Closed chest CPR was first discovered during animal research at Johns Hopkins Medical School and its use was first published in a landmark 1960 article in the Journal of the American Medical Association. The authors of this study concluded that “Anyone, anywhere, can now initiate cardiac resuscitation procedures. All that is needed is two hands”.1 Since then numerous algorithms stressing appropriate techniques for basic life support as well as advanced life support have been published based on laboratory and clinical research. Unfortunately, outcomes for patients undergoing cardiopulmonary arrest (CPA) in both human and veterinary medicine remain dismal.2

Current survival rates for humans undergoing CPR is around 20%. Various veterinary publications have reported a survival to discharge rate of 3-6% for dogs and 2-10% for cats.3-4 In these reports nearly all survivors had anesthesia related CPA. Positive prognostic indications in one study were animals with CPA caused by something other than hemorrhage, anemia, shock, hypoxemia, MODS, TBI, malignant arrhythmias, or an anaphylactoid reaction.3

Recently the RECOVER initiative was launched to review the literature associated with CPR in veterinary species and to publish guidelines similar to those found in human medicine through the International Liaison Committee on Resuscitation (ILCOR).5 This initiative was spearheaded by Dan Fletcher and Manuel Boller, both Diplomates of the American College of Emergency and Critical Care. These guidelines are the result of a consensus process introduced at the 2011 IVECCS meeting, and published on the internet for public comment for a period of 4 weeks. A special issue of JVECC6 was then published containing these guidelines and is available for free at www.veccs.org.

The RECOVER guidelines7 contain guidelines and algorithms based on a systematic review of all available veterinary literature. The guidelines cover topics associated with CPR including preparedness and prevention, basic life support, advanced life support, monitoring, and post-cardiac arrest care. Preparedness and prevention includes equipment organization and cognitive aids, CPR training (lectures and mock codes), and ensuring that all members of the CPR team understand their role.

Basic life support includes the recognition of CPA, administration of chest compressions, airway management, and provision of ventilation. The recognition of CPA and immediate institution of CPR should CPA occur is of utmost importance. CPR should be initiated in any
unresponsive and apneic patient. You should not wait for confirmation of absent pulses or auscultable heart beat if CPA is highly suspected. If there is any doubt as to whether the patient has experienced CPA, CPR should be initiated immediately while further assessment to support the diagnosis of CPA is accomplished simultaneously by other personnel or after a 2 minute cycle of CPR. Current recommendations for chest compressions are to place the patient in lateral recumbency and administer 100-120 compressions per minute, compressing the chest 33-50% of the width of the thorax, while allowing full chest recoil (avoid leaning). Chest compressions should be performed in 2 minute cycles to avoid fatigue. Recommendations for ventilation include early endotracheal intubation when possible, administration of 10 breaths per minute, and maintanence of normocapnea and normoxemia. It is important not to ventilate too quickly or too slowly as both of these may lead to worse outcomes. Mouth to snout ventilation may be performed in a 30:2 compression to ventilation ratio when intubation is not feasible.

Advanced life support (ALS) encompasses the components of veterinary CPR performed after basic life support has been initiated until return of spontaneous circulation (ROSC) is achieved. ALS includes therapy with vasopressors, positive inotropes, anticholinergics, correction of electrolyte and acid-base disturbances, correction of volume deficits, and prompt defibrillation. Low dose epinephrine (0.01 mg/kg IV ) are currently recommended for routine administration during CPR. High dose epinephrine (0.1 mg/kg IV) may be considered in prolonged CPR. Vasopressin (0.8 u/kg IV) may be substituted for low dose epinephrine. Recently, atropine has been removed from the algorithm for CPR in human medicine due to a lack of evidence for improvement of outcomes. Atropine is still recommended in veterinary patients with asystole or pulseless electrical activity (PEA) associated with high vagal tone at a dose of 0.04 mg/kg. Due to the lack of any clear detrimental effect, the routine use of atropine can be considered for routine use.

Defibrillation can be by either electrical or pharmacological means. Electrical defibrillation with a monophasic or biphasic defibrillator is recommended immediately after recognition of ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT). Electrical defibrillation should be followed immediately by a 2 minute cycle of CPR rather than “stacking” defibrillation attempts as has previously been recommended. Amiodarone should be considered in cases of VF or pulseless VT refractory to electrical defibrillation. If Amiodarone is not available lidocaine may be considered. It is NOT recommended to administer these medications prior to defibrillation attempts as it may increase the energy required to electrically defibrillate the heart.

IV fluids should not be administered routinely during CPR due to its adverse effects on coronary perfusion pressure. However, in cases of known or suspected hypovolemia (such as hemorrhage) IV fluids should be administered to restore adequate circulating volume. During CPR all anesthetic agents should be reversed. Documented electrolyte abnormalities (such as hypocalcemia or hyperkalemia) should be treated appropriately. Corticosteroids are NOT recommended. Bicarbonate may be considered in prolonged CPA. Open chest CPR is more effective than closed chest CPR in restoring ROSC and promoting good outcomes in canine
models of VF. It should be promptly considered in cases of significant thoracic disease such as pneumothorax or pericardial effusion.

Many animals will ultimately die despite initial successful resuscitation. Survival rates to discharge range from 2-10% despite initial rates of ROSC of 35-45% in dogs and cats. Appropriate post-cardiac arrest (PCA) care could lead to improved rates of discharge from the hospital. PCA care includes hemodynamic optimization strategies, control of respiratory function, hypothermia and slow rewarming. Patients should be transferred to a 24 hour critical care facility as many patients remain critically ill for a significant period of time.

References: