Original Research Paper

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Anesthesiology

EPIDURAL VOLUME EXTENSION IN COMBINED SPINAL EPIDURAL ANAESTHESIA IN PREGNANT PATIENTS COMING FOR ELECTIVE CESAREAN SECTION WITH ROUTINE SPINAL ANAESTHESIA - A COMPARATIVE STUDY.

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KEYWORDS :

INTRODUCTION

Pregnancy is the most vital period in every women's life, in which delivery is the critical period risking the life of both mother and fetus. For every pregnant woman, pain during delivery continues to be a nightmare. Generally in very olden days, almost all parturientswere subjected to undergo normal vaginal delivery. Eventhough vaginal delivery is beneficial to the mother in many ways (decreased maternal morbidity, resumption of routine work earlier and less blood loss). In recent days, the incidence of cesarean deliveries has increased tremendously. There are some conditions or situations during which allowing the pregnant women to undergo normal vaginal delivery may be life threatening to either mother or fetus. The most common conditions are fetal distress, failure of progression of secondstageoflabor, malpresentations, uterineanomalies, cephalopelvic disproportion, etc.[3] In these situations, cesarean section plays a major role in the safe confinement of mother.

The word cesarean section means 'cutting the uterus and expelling the baby through the incision'. Never can a surgery be planned without Anaesthesia. ObstetricAnaesthesia is different in many ways from anaesthesia for non obstetric surgeries. In pregnant women, the anaesthesiologists are responsible to take care of two lives simultaneously throughout the procedure. Hence special considerations aretaken even during planning the modalities of anaesthesia, pre operative assessment and intra operative monitoring. Hence regional anaesthesia has gained more popularity in obstetrics than general anaesthesia. Among regional techniques spinal anaesthesia is routinely practiced, but due to its definite duration and adverse effects, other techniques have evolved. Epidural anaesthesia can provide prolonged duration of operative anaesthesia with less adverse effects but it may result in patchy blockade or catheter related problems.

Now Combined Spinal Epidural(CSE) anaesthesia provides advantages of both techniques,with minimal adverse effects as drug dosage used here would be nearly 50% less than that used for routine spinal anaesthesia. Failure rate of both techniques combined is only 0.16%.[2] but when used separately each technique had a failure rate of about 2-5%.[2].

This study is based on the principle of Epidural Volume Extension(EVE), which is a modification of CSE. Here a small volume of normal saline is used epidurally, aiming at rapidly increasing the level of sensory blockade with a low dose of intrathecal bupivacaine administered. This normal saline produces a mechanical compression effect intrathecally, causing a more cephalad spread of the drug administered obtaining an adequate surgical anaesthesia with fewer complications.

AIM OF THE STUDY

The Aim of this study is to evaluate the effects of Epidural volume extension with Normal saline given along withIntrathecal Hyperbaric bupivacaine in combined spinal epidural technique for parturients planned for elective cesarean section to achieve adequate anaesthesia.

ANATOMICAL CHANGES OF VERTEBRAL COLUMN IN PREGNANCY[4,5]

The two major changes in vertebral column of a pregnant women which is of main concern for an anaesthesiologists are the following

1. Shift of apex of thoracic kyphosis to a higher level
2. Exaggerated lumbar lordosis.

Fig 2. Exaggerated lumbar lordosis in pregnancy

ANATOMY OF EPIDURAL SPACE[2]

A vital space surrounding the dura,most commonly used by anaesthesiologists. Epidural space extends from the foramen magnum upto sacral hiatus.

BOUNDARIES

Anteriorly – posterior longitudinal ligaments
Laterally –pedicles and intervertebral foramina
Posteriorly – ligamentumflavum

CONTENTS OF THE SPACE

Nerve roots
Fat and areolar tissue
Lymphatics
Venous plexus of Batson

This epidural space is highly segmented and not uniform in size, hence spread of drugs injected epidurally were unpredictable and may

result in patchy blockade.[2].

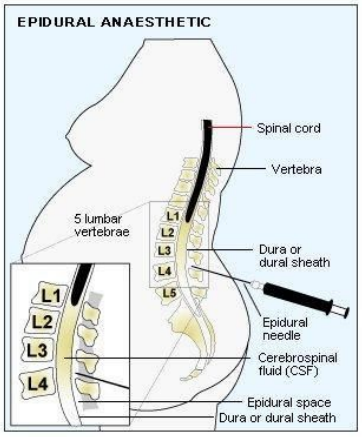


Fig 3. Anatomy of epidural space in pregnant woman (Image courtesy: frca.co.uk)

This picture shows the level of termination of spinal cord, epidural space and subarachnoid space

CHANGES IN PREGNANCY[5]:

In pregnancy, compression of inferior vena cava by gravid uterus results in increased flow of blood through the epidural venous plexus, as these are the collateral route for blood from lower half of body. Due to engorgement of epidural venous plexus, the subarachnoid space becomes compressed.

Moreover, there will be increased intra abdominal pressure in pregnancy, which is transmitted to epidural space via intervertebral foramina. Hence the pressure in the Epidural space is positive while it is negative in most of the non pregnant women. This makes the identification of Epidural space . So finding of Epidural space should be done cautiously.

This leads to further compression and narrowing of subarachnoid space. This leads to higher sensory blockade achieved with lower doses of spinal local anaesthetics.

