Original Research Paper

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THE INFLUENCE OF INTRATHECAL FENTANYL ON THE CHARACTERISTICS OF SUBARACHNOID BLOCK FOR EMERGENCY CAESAREAN SECTION- A RANDOMIZED CONTROLLED TRIAL

Dr.S.Loganathan M.D, Senior assistant professor, Department of Anaesthesiology, Government theni medical college, Theni, Tamilnadu.

ABSTRACT

Background: Neuraxial opioids augmenting the analgesia produced by local anaesthetics due to synergistic action and binding directly to opiate receptors.Aim of this study is to compare the influence of intrathecal fentanyl in providing onset of analgesia,muscle relaxation,Quality of surgical anaesthesia,regression time to T12,period of effective analgesia and side effects in emergency caesarean section.

Materials and Methods: This randomized controlled trial conducted among 60 pregnant patients belonging to ASA physical status I in the age of 20-37 years, weight from 51-70kg and height from 140-160cm. Group I patients (study group) received subarachnoid injection of Inj.Fentany1 citrate 15 mg (0.3ml of preservation free drug) along with 2 ml of 0.5% Hyperbaric Bupivacaine over a period of 10 seconds.Group II patient (control group) received subarachnoid injection of 2ml of 0.5% Hyperbaric Bupivacaine along with 0.3 ml of normal saline over a perod of 10 seconds.

Results: The age,height,weight were similar in both groups. Onset anaigesia is faster in gr I ($P<0.01$). Quality of anaesthesia and muscle relaxation were excellent in gr I.Regression to T12 and duration of analgesia is statistically significant in group I. Side effects were similar in both groups.

Conclusion: In this study, it is inferred that addition of 15mg Fentany1 to 2ml of 0.5% Hyperbaric Bupivacaine intrathecally provides a better anaesthesia and analgesia than bupivacaine alone in caesarean section without increasing significant maternal and fetal side effects.

KEYWORDS : Fentanyl citrate, Hyberbaric Bupivacaine, Dermatome level, Analgesia.

BACKGROUND:

Pain is an emergency for the person who experiences it, regardless of the urgency of the pathology underlying. We must apply the science and art of pain relief as though life depended upon it, certainly the quality of life does.

International Association for the study of pain defines, PAIN is "an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage."[1]

The use of neuraxial opioids has increased dramatically in recent years, augmenting the analgesia produced by local anaesthetics due to synergistic action and binding directly to opiate receptors.[2,3]

After the advent of newer lipophilic groups like Fentanyl, Alfentanil, Sufentanil, etc., the quality of pain relief has improved with lesser side effects. Fentayl citrate with its high lipophilicity, early fixation and intermediate duration of action brings a new era in improving the quality of intra operative surgical anaesthesia as well as effective post-operative analgesia.[4,5] Small doses of opioids administered in the subarachnoid space provides profound and prolonged analgesia without significant systemic side effects.[6,7]

The unique feature of spinal opioid analgesia is the lack of sensory, sympathetic or motor blockade which allows the patient to ambulate even without the risk of orthostatic hypotension or motor incoordination which usually occurs with the local anaethetics administered epidurally or opiods administered parenterally. For the above reasons spinal opioids along with local anaesthetics give a better intraoperative & postoperative analgesia than local anaesthetics along.[8]

Bupivacaine is an amide type of local anaesthetic agent. It is the longest acting local anaesthetic knowm. It has a lipophilic and a hydrophilic portion connected by an amide linkage. It is a butylpiperidine derivative.[9] Biodegradation of bupivacaine takes place in the liver by N-dealkylation. The metabolite pipecolyloxylidine is excreted in the urine. Less than 2% of the drug is excreted unchanged in the urine. The rate of clearance is dependent on hepatic blood flow and drug extraction by the liver.[10]

AIM OF THE STUDY:

A. To compare the effect of intrathecal fentanyl added to bupivacaine with that of intrathecal bupivacaine alone in providing,
   1.Onset time
   2.Muscle relaxation
   3.Quality of surgical anaesthesia in emergency caesarean section.
B. To study the influence of fentanyl on the
   1.Regression time to T_{12}.
   2.The period of effective analgesia.
C. To compare the incidence of side effects in both the groups.

MATERIALS & METHODS:

The present study was conducted at emergency operation theatre, Government Theni Medical College Hospital,Theni between June 2016 and May 2017.

Patients undergoing emergency lower segment caesarean section were taken up for this study. Studies were carried out on 60 patients in 2 groups of 30 each. The study was approved by the ethics committee of the Hospital. Patients with ASA physical status I were taken up for this study. Patients with any other systemic illness were not taken up for the study.

