Abstract

Basic life support includes the rapid recognition of cardiopulmonary arrest, management of the airway, ventilation support, and chest compressions. When a patient is found unresponsive, a quick 5-15 second exam is performed to identify cardiopulmonary arrest. If there are any doubts, cardiopulmonary arrest should be assumed, and chest compressions should be started right away. Two major theories have been proposed to explain how blood is pumped during cardiopulmonary resuscitation: the cardiac pump theory and the thoracic pump theory. These two models can be employed depending on the body conformation of the patient. Chest compressions are performed for two-minute cycles at a rate of 100-120 beats per minute to compress the chest one-third to one-half the width of the chest with each compression. Proper positioning of the person performing chest compressions is of great importance to ensure the most effective compressions are being performed. Manual ventilation, whether it is performed through intubation or with a
bag-mask, is performed at a rate of ten breaths per minute with a rapid inspiration time of one second.

**Keywords:** Cardiopulmonary resuscitation, basic life support, compressions

**Cardiopulmonary resuscitation - Basic life support**

Basic life support (BLS) in veterinary medicine involves rapid recognition of cardiopulmonary arrest (CPA), maintenance of the airway, ventilation, and chest compressions\(^1\). A recent study showed 53% of clients at a veterinary teaching hospital think CPR at a veterinary clinic is similar to CPR in people and includes some form of compression and artificial breathing\(^2\). The 2012 RECOVER guidelines provide evidence-based recommendations for dogs and cats with CPA, and readers here are referred to these guidelines for a more complete review of current literature and recommendations for BLS. The RECOVER guidelines make specific recommendations based on human and animal studies to standardize CPR efforts to improve outcomes of veterinary patients undergoing CPA. Unfortunately, awareness of these RECOVER guidelines is still incomplete among general practitioners\(^3\).

When an unresponsive patient is identified, a rapid assessment of the airway and breathing is recommended first. The patient is typically placed in lateral recumbency for evaluation and initiation of chest compressions. Rapid assessment of the airway, breathing, and circulation (ABC) should be completed in 5-15 seconds or less. Palpation of pulses is not recommended as human studies have shown unreliability of this technique and may delay the initiation of BLS. Several human studies have shown that delays in initiation of BLS lead to decreased survival rates\(^4\) while
minimal adverse effects are caused by the initiation of unnecessary compressions in people that have not undergone CPA¹⁻⁶.

The first part of the rapid assessment is of the airway. A brief inspection, including pulling out the tongue, is performed to evaluate for obvious upper airway obstruction. If an obstruction is identified and can be removed, the patient should then be further evaluated to confirm CPA. After evaluating the airway, breathing is assessed by either feeling for air movement around the mouth and nose or by visualizing chest expansion. If no breathing is noted, CPA should be assumed, and chest compressions should be started.

Chest compressions are performed in right or left lateral recumbency (or dorsal recumbency if the patient is a barrel-chested dog). There are two main theories described to explain how chest compressions lead to blood flow during CPR. The cardiac pump theory suggests direct compressions of the heart allows for blood to be pumped out of the left ventricle and into the aorta during compression followed by filling of the heart chambers and coronary perfusion during recoil. The thoracic pump theory supposes blood from the thoracic cavity is pumped into circulation as the intrathoracic pressure increases during compressions due to compression of the aorta and collapse of the vena cava. During recoil, the decrease in intrathoracic pressure allows blood to flow from the periphery into the thorax and lungs, thereby suggesting the heart is a passive conduit for blood flow. Veterinary patient conformation is variable, and some patients may benefit from the cardiac pump technique while others will benefit more from the thoracic pump technique. Most medium to giant breed dogs have chests that are rounded and are too large to allow for direct compression of the heart. Therefore, chest compressions in these patients should be performed at
the widest part of the chest in lateral recumbency to utilize the thoracic pump model. Cats, small dogs, and dogs with keel-shaped chests (such as greyhounds, and Salukis) have a size and/or conformation that generally allows for direct compression of the heart, so chest compressions on these animals should be performed directly over the heart with animals in lateral recumbency. Dogs with barrel-shaped chests generally benefit more from being placed in dorsal recumbency with chest compressions performed directly over the sternum to employ the cardiac pump technique by compressing the heart between the sternum and spine\textsuperscript{6}.

The person performing chest compressions should be positioned on the dorsal (spine-side) of the patient. One hand is placed on top of the other with fingers interlocked, and the heel of the palm is placed on the area of compression while the elbows are locked in extension. The rescuer’s shoulders should be directly in line with their hands, and the weight of the body is used to strengthen compressions. Attempts should be made to compress the chest one-third to one-half the width of the chest. If the patient is a cat or small dog, their chest walls are generally compliant enough to allow compression of the heart using a single-hand technique with the rescuer’s thumb on one side of the chest and the four fingers on the other side (called the circumferential technique). Regardless of the compression technique, the rescuer should be on the spine-side of the patient to prevent inadvertently pushing the patient further away from the rescuer (assuming the patient is in lateral recumbency). Compressions are performed at a rate of 100-120 beats per minute\textsuperscript{4}. Many songs, such as “Stayin’ Alive” by the Bee Gees and “I Will Survive” by Gloria Gaynor, have beats between 100-120 beats per minute and can be used to improve the timing of compressions. Common pitfalls that must be avoided include the following: too rapid or too slow of a compression rate, arms bent at the elbow during compressions, a participant positioned too
low to the patient so as adequate compressions cannot be performed, compressions exceeding one-half the width of the chest (causing unnecessary thoracic trauma) or less than one-third the width of the chest (inadequate compressions), not allowing full recoil of the chest between each compression, or standing on the sternum-side of the animal, which will lead to the participant inadvertently pushing the patient away with each compression.

Performing successful chest compressions can be a physically demanding and exhausting process—especially in larger dogs—and there are many studies showing rescuer fatigue and decreased depth of compressions after anywhere between 1 and 10 minutes of compression. However, it takes one minute of continuous compressions to reach maximal blood flow. With these results in mind, the RECOVER guidelines suggest performing uninterrupted chest compressions at two-minute intervals with minimal delay between intervals.

In addition to chest compressions, interposed abdominal compressions can be performed in patients that do not have intra-abdominal disease. However, the timing of abdominal compressions can be difficult and may negatively impact the quality of chest compressions.

While chest compressions are being performed, it is also important to provide ventilation because prolonged hypoxia decreases cerebral perfusion pressure and leads to metabolic acidosis. All efforts should be made to intubate the patient without disrupting chest compressions. In a few different studies, Yannopoulos, et al showed a ventilation rate of 10 breaths per minute improved outcomes in porcine CPA models. If intubation is not available, patients should be ventilated
mouth-to-snout at a 30:2 compression/ventilation ratio. A bag-mask may also be utilized. Respi-
rations should be performed with a rapid inspiration time of 1 second whether that is performed with a ventilation machine or a bag-mask.

Conflicts of interest: The author has no conflicts of interest to declare.
References:


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