DYNAMICS OF CSF FLOW[4]

CSF flow dynamics remain unaltered in pregnancy

UTEROPLACENTAL BLOOD FLOW[8]

Growth and wellbeing of the developing fetus depends upon adequate uteroplacental blood flow. The main blood supply to the uterus is derived from uterine artery, a branch of internal iliac artery. Uterine artery branches into arcuate arteries. These arcuate arteries gives rise to radial arteries in the myometrium, which enters the endometrium and forms spiral arteries which are convoluted. During the placental formation, the spiral arteries are invaded by the trophoblasts, which causes the loss of smooth muscles in those arteries and makes them non responsive to vasoconstrictors. Non pregnant uterus receives a meager blood supply when compared to vital organs. But gravid uterus receives more and more blood supply as the pregnancy progresses approaching around 600mL/min during term. Uterus of non pregnant women exhibit autoregulation of blood flow. Blood flow remains stable even when blood pressure fluctuates. But in gravid uterus, the spiral arteries dilate tremendously and hence the autoregulating capacity is lost. Uteroplacental perfusion decreases whenever hypotension occurs (uteroplacental perfusion becomes pressure passive)[8]. Labor induced pain and stress increases the circulating levels of catecholamines, thereby decreases the uteroplacental blood flow. Neuraxial blockade induced hypotension also reduces uteroplacental blood flow. But when hemodynamic stability is maintained during neuraxial blockade, it has advantage in maintaining uteroplacental blood flow, as stress is reduced in neuraxial blockade due to adequate pain relief and hence reduced catecholamine release. Dose of local anaesthetics within the clinical limits does not have any effect on uteroplacental blood flow. But large doses of local anaesthetics can induce intense vasoconstriction, thereby decreasing uteroplacental blood flow.Intrathecalopioids increase the uterine tone and thereby decreases the placental blood flow. This results in bradycardia in the fetus. But this effect of opioid is controversial. Further studies in epidural fentanyl and morphine found to have no effect on uterine blood flow in pregnant women. But meperidine and sufentanil given intrathecally has been found to decrease the blood flow to gravid uterus. Intravenous anaesthetics cause hypotension during induction which can reduce the uteroplacental perfusion. Moreover, large amount of catecholamines released during intubation response also reduces uteroplacental perfusion to a great extent. Volatile anaesthetics increase uteroplacental blood flow when used in more than 2 MAC concentration. This is due to the decrease in uterine tone by volatile anaesthetics. Positive pressure ventilation during general anaesthesia reduces the cardiac output due to increase in intrathoracic pressure. This results in reduction of uteroplacental blood flow. Hence hyperventilation should be avoided in pregnant women undergoing general anaesthesia.

SPINAL ANAESTHESIA[2,3]

Since spinal anaesthesia avoids airway manipulation and its attendant complications, it has become very popular nowadays for cesarean delivery. During spinal anaesthesia, patient will be aware of her delivery, bleeding chances are less and polypharmacy is avoided. Other advantages of spinal anaesthesia are rapid onset of reliable and dense blockade, minimal transfer of drug to the fetus, less risk of local anaesthetic toxicity and promotes earlier breast feeding. But even this spinal anaesthesia is not without any adverse effects. Some of the adverse effects are hypotension, post dural puncture headache and rare neurologic complications. For a satisfactory anaesthesia, a sensory level of T4 should be present for a cesarean delivery. Such high level results in profound hypotension and prolonged motor blockade. Moreover pregnant women depends entirely on the sympathetic nervous system integrity for their haemodynamic stability. Thus the pharmacological therapeutic sympathectomy results in profound hypotension than when compared to that of non pregnant women.

In order to overcome these two major adverse effects of sub arachnoid blockade, technique of epidural anaesthesia has come into practice.

Factors affecting the height of spinal blockade[2]:

Spinal anaesthetic block height is influenced by several factors which can be classified into controllable and not controllable.

Factors controllable

Local anaesthetic dose
Local anaestheticbaricity
Injection site along the neuraxis
Patient posture

Factors cannot be controlled

CSF volume (lumbosacral)
CSF density

EPIDURAL ANAESTHESIA[2,3]

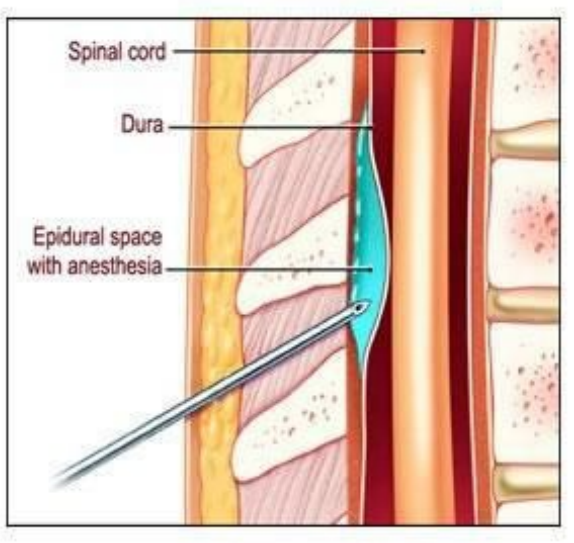


Fig 4. Epidural injection (Image courtesy: frca.co.uk)

In epidural anaesthesia for cesarean delivery, usually a catheter is placed inside the epidural space, through which both operative anaesthesia and post operative pain relief can be provided. Since the local anaesthetic is delivered outside the duramater, it has to cross the dura and arachnoid into the CSF and then into the nerve roots to exert its effect. So the onset of sympathetic blockade is gradual and less severe compared to that of spinal anaesthesia. so the severity of hypotension is reduced in this technique. But here, the onset of blockade is slower. The requirement of total amount of local anaesthetic is very high to achieve a sensory blockade similar to that of spinal anaesthesia. So chances of local anaesthetic toxicity is high. Catheter related problems like occlusion, migration (intrathecally or intravascularly), kinking may pose a great problem for anaesthetic supplementation during intra operative period.

