective analgesia

The mean duration of effective analgesia defined as the time to reach VAS score ≥ 4 from the time of subarachnoid block was 216.8 min in Group F and 264.6 min in Group S. This was statistically significant among the groups.

Table 8: Distribution of duration of post operative anaesthesia of cases by groups*

Duration of post op anaesthesia	Gr. F	Gr. S	p-value
No. of cases	25	25	
Mean	216.8	264.6	
S.D.	46.16	29.89	<0.001
Median	210	275	
Mode	200	280	
Range	120-340	195-300	

* *Statistically significant*

The mean duration of post operative anaesthesia was observed to be higher in Group S than Group F and is statistically significant

Maximum grade of motor block

The maximum degrees of motor block in Group F ranged between B2-B4 with maximum at B3 [60%]. In groups the range was between B1-B4 and maximum at B3 [60%]. This was not statistically significant between the groups.

Table 9: Distribution of maximal grade of motor block by groups[$]

Attempt	Gr. F (25)		Gr. S (25)		p-value
	No.	%	No.	%	
B1	0	0.0	1	4.0	
B2	4	16.0	8	32.0	0.11
B3	15	60.0	15	60.0	
B4	6	24.0	1	4.0	

[$] *Not statistically significant*

Duration of motor block

The duration was read when bromage scale referred to BO. The mean duration of motor block in Group F was 131.6 min while it was 90.8 min in Group S which was statistically significant.

Table 10: Distribution of duration of motor block by groups[*]

Duration of motor block	Gr. F	Gr. S	p-value
No. of cases	25	25	
Mean	131.6	90.8	
S.D.	17.84	15.12	<0.001
Median	130	90	
Mode	130	80	
Range	90-180	60-120	

** Statistically significant*

The mean duration of motor block was observed to be higher in Group F than Group S and is statistically significant.

Haemodynamic parameters

Heart rate

The distribution of cases by heart rate and mean values were observed to be generally not statistically significant between the Group F and Group S when all times are taken together and at all the different time points both intra and post operatively.

Table 11: Mean Distribution of cases by groups and HR[$]

HR	Gr. F *(n=25)*	Gr. S *(n=25)*	p-value
Intra OP time (0-60) - Average			
Mean	80.5	79.0	0.55[$]
SD	10.93	6.42	
Intra OP time 0			
Mean	84.8	80.4	0.22
SD	13.48	11.51	
Intra OP time 15			
Mean	76.3	76.6	0.94
SD	13.45	9.84	
Intra OP time 30			
Mean	75.1	77.3	0.49
SD	12.97	8.35	
Intra OP time 45			
Mean	75.5	76.2	0.83
SD	12.82	7.74	
Intra OP time 60			
Mean	73.7	76.3	0.33
SD	10.92	7.38	
Post OP time (0-60) - Average			
Mean	77.6	78.1	0.78[$]
SD	7.74	4.55	
Post OP time 0			
Mean	77.3	77.0	0.90
SD	9.86	6.61	
Post OP time 15			
Mean	78.3	78.0	0.91
SD	9.86	7.94	
Post OP time 30			
Mean	76.4	79.4	0.19
SD	8.35	7.25	
Post OP time 45			
Mean	78.3	77.8	0.79
SD	7.97	5.55	
Post OP time 60			
Mean	77.6	78.3	0.67
SD	6.30	5.72	

[$] *Not statistically significant*

Systolic blood pressure

The distribution of cases and mean value of systolic blood pressure were observed to be generally not statistically significant between Group F and Group S at all time points taken together and at every different time patients both intra and post operatively.

Table 12: Distribution of cases by groups and systolic blood pressure[$]

Systolic blood pressure	Gr. F *(n=25)*	Gr. S *(n=25)*	p-value
Intra OP time (0-60) - Average			
Mean	125.4	128.5	0.41[$]
SD	10.75	15.56	
Intra OP time 0			
Mean	128.0	133.7	0.26
SD	13.33	20.93	
Intra OP time 15			
Mean	125.1	120.1	0.33
SD	16.19	19.41	
Intra OP time 30			
Mean	123.2	125.7	0.62
SD	15.57	19.23	
Intra OP time 45			
Mean	124.0	126.8	0.56
SD	16.02	17.84	
Intra OP time 60			
Mean	123.4	127.4	0.40
SD	14.80	17.89	
Post OP time (0-60) - Average			
Mean	123.4	127.7	0.20[$]
SD	7.57	14.67	
Post OP time 0			
Mean	124.1	126.4	0.63
SD	12.09	20.63	
Post OP time 15			
Mean	126.2	129.4	0.51
SD	12.9	20.02	
Post OP time 30			
Mean	124.0	126.3	0.64
SD	13.03	20.68	
Post OP time 45			
Mean	122.5	128.7	0.16
SD	10.01	19.65	
Post OP time 60			
Mean	120.2	127.8	0.07
SD	8.02	18.39	

[$] *Not statistically significant*

Diastolic blood pressure

The distribution of cases and the mean values of diastolic blood pressure were observed to be generally not statistically significant between Group F and Group S when all time points are taken together and at all the different time points postoperatively with the exception of time points 15 min and 60 min intra operatively.

Table 13: Distribution of cases by groups and diastolic blood pressure[$]

Diastolic blood pressure	Gr. F *(n=25)*	Gr. S *(n=25)*	p-value
Intra OP time (0-60) - Average			
Mean	76.6	79.7	0.10[$]
SD	6.19	6.89	
Intra OP time 0			
Mean	78.9	81.0	0.39
SD	9.07	7.83	
Intra OP time 15			
Mean	73.0	80.5	0.03*
SD	10.50	13.07	
Intra OP time 30			
Mean	75.5	78.6	0.33
SD	8.33	13.30	
Intra OP time 45			
Mean	74.8	77.8	0.29
SD	7.77	11.79	
Intra OP time 60			
Mean	73.5	79.4	0.03*
SD	7.18	11.21	
Post OP time (0-60) - Average			
Mean	94.6	97.5	0.12[$]
SD	6.63	6.35	
Post OP time 0			
Mean	79.0	81.4	0.37
SD	10.08	8.34	
Post OP time 15			
Mean	84.1	82.7	0.59
SD	9.73	9.29	
Post OP time 30			
Mean	77.9	82.2	0.16
SD	13.12	8.07	
Post OP time 45			
Mean	77.5	81.0	0.07
SD	7.08	5.91	
Post OP time 60			
Mean	77.7	80.5	0.13
SD	6.67	5.82	

[$] *Not statistically significant; * p≤0.05*

Side effects and complication

The incidence of hypotension was 8% in Group F and 16% in Group S.

The incidence of bradycardia was 12% in Group F and 20% in Group S.

The incidence of pruritis was 40% in Group F and 48% in Group S.

The incidence of nausea was 4% in each of the groups.

There seems to be no significant difference in the distribution of cases by bradycardia, hypotension, nausea and pruritis. None of the cases in both experienced the following condition like respiratory depression, sedation, vomiting, urinary rentention or neurological complication.

Table 14: Distribution of cases by groups and complications[$]

Co-morbid conditions	Gr. F		Gr. S		p-value
	No.	%	No.	%	
Bradycardia					
Yes	3	12.0	5	20.0	0.70
No	22	88.0	20	80.0	
Hypotension					
Yes	2	8.0	4	16.0	0.67
No	23	92.0	21	84.0	
Nausea					
Yes	1	4.0	1	4.0	1.00
No	24	96.0	24	96.0	
Pruritis					
Yes	10	40.0	12	48.0	0.57
No	15	60.0	13	52.0	

[$] *not statistically significant*

There seems to be no significant difference in the distribution of cases by Bradycardia, hypotension, Nausea and Pruritis. None of the cases in both experienced the following conditions: Respiratory Depression, sedation, vomiting, urinary retention and others.

DISCUSSION

The intrathecal injection of opioids combined with local anaesthetics at lower than conventional doses provides effective central neuroxial block with satisfactory analgesia and adequate relaxation for surgeries of inguinal region. The adding of opioids to local anaesthetics had an added advantage of prolonged post op ambulation with earlier mobilization due to shorter duration of motor blockade. It is now apparent that with attention to patient selection, appropriate choice of drugs, dosage, route of administration and adequate patient monitoring, the benefits of intra spinal local anaesthetic opioid combination can be obtained with a high degree of safety.

