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 Title : BUPIVACAINE AND THE LARYNGEAL CHEMO AND DIVING-REFLEX
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Introduction. Bupivacaine is frequently administered by epidural injection to produce analgesia during labor. Since it can be detected in the neonate following administration to the mother, placental transfer must occur. Neonatal studies including neuro-behavioral examinations have been unable to detect any significant effects upon the infant. This study looks specifically at the changes in the laryngeal chemo (L.C.R.)¹ and diving (D.R.)² reflex responses in the newborn lamb.

Stimulation of the L.C.R. with water produces a response consisting of apnea, a fall in heart rate, and redistribution of blood flow in the dive pattern with a subsequent rise in blood pressure. Normal saline results in a similar but reduced response. The afferent pathway being the superior laryngeal branch of the vagus. The D.R. produces a similar response, the afferent pathway being through the trigeminal nerve.

Method and Materials. Six healthy newborn lambs were chronically prepared by the fashioning of a tracheostomy stoma and the insertion of arterial and venous catheters.

The lambs were allowed to recover for at least 24 hours and then studied unanesthetized. Stimulation of L.C.R. was produced by retrograde injection of water and normal saline into the larynx during a 25 sec period, the airway remaining patent through an endo-tracheal tube. The D.R. was initiated by placing a wet ice-pack on the lamb's nose for 25 sec. Measurements of ventilation were made using a thermister probe inserted into the endotracheal tube and the cardiovascular variables, heart rate and systemic blood pressure, were obtained from the arterial blood pressure tracing.

A series of four stimulations of L.C.R. with water and saline infusions and the D.R. with ice-pack were made as a base-line. 10 mg bupivacaine was then injected IV into the lamb and the studies repeated.

The response to reflex stimulation was expressed as percent change of ventilation during the test period compared with the immediately preceding baseline period. The heart rate and blood pressure response was expressed as percent change of the variable measured at the end of stimulation compared to the baseline period.

Results. There was no significant change in respiratory rate or blood pressure following the injection of bupivacaine. There was a statistically significant fall in heart rate of approximately 5%.

	L.C.R. % Change - Mean (±S.E.M.)			
	H ₂ O		N.S.	
	Control	Drug	Control	Drug
Ventilation	-76.5 (±5.0)	-30.0 (±6.5)	-57.7 (±6.5)	-30.07 (±5.2)
	p < .00001		p < .002	
Heart Rate	-38.7 (±2.8)	-11.81 (±1.72)	-20.94 (±3.1)	-10.04 (±1.9)
	p < .00001		p < .01	
Systolic BP	+36.43 (±4.7)	+14.48 (±2.2)	+28.5 (±4.6)	+13.79 (±2.9)
	p < .0001		p < .01	
Diastolic BP	+39.39 (±4.9)	+14.59 (±3.1)	+31.28 (±5.6)	+17.36 (±4.5)
	p < .0001		n.s.	
	D.R. % Change - Mean (±S.E.M.)			
	Control	Drug		p
Ventilation	-49.7 (±6.6)	-26.6 (±5.7)		<.01
Heart Rate	-23.8 (±2.6)	-10.3 (±1.8)		<.001
Systolic BP	38.3 (±4.9)	15.8 (±2.5)		<.001
Diastolic BP	53.0 (±7.1)	23.0 (±4.6)		<.001

Conclusions/Discussion. From the results, it is apparent that bupivacaine significantly blocks both L.C.R. and D.R. in the unanesthetized newborn lamb. Further studies were initiated in an attempt to elicit the anatomical site at which the inhibition occurs. Two similar preparations were anesthetized with chloralose and the superior laryngeal nerve (S.L.N.) was dissected on the right side. The L.C.R. was initiated by stimulation of the right S.L.N. electrically. The response was compared to the response elicited by laryngeal water stimulation (mediated by the left S.L.N.). After bupivacaine administration intravenously the response to direct nerve stimulation was not attenuated whereas the response to water stimulation was considerably reduced. This indicates that the block produced by bupivacaine is occurring distal to the superior laryngeal nerve and presumably in the receptors of the larynx. The ability of bupivacaine to block reflex heart rate changes as shown by this study may be of clinical importance, since similar reflex changes are used as indices of well being in the fetus during labor. This may be of particular importance if blood levels in the fetus become excessive. Future studies may tell us whether such changes are of real significance.

References.

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