

Hypocapnia-induced bronchoconstriction following cardiac arrest: fact or myth?

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Argomento: Trauma e arresto cardiaco

Introduction. Massive bronchoconstriction has been reported in a guinea pig model of cardiac arrest (CA) induced by heart ligation during controlled mechanical ventilation^{1,2}. When CA occurs during controlled mechanical ventilation, alveolar and bronchial CO₂ suddenly decrease. The resulting bronchial hypocapnia has been suggested as the main mechanism of bronchoconstriction occurring in this setting.

Aim. To assess the occurrence of bronchoconstriction following CA under controlled mechanical ventilation in a large animal model.

Methods Thirteen pigs (27±13 kg) were anesthetized and mechanically ventilated in volume controlled mode (V_T 12 ml/kg, RR 20 and PEEP 0). Cardiac arrest was induced in 8 pigs (Group 1) via intravenous administration of 20 mEq of potassium chloride (KCl), while in 5 pigs (Group 2) ventricular fibrillation (VF) was induced through endocavitary pacing lead stimulation. Airway resistances (Raw), intrinsic PEEP (iPEEP), respiratory system (Crs), lung (Cl) and chest wall (Ccw) compliance were measured/calculated at baseline and after CA. Data were compared by paired t-test or Signed Rank test, as appropriate.

Results A significant increase in Raw, decrease in Crs, Cl and increase in iPEEP was observed in Group 1, while no significant change in respiratory variables was observed in Group 2 (Table 1).

Conclusions Cardiac arrest induced by KCl caused a massive bronchoconstriction leading to increase in Raw. The observed marked reduction in Crs and Cl was likely due to severe bronchial obstruction resulting in a reduction of lung parenchyma open to ventilation. No change in respiratory mechanics was observed in pigs undergoing VF-induced CA. A direct effect of KCl on bronchial smooth muscles³ could explain our findings. In our large animal model, bronchial hypocapnia does not play a significant role in determining bronchoconstriction following cardiac arrest.

References

1. Lai YL *J Appl Physiol* 1984.
2. Reynolds AM *J Appl Physiol* 1989
3. Du W *J Biol Chem* 2006.

Table 1

	Group 1 (KCI)			Group 2 (VF)		
	Baseline	Post-CA	p	Baseline	Post-CA	p
Raw [cmH ₂ O·s/L]	51±23	108±38	.003	37±26	24±11	.33
Crs [mL/cmH ₂ O]	18±13	7±5	.007	22±12	22±11	1.0
Cl [mL/cmH ₂ O]	32±25	9±7	.002	34±24	29±14	.84
Cew [mL/cmH ₂ O]	58±34	45±14	.57	72±15	100±59	.69
PEEPi [cmH ₂ O]	0.9±0.7	3.3±1.8	<0.001	1.5±2.3	3.9±2.0	.095