Age of the patients ranged from 20-37 years and weight from 51-70 kgs and height from 140-160cms.

An initial preoperative counseling and reassurance to gain the confidence of the patient was done. The emotional component of pain is thereby minimized. Informed consent was obtained from the patient after explaining the procedure.

In the immediate preoperative assessment after thorough systemic examination basic date like pulse rate, blood pressure, basic inverstigations like haemoglobin percentage and urine analysis for albumin and sugar were collected.

Patients were enquired about starvation. Duration of starvation in this study ranged between 6-8 hours.

The patients were specifically instructed to inform immediately if they experienced pain or discomfort during the intra and postoperative period.

No premedication was given to these patients.
An 18 gauge intravenous cannula was started and all the patients were preloaded with 10-12 m1/kg of ringer lactate before the subarachnoid block.

Boyle's machine was checked and all the drugs for resuscitation and instruments for intubation were kept ready for usage if need arises.
The subjects were randomly divided into 2 groups of 30 each. The lumber puncture was performed in right lateral position with a 23G spinal needle through the L_{3-4} interspace under strict aseptic precautions.[11,12]

Group I patients (study group) received subarachnoid injection of Inj.Fentany1 citrate 15 mg (0.3ml of preservation free drug) along with 2 ml of 0.5% Hyperbaric Bupivacaine over a period of 10 seconds.

Group II patient (control group) received subarachnoid injection of 2ml of 0.5% Hyperbaric Bupivacaine along with 0.3 ml of normal saline over a period of 10 seconds.

After the subarachnoid injection the patients were put in supine position with the operation table horizontal and a wedge placed below the right buttock to provide a 15^0 left uterine tilt. The onset of analgesia was tested by gentle pin prick. The onset time to achieve a sensory loss upto T_4 level was noted. Oxygen 4 L/min was administered through a face mask.

A fall of systolic blood pressure below 100 mmHg or 20% from the baseline was taken as hypotension and was promptly treated with vasopressors and intravenous fluids. Bradycardia is said to be present if pulse rate was $\leq$ 60/min & was treated with Inj.Atropine sulphate.

Respiratory depression was taken into account if the respiratory rate went below 10 breaths/min or the oxygen saturation went below 90% and were given Assisted ventilation with 100% O_2.

To assess the quality of surgical anaesthesia scale proposed by Belzarena et al (1992) was used, which is

1. Excellent — There were no complaints from the patients at any time of surgery
2. Good — Mild discomfort
3. Regular — Minimal Pain
4. Poor — Severe discomfort or pain where the patients needs large doses of analgesics or GA had to be administered.

Muscle relaxation provided by the drug was assessed by the operating surgeon and the grade was given as

1. Excellent
2. Good
3. Poor

Neonatal well being was assessed by APGAR scores at 1 & 5 mins after delivery. They were also evaluated by the paediatricians on duty who were unaware of the study.

Time for regression of analgesia to pinprick below the T_{12} dermatome was considered the duration of anaesthesia provided by the subarachnoid injection. Duration of effective post operative analgesia was measured as the time between the administration of subarachnoid injection and first request for a supplemental analgesic by the patient.During the surgery the patients were observed for hypotension, bradycardia, respiratory depression, pruritus, nausea and vomiting.

Thereafter all the patients, were monitored for the next 12hrs and observed for any complications like respiratory depression, vomiting, pruritus, urinary retention, headache, etc.

The collected data was analysed with SPSS 16.0 version. Percentage analysis were used for categorical data and for continuous variables mean and SD were used.Chi square and student t test were used to find the significance. P value <0.01 was considered significant.

OBSERVATION AND RESULTS:

Of the 60 patients taken up for the study, 30 patients belonged to group I (15 mg of Fentany1 citrate + 2ml of 0.5% Hyperbaric Bupivacaine) and other 30 patients belonged to group II (2ml of 0.5% Hyperbaric Bupivacaine)

Age Distribution:

The range of ages in Group I was 20-35 yrs while in Group II it was 20-37 yrs.

Table-1 Age Of The Patients

AGE (IN YRS)	GROUP I	GROUP II
MINIMUM	20	20
MAXIMUM	35	37
MEAN	25.16	25.06

The distribution of ages were also similar in both the groups,

Height:

There was no statistically significant variation in mean height of patients in both the groups.

Table-2 Height Of The Patients

HEIGHT (in cm)	GROUP I	GROUP II
MINIMUM	144	140
MAXIMUM	160	158
MEAN	151.7	150.8

Weight : The mean weight was also statistically comparable in both the groups.

