SOAP 2025 Annual Meeting
APRIL 30 - MAY 4, 2025
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The Effect of Sufentanil for Combined Spinal-Epidural Anesthesia on Fetal Heart Rate During Labor Analgesia

Jian Xu[1],Mingjun Xu[1]
1. Department of Anesthesiology, Beijing Obstetrics and Gynecology Hospital, Capital Medical University

Introduction

- The use of intrathecal opioids for labor analgesia is currently a commonly employed method.
- There is evidence that this technique may cause fetal bradycardia.
- Possible mechanism： rapid onset of analgesia leads to a decrease in catecholamine levels, enhanced uterine contractions, and a subsequent reduction in fetal heart rate[1].
- Intrathecal administration of local anesthetics alone for labor analgesia can also produce a rapid onset of action， but limited studies have indicated an increased incidence of fetal bradycardia.

Methods

Primary objective: To investigate whether intrathecal sufentanil administration during CSEA affects fetal heart rate, while simultaneously monitoring maternal hormonal changes and uterine contractions to explore potential mechanisms.

Study design: Prospective, randomized, controlled clinical study.

Population: primiparous who voluntarily request labor analgesia, with a singleton term pregnancy, cervical dilation of 2 – 3 cm. Unless complicated by severe hypertension, diabetes, hyperthyroidism, or hypothyroidism.

Exclusion criteria: Inadequate monitoring data due to a shortened labor, either before or after analgesia, and the use of oxytocin from 30 minutes before to 30 minutes after analgesia.

Randomization: The parturients were divided into three groups using a random number table method: the sufentanil 8 μg group (S8 group), sufentanil 5 μg group (S5 group), and ropivacaine 3 mg group (R3 group).

- S8 group: Intrathecal administration of 8 μg sufentanil for CSEA

Primary outcomes: Fetal heart rate changes 30 minutes after labor analgesia.

Secondary outcomes:

- Maternal hormone levels, uterine contraction status, and VAS scores before labor analgesia, and at 5, 15, and 30 minutes after labor analgesia.
- Hypotension, pruritus, conversion to cesarean section, and newborn Apgar scores.

Results

Table 1 Patient characteristics

Group	Age (years)	Height (cm)	BMI (kg/m^2)	Before labor analgesia		
				FHR (bpm)	SBP (mmHg)	DBP (mmHg)
S8 (n=30)	30.9±2.8	161±4	26.5±2.3	153±4	121±8	73±6
S5 (n=30)	30.5±3.2	163±4	26.3±2.8	152±4	122±7	72±5
R3 (n=30)	30.5±2.3	164±5	26.5±2.4	152±3	120±7	72±5

Table 2.
Major Outcomes and Some Secondary Outcomes After Labor Analgesia in the Three Groups of Parturients

Group	Cases	Fetal heart rate abnormalities	Pruritus	Cesarean section	Hypotension	Uterine hypertonus
S8	30	3	7	6	4	3
S5	30	0	3	10	3	3
R3	30	1	0	3	3	2
P value		0.215	0.010[a]	0.062	0.918	0.812
X^2		2.96	8.54	5.57	0.34	0.49

S8 Group: 8 μg sufentanil group; S5 Group: 5 μg sufentanil group; R3 Group: 3 mg ropivacaine group;

[a] Compared with the S5 group and R3 group, $P < 0.05$

Results

Table 5 Maternal Hormone Levels Before and After Labor Analgesia in Three Groups ($\bar{x} \pm s$)

	Group	T_0	T_1	T_2	T_3
Epinephrine (μg/L)	S8	50±15	50±14	50±14	49±13
	S5	50±16	50±14	49±13	50±14
	R3	51±13	48±14	48±13	48±14
Norepinephrine (pmol/L)	S8	1 348±429	1 367±506	1 314+474	1 268±440
	S5	1 424±421	1 451±421	1 495±486	1 403±431
	R3	1 346±365	1 313±455	1 350±439	1 260±413
Oxytocin (ng/L)	S8	77±40	77±37	76±35	75±38
	S5	72±31	74±35	72±32	72±33
	R3	66±28	64±31	63±24	64±31
PGE2 (ng/L)	S8	233±98	230±99	223±93	232±105
	S5	227±78	217±90	221±91	212±71
	R3	220±87	212±83	209±79	206±75

T0: Before labor analgesia; T1: 5 minutes after labor analgesia; T2: 15 minutes after labor analgesia; T3: 30 minutes after labor analgesia; PGE2: Prostaglandin E2

Fig1.

