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Title: MATERNAL TEMPERATURE REGULATION DURING EPIDURAL ANALGESIA FOR LABOR

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The effect of analgesic intervention on maternal temperature progression during labor is unclear. A recent study reported a significant rise in both oral and vaginal temperature when epidural analgesia was used for labor[1]. However, vaginal temperature may rise in response to epidural-induced increases in vaginal blood flow. We therefore measured both oral and tympanic membrane (TM) temperature throughout labor, with and without epidural analgesia. The effect of the addition of an epidural opioid (fentanyl) on these findings is also addressed.

Methods: Fifty-three term parturients in active labor with no clinical signs of infection, and no pregnancy-related complications gave institutionally approved informed consent. Each patient chose either parenteral narcotics or epidural analgesia for labor. The epidural patients were randomly divided into two groups: both groups received a continuous epidural infusion of 0.25% bupivacaine solution maintained at 10 cc/hr. In one group (n=20) fentanyl, 2 mcg/cc, was added to the infusion, while the other group (n=20) received no epidural narcotics. Patients choosing only parenteral narcotic analgesia served as a control group (n=13). Oral and TM temperatures were recorded immediately prior to epidural placement (or when the control patients reached 3 cm cervical dilation with regular contractions), then hourly until delivery. Ambient room temperature was regulated at 20-22°C throughout the study. One-way and two-way ANOVA and Chi-squared tests were used to analyze characteristics of the three groups.

Results: The oral and TM temperature readings were well correlated ($r=0.62$, $p < 0.001$). Mean maternal temperature did not differ between groups during the first four hours; however, at five hours and thereafter, mean TM temperature was significantly higher in both epidural groups than in the control group, and mean TM temperature within both epidural groups was significantly higher than the pre-epidural temperature. The addition of fentanyl to the epidural infusion did not alter the progression of temperature readings. No rise in temperature over time was observed in the parenteral narcotic group. There was a weak but significant correlation between fetal heart rate (FHR) and maternal temperature ($r=0.22$, $p < 0.01$). No patients showed signs of infection, sepsis or chorioamnionitis.

Discussion: Our results confirm a small, but consistent elevation in maternal temperature during labor in parturients receiving epidural analgesia which is not observed in patients receiving only parenteral narcotics. We chose to measure TM temperature because it more accurately reflects core temperature.

It is possible that patients receiving only parenteral narcotics lose more heat to the environment than do epidural patients, owing to pain-induced perspiration and hyperventilation. Furthermore, patients in the parenteral narcotic group often ingested ice chips, which may lead to lower temperature readings. The elevation in temperature in the epidural group, although statistically significant, never exceeded 1°C. The precise mechanism for this observation is unclear, and further studies are warranted.

References: 1. Fusi L, Maresh MJA, Stees PJ, Beard RW: Lancet 1:1250-1252, 1989.

A850

TITLE: DEVELOPMENTAL TOXICITY OF NON-DEPOLARIZING MUSCLE RELAXANTS IN CULTURED RAT EMBRYOS

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Muscle relaxants are difficult to test in vivo for reproductive toxicity because of their confounding respiratory effects. To overcome this difficulty, we used an in vitro rat whole embryo culture system. Embryos were explanted at 8 AM on Day 9 of gestation (presomite stage, plug day = Day 0), and were cultured in the rotating bottle with medium (80% rat serum and 20% Hank's balanced salt solution) containing various concentrations of the following non-depolarizing muscle relaxants: d-tubocurarine, pancuronium, atracurium, and vecuronium. At 10 AM on Day 11 of gestation (20-25 somite stage), culture was terminated and embryos were examined for general morphology, and crown-rump length and number of somites pair were determined. Morphological abnormalities were only produced at concentrations greater than 100 times of the $C_{PSS(50)}$ (Steady-state plasma concentration that results in 50% paralysis) in humans, e.g., 0.2-0.6 μg/ml for d-tubocurarine and atracurium, 0.1-0.3 μg/ml for pancronium, and approximately 0.1 μg/ml for vecuronium. The rank order of toxicity was as follows: pancronium > d-tubocurarine = atracurium > vecuronium. Our results suggest relatively low teratogenic potentials of these agents on development of rat embryos during the early organogenesis. An interesting finding was that atracurium caused high incidence of situs inversus at concentrations more than 75 μg/ml. However, at these concentrations, atracurium always caused additional morphological abnormalities unlike phenylephrine, an α_1 adrenergic agonist, which causes only situs inversus[1].

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Reference
1. Developmental Biology 143:203-205, 1991

	No. of embryos studied	Abnormal embryos (%)	Embryos with situs inversus (%)	Crown-rump length (mean ± S.D., mm)	No. of somites pair (mean ± S.D.)
control	107	0 (0.0)	9 (8.4)	3.45 ± 0.19	24.8 ± 2.4
d-tubocurarine (μg/ml)					
3	20	0 (0.0)	0 (0.0)	3.43 ± 0.21	24.3 ± 1.3
30	34	0 (0.0)	3 (8.8)	3.35 ± 0.20*	24.4 ± 1.3
60	25	1 (4.0)	2 (8.0)	3.19 ± 0.17*	23.4 ± 1.0*
90	25	9 (36.0)#	0 (0.0)	2.82 ± 0.19*	22.1 ± 1.9*
120	25	17 (68.0)#	3 (12.0)	2.77 ± 0.19*	22.0 ± 2.1*
150	25	25 (100.0)#	0 (0.0)	2.59 ± 0.18*	19.8 ± 2.2*
atracurium (μg/ml)					
25	30	0 (0.0)	2 (6.7)	3.49 ± 0.15	24.9 ± 1.0
50	28	0 (0.0)	5 (17.9)	3.35 ± 0.16*	24.7 ± 0.8
75	31	8 (25.8)#	13 (41.9)#	2.94 ± 0.25*	23.0 ± 1.7*
100	35	16 (45.7)#	16 (45.7)#	2.78 ± 0.20*	22.4 ± 1.2*
125	29	25 (86.2)#	12 (41.4)#	2.47 ± 0.32*	20.7 ± 2.1*
pancronium (μg/ml)					
1	19	0 (0.0)	2 (10.5)	3.40 ± 0.11	24.8 ± 1.0
10	34	0 (0.0)	2 (5.9)	3.23 ± 0.20*	24.9 ± 1.4
20	25	0 (0.0)	2 (8.0)	3.08 ± 0.12*	23.4 ± 0.8*
30	25	13 (52.0)#	2 (8.0)	2.48 ± 0.27*	20.4 ± 2.9*
40	24	22 (91.7)#	2 (8.3)	2.11 ± 0.36*	16.1 ± 3.5*
vecuronium (μg/ml)					
50	26	0 (0.0)	2 (7.7)	3.42 ± 0.14	24.8 ± 0.7
200	23	0 (0.0)	0 (0.0)	3.02 ± 0.20*	24.1 ± 0.7
250	25	0 (0.0)	5 (20.0)	2.84 ± 0.16*	22.5 ± 1.2*
275	25	0 (0.0)	2 (8.0)	2.81 ± 0.14*	22.6 ± 1.1*
300	23	23 (100.0)#	1 (4.3)	2.61 ± 0.21*	21.7 ± 2.0*

* $p < 0.05$ vs. control by analysis of variance
\# $p < 0.05$ vs. control by chi-square test