Table-3 Weight Of The Patients

WEIGHT (in kg)	GROUP I	GROUP II
MINIMUM	51	52
MAXIMUM	68	70
MEAN	59.5	60.2

Onset of analgesia to T_4 dermatome:

The range of onset of analgesia to T_4 level was variable in both the groups with 4-6.25 minutes in group I & 6.0 – 8.25 minutes in group II.

Table-4 Onset Of Analgesia To T_4 Dermatome Level

ONSET to T_4 (in min)	GROUP I	GROUP II
MINIMUM	4.0	6.0
MAXIMUM	6.25	8.25
MEAN	5.166	7.116
S.D	0.807	0.703

The mean duration of onset to T_4 level was 5.2 ± 0.80 minutes in group I and 7.1 ± 0.70 minutes in group II.

The value was statistically significant as detected by one tailed two sample 't' test.

Calculated 't' value 9.974.

Fentany1 treated group have a quicker onset of analgesia to T_4 level ($P<0.01$)

Quality of surgical Anaesthesia:

Table-5 Quality Of Surgical Anaesthesia

GRADES	GROUP I	GROUP II
I EXECELLENT	28 (93.3%)	19 (63.3%)
II GOOD	2 (6.6%)	11 (36.7%)
III REGULAR	-	-
IV POOR	-	-

The quality of intraoperative surgical anaesthesia was excellent in >90% of patients in Fentany1 treated groups compared to 63% in Bupivacaine group.

Muscle Relaxation:

Table-6 Muscle Relaxation

GRADES	GROUP I	GROUP II
I EXECELLENT	27 (90%)	11 (36.6%)
II GOOD	3 (10%)	19 (63.3%)
III POOR	-	-

90% Of fentany1 treated patients had excellent muscle relaxation as compared to 36% in the non treated patients.

Neonatal Outcome:

No abnormality in APGAR scoring was noted in neonates of both the groups. The scores at 1st minute & 5th minute after birth of all the neonate were 9 or 10. No drugs were required in neonatal resuscitation.

Regression time to T_{12} dermatome.

Table-7 Regression To T_{12} Dermatome

Reg. to T_{12} (in mins)	GROUP I	GROUP II
MINIMUM	170	128
MAXIMUM	210	174
MEAN	187.2	145.2
S.D.	9.87	13.02

The mean time for regression to T12 was 187.2 ± 0.87 mins. In Fentany1 group as compared to 145.2 ± 13.02 mins. In Bupivacaine group.

This was statistically significant as detected by one tailed two sample student's 't' test. ($P<0.01$)

Period of Effective analgesia:

Table-8 Period Of Effective Analgesia

Eff. Analgesia (in mins)	GROUP I	GROUP II
MINIMUM	220	150
MAXIMUM	260	200
MEAN	235.66	179.23
S.D	9.38	13.03

Fentany1 treated group (Group I) had a longer duration of effective analgesia.

The mean period of effective analgesia was 235.6 ± 9.38 mins. In group I and 179.2 ± 13.03 mins. In Group II.
This value has statistically significant as calculated by students' 't' test ($P<0.01$).

Side Effects:

The side effects in both the groups are tabulated below.

Table-9 Side Effects

SIDE EFFECTS	GROUP I	GROUP II
Hypotension	5	4
Nausea & Vomiting	3	-
Respiratory Depression	-	-
Pruritus	3	-
Headache	-	-
Bradycardia	-	-
Urinary retention	2	2

All the side effects were easily managed. The patients who had urinary retention even after 12 hrs were treated conservatively and they passed urine. Only one patient in group I needed catheterization due to failure of conventional methods.

DISCUSSION:

60 patients undergoing emergency caesarean section with physical status of ASA-I were taken up for this study. They were randomly allocated into 2 groups, 30 patients in each group. Variables like age, weight and height were standardized in both the groups.

Group I (study group) received 15mg (0.3ml) of Fentany1 citrate along with 2ml of 0.5% Hyperbaric Bupivacaine intrathecally –

Group II (contro group) received 2ml of 0.5% Hyperbaric Bupivacaine alone with 0.3ml of normal saline**.**

Anaesthetic Variables:

1. Onset time to achieve the level of T4 dermatome was earlier in Fentany1 treated group, 5.2±0.8 minutes as compared to Bupivacaine group, 7.1 ± 0.7 mins. This was proved statistically significant. ($P<0.01$).