The study was designed to compare and contrast the combination of a local anaesthetic at lower than conventional doses with two different opioids administered intrathecally with regards to their efficacy and safety. A total of fifty patients belonging to ASAI physical status within the age group 20-50 years scheduled to undergo surgeries of inguinal region were taken up for the study. Patients belonging to Group F [fentanyl group] received 2 ml of 0.5% Bupivacaine with 50 μg Fentanyl (1 ml) intrathecally. Other Group (Group S – Sufentanil group) received 2 ml of 0.5% Bupivacaine with 5 μg of Sufentanil. Both the groups were closely observed for the pattern of block characteristics and hemodynamic stability. The quality of analgesia, pattern and duration of motor blockade was studied. For assessing hemodynamic stability, parameters such as heart rate, systolic and diastolic blood pressure was recorded at specific intervals both intra op and post-operatively. The occurrence of any side effects such as nausea, vomiting, respiratory depression, sedation; pruritis and urinary retention was also analysed.

Quality of Analgesia: The onset time to sensory block, two segment regression duration of surgical anaesthesia and post op analgesia were documented and statistical significance derived.

With regards to sensory block, onset time was much quicker in the Sufentanil Group S group with a mean of 7.4 mins when compared to the Fentanyl group (Group F) which recorded 9.04 min which was statistically significant. The time to two segment regression was comparable between the groups. Even though there was a mild variation, it was not statistically significant.

ROXANE et al.[38] compared the use of intrathecal analgesia with Fentanyl and Sufentanil in geriatic patients undergoing total hip replacement under spinal anaesthesia. In his study onset time to sensory block was comparable with Fentanyl having a onset time of 11 ± 8 min and Sufentanil 9 ± 8 min which is supportive to our finding.

GOEL et al in his study for day case surgery observed the time to two segment regression and S2 regression and with Fentanyl it was significantly longer than Sufentanil.

SINGH HARBHEJ et al[39] studied the effect of intrathecal Fentanyl when used with hyperbaric bupivacaine in spinal block in adult male patients. The time to 2 segment regression and sensory regression to L1 dermatone was 93 ± 22 min and 141 ± 37 min.

In regards to the duration of surgical anaesthesia, there was not statistically significant difference between the two group and it was in the

comparable range of 137-143 min. In our study with equipotent doses of Fentanyl and Sufentanil, the duration of postoperative analgesia was much longer in the Sufentanil group (216.8 vs. 264.6 min).

ROXANE et al[38] in his study found that duration of action of intrathecal Fentanyl was 214 ± 120 min and that of Sufentanil 240 ±102 min. His findings are comparable to the findings of our study.

NORMAN L HERMAN[19] in his study on labor patients, analgesic duration with intrathecal Fentanyl and Sufentanil was 76 ± 33 min and 101 ± 58 min respectively. This study also shows the prolonged analgesic effect of Sufentanil.

Motor Blockade: With regards to motor block number of patients in both group exhibiting maximal grade of motor block (B4) was not statistically significant. The significant finding in our study was the difference in duration of motor blockade between the two groups. The Group S had a much longer duration of motor block than groups establishing a slight advantage of Sufentanil over Fentanyl.

JOHN H STROGER et al[23] reported use of intrathecal lignocaine with Sufentanil for shorter post op recovery for outpatient rectal surgery. In his study there was a significant shorter ambulation time (120 ± 26 min) after intrathecal low dose lignocaine with 10 μg Sufentanil compared to 50 mg of intrathecal lignocaine alone (102 ± 32 min).

WE LAU et al[21] reported earlier discharge of patients undergoing extra corporeal shock wave lithotripsy following intrathecal sufentanil – local

anaesthetic combination administered intrathecal.

With regards to hemodynamic stability between the two groups there was not statistical significant variation in systolic, diastolic blood pressure and heart rate. Even though the number of cases reporting hypotension in Group S was 4 compared to 2 in Group F, it was not statistically significant.

