

Title: AGGRESSIVE APPLICATION OF POSITIVE END EXPIRATORY PRESSURE (PEEP) PRODUCES INCREASED MORBIDITY AND MORTALITY

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**Introduction.** There are several definitions of optimal PEEP each of which is based upon PEEP induced physiologic changes. Unfortunately, improved patient outcome for any method of PEEP titration has not been shown in a controlled study. Therefore, we prospectively randomized postoperative patients to receive PEEP titrated aggressively to a physiologic endpoint thought to be therapeutic (recruitive PEEP) or to receive only that level of PEEP necessary to prevent hypoxemia (supportive PEEP).

**Method and Materials.** After obtaining informed consent 118 surgical intensive care patients were monitored for the development of mild, relative hypoxemia ( $\text{PaO}_2/\text{FiO}_2 < 200$ ). Fifty-eight patients who met that criterion were randomized: 26 to recruitive PEEP and 28 to supportive PEEP. Recruitive PEEP patients had PEEP increased in increments of 5 cm H<sub>2</sub>O until veno-arterial admixture (SHNT) was either: 1) reduced to below 10%; or 2) half of baseline SHNT and reduced to less than 25%. Supportive PEEP patients had PEEP increased in increments of 5 cm H<sub>2</sub>O until  $\text{PaO}_2$  exceeded 60 torr while receiving 50% O<sub>2</sub>. PEEP withdrawal was begun anytime within 24 hrs of meeting titration goals. Retitration of PEEP was done if SNT exceeded 25% in the recruitive group or  $\text{PaO}_2$  decreased to below 60 torr on 50% O<sub>2</sub> in the supportive group.

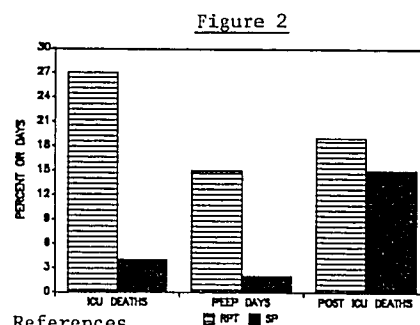
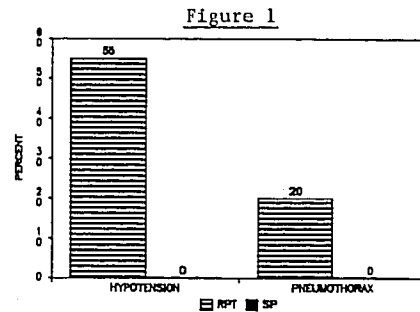
**PEEP Postponement.** PEEP increases were postponed if 1) the respiratory rate was less than 25/min in the absence of mechanical ventilation, 2) there was an inadequate airway, 3) there was an untreated pneumothorax or 4) there was an anatomic right to left shunt.

**Results (Table I).** Severity of illness and patient characteristics were comparable between recruitive and supportive PEEP patients. Four recruitive PEEP patients received no PEEP because their respiratory rates remained less than 25/min in the absence of mechanical ventilation. Hypotension and pneumothorax were greater for recruitive patients undergoing recruitive PEEP titration as compared to supportive PEEP patients (Figure 1). Deaths during PEEP therapy (but not thereafter) and time PEEP was required were all greater for recruitive PEEP titrated patients (Figure 2). All patients who died had severe ARDS. Refractory hypoxemia appeared to contribute to the deaths of 2 recruitive patients. All deaths appeared to be primarily caused by multisystem failure/sepsis.

**Discussion.** In the original reports of PEEP application, PEEP was prescribed at constant low levels (5-10 cm) in uncontrolled series.<sup>(1)</sup> The survival results were not statistically significant yet PEEP was generally adopted as standard therapy for acute hypoxic pulmonary failure.<sup>(2)</sup> Subsequently, PEEP was titrated to a physiologic endpoint thought to signify recruitment of collapsed lung and thereby promote

its healing.<sup>(3)</sup> If PEEP were therapeutic, some manageable complications or physiological disturbances might be justified. However, if the only benefit of PEEP is the prevention of early hypoxic deaths, than it is more appropriate to administer only the lowest level necessary to keep  $\text{PaO}_2$  satisfactory. This study demonstrates that outcome can be adversely affected by aggressive PEEP therapy. We believe that minimal PEEP may be best PEEP.

	Recruitive	Supportive	P
Death during PEEP	27%	4%	.05
Death after PEEP	14%	15%	NS
PEEP days	15	2	.01
Pneumothoraces	20%	0%	.02
Treated hypotension	55%	0%	.001



#### References.

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