Complications of Epidural anaesthesia[2]:

Inadvertent intravascular injection
Accidental subarachnoid injection
Neurological injury

COMBINED SPINAL EPIDURAL ANAESTHESIA'

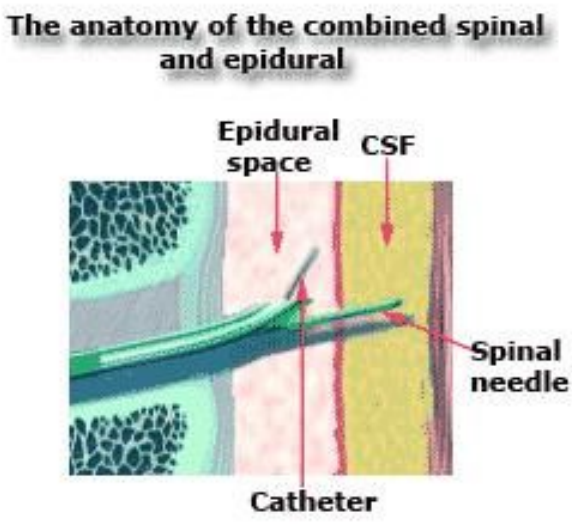


Fig 5. Depiction of CSE- needle through needle technique(Image courtesy: frca.co.uk)

Hence in recent days a new technique is gradually becoming very popular after 1987. In 1981,Brownridge suggested the application of CSE in LSCS.In 1984,Carrie described the method of needle through needle technique. This method combines the advantages of both spinal and epidural techniques.There are several methods in performing CSE.

Single pass method – not used nowadays
Needle through needle
Needle through needle with backeye
Needle through needle with a locking device – method used in this study

Fig 6.Portex combined spinal epidural needle set (Image courtesy: portexsafety.com)

Fig 7. Tip of CSE needle through needle set(Image courtesy: weiku.com)

Two needles through two different interspaces
Two needles through the same interspace
Combined needles

Here the technique is performed by using a needle through needle method i.e first epidural space is identified by using an epidural needle then in the same space a smaller gauge spinal needle is inserted through the epidural needle, after the flow of CSF is seen, subarachnoid blockade is given following which the spinal needle is removed and epidural catheter is inserted through the same space. The major advantage of this technique is the amount of local anaesthetic given spinally can be reduced by 50-55% of normal amount but the desired level can be achieved by giving either normal saline(pressure effect) or local anaesthetic through the epidural catheter. Minimal amount of opioid additives can be used intrathecallyto improve the quality of blockade without any adverse effects to the fetus in uterus. As the amount of local anaesthetic used for spinal anaesthesia is reduced to half, most deleterious adverse effects like hypotension and unwanted prolonged motor blockade can be avoided[3].

Other advantages of this newer methods are

1. Failure rate is almost nil because even if one method fails we can stil provide adequate operative anaesthesia through the other method.
2. Generally pregnant women will be slightly edematous and obese when compared with normal ones, hence this strong epidural needle acts

DISADVANTAGES OF COMBINED SPINAL EPIDURAL TECHNIQUE[2]

1. Technically difficult
2. Increased incidence of accidental postdural puncture headache
3. Not suitable for emergency situations

CONTRAINDICATIONS FOR REGIONALANAESTHESIA[2]

Patients refusal (The absolute contraindication) Skin or soft tissue infection at the site of entry Intrinsic and idiopathic coagulapathy Patients on anticoagulant treatment Stenotic Cardiac lesions (Mitral stenosis , Aortic stenosis) Raised intracranial tension expiratory pressure was seen in pregnant women given lignocaine during cesarean section than when bupivacaine is given.

Usually inspiratory muscles which are active in respiration are not affected by spinal blockade in normal patients. Passive expiratory muscles are more commonly involved. Hence caution should be there while giving neuraxial blockade in a respiratory compromised patients.

NEURAXIAL FENTANYL

Intrathecal fentanyl produces rapid and intense analgesia, it has been used for labor analgesia and as an adjuvant to local anaesthetic for LSCS and other lower limb surgeries done under spinal anaesthesia. It improves the quality of spinal blockade . The maximal analgesic benefit is achieved with 25mcg of intrathecal fentanyl. This small intrathecal dose caries less side effects and can be used safely.

ADVERSE EFFECTS[2,4]

1. Pruritis
2. Nausea and vomiting
3. Urinary retention
4. Respiratory depression (in high doses)
5. Sedation
6. CNS excitation
7. Viral reactivation
8. Sexual and ocular dysfunction
9. Thermoregulatory dysfunction
10. Water retention

LOCAL ANAESTHETIC DOSE REQUIREMENTS IN PREGNANCY[5]:

Local anaesthetic dose requirement is 25% lower in pregnant women compared to non pregnant patients. Factors responsible for this reduced dose requirement are:

1. Decrease in CSF volume in Lumbosacral region due to inferior vena cava compression by the gravid uterus and diversion of blood flow through the collateral vertebral venous plexus.
2. Increase in neural sensitivity to local anaesthetics due to CSF alkalosis, increased progesterone levels and increase in the endorphin levels in the blood.
3. Exaggerated lumbar lordosis producing a natural head down tilt in lateral position makes the local anaesthetic spread favourably in cephalad direction.

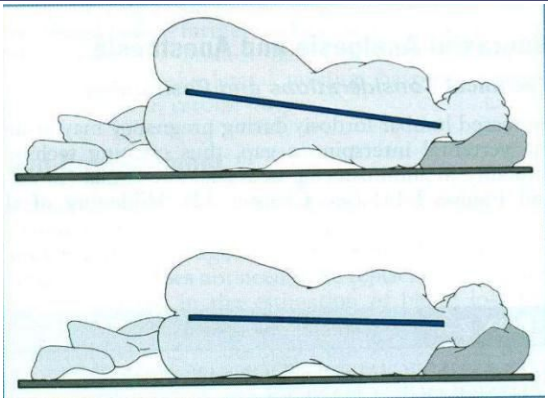


Fig 10. Head down tilt of vertebral column in lateral position in comparison to normal(Image courtesy: quizlet.com)

4. Apex of the thoracic kyphosis is at a higher level during pregnancy.

Inspite of all these above mentioned factors, the epidural dosage requirements remain the same both in pregnant and non pregnant women.

Pharmacokinetics and pharmacodynamics of bupivacaine are not altered during pregnancy, because the bound and unbound fractions remain the same[1].

MATERIALS AND METHODS

This study was conducted at the Institute of obstetrics and gynecology, Madras medical college, Egmore, Chennai, for a period of three months, on 60 parturients of ASA physical status I and II posted for elective cesarean section.