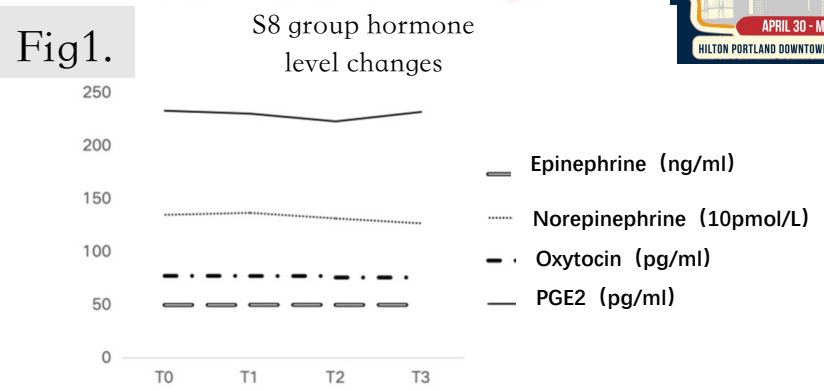


Fig2.

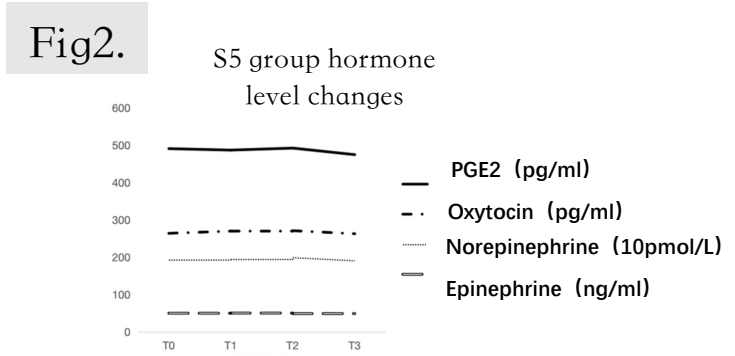
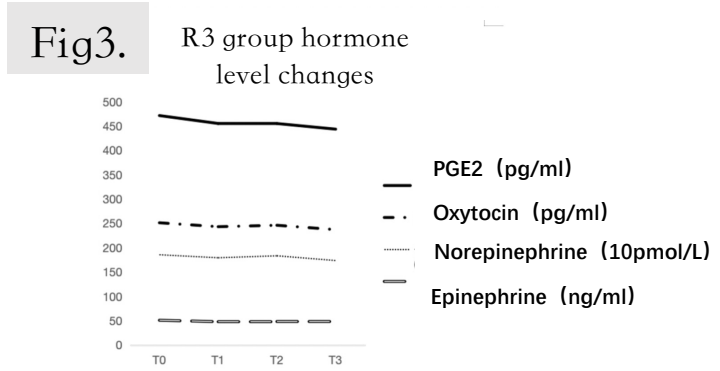


Fig3.



Discussion

- The study found that the use of sufentanil for CSEA in the intrathecal does not lead to an increased incidence of abnormal fetal heart rate.
- The use of 8 μg or lower doses of sufentanil for CSEA in the intrathecal is safe and effective; however, higher doses of sufentanil should be avoided to prevent the occurrence of abnormal fetal heart rates[2].
- After labor analgesia, there was no significant change in uterine contractions or maternal hormone levels. It is possible that the pharmacological mechanism of sufentanil or other underlying mechanisms contribute to the occurrence of fetal heart rate abnormalities after labor analgesia.

Limitations

- The sample size of this study was relatively small. Future research with larger sample sizes and multi-center studies is warranted for more in-depth investigation.
- The monitoring period after labor analgesia was relatively short.
- There are many factors that can influence the monitoring of uterine contractions in parturients.

References

1. Hattler et al. Anesth Analg, 2016, 123(4): 955-964. DOI:10.1213/ANE.0000000000001412.

2. Hembrador et al. Rom J Anaesth Intensive Care, 2020, 27(2): 27-33. DOI:10.2478/rjaic-2020-0015.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