

Title : NEONATAL PATTERN OF BREATHING AFTER CESAREAN SECTION WITH OR WITHOUT EPIDURAL FENTANYL

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INTRODUCTION: The neonatal pattern of breathing and lung mechanics in fullterm newborns delivered by cesarean section with lidocaine epidural anesthesia are normal at delivery (1). Moreover, it has been recently shown that the addition of fentanyl to epidural bupivacaine during labor improves analgesia, without an increase in neonatal side effects (2); thus Apgar and neurobehavioral scores were good. However no information is available on the evolution of the pattern of breathing following epidural fentanyl. The aim of this study was to evaluate the pattern of breathing and lung mechanics during the first hours of life in fullterm newborns delivered by cesarean section and bupivacaine with or without fentanyl epidural anesthesia.

METHODS: Fifteen fullterm healthy newborns weighing 3.4 ± 0.1 kg (mean \pm SD) were studied. Parental consent and Human Investigation Committee approval were obtained. Newborns were delivered by cesarean section indicated for previously known dystocia. All the parturients had ASA physical status I. Two groups were studied: epidural anesthesia was performed with 1) 20 ml of 0.5 % bupivacaine with 1/200,000 epinephrine (group I; n= 8), and 2) 20 ml of 0.5 % bupivacaine with epinephrine plus 100 μ g of fentanyl (group II; n= 7). At delivery, mouth suction was performed and Apgar score was evaluated in each newborn. The following measurements were performed continuously during 6 hours from the end of the first hour of life (H1) : respiratory movements by Resptrace, nasal flow by thermistance (in order to detect the occurrence of apnea) and pulse oximetry (Biox 3700). Pattern of breathing was compared during two time periods : period I (from H2 to H4 following birth) and period II (from H5 to H7). In addition each newborn breathed with a mask which allowed an optimal fit to the newborn's face, through a Fleish number 0 pneumotachograph. A Validyne differential pressure transducer was used during the measurement of the passive compliance. Flow and tidal volume (VT) were recorded at H1 and H7 during a 5 min period in order to measure inspiratory time (TI) and total breathing time (TTOT) and to calculate by averaging 20 breathing cycles in each newborn, respiratory rate (RR), mean inspiratory time (VT/TI) duty cycle (TI/TTOT). Compliance was recorded with the occlusion technique during expiration at H1 and H7. All the signals were recorded on a paper tape recorder Gould ES 1000. All the results are expressed as mean \pm SD. Two ways repeated mesures ANOVA was used to compare the two periods and the groups. The appropriate test (t test for paired data or Neuman-Keuls test) was used when ANOVA was significant. $p < 0.05$ was considered statistically significant.

RESULTS: Weight and term were similar in the two groups. Apgar score at 5 min was 10 in all newborns. All the respiratory variables are summarized in table. There was no significant difference between group I and group II. The duration of apneas of more than 3s decreased significantly from period I

to period II. RR decreased significantly from H1 to H7. Compliance increased significantly from H1 to H7. All the other comparisons were not significant.

DISCUSSION: The pattern of breathing improves during the first 7 hours after cesarean section with epidural anesthesia as shown by the decrease in duration of apneas and in RR. Furthermore, compliance of total respiratory system is low at birth and increases probably because of the absence of squeezing of the thorax which is an important mechanism for pulmonary fluid removal during vaginal delivery (3). In addition, our study shows that the addition of fentanyl to epidural bupivacaine was not associated with an abnormal neonatal pattern of breathing in healthy fullterm newborns. However, further studies are needed to be sure that the risk of apneas due to fentanyl is not increased in newborns with acute fetal distress.

REFERENCES: 1. FISHER JT, MORTOLA JP, SMITH B, FOX S, WEEKS SK: Neonatal pattern of breathing following cesarean section: epidural versus general anesthesia. ANESTHESIOLOGY 59: 385-389, 1983 2. COHEN SE, TAN S, ALBRIGHT GA, HALPEN J: Epidural fentanyl/bupivacaine mixtures for obstetric analgesia. ANESTHESIOLOGY 67: 403-407, 1987 3. SAUNDERS RA, MILNER AD: Pulmonary pressure/volume relationship during the last phase of delivery and the first postnatal breaths in human subjects. J Pediatr 93: 667-673, 1978

TABLE. Respiratory variables (mean \pm SD).

* $p < 0.05$ versus period I.

| | group I (bupivacaine) | group II (bupivacaine fentanyl) |
|--|--------------------------|---------------------------------------|
| Number of apneas (> 3s) | | |
| period I | 5.2 \pm 1.0 | 6.5 \pm 3.8 |
| period II | 4.1 \pm 1.1 | 4.5 \pm 3.5 |
| Duration of apneas (s) | | |
| period I | 7.6 \pm 0.7 | 6.7 \pm 1.2 |
| period II | 4.1 \pm 0.5 * | 5.1 \pm 1.0 * |
| Resting O2 saturation (%) | | |
| period I | 96.2 \pm 1.4 | 95.5 \pm 1.3 |
| period II | 96.1 \pm 1.0 | 96.3 \pm 1.3 |
| Change in O2 saturation during apnea (%) | | |
| period I | 2.7 \pm 1.1 | 2.4 \pm 0.6 |
| period II | 2.8 \pm 0.6 | 2.7 \pm 0.7 |
| RR (breath.min⁻¹) | | |
| H 1 | 59 \pm 5 | 60 \pm 2 |
| H 7 | 46 \pm 2 * | 51 \pm 1 * |
| VT (ml) | | |
| H 1 | 18 \pm 2 | 18 \pm 1 |
| H 7 | 18 \pm 2 | 19 \pm 2 |
| TI/TTOT | | |
| H 1 | 0.42 \pm 0.03 | 0.48 \pm 0.03 |
| H 7 | 0.47 \pm 0.05 | 0.49 \pm 0.01 |
| VT/TI (ml.s⁻¹) | | |
| H 1 | 33 \pm 2 | 34 \pm 3 |
| H 7 | 34 \pm 2 | 33 \pm 2 |
| Respiratory compliance (ml.kg⁻¹.cmH₂O⁻¹) | | |
| H 1 | 0.53 \pm 0.02 | 0.55 \pm 0.02 |
| H 7 | 0.72 \pm 0.03 * | 0.65 \pm 0.03 * |