This study was performed after getting approval from Ethics committee, Madras Medical College and on obtaining written informed consent from all the parturients subjected to this study.

STUDY DESIGN

Prospective, randomized controlled study.

GROUPS

The parturients were randomly divided into 2 groups (group C and group E), each containing 30 subjects.

GROUP C

Parturients allotted to this group received 10mg(2mL) of 0.5% hyperbaric bupivacaine along with 25mcg of fentanyl intrathecally.

GROUP E

Parturients allotted to this group received 5mg(1mL) of 0.5% hyperbaric bupivacaine along with 25mcg of fentanyl intrathecally, followed by 6mL of normal saline injected into the epidural space via epidural catheter.

CASE SELECTION

INCLUSION CRITERIA

Age : 18years to 35years
ASA : I,II
Surgery : Elective lower segment cesarean section
Who have given written informed consent

EXCLUSION CRITERIA

Patients younger than 16 years of age
Patients with pregnancy induced hypertension
Patients with gestational age < 36 wks
Patients in active labour and other emergency situations
Patients with contraindications for regional anaesthesia**PRE**

ANAESTHETIC EVALUATION

Pregnant women selected for this study were evaluated thoroughly .

HISTORY

Any previous surgeries in the past
Any associated comorbid illnesses
Any drug allergies
Any complications during previous pregnancies

These information were obtained from the pregnant women in both groups.

EXAMINATION

General condition
Height, weight
Vital parameters- BP, PR, SpO2
Systemic examination- CVS, RS, CNS, Abdomen and spine
Airway assessment

INVESTIGATIONS

Complete blood count
Hemoglobin concentration
Renal function test
#blood urea
#serum creatinine
serum electrolytes Random blood sugar Urine routine

Bleeding time, Clotting time Blood grouping and Typing Electrocardiogram

Patients who satisfied the inclusion criteria were included in the study after explaining the procedure and nature of the study.

Written informed consent were obtained from all the parturients in their own language.

PATIENT PREPARATION

After the assessment of the parturient, under strict aseptic precautions, an 18 G intravenous cannula was started in the waiting room.

Parturients were premedicated with inj. Metoclopramide 10 mg IV and inj. Ranitidine 50 mg IV half an hour before surgery.

Parturients were kept in the left lateral position and shifted to the operation theatre. All parturients were pre loaded with 500mL of normal saline over a period of 15 minutes.

Baseline vitals such as blood pressure, pulse rate, oxygen saturation and fetal heart sounds were noted.

EQUIPMENTS

Autoclaved Spinal tray has been arranged with the following equipments for performing the combined spinal epidural technique.

1. 18 G hypodermic needle
2. 22 G hypodermic needle
3. 27 G spinal needle
4. 18 G epidural needle
5. 20 G epidural catheter
6. 2mL syringe
7. 5mL syringe
8. 5mL loss of resistance (LOR) syringe
9. Skin drape
10. Swabs
11. Chlorhexidine skin preparation solution
12. Betadine skin preparation solution
13. Sponge holding forceps

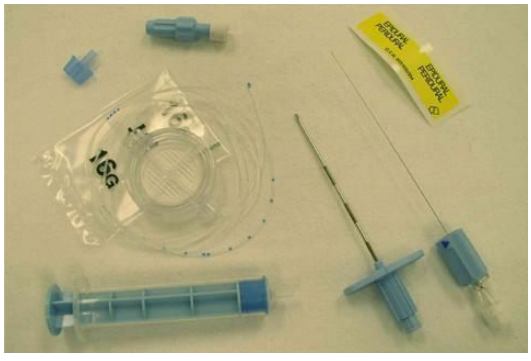


Fig 11. Combined spinal epidural

DRUGS

1. 2% lignocaine solution for local infiltration
2. 0.5% hyperbaric bupivacaine
3. Fentanyl

PROCEDURE

The parturients were positioned laterally on a horizontal operating table. The back of the parturients was painted with betadine solution followed by chlorhexidine solution and finally wiped clean with dry gauze.

The painted area was draped with a sterile towel. L3-L4 interspace was identified and infiltrated with local anaesthetic (2mL of 2% lignocaine). Combined spinal epidural technique was planned to perform by needle through needle technique.18G epidural needle was inserted into L3-L4 space and epidural space was identified by the loss of resistance technique to air using an LOR syringe.

After the identification of epidural space, epidural needle is kept in position and 27 G spinal needle was inserted into the epidural needle reaching into the subarachnoid space ,then locked with the epidural needle at its provision for locking. After the free flow of CSF from the spinal needle, 0.5% hyperbaric bupivacaine (1ml, 2ml each according to their allocated group) was injected at a rate of 0.2ml/second.

Following which the spinal needle was unlocked and removed, epidural catheter was threaded into the same L3-L4 interspace through the epidural needle into the epidural space and tip placed 5cm in cephalad direction. Epidural catheter was well secured with tapes.

The parturients were immediately turned on their back to supine position and a wedge is placed on the right side under gluteal region. For parturients allotted to group E, 6ml of 0.9% normal saline given through the epidural catheter at the 5th minute of administration of spinal blockade. Parturients were given 6 liters of oxygen through hudson's face mask till the delivery of the baby. Necessary observations were noted.

PRIMARY OUTCOME MEASURES

VITAL SIGNS

Systolic and diastolic blood pressure, pulse rate, SpO2 were recorded for every 5 minutes for the first 30 mins , then every 10 mins for a period of upto 2 hours both intraoperatively and post operatively.

Hypotension is defined as fall in systolic blood pressure of more than 20% from the baseline values.

A heart rate of less than 60 beats/min defines Bradycardia Parturientswho develop hypotension will be managed with bolus fluid administration and inj Ephedrine in 6mg increments intravenously.

Parturients who develop Bradycardia will be treated with inj.atropine intravenously.

SENSORY BLOCKADE

Sensory blockade level was assessed every 15 minutes from the 5th minute of the initiation of spinal blockade by using loss of pin prick sensation in both groups.