   In a study conducted by B.RANDALLS, J.W.BROADWAY, D.A.BROWNE & M.MORGAN the onset time to T_4 level was 6.1 minutes in Group I who received 10mg of fentany1 along with 2.5ml of 0.5% Hyperbaric Bupivacaine compared to 7.9 minutes in Group II who received 2.5ml of 0.5% Hyperbaric Bupivacaine alone. Probably the earlier onset in our study may be due to 15 mg of Fentany1 used.[13,14]

2. **Intra operative study:**
   The quality of intra operative surgical anaesthesia was execellent in 93% of patients in Fentany1 treated group as compared to 63% in Bupivacaine group.
   90% of Fentany1 treated patients had excellent muscle relaxation, whereas 36% in Bupivacaine group.

   All the patients who received 2ml of 0.5% Hyperbaric Bupivacaine without Fentany1 were awake & calm. But Fentany1 treated group were comfortable & felt sleepy during the intraoperative period. But they were easily arousable.[15]

   SERGIO D.BELZARENA studied the quality of intraoperative surgical anesthesia & level of consciousness in patients undergoing caesarean section. The quality of surgical anaesthesia was execellent in 100% of Fentany1 (25mg) treated group as compared to <80% in 75% of patients were sleepy but in a state of easy arousal in treated group.

   The better quality of surgical anaesthesia, muscle relaxation & level of consciousness was achieved with 15mg of Fentany1 added to local anaesthetics with lesser side effects.[16,17]

3. Time of regression to T_{12} dermatome level
   Regression of anaesthesia to T12 dermatome took longer (187.2 ± 9.8 mins) in Fentany1 treated group as compared to 145.2 ± 13.0 mins) in Bupivacaine group. This was proved statistically significant.

   The results of our study goes in consistent with the study conducted by D.SHENDE, G.M.COOPER & M.I.VOWDEN. in their study the mean time for regression to T12 was 184 minutes in study group who received 15mg of Fentany1 along with 2.5ml of 0.5% Hyperbaric Bupivacaine compared to 156 minutes in control group who received 2.5ml of 0.5% Hyperbaric Bupivacaine alone.[18]

4. **Duration of effective analgesia**
   The duration of effective analgesia evaluated was significantly prolonged in Fentany1 treated goup, 235.6 ± 9.3 mins. As compared to 179.2 ± 13.0mins. in Bupivacaine group. The requirement for first dose of analgesia is significantly prolonged in Fentany1 group.[19]

5. **Side effects**
   The incidence of hypotension were similar in both the groups. It is clear that hypotension in this study was due to inherent property of the local anaesthetics used rather than the Fentany1. Minimal amount of intrathecal fentany1 (15 mg) produce negligible haemodynamic changes with prior fluid administration.

   Fentany1 causes little histamine release. Intrathecal administration of fentany1 is associated with pruritus, the mechanism of which is not clear. It is self limiting, can also be antagonized by antihistamines. No patients required treatment in our study.

   10% of patients In our study had pruritus as compared to 27.8% in a study conducted by, N giam SK, Chong JL & 15% in a study conducted D.Shende. C.M.Cooper & M.I.Bowden.

   Opioids produce nausea & vomiting by direct stimulation of chemoreceptor trigger zone. This effects is dose related and can be treated with anticholinergics or phenothiazines those are antagolistic at dopamine receptor.[20]

   The incidence of vomiting in our study is 10% but is was 25% in the study by Kenneth H, Gwirtz., M.D.Jerry V. & Young of Indiana university school of Medicine. The higher incidence in their study might be due to combined administration of Fentany1 & Morphine intrathecally.

   Retention of urine is a frequent finding with intrathecal opioids. It is caused by and increase in the urinary sphincter tone and a decrease in central inhibition of detrussor tone. The incidence of urinary retention in managed conservatively and all passed urine except one who required catheterization.

   Respiratory depression did not occur in any of the cases in our study probably due to minimal dose of intrathecal fentany1.

CONCLUSION:

It has been found out by this study, that 15mg of intrathecal fentany1 with 2ml of 0.5% heavy Bupivacaine provides.

1. A quicker onset of analgesia upto T_4 dermatome level, 5.2 ± 0.8 mins.
2. An improved quality of intraoperative surgical anaesthesia & good relaxation.
3. Increase in duration of regression to T_{12}dermatome (187 ± 9 mins) and an effective postoperative analgesia, (235 ± 9 mins)
4. The occurrence and intensity of side effects were so minimal & not significant that the benefits associated with administration of intrathecal fentany1 citrate in a dose of 15mg outweight the disadvantage of it.

So the addition of 15mg Fentany1 to 2ml of 0.5% Hyperbaric

Bupivacaine intrathecally provides a better anaesthesia and analgesia than bupivacaine alone in caesarean section without increasing significant maternal and fetal side effects.

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