AGONAL BREATHING

WHAT IS NORMAL BREATING?

Let us first define normal breathing. As you already know, the goal of respiration is to oxygenate the blood and to purge it from its waste, carbon dioxide (CO_2)[i]. An adult breathes on average 500 ml of air per minute when resting[ii - iii]. The main muscles used for normal breathing are the diaphragm and the intercostal muscles which allow the lungs to expand[iv]. Normal expiration is passive[v] and without effort since the lung's elasticity is the main responsible to expelling air. Breathing is controlled by the brainstem, located at the base of the brain, which allows the diaphragm to lower thanks to the phrenic nerve, creating inspiration[vi]. The medulla, located in the brainstem, contains special cells whose function is to analyse the concentration of different gasses in the blood and to regulate the speed of breathing accordingly. Contrarily to popular belief, what influences the speed of breathing in a healthy person is not the rate of oxygen in the blood, but rather the level of carbon dioxide and the pH[vii]. Indeed, the higher the level of CO_2 in the blood, the more acid the blood will be and the faster the breathing, in order to purge the CO_2 in the blood and to bring it back to a normal concentration. Inversely, the lower the rate of CO_2, the more the blood will be alkaline and the slower the respiration will be to increase the CO_2 concentration and to stabilize the pH in a normal range of values. If, however, the oxygen level goes under a critical threshold, the medulla will activate a survival mechanism called agonal breathing.

WHAT IS AGONAL BREATHING?

Return Agonal breathing is the late sign of a severe lack of oxygen (hypoxemia or anoxia)[viii] and is generally the last stage before complete apnea[ix]. This type of respiration is considered a survival reflex for a body desperately trying to increase the oxygen level in the blood; at this stage, it is neither the level of CO_2 not the lowering of the blood's pH that regulates breathing, but rather the important lack of oxygen[x]. Its length can vary from a few seconds to many minutes. It is important to note that **agonal breathing is NOT efficient** and will inevitably lead to the victim's respiratory arrest if they are not managed [xi - xii]. We can therefore assert that even if agonal breathing has many different causes, it must be considered as a sign of cardiac arrest until proven otherwise. We would like to emphasize the importance of recognizing agonal respiration; it must never be confused with normal respiration, since it does not allow for a proper oxygenation of the victim's blood. A scientific study from 1991 suggested that agonal breathing was present in about 40% of all cardiorespiratory arrests[xiii].

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Interesting fact, another study published in the Circulation journal shows that agonal breathing is associated with a better survival rate for cardiorespiratory arrests: 39% of victims who showed signs of agonal breathing, versus 9% of victims who didn't[xiv]. One of the reasons explaining this difference in the rate of survival is the following. Since agonal breathing usually happens shortly before or after the cardiac arrest, it is an indicator of the event that just happened. The victim will have more chances of survival if someone is witness to the agonal breathing and executes the maneuvers quickly. Remember that the phenomenon of agonal breathing not well known and hard to study, given its unpredictable nature and its multiple manifestations. The results of the studies of this phenomenon are therefore based mainly on data reported by rescuers rather than on rigorous scientific research.

HOW TO DISTINGUISH AGONAL BREATHING FROM NORMAL BREATHING?

As explained above, agonal breathing is a survival reflex and not an efficient way of breathing. It uses mainly the accessory muscles of the neck, the jaw as well as the diaphragm[xv] and is usually noisy, like snoring [xvi - xvii], because the victim's tongue is partially obstructing their airways. It is characterized by a short and fast inspiratory phase, followed by a late and slow expiratory phase and broken by a phase of apnea[xviii]. Agonal respiratory cycles (inspiratory and expiratory phases broken by phases of apnea) generally occur at larger and larger intervals until they completely stop[xix]. Agonal breathing is often compared to a fish out of water vainly trying to breathe through its mouth. Agonal breathing is always accompanied with a state of unconsciousness[xx] and often a cadaveric paleness as well as facial cyanosis, signs of a deep lack of oxygen.

HOW TO DISCUSS AGONAL BREATHING WITH YOUR CANDIDATES?

To discuss the subject of agonal breathing, remind your candidates that according to the Lifesaving society's guidelines, they must look, during the primary assessment, for a NORMAL breathing for a maximum of 5 seconds [xxi - xxii]. If the victim is unconscious and their breathing is abnormally noisy, slow or inefficient, they must absolutely rapidly begin cardiorespiratory reanimation, as since the resuscitation update of 2010, cardiac arrest is defined as an unconsciousness associated to an absent or abnormal breathing[xxiii]. Finally, remind them that performing a cardiac massage on an unconscious victim with a pulse is less severe than not having performed one on a victim in cardiorespiratory arrest for which each minute without cardiac massage reduces their chance of survival by 7 to 10%.[xxiv]

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In case of discrepancy between the original and the translation, the original version in French will prevail.