Title: THE EFFECTS ON ALTERING INSPIRATION/EXPIRATION RATIO ON V/Q DISTRIBUTION
           IN NORMAL AND INJURED LUNGS

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Introduction. Inverse of inspiration/expiration (I/E) ratio has been suggested as an alternative modality in treatment of respiratory distress syndrome. The possible mechanism of improvement of oxygenation has been attributed to the increased mean airway pressure. Inverse I/E ratio may hold alveoli at a relatively normal volume for a large part of each ventilatory cycle, and thus it facilitates gas exchange and diminishes shunt fraction. However, the results of previous studies have been conflicting. The purpose of the study was to examine the effects of altering the I/E ratio in terms of V/Q distribution in normal and injured lungs.

Methods. Seven mongrel dogs weighing 15.2-18.5 kg were anesthetized with pentobarbital (30 mg/kg IV). The trachea was intubated with a cuffed endotracheal tube and the dog was mechanically ventilated in supine position with constant FIO_2 of 0.5 The minute ventilation was maintained constant with a frequency of 10/min and tidal volumes of 16-20 ml/kg adjusted to produce the initial $PaCO_2$ of 30-35 torr. Catheters were placed into the femoral artery, superior vena cava, and main pulmonary artery (Swan-Ganz catheter) for blood sampling and pressure monitoring. Lung injury was produced by injecting oleic acid, 0.1 ml/kg, into a central venous line. The I/E ratio was manipulated in 3 stages by changing from 1/2, 2/1, to 4/1 during the periods before and after oleic acid injury. The Wagner-West method with six inert gases technique was used to study V/Q distribution.

Results. The results showed significant decrease of PO_2 and CO, and increase of Qs/Qt, PCWP, MPAP, and MPaw after oleic acid injection. Table 1 and Table 2 show distribution of blood flow and ventilation in different V/Q ratio compartments following changes of I/E ratio before and after oleic acid, respectively. The numbers are mean values ± standard error. Manipulation of I/E ratio by altering from 1/2 to 2/1, and 4/1 did not significantly change PaO_2, Qs/Qt, CO, Vd/Vt, MPAP, PCWP and MPaw in normal lungs as well as injured lungs.

Discussion. Distribution patterns of ventilation and perfusion in different V/Q ratio compartments failed to show any favorable matching redistribution following inversion of I/E ratio in either normal or damaged lungs.

TABLE I. DISTRIBUTION OF PERFUSION

	V/Q →	0	0-.01	.01-.1	.1-1	1-10	10-100	Infinity
Before O.A.	1/2	0.11±0	0.01±0	0.0±0	0.8±0.1	0.07±0	0.00	0
	2/1	0.10±0	0.01±0	0.0±0	0.72±0.01	0.15±0	0.01±0	0
	4/1	0.12±0.01	0.01±0	0.0±0	0.63±0.01	0.23±0.02	0.01±0	0
After O.A.	1/2	0.44±0.08	0.0±0	0.0±0	0.37±0.03	0.21±0.01	0.02±0	0
	2/1	0.36±0.04	0.0±0	0.01±0	0.30±0.15	0.30±0.01	0.02±0	0
	4/1	0.41±0.05	0.0±0	0.0±0	0.30±0.02	0.30±0.02	0.01±0	0

TABLE II. DISTRIBUTION OF VENTILATION

	V/Q →	0	0-.01	.01-.1	.1-1	1-10	10-100	Infinity
Before O.A.	1/2	0	0	0	0.45±0.05	0.17±0.52	0.03±0.06	0.29±0.09
	2/1	0	0	0	0.37±0.04	0.23±0.05	0.14±0.07	0.26±0.06
	4/1	0	0	0	0.41±0.10	0.20±0.08	0.07±0.05	0.31±0.14
After O.A.	1/2	0	0	0	0.16±0.03	0.45±0.02	0.19±0.04	0.21±0.02
	2/1	0	0	0	0.12±0.01	0.51±0.03	0.18±0.03	0.20±0.04
	4/1	0	0	0	0.14±0.0	0.50±0.06	0.18±0.05	0.18±0.06