● 175 DETERMINATION OF CRITICAL CARDIAC OUTPUT AND OXYGEN TRANSPORT WITH AGE IN THE CONSCIOUS LAMB.

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We have developed a method to lower cardiac output (Q) instantaneously, reversibly, and in a controlled, stepwise fashion in conscious lambs, using a balloon tipped (Foley) catheter inflated in the right atrium. The hemodynamic and metabolic effects of selective lowering of Q in the conscious, unsedated lamb has not previously been reported. Under conditions of low Q, we studied lambs at 2 weeks (n=5), 4 weeks (n=6) and 8 weeks (n=5) of age to determine the critical Q necessary to decrease oxygen consumption (VO_2) or increase lactate (L) production at each age. At each level of balloon inflation we measured: VO_2, CO_2 production (VCO_2), venous hemoglobin concentration (Hb), heart rate, arterial L, and systemic and pulmonary arterial blood gases, % HbO_2 and pressures. The actual critical Q varied between lambs at a given age, although it was lower in the older lambs. However, when Q was normalized to resting cardiac output (Qo), L production increased and VO_2 decreased in all lambs whenever Q $\leq$ .6 Qo, thereby establishing a critical Q which was similar for all ages. Due to the wide differences with age in Hb and Qo, the critical systemic oxygen transport (SOT) also decreased with age from 15 (2 weeks) to 11 (8 weeks) mlO_2/min kg. These data provide evidence of a critical Q in the young subject and provide a model for studying the metabolic effects of low Q in the conscious lamb. Furthermore, the relationship between VO_2 and SOT determined here for low flow states is similar to that established previously for anemia and hypoxemia.

176 LIMITATIONS OF SELF-INFLATING BAGS.

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Self-inflating bags are frequently used in neonatal and pediatric resuscitation. Because of concerns that these devices tend to be unreliable and inconsistent we studied a representative number: 12 Ohio (Hope II), 5 Leardal, 5 PMR2 Puritan with and without reservoirs (R). These bags were connected to a small test lung ventilated at rates (RR) from 10 through to 60 & >60 at 5, 10 & 15 lpm both below and above the blow-off (B/O) pressure while being connected continuously to a transducer and oxygen analyzer.

	RANGE B/O PRESSURE	<B/O (+R)	MEAN ACHIEVABLE FIO_2 WITH & WITHOUT R	>B/O (+R)
Ohio	36 - 108 cm H_2O	.56 (.75)	Mean Values	.39 (.55)
Leardal	47 - 72 cm H_2O	.72 (.97)	Flow = 10 lpm	.49 (.97)
PMR2	51 - 97 cm H_2O	.34 (.91)	RR = 30	.29 (.75)

For those bags without a reservoir the maximum FIO_2 at 10 lpm achievable at RR =>20 was .74. For the Ohio without reservoir FIO_2 fell as the ventilatory rate increased for all RR (p <.001). For all bags the FIO_2 was significantly less when the B/O valve was activated (p <.001) and fell with increasing RR on bags with reservoirs when compressed above the B/O pressure (p <.001). Only 1 model (Leardal) could deliver FIO_2 >.90 at RR <=30 using 15 lpm when the B/O valve was activated. All self-inflating bags with reservoirs are not "100% baggers" and in view of the unpredictability and wide range of B/O pressures and achievable FIO_2's anesthesia type bags are preferable for acute resuscitation when a compressed oxygen source is available.

177 PREDICTION OF MORPHINE DEPENDENCY IN ENDOTRACHEALLY INTUBATED CHILDREN.

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Endotracheally intubated (EI) children usually require some combination of sedative (i.e., morphine) and paralyzing (i.e., pancuronium) medications. The potential for inducing physiological drug dependency in such children should increase in proportion to both the dosage and duration of sedation. A retrospective review of 13 admissions to a multidisciplinary pediatric ICU who are EI $\geq$ 9 days revealed a progressive increase in morphine requirement on a stable pancuronium dosage.

Medication	Mean Mg/Kg (SE) Day 1	Day 9	Student's Test Two Tailed T
Morphine	0.57 (0.16)	1.14 (0.47)	p = 0.053
Pancuronium	0.44 (0.22)	0.34 (0.18)	p = 0.349

Ten children received < 8mg/kg total morphine dosage for the first nine days of EI. Of this group, only one patient developed morphine dependency and only after receiving > 16mg/kg cumulative morphine dosage over several subsequent weeks of EI. The remaining three children received > 16mg/kg cumulative morphine dosage and each showed signs of dependency. Our conclusion is that cumulative morphine dosage may help to identify EI children at risk of withdrawal.