MOTOR BLOCKADE

Motor blockade was assessed using Bromage scale.

Grade	Criteria	Degree of Block
I	Free movement of legs and feet	Nil (0%)
II	Just able to flex knees with free movement of Feet	Partial (33%)
III	Unable to flex knees, but with free movement of Feet	AlmostComplete (66%)
IV	Unable to move legs or feet	Complete (100%)

SECONDARY OUTCOME MEASURES

NEONATAL APGAR SCORE

	Signs	0 Points	1 Point	2 points
A	Activity (Muscle Tone)	Absent	Arms and Legs Flexed	Active Movement
P	Pulse	Absent	Below 100 bpm	Above 100 bpm
G	Grimace (Reflex Irritability)	No Response	Grimace	Sneeze, cough, pulls away
A	Appearance (Skin Color)	Blue-gray, pale all over	Normal, except for extremities	Normal over entire body
R	Respiration	Absent	Slow, irregular	Good, crying

INCIDENCE OF COMPLICATIONS

Apart from hypotension, other complications such as nausea and vomiting, breakthrough pain intraoperatively were measured and compared between both the groups.

In case of breakthrough pain, analgesic supplementation was given with inj.pentazocine 0.5mg/kg IV. If not subsided, conversion to General Anaesthesia to be considered.

QUALITY OF SURGICAL ANAESTHESIA

Adequacy of muscle relaxation during the surgery in both groups were enquired from the surgeons.

OBSERVATION AND RESULTS

The study was conducted at Institute of Obstetrics and Gynaecology, Madras Medical College, Egmore. 60 parturients were enrolled in this prospective randomized study. The parturients were divided into 2 groups. Parturients in group E received 5mg of 0.5% hyperbaric bupivacaine plus 25mcg of fentanyl intrathecally followed by epidural volume extension with 6mL of normal saline through the epidural catheter. Parturients in group C received 10mg of 0.5% hyperbaric bupivacaine plus 25mcg of fentanyl intrathecally

STATISTICAL ANALYSIS

Statistical analysis was done using SPSS software version 17.0.

If the P value is 0.000 to 0.010, it implies Highly significant
If the P value is 0.011 to 0.050, it implies significant
If the P value is 0.051 to 1.000 it implies Not Significant

DEMOGRAPHIC DATA

The two groups were comparable in respect to their age, weight and height. There was no statistical difference between the two groups.

Table 1. comparison of age, weight and height among the group C and group E

	Group	N	Mean	Std. Deviation	P value
Age in years	C	30	25.73	2.612	0.213
	E	30	24.80	3.112	
Weight	C	30	66.87	7.333	0.376
	E	30	64.97	9.076	
Height	C	30	159.90	5.598	0.153
	E	30	157.67	6.315	

Here the P values are greater than 0.05, hence the difference between age, weight and height of two groups are not significant.

BASELINE SYSTOLIC BLOOD PRESSURE

Baseline systolic blood pressure of both groups were comparable.

There was no statistically significant difference between the two groups

(P 0.137)

COMPARISON OF SYSTOLIC BLOOD PRESSURE AT VARIOUS INTERVALS AFTER THE INITATION OF BLOCKADE

The systolic blood pressure between the two groups at 5th,10th,and 15th minutes after the administration of allotted amount of drugs for both group C and group E were found to be comparable.The P values respectively at 5th,10thand 15thminutes were 0.896, 0.299,0.287 . Hence the systolic blood pressure between the two groups were not statistically significant upto the 15th min after the initiation of blockade.

Table 2. Comparison of systolic blood pressure at various intervals between the two groups

Following table shows the changes in SBP between two groups at various intervals.

	Group	N	Mean	Std. Deviation	Std. Error Mean	P value

SBP Baseline	C	30	124.17	4.857	.887	.137
	E	30	120.80	11.238	2.052	
SBP.5	C	30	114.87	5.532	1.010	.896
	E	30	114.57	11.212	2.047	
SBP.10	C	30	108.50	5.619	1.026	.299
	E	30	106.07	11.414	2.084	
SBP.15	C	30	102.37	6.145	1.122	.287
	E	30	104.83	10.980	2.005	
SBP.20	C	30	97.03	7.228	1.320	.001
	E	30	104.47	9.612	1.755	
SBP.25	C	30	93.70	8.318	1.519	.000
	E	30	103.90	10.571	1.930	
SBP.30	C	30	97.30	7.382	1.348	.002
	E	30	103.80	7.980	1.457	
SBP.40	C	30	101.70	7.363	1.344	.012
	E	30	107.07	8.670	1.583	
SBP.50	C	30	105.17	6.968	1.272	.062
	E	30	108.83	7.914	1.445	
SBP.60	C	30	108.03	4.923	.899	.063
	E	30	111.37	8.294	1.514	
SBP.90	C	30	110.60	3.490	.637	.063
	E	30	113.37	7.175	1.310	

Systolic blood pressures from the 20th minute after the initiation of blockade were found to be significantly different between the two groups. When analysed it has been found that the systolic blood pressure in group C ,were significantly lower than that of group E from 20th minute to 40th minute after the initiation of blockade. The P values respectively were 0.001, <0.001, 0.002, 0.012 at 20th, 25th ,30th, 40th minutes.

After the 40th minute, there were no significant difference in the systolic blood pressure measured between the two groups. The values were comparable, the P values respectively were 0.062, 0.063, 0.063 at 50th, 60th, 90th minutes.

Thus the above table shows that significant difference in the systolic blood pressure exists between the groups from 20th to 40th minutes after the initiation of respective blockade in both groups.

COMPARISON OF DIASTOLIC BLOOD PRESSURE

Diastolic blood pressure between the two groups were found to be comparable in the baseline values and also at various intervals during the study. Diastolic blood pressure between the groups were not statistically different. Hence they were comparable.

