

EDITORIAL COMMENT

A Natural Biomarker Deserving Attention

Gasping Following Primary Cardiac Arrest*



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Out-of-hospital cardiac arrest (OHCA) remains a major public health challenge. Approximately 374,000 U.S. adults are afflicted each year (1). Despite major investments in enhancing emergency medicine systems, the training of scores of laypersons in cardiopulmonary resuscitation (CPR), and wider availability of automated external defibrillators, the survival at hospital discharge remains poor. Rapid resuscitation, especially in the context of a shockable cardiac rhythm, portends a better outcome. A quarter century ago, agonal respirations were found to be associated with improved hospital survival and most common when OHCA was witnessed (2). In this issue of the *Journal*, a highly respected group of researchers report a secondary analysis from a randomized trial of standard CPR versus active compression-decompression CPR with augmentation of negative intrathoracic pressure for OHCA (3,4). This National Institutes of Health-

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funded research, conducted in 46 emergency medical service agencies located in 7 U.S. communities, represents a retrospective evaluation of prospectively collected data on gasping during OHCA in 1,888 subjects. There were 98 1-year survivors who had favorable neurological function defined as a Cerebral Performance Category (CPC) of ≤ 2 : of those, 37% gasped, whereas it was present in only 8.2% of non-survivors. Multivariable analysis for pre-specified

prognostic factors (including initial cardiac rhythm and time to emergency call) revealed gasping was associated with a 1-year survival odds ratio advantage of 3.94 (95% confidence interval: 2.09 to 7.44). This advantage rose many-fold when accompanied by a shockable rhythm.

Research from the University of Arizona Cardiopulmonary Resuscitation Research Group has reported that following primary cardiac arrest secondary to ventricular fibrillation gasping is common in both animals and man and is associated with improved survival (5,6). However, it should be emphasized, as observed in the current study that in the absence of adequate CPR, gasping is short lived and declines rapidly as minutes elapse from call to first response.

Breathing is controlled by the brain, whereas gasping is generated by signals from the brain stem. It is important to emphasize that for the first minute of ventricular fibrillation (VF)-induced cardiac arrest, continued breathing is common (6). In swine studies of respiratory activity following untreated VF arrest, during the first minute, the airflow pattern was similar to those recorded during spontaneous breathing, occurring at about 10 breaths/min (5). This phenomenon is readily misinterpreted and can result in significant delays in the recognition and treatment of primary cardiac arrest.

Moreover, from the second to the fifth minute of untreated VF in the swine model, gasping occurred in a crescendo-decrescendo pattern; once per minute during the second minute of VF arrest, 3 gasps/min following the third minute, 2 gasps/min after 4 min, 1 gasp/min after 5 min, followed by no spontaneous respiration after 6 min of untreated VF; a crescendo-decrescendo pattern (5). In the absence of resuscitation efforts, all ventilation activity stopped 6 min after VF arrest (5).

To our knowledge, this observation, that for the first minute of VF arrest in swine normal breathing

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often continues, has not been reported in man. This postulate might be usefully further explored clinically in hospital intensive care units that simultaneously record the patient's electrocardiogram and ventilator activity.

We commend Debaty et al. (3) for their study that highlights gasping during CPR as a "natural biomarker for the presence of brainstem activity" and demonstrating its association with greater long-term survival accompanied by good brain function. The implications of their findings should be heeded. Recognizing that gasping is an early

sign of cardiac arrest is of utmost importance. This knowledge should be emphasized during CPR training, so that bystanders do not misinterpret gasping as normal breathing. Recording gasping prospectively and systematically will inform future registries and much-needed research in OHCA.

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