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Controversies

Bag 'em or tube 'em: how to decide☆,☆☆

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In an effort to identify or at least shed light on optimal out-of-hospital cardiac arrest (OHCA) airway management strategies, McMullan et al [1] compared OHCA outcomes between patients receiving endotracheal intubation (ETI) vs supraglottic airway (SGA) and between patients receiving ETI or SGA and those receiving no advanced airway. They found that survival was higher among OHCA receiving ETI than those receiving SGA and for patients who received no advanced airway than those receiving ETI or SGA. Although their findings of an association of improved outcomes with no advanced airway management are consistent with previous reports, they urged caution in the interpretation of those and the current findings. Confounding by indication is of major influence in studies of medical interventions. It was noted that, unlike the comparison of ETI vs SGA, the observed survival differences between the airway and nonairway groups were very large, even after stratification by initial electrocardiographic rhythm, propensity score adjustment, and propensity score matching. They suggested that the large associations—despite the use of multivariable adjustment and propensity score matching—reflected the presence of unmeasured and immeasurable confounders. One significant confounding factor that was not accounted for in their analyses is the presence of witnessed gasping and/or gasping upon arrival of emergency rescuers.

Gasping is the only source of clinically significant ventilation during chest compressions only (CCO) cardiopulmonary resuscitation (CPR) [2-4]. Moreover, studies in animals demonstrate that spontaneous gasping alone during ventricular fibrillation cardiac arrest generates cardiac output, maintains more optimal amplitudes of ventricular fibrillation waveforms, circulates blood to the brain, and decreases intracranial pressure (ICP) [5-7]. Furthermore, the elevation of intrathoracic pressure during standard CCO-CPR in animals (caused by air trapping in the lungs [8]) not only generates carotid pressure and flow but also increases ICP [9]. Intracranial pressure is also known to increase during the chest compression phase of conventional CPR in humans and may be what limits cerebral blood flow [9]. The lower ICP is, the lower resistance is to forward blood flow to the brain. This may explain why performance of standard CCO-CPR in animals at 100 per minute results in only 25% of normal perfusion to the brain, but during LUCAS CCO-CPR, cortical cerebral blood flow is significantly increased [10]. Therefore, gasping not only significantly improves the effectiveness of bystander CPR but also, without any bystander CPR, has the potential to increase both survival and neurologic outcome.

Among patients who are found gasping, survival to hospital discharge is 3 times greater compared with those not found gasping [11,12]. Among those who gasp and receive bystander CPR, survival to hospital discharge is more than 4 times greater [12]. Gasping observed upon arrival of emergency rescuers is evidence that either emergency rescuers arrived very quickly and/or bystander CPR was effectively applied [12]. Results from the SOS-KANTO study [13] showed that 30-day favorable neurologic outcome for those receiving CCO-CPR with gasping present before arrival of emergency rescuers (as evidenced by gasping observed upon arrival of emergency rescuers) was virtually no better than for those who gasped but received no CPR at all (6% vs 5%). In addition, when bystander CPR was performed with gasping present, patients receiving conventional CPR had far superior 30-day favorable neurologic outcome than those receiving CCO-CPR (14% vs 6%). As evidenced, gasping is an important confounding factor because it is associated with higher survival and good neurologic outcome. The absence of gasping observed upon arrival of emergency rescuers may be an important factor in the determination of whether to manage the airway with ETI.

References

[1] McMullan J, Gerecht R, Bonomo J, et al, CARES Surveillance Group. Airway management and out-of-hospital cardiac arrest outcome in the CARES registry. Resuscitation 2014;85:617–22.
[2] Safar P, Bircher N, Pretto E, Berkebile P, Tisherman SA, Marion D, et al. A reappraisal of mouth-to-mouth ventilation during bystander-initiated cardiopulmonary resuscitation. Resuscitation 1998;36:75–6 [letter].
[3] Safar P, Bircher N, Prieto E, Berkebile P, Tisherman SA, Marion D, et al. Reappraisal of mouth-to-mouth ventilation during bystander-initiated CPR. Ann Emerg Med 1998;31:653–4 [letter].
[4] Safar P, Bircher N, Prieto Jr E, Berkebile P, Tisherman SA, Marion D, et al. Reappraisal of mouth-to-mouth ventilation during bystander-initiated CPR. Circulation 1998;98:608–10 [letter].
[5] Xie J, Weil MW, Sun S, Yu T, Tang W. Spontaneous gasping generates cardiac output during cardiac arrest. Crit Care Med 2004;32:238–40.
[6] Pernat AM, Weil MH, Bisera J, Tang WC, Fukui M. Spontaneous gasping maintains more optimal amplitudes of ventricular fibrillation waveforms during cardiac arrest. Circulation Supplement 1998;17:2511 [abstract].
[7] Srinivasan V, Nadkami VM, Yannopoulos D, et al. Spontaneous gasping decreases intracranial pressure and improves cerebral perfusion in a pig model of ventricular fibrillation. Circulation Supplement IV 2003;108:1761 [abstract].
[8] Halperin HR, Brower R, Weisfeldt ML, et al. Air trapping in the lungs during cardiopulmonary resuscitation in dogs. A mechanism for generating changes in intrathoracic pressure. Circ Res 1989;65:946–54.
[9] Guerci AD, Shi AY, Levin H, Tsitlik J, Weisfeldt ML, Chandra N. Transmission of intrathoracic pressure to the intracranial space during cardiopulmonary resuscitation in dogs. Circ Res 1985;56:20–30.

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[10] Rubertsson S, Karlsten R. Increased cortical cerebral blood flow with LUCAS: a new device for mechanical chest compressions compared to standard external compressions during experimental cardiopulmonary resuscitation. Resuscitation 2005;65:357–63.
[11] Clark JJ, Larsen MP, Culley LL, Graves JR, Eisenberg MS. Incidence of agonal respirations in sudden cardiac arrest. Ann Emerg Med 1992;21:1464–7.
[12] Bobrow BJ, Zuercher M, Ewy GA, et al. Gasping during cardiac arrest in humans is frequent and associated with improved survival. Circulation 2008;118:2550–4.
[13] SOS-KANTO study group. Cardiopulmonary resuscitation by bystanders with chest compression only (SOS-KANTO): an observational study. Lancet 2007;369:920–6.