Table 3. Comparison of diastolic blood pressure at various intervals between the 2 groups

The following table shows the diastolic blood pressure at various intervals in both groups

	Group	N	Mean	Std. Deviation	Std. Error Mean	
DBP Baseline	C	30	76.47	5.419	.989	.864
	E	30	76.83	10.373	1.894	
DBP.5	C	30	72.27	5.258	.960	.100
	E	30	69.40	7.766	1.418	
DBP.10	C	30	67.73	5.152	.941	.324
	E	30	65.43	11.563	2.111	
DBP.15	C	30	64.57	4.911	.897	.171
	E	30	61.60	10.656	1.946	
DBP.20	C	30	61.07	4.593	.839	.858
	E	30	61.43	10.183	1.859	
DBP.25	C	30	58.97	4.716	.861	.831
	E	30	58.53	10.037	1.832	
DBP.30	C	30	59.63	3.518	.642	.407
	E	30	58.07	9.645	1.761	
DBP.40	C	30	60.50	3.712	.678	.744
	E	30	61.13	9.906	1.808	
DBP.50	C	30	63.30	3.771	.688	.298
	E	30	65.57	11.196	2.044	

There were no significant difference in the diastolic blood pressure measured between the two groups. The P values measured at all the intervals were >0.05, hence we found that the diastolic blood pressure values were not statistically significant at any point during the study.

EPHEDRINE CONSUMPTION

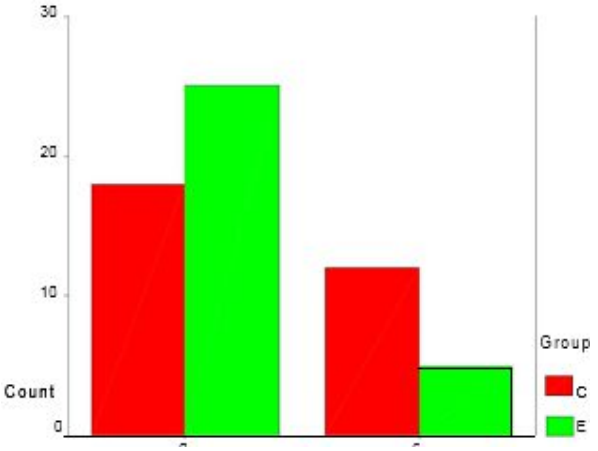
Ephedrine, the amount of ephedrine consumed during study was compared between the two groups.

Out of total 60 parturients under study, ephedrine consumption (6mg) were found in more number of parturients in group C (n=12) than parturients in group E (n=5). Hence with a P value of 0.042, significant difference was found in consumption of ephedrine between two groups.

Table 4. Comparison of ephedrine consumption between the 2 groups

			Group		Total	P value
			C	E		0.043
Ephedrine Consumption	0	Count	18	25	43	
		% within Ephedrine Consumption	41.9%	58.1%	100.0%	
		% within Group	60.0%	83.3%	71.7%	
	6	Count	12	5	17	
		% within Ephedrine Consumption	70.6%	29.4%	100.0%	
		% within Group	40.0%	16.7%	28.3%	
Total		Count	30	30	60	
		% within Ephedrine Consumption	50.0%	50.0%	100.0%	
		% within Group	100.0%	100.0%	100.0%	

The above table shows the comparison of ephedrine consumption between the two groups.



Ephedrine Consumption

Fig:12 Ephedrine consumption between two groups.

Requirement of ephedrine to treat hypotension is seen in more number of group C than in group E parturients.

COMPARISON OF PULSE RATE AND DURATION OF STUDY

On comparison pulse rate between the two groups at various intervals during the study did not have much difference in their values. They were comparable. Duration of the surgery in both the groups were found to be similar.

Table 5. Comparison of duration of surgery between the 2 groups

	Group	N	Mean	Std. Deviation	Std. Error Mean	P value
Durati on	C	30	60.67	4.498	.821	0.111
	E	30	58.17	7.130	1.302	

Hence from the P value obtained was 0.111, duration of the surgery between the two groups was not statistically significant.

COMPARISON OF SENSORY BLOCKADE

Level of Sensory blockade after the procedure had variety of observations at various intervals of time . Maximal level of sensory blockade (T4) achieved in both groups were similar. Time at which the maximal sensory blockade achieved (5-10 mins) in both groups were also of not much significance. Level of sensory blockade were checked every 15mins for a total of about 2 hrs.

Table 6. Comparison of Sensory blockade at various intervals after blockade between the two groups

Duration in mins		T4 Number of	T5 parturients	T6 at	T7 Various	T8 Study	T9 Intervals
SB 5th	C	30		0			
	E	26		4			
SB 15th	C	30					
	E	30					
SB 30th	C	18	10	2			
	E	28	0	2			
SB 45th	C	0	6	14	9	1	
	E	12	6	11	1	0	
SB 60th	C			2	8	11	9
	E			6	11	8	5

Duration in mins		T8	T9	T10	T11	T12	L1	L2	L3
SB 90	C	2	6	8	14	0			
	E	0	4	8	8	10			
SB 120	C			2	5	10	13	0	0
	E			0	0	3	9	9	9

According to the above table, regression of sensory blockade level below T8, were noticed after 60 minutes post procedure in both group C and group E. Between the two groups,the number of parturientswhose sensory level regressed below T8,were more in group E than in group C. Hence as a whole the maximal level of sensory blockade achieved, time at which the maximal level is reached and progressive regression of sensory blockade levels at various intervals were not much significant between the two groups.

COMPARISON OF TIME FOR FIRST ANALGESIC REQUIREMENT AFTER SURGERY

Time at which the patient needed the first analgesic dose after the cesareansection is compared between the two groups. The following table suggests that the time for first analgesic requirement did not statistically differ between the two groups.

Table 7.comparison of time of first analgesic requirement after surgery between two groups

	Group	N	Mean	Std. Deviation	Std. Error Mean	P value
Time of 1st C AnalgesicRequirement after Surgery		30	155.17	6.884	1.257	0.078
	E	30	149.67	15.309	2.795	

The P value obtained in comparison of both groups is 0.078, hence it is not statistically significant.