178 PIGTAIL CATHETER TECHNIQUE REDUCES TRAUMA OF CHEST TUBE PLACEMENT.

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Chest tube placement for drainage of pleural fluid or evacuation of pneumothorax is often traumatic and may injure the underlying lung. In 11 infants and children (age range 4 days to 6 yrs, including 32 and 36 wk prematures), satisfactory drainage was achieved using 40 cm long, taper tipped, 8.3 Fr. pigtail catheters with six .050" holes positioned in the plane of the pigtail curve, catheters previously modified for percutaneous pericardiocentesis (Cook PCS830G-Lock). For placement, the thorax and pleura were punctured with an 18 gauge needle. A curved .038" guidewire was introduced and the needle withdrawn. The puncture site was enlarged by passing an 8 Fr. dilator along the wire, penetrating the chest wall to a depth of about 1". The catheter was then advanced over the guidewire, positioned in the pleura, and Luer-locked to a negative pressure, closed drainage system. In all, 16 catheters were placed, 6 for effusions (2 chylous and 2 purulent), 2 for collections of hyperalimentation fluid, and 8 for pneumothoraces. Catheters drained for an average of 5.4 days (range 1 to 20 days). In only 4 cases were supplementary drainage procedures required. In one instance, air entered the thorax on removal of the catheter. There were no other complications, either of placement, or of prolonged use. Insertion is facilitated by the tapered tip of the catheter. Safety is enhanced by wire guidance of the tube, and by the curves of the wire and of the pigtail. Pigtail drainage of pleural fluid or air is simple, safe, and effective, and is less traumatic than standard chest tube placement.

179 PROXIMAL AIRWAY AND AVEOLAR PRESSURES DURING MECHANICAL VENTILATION.

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During continuous positive pressure breathing(CPPB), proximal airway pressure(AP) and its mean value(MAP) reflect lung distending pressure, although their relationships to alveolar pressure (ALP) and its mean value(MALP) await definition. 10 infant lambs, under chloralose anesthesia and pancuronium bromide, were subjected to volume regulated, time cycled CPPB under conditions of constant inspiratory airflow. To estimate ALP, static recoil pressure was determined by interruption of airflow once every 10th breath, at a time in the respiratory cycle that was varied from trial to trial. From determinations of occlusion time, AP and ALP, real time AP and ALP curves were generated representing one respiratory cycle; MAP and MALP were calculated by integration; and the contribution to MALP of airway resistance(MALPr) was estimated from inspiratory(I) time, positive end-expiratory pressure(PEEP), peak ALP and MALP. Curves were generated at 25 and 50% I, and at levels of PEEP between 0 and 11 mmHg.

%I	Regression	r	$\int(AP-ALP)_I$	$\int(AP-ALP)_E$	MALPr
25	MALP=0.98MAP+0.19	.99	1.1±0.1	-1.2±0.1	1.6±0.1
50	MALP=1.00MAP-0.10	.99	1.1±0.1	-0.9±0.1	1.4±0.2

all pressures mmHg, $\bar{x}$±SEM

Due to airway resistance, AP exceeded ALP in inspiration and ALP exceeded AP over much of expiration(E). Yet airway resistance contributed little to MALP. Over the range of PEEP applied, and at both %I, proximal mean airway pressure was an accurate and precise estimator of mean alveolar pressure.

● 180 AIRWAY AND ALVEOLAR PRESSURES IN VENTILATED, ABNORMAL LUNGS.

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To describe the relations, during mechanical ventilation(CPPB), of airway pressure(AP) and its mean value(MAP) to alveolar pressure(ALP) and its mean value(MALP) in the diseased lung, 19 infant lambs were subjected to controlled, volume regulated CPPB at inspiratory(I) times of 25 and 50%, and at 0 to 11mmHg positive end-expiratory pressure(PEEP), under conditions of fixed inspiratory airflow. To estimate ALP, static recoil pressure was determined by airway occlusion once every 10th breath, at a time in the respiratory cycle that was varied from trial to trial. From measured occlusion times, AP and ALP, real time AP and ALP curves were generated representing one respiratory cycle; MAP and MALP were calculated by integration; and the contribution to MALP of airway resistance(MALPr) was estimated from %I, PEEP, peak ALP and MALP. After control determinations, 10 lambs received oleic acid (OA-.15 ml/kg) and 9 received propranalol and serotonin(S) infusion (80μ/kg/min.) Data at 25%I:

Rx	Ct(%C)	Raw(%C)	pO_2	Regression	r	MALPr
Control	100	100	97±5	MALP=.99MAP+.25	.99	1.53±0.11
Oleic Acid	61±7*	284±47*	37±3*	MALP=.99MAP+.27	.99	2.30±0.13
Serotonin	58±6*	470±116†	50±4*	MALP=.99MAP+.31	.99	1.71±0.20

all pressures mmHg, $\bar{x}$±sem, †p<.05 vs control *p<.01 vs control

Both OA and S increased airway resistance (Raw) and reduced both thoracic compliance(Ct) and arterial pO_2. Proximal mean airway pressure was an accurate and precise estimator of mean alveolar pressure both in normal and in abnormal lungs, in spite of elevated airway resistance.