

Title: EFFECT OF CPAP, ZEEP AND EXTUBATION ON HEMODYNAMICS IN THE POST OPEN HEART SURGERY PERIOD

Authors: M. Tabatabai, M.D., Ph.D. and J.R. Keefer, M.D.

Affiliation: Department of Anesthesiology, Yale University School of Medicine, New Haven, Connecticut 06510

Introduction. The use of continuous positive airway pressure (CPAP) has been advocated to increase lung volume, prevent alveolar collapse and improve blood oxygenation in intubated patients with spontaneous breathing (1). After open heart surgery, CPAP and sometimes ZEEP (zero end expiratory pressure) are used before extubation. This study was undertaken to measure and compare hemodynamics under conditions of CPAP, ZEEP and after extubation in patients who have undergone open heart surgery.

Methods. Ten patients, 51 to 75 years old, who had undergone coronary artery bypass graft (n=4), valve replacement (n=3), or both (n=3) were included in this study. Institutional approval was obtained. Extubation was performed 15 to 25 hours after the surgery and the study started 8 minutes before extubation. The patients did not receive any narcotic or sedative, nor were they on any vasopressor agent, for at least four hours prior to extubation. With the patients breathing spontaneously at a CPAP of 5 cm H₂O and F_IO₂ of 0.4, the following measurements were made: heart rate (HR), systolic, diastolic and mean arterial blood pressure (SBP, DBP, BP), systolic, diastolic, and mean pulmonary artery pressure (PAS, PAD, PAP), mean right atrial pressure (RAP) and thermodilution cardiac output (CO). Calculated data included cardiac index (CI), stroke volume index (SVI) and systemic vascular resistance (SVR). Following this CPAP was replaced by ZEEP, and after a 5-minute interval, a new set of measurements was made while F_IO₂ was maintained at 0.4. The patients were carefully observed in the 5-minute interval for any apparent indication of discomfort and intolerance resulting from elimination of CPAP. Next, we extubated the patients, waited for 12 minutes to allow for the cardiovascular changes due to oropharyngeal suction and extubation to disappear (2), and repeated the measurements. The data were analyzed using repeated measures analysis of variance. P values of < 0.05 were considered statistically significant.

Results. The data are presented in the Table. The hemodynamic variables did not show any statistically significant changes from each other under the three different

experimental conditions. On the basis of the clinical observation during the 5-minute period between CPAP and ZEEP, the patients seemed to tolerate the transition from the former to the latter well.

Discussion. The results show that the presence of CPAP at 5 cm H₂O in intubated, spontaneously breathing patients does not produce any adverse effect on the cardiovascular system in the post open heart surgery period. Further, the mere presence of the endotracheal tube in this group of patients under the settings of the experiment does not cause any significant change in the hemodynamic variables. It has been shown that extubation from ZEEP results in lowering of the functional residual capacity and arterial blood oxygen tension as compared with extubation from positive end expiratory pressure (3). We conclude that extubation may be performed directly from CPAP without affecting cardiovascular performance adversely, and that a period of ZEEP is unnecessary.

References.

1. Gregory GA, Kitterman JA, Phibbs RH, et al: Treatment of the idiopathic respiratory distress syndrome with continuous positive airway pressure. *NEJM* 284:1333-1340, 1971.
2. Wohlner EC, Usubiago LJ, Jacoby RM, et al: Cardiovascular effects of extubation. *Anesthesiology* 51:S194, 1979.
3. Quan SF, Falltrick RT, Schlobohm RM: Extubation from ambient or expiratory positive airway pressure in adults. *Anesthesiology* 55:53-56, 1981.

Hemodynamic Data (Mean ± SE)

	CPAP	ZEEP	Post Extubation
HR (bpm)	88±3.4	87.9±3.6	87.1±3.7
SBP (torr)	131±3.6	129±3.1	129±4.7
DBP (torr)	67±3	66±3	68±3.8
BP (torr)	86±3.2	86±3.6	86±4
PAS (torr)	31±1.2	31±1.7	31±1.6
PAD (torr)	8±0.5	8±0.8	9±1
PAP (torr)	21±1	21±1	20±1.2
RAP (torr)	9±0.5	9±0.6	8±0.5
CO (L/min)	5.6±0.3	5.9±0.4	5.6±0.3
CI (L/min/M)	3.1±0.2	3.2±0.2	3.1±0.2
SVI (ml/beat/M)	35±2	36±1.8	35±2
SVR (RU)	26±1.3	26±2	27±1.7