COMPARISON OF MOTOR BLOCKADE

Motor blockade was measured using the modified Bromage scores ranging from 4 to 1. Maximum motor blockade achieved in both groups were 4, the time to attain the maximum motor blockade and time of motor blockade regression were compared between both groups. Motor blockade scoring is checked every 15 min upto a maximum of 2 hrs.

At 5th min after the initiation of blockade, all parturients in both groups attained the maximum level of blockade. They were not significantly different.

At 15th min after the initiation of blockade, no change in the level of blockade is noted in both groups. Hence there is no significant difference between them.

Table 8.comparison of motor blockade scoring between two groups from 5th min to 30th min (Bromage scoring of motor blockade)

Duration in mins	Groups	4	3	2	1
MB 5TH	C	30	_	_	_
	E	30	_	_	_

MB 15TH	C	30		_	_	_
	E	30		_	_	_
MB 30TH	C	30		_	_	_
	E	20	10		_	_

At 30thmin , motor blockade level begins to regress in group E, but group C remains in the maximal level of blockade. significant difference is observed with P value of <0.001 (highly significant).

From 45th min, regression of motor blockade level begins in group C also, but the speed of motor recovery is more faster in group E than in group C. P value is 0.009, hence the differences are statistically significant.

Table 9. comparison of motor blockade between 2 groups from 45th min to 120th min

Duration in mins	Group	4	3	2	1
MB 45TH	C	13	17	_	_
	E	5	25	_	_

MB 60TH	C	1	29		_	_
	E	_	13	17		_
MB 90TH	C	_	29	1		_
	E	_	1	16		13
MB 120TH	C	_	18	12		_
	E	_	_	2		28

So at 120th min observation, nearly all parturients in group E (n=28) has reached the lowest level of motor blockade scoring, whereas none of the parturients in group C has reached the lowest score of 1. Differences between both groups in motor blockade regression was found to be highly significant with a P value of <0.001.

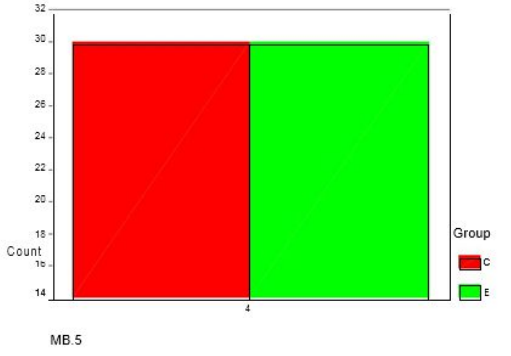


Fig .13 Motor blockade (Bromage 4) at 5th minute of the two groups

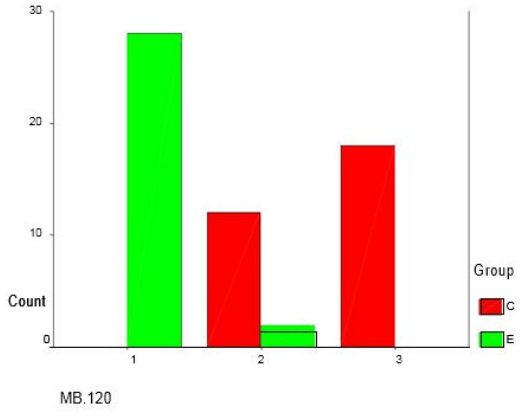


Fig .14 Bromage scores 1,2,3 at 120th minute in the two groups

NEONATAL SCORES COMPARISON

Neonatal scores between the two groups were compared by calculating the mean of APGAR scores measured at 1st and 5th min of life. P value obtained were 0.087, which denotes that the difference in the neonatal scores between the two groups was not significantly different.

Table 10.comparison of neonatal scores between the two groups

			Group		Total	P value
			C	E		0.087
Neonatal Scores	7	Count	7	12	19	
		% within Neonatal Scores	36.8%	63.2%	100.0%	
		% within Group	23.3%	40.4%	31.7%	
	8	Count	17	17	34	
		% within Neonatal Scores	50.0%	50.0%	100.0%	
		% within Group	56.7%	56.7%	56.7%	
	9	Count	6	1	7	
		% within Neonatal Scores	85.7%	14.3%	100.0%	
		% within Group	20.0%	3.3%	11.7%	
Total		Count	30	30	60	
		% within Neonatal Scores	50.0%	50.0%	100.0%	
		% within Group	100.0%	100.0%	100.0%	

Neonatal scores of all parturients in both groups were comparable.

OTHER VARIABLES

Complications such as nausea and vomiting, breakthrough pain were not seen in any of the patients in both group C and group E. There was no need of any analgesic supplementation for any of the parturients in both groups intraoperatively. The quality of muscle relaxation during surgery were rated by Surgeons as good for all the parturients in both groups. All these variables had been found to have no statistically significant difference between the group C and group E.

DISCUSSION

Nowadays cesarean section has become a preferred mode of delivery for some pregnant women. That too elective cesarean section for the safe and painless delivery has gained more attraction. Similarly the anaesthetic techniques in practice for cesarean section had also improvised a lot from olden days and it is continuing.

Among the various techniques practiced routinely in the society, spinal anaesthesia is considered to be the safest and most versatile technique. Here the patient can communicate and enjoy the birth of their baby.

The rapid onset and dense blockade made this technique a favourable one even during some of the emergency situations. But the sudden hypotension occurring after the spinal blockade, resulting in decrement of uteroplacental blood flow can be deleterious to the fetus inside uterus. As the uteroplacental circulation lacks Autoregulation, they are highly susceptible to the changes in the maternal circulation. Moreover the motor blockade occurring during spinal anaesthesia, remains for more than 3 hrs, making the newborn mother immmobilised. This may make them feel uncomfortable while feeding the baby .

Epidural anaesthesia for cesarean delivery,has certain advantages like lower incidence of hypotension and early mobility it has got more disadvantages which made their popularity to decline in its application for cesarean delivery. Some of the disadvantages are catheter related problems, quality of anaesthesia is inadequate, patchy blockade, increased chances for local anaesthetic toxicity due to administration of larger doses of drugs epidurally, not preferred in emergency situations.