KARIM ASHEHOUNE et al[25] in his study showed that small dose of Bupivacaine with Sufentanil administered intrathecally prevented the cardiac output modification in patients undergoing elective urological, lower abdominal and lower limb surgeries when compared to large dose conventional Bupivacaine.

B BEN DAVID et al[5] reported synergism between intrathecal opioids and local anaesthetics and with this combination it may be possible to achieve reliable spinal anaesthesia with minimal hypotension.

GOODZARI et al[17] reported in his study that there were cases showing decrease in blood pressure after spinal injection of opioids and this may be due to the sympatholytic effect of opioids similar to that of local anaesthetic drugs. This finding could account for some of the cases in our study developing hypotension requiring the use of vasopressors.

With regards to side effects, it is significant to note that there was no incidence of early or delayed respiratory depression (or) urinary retention in any of the patients involved in the study. Pruritis was the only significant side effect having almost an equal representation in both the groups. It responded well to antihistamine and reassurance. One patient in each of the group

complained of nausea. No case in either of the groups had vomiting.

BROMAGE PR et al [1982][7] suggested that pruritus may be due to alterations in sensory modulations following opioid spread over the spinal cord to the brain. They also found naloxone to be effective in the control of pruritus in some cases.

ROSCOW CE et al[37] [1982] reported pruritis associated with spinal opioids but was a opinion that it was unlikely to be due to histamine release since pruritus occurred with fentanyl which does not cause systemic release of histamine.

WL LOCK et al described cases of pruritus in patients receiving combined spinal epidural for labor analgesia who had received fentanyl or sufentanil but not in patients who were administered plain bupivacaine.

It can be concluded from our study that intrathecal opioids when administered with local anaesthetics in subarachnoid space is quiet safe. It has also been shown that by adding opioids to local anaesthetics intrathecally, the dose of the local anaesthetic can be substantially reduced and hence its side effects like excessive hypotension or bradycardia. With vigilant intra op and post op patient monitoring in place, intrathecal low dose local anaesthetic opioid combination appears superior to plain local anaesthetic alone. Among the two opioids Sufentanil appears to be more patient friendly with regards to its analgesic duration and early ambulation excepting for its cost.

SUMMARY

This double blind prospective randomized control study was designed to evaluate the efficacy and safety of low dose bupivacaine in combinations with

fentanyl and sufentanil with regards to hemodynamic stability and block characteristics.

A total of fifty patients belonging to ASA physical status I belonging to age group between 20-50 years scheduled for inguinal surgeries were divided into two group. The patients in group F received 2 ml of 0.5% hyperbaric bupivacaine with 50 μg [1 ml] of fentanyl [total volume of 3 ml]. The 25 patients in Group S received 1 ml of 5 μg sufentanil [diluted with 5% dextrose] with 2 ml of 0.5% hyperbaric bupivacaine.

Time to onset and duration of sensory and motor block and the maximal dexmatome level of sensory block wave observed and noted. Post operatively the duration of analgesia was noted. During intra operative and post operative periods hemodynamic stability was assessed with recording of heart rate, systolic blood pressure and diastolic blood pressure at specified intervals. Special attention was paid to detect any side effects in either of the groups.

Following observation were made:

1. Intrathecal opioids [either Fentanyl or sufentanil] in combination with low doses of local anaesthetic [10 mg of 0.5% bupivacaine] produced satisfactory sensory block of the lower abdomen.

2. The onset of sensory block was little earlier when bupivacaine was combined with sufentanil [7.4 min] than fentanyl [9.04 min].

3. The mean duration of sensory block was almost the same when bupivacaine was either combined with fentanyl [142.8 min] or sufentanil [137.8 min].

4. The mean duration of analgesia was significantly longer with bupivacaine combined with sufentanil [264.6 min] than with fentanyl 216.8.

5. The mean duration of motor block was shorter with sufentanil in combination with bupivacaine [90.8 min] than fentanyl-bupivacaine combination [131.6 min].

6. The variation of heart rate, systolic blood pressure and diastolic blood pressure from the baseline in both the groups was not statistically significant establishing a hemodynamic stability of intrathecal opioid low dose local anaesthetic combination than intrathecal local anaesthetic alone.