Further advancements had let to the beginning of a newer technique , which was introduced by brownfield in 1981 combining both both spinal and epidural methods. This combined spinal epidural technique had the advantages of both the techniques. Presence of an Epidural catheter allows smaller dose of intrathecal Localanaesthetic to be given. This results in less incidence of hypotension, at the same time rapid onset of anaesthesia. If anaesthesia level seems to be inadequate , Local anaesthetic can be supplemented epidurally.

As there is decreased incidence of hypotension and provision for post operative pain relief, CSE is a more suitable technique in pregnant patients with associated cardiac conditions. Due to the advancements in all fields of medicine, now more and more women with congenital cardiac illnesses were able to overcome all the physiological changes in pregnancy and coming for a safe confinement. Hence this technique is a boon in the practice of obstetric anaesthesia.

In this study we evaluate the effects of epidural volume extension using Normal saline through the epidural catheter after the administration of low dose intrathecal bupivacaine in providing adequate sensory blockade with less incidence of hypotension and a faster motor recovery.

Parturients of ASA I and ASA II Physical status are included in this study. Age, height and weight of pregnant women involved in this were comparable. Duration of the procedure, time from spinal blockade to supine positioning of the patient, and duration of the surgery were identical among both groups.

Baseline values of systolic and diastolic blood pressure, pulse rate, SpO2 were similar between both groups. Before the procedure all these patients were preloaded with 500ml of normal saline over a period of 15 mins.

Parturients in Group C received 10mg of hyperbaric bupivacaine 0.5% along with 25mcg fentanyl intrathecally without any epidural volume extension. Parturients in Group E received only 5mg of hyperbaric bupivacaine 0.5% along with 25mcg fentanyl intrathecally with 6ml of normal saline given through epidural catheter as epidural volume extension.

HEMODYNAMIC CHANGES

The term hypotension is defined as decrease in systolic blood pressure of more than 20% from the baseline values.

A pulse rate of less than 60 beats /min is termed as bradycardia.

In 2006, a study conducted by Choi DH et al[13] , states that incidence of hypotension is lower in low dose combined spinal epidural than single shot spinal anaesthesia. In this study 10ml of 0.25% bupivacaine was given epidurally. In our study we have given 6ml of normal saline epidurally after a low dose intrathecal local anaesthetic (bupivacaine).

In the above mentioned study, lower incidence of hypotension was seen even with epidural administration of 0.25% bupivacaine, In our study also, there is a less incidence of hypotension in Parturients who received EVE in CSE compared to parturients who received only intrathecal local anaesthetic . The findings in our study was supported by this study .

Time of First Analgesic Requirement Postoperatively

Time of first analgesic requirement indirectly measures the time taken for the regression of sensory blockade level completely and when the patients starts to perceive surgical pain postoperatively. Our study shows that there is no siginificant difference between the time for first analgesic requirement between the two groups.

These results were supported by the study conducted by Lew E et al[18], where he found that the time taken for regression of sensory blockade between the two groups were similar.

SUMMARY

This prospective randomized study was conducted in institute of obstetrics and gynecology, Madras Medical College, Chennai.

60 term parturients were enrolled in the study and were randomly allocated into one of the 2 groups comprising 30 in each.

One group received epidural volume extension with 6mL of normal saline along with 5mg of 0.5% hyperbaric bupivacaine plus 25 mcg fentanyland the other group received only spinal anesthesia with 10mg of 0.5% hyperbaric bupivacaine plus 25 mcg fentanyl.

Haemodynamics, peak sensory block height, time of regression of

sensory blockade, degree and duration of motor blockade, ephedrine consumption, neonatal scores, nausea, vomiting, time to first analgesic supplement required were noted and compared between the two groups.

Results were statistically analysed using SPSS software version 17.0.

Our study results show that the technique of epidural volume extension results in reduced dose requirement(upto 50% reduction) of intrathecal local anaesthetic to obtain the same level of sensory blockade as that of single shot spinal anaesthesia, maintenance of stable haemodynamics, earlier regression of motor blockade which helps in earlier ambulation of the postpartum women.

Neonatal APGAR scores, time to requirement of first analgesic supplementation, nausea and vomiting were not significantly different between the two groups.Hence Epidural volume extension in combined spinal epidural anaesthesia is a safe and viable alternative to routine single shot spinal anaesthesia for elective cesarean section.

CONCLUSION

It is concluded that epidural volume extension with normal saline in combined spinal epidural anaesthesia provides a hemodynamically stable anaesthesia with reduced duration of motor blockade without compromising the duration and quality of anaesthesia and with no adverse fetal effects, for elective cesarean section. These benefits are obtainable at a reduced dose of intrathecal local anaesthetic.

PROFORMA

IP NO: OBS H/O:
NAME: OBS PROC:
AGE: WT: kgs HT: cms

COMORBIDITIES : HT/DM/ASTHMA/EPILEPSY/OTHERS
ASAPS: I/II

PREOP VITALS : PR-/minBP- mmhg
Sp02- IVF-

PROCEDURE: SAB / CSE

DETAILS:

EVENTS	TIME	BP mmhg	PR/min	IVF NS/RL	LEVEL OF BLOCKADE	
					SENSORY	MOTOR {mod.bromage scale)

NEONATAL SCORES: Apgar
NAUSEA/VOMINTING: YES/NO
EPHEDRINE CONSUMPTION : YES/NO, if Yes_____mg/dl
BREAKTHROUGH PAIN: YES/NO
ANALGESIC SUPPLEMENTATION: YES/NO, if yes

SENSORY LEVEL AT 1hr_____, 11/2hr_____, 2hr_____post op.

MOTOR LEVEL AT 1hr_____, 11/2hr_____, 2hr_____post op.

TIME OF FIRST ANALGESIC REQUIREMENT _____hrs after surgery.

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