7. The incidence of side effects was relatively low with both the combination with only pruritis emerging as the leading complication in the either of the groups.

8. The percentage of cases reporting nausea, vomiting was very few in either of the groups.

9. None of the cases in either of the groups was complicated by respiratory depression, sedation and urinary retention.

10. No neurological complication were observed in any of the patients.

CONCLUSION

This study confirms the safety and efficacy of intrathecal low dose local anaesthetic opioid combination in patients undergoing surgeries of inguinal region region of intermediate duration.

When compared to intrathecal bupivacaine fentanyl combination; intrathecal bupivacaine sufentanil combination provided prolonged post operative analgesia with a lesser duration of motor blockade thus allowing early post operative ambulation. Both the groups were comparable with regards to haemodynamic stability. The side effects of intrathecal opioids are not significant and can be easily managed.

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PROFORMA

COMPARATIVE EVALUATION OF SUBARACHNOID BLOCK WITH LOW DOSE BUPIVACAINE AND FENTANYL VS. LOW DOSE BUPIVACAINE AND SUFENTANIL IN PATIENTS UNDERGOING INGUINAL SURGERIES

Name: Age: Sex:
Height: Weight: Unit:
I.P.No.:
Diagnosis:
Surgical Procedure:
Pre-Anaesthetic Evaluation:

a. History:
b. Clinical Examination:

General Examination:
CVS: CNS:
RS: Spine:
Vital Signs
BP (mmHg): Pulse rate: Respiratory rate:
Airway:

c. Investigations:

Urine analysis
Complete Hemogram
Blood Sugar
Blood Urea
Serum creatinine
Bleeding time
Clotting time
Chest X-ray
Electrocardiogram
ASA Physical Status:
Pre-operative vital signs
Pulse rate: Respiratory rate:
B.P.: Oxygen saturation:
Premedication:
Preloading:
Baseline vital signs
B.P.: Respiratory rate:
Pulse rate: Oxygen saturation:
Position in which subarachnoid block done:
Interspace chosen for subarachnoid block:
Size of spinal needle:

Modified Bromage Scale

0	No block-able to raise extended leg against gravity
1	Unable raise extended leg but just able to flex knees
2	Unable to flex knee, but able to flex hip
3	Total block-inability to flex ankle/move leg

Block Characteristics:

Height of block (intra-operative):

	1 min	5 min	10 min	15 min	30 min	45 min	60 min	75 min	90 min	105 min	120 min
Levels											
Sensory											
Motor											

Drug Dosage:
Time to sensory block T10:
Time to motor block (Gr 1 Bromage):
Maximum levels of sensory block:
Maximum degree of motor block:
Time to 2 segment regression (assessed every 15 minutes):
Intraoperative monitoring

Time (min)	0 min	1 min	2 min	3 min	4 min	5 min	10 min	15 min	30 min	45 min	60 min	75 min	90 min	105 min	120 min	135 min	150 min
PR																	
BP																	
RR																	
SpO2																	

Intraoperative side effects:
Treatment given:

Hypotension	Y/N	Pruitis	Y/N
Bradycardia	Y/N	Rigors	Y/N
Respiratory depression	Y/N	Others	Y/N
Nausea and vomiting	Y/N		
Sedation	Y/N		

Duration of surgery:
Total amount of intravenous fluids given:
Total amount of blood given:
Intraoperative urine output:
Level of sensory block at end of surgery:
Degree of motor block at end of surgery:
VAS Score at end of surgery:
Postoperative vital signs:

	1st hour					2nd hour		3rd hour		4th hour	5th hour	6th hour
	0	15	30	45	60	90	120	150	180	240	300	360
BP												
PR												
RR												
SpO_2												

Duration of motor blockade
Duration of sensory blockade Assessed every 15 minutes
Side effects in post operative period:
Treatment given

Hypotension	Y/N	Sedation	Y/N
Bradycardia	Y/N	Pruitis	Y/N
Respiratory depression	Y/N	Rigors	Y/N
Nausea and vomiting	Y/N	Others	Y/N

Post operative analgesia (VAS measured every 15 minutes):
Duration of effective analgesia:
Time of administration of rescue analgesia:
Postoperative urine output: