Cardiopulmonary cerebral resuscitation – ABC vs. CAB

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ABSTRACT: Recently in human medicine there has been a shift in advice from ABC (airway, breathing, circulation) to CAB (circulation, airway, breathing) in cases of cardiopulmonary cerebral resuscitation (CPCR); with a public campaign from the British Heart Foundation stating a preference towards hands-only CPCR (www.bhf.org.uk). There has been much debate in veterinary medicine as to which approach is best to take in our patients and if there should be a shift in thinking. This article will be focusing on Basic Life Support (BLS).

Cardiopulmonary arrest (CPA) is defined as a cessation of spontaneous and effective ventilation and circulation.[1] Often veterinary nurses are in the position first to recognise the impending signs of CPA; or may be presented at triage with a patient already in CPA.

With this in mind it is important to recognise when CPA may be imminent. The following are signs of impending CPA:

- change in respiration effort, rate or rhythm (e.g. Cheyne-Stokes respiration, decrease in rate)
- pale/grey mucous membranes
- change in pulse rate, rhythm or quality – or even absence
- significant hypotension (systolic blood pressure <50mmHg)[2]
- collapse
- changes in heart rate or rhythm
- abnormal ECG traces
- unexplained anaesthesia depth change
- change in mentation, if conscious.

Prevention of CPA is much better than cure, and if the above signs are observed then medical and nursing interventions will be required. The veterinary surgeon must be informed of changes immediately.

The major signs of CPA are:

- apnoea
- absence of pulse
- inaudible heart beat
- fixed and dilated pupils (this can occur within 20-40 seconds after arrest)[3]
- non-responsiveness.

Upon recognition of CPA, if under general anaesthesia, the anaesthetic agent should be turned off and in all cases assistance sought. The time of CPA should be noted.

Rapid diagnosis of CPA is vital, as a delay in cardiopulmonary cerebral resuscitation (CPCR) can have a significantly detrimental effect on the chance of survival to discharge as reported in numerous studies.[4] If there is any doubt as to whether the patient is in CPA then Basic Life Support (BLS) should be started immediately.

Studies into whether compressions performed on patients not in CPA are harmful are inconclusive owing to lack of research.[5] In human medicine, the number of people exhibiting adverse effects from compressions is less than two per cent; and the human clinical studies suggest that the benefit of early compressions to subjects in CPA outweighs the risk of injury to those not in CPA.[5]

Some patients may not be candidates for CPCR, such as those with a 'do not resuscitate' agreement, severe head trauma cases and patients in end-stage terminal conditions.

ABC versus CAB

ABC (airway, breathing, circulation)

Figure 1. Although CAB is most appropriate for cardiac arrest cases that have been witnessed, for respiratory arrest ventilation is mandatory

has traditionally been instituted as the methodical approach for CPCR. In human medicine, there has recently been a television campaign by the British Heart Foundation to shift from ABC to CAB, or hand-only CPCR. Some veterinary studies have agreed with this change in priority for patients.

In a study of compression-only CPCR in cardiac arrest cases, it was found that chest compressions alone maintained SPO_2 levels at >90% for four minutes, demonstrating that if compressions are started within one minute of arrest, there will still be adequate gas exchange.[6]

External compression of the chest alone can cause the animal to breathe artificially.[7]

As already discussed, any delay in CPCR will have a detrimental effect, so if the rescuer is alone there will be more chance of providing some circulatory and ventilator support through compressions alone than by ventilation alone. In the first few minutes of CPA, blood is still well oxygenated.

If the first person on the scene is not confident with intubation, this could delay BLS; and ventilation prior to the airway being secure can potentially cause gastric insufflation and aspiration pneumonia.[8]

However, there are arguments for continuing with the mnemonic, ABC. Although CAB is most appropriate for cardiac arrest cases that have been witnessed, for respiratory arrest ventilation is mandatory (**Figure 1**). It is important to consider the aetiology of the arrest when deciding which protocol to use.[9]

As most CPA in veterinary patients is respiratory or vagally induced, ABC is still deemed the most appropriate initial approach in a large proportion of these cases.[1] Airway and ventilation are important to establish, because hypoxia and hypercapnia can reduce the likelihood of the return of spontaneous circulation (ROSC).[4]

It has been shown that patients that arrest during general anaesthesia have a slightly more favourable outcome, probably because the patient already has a patent airway and is able to receive 100 per cent oxygen, as well as vascular access.[7]

It has also been shown that patients have a better outcome if a team of resuscitators is present and the patient has a reversible underlying disease process or an anaesthetic overdose.[10] So having a patent airway is not the only factor involved in a positive outcome.

In veterinary medicine, there is currently no direct evidence comparing the

TABLE 1 American Society of Anesthesiologists (ASA) Physical Status Scale (www.avta-vts.org)

Class I	Minimal risk. A normal healthy animal with no underlying disease.
Class II	Slight risk, minor disease present. Animal with slight to mild systemic disturbance, animal able to compensate; for example, neonate or geriatric animals, obese animals.
Class III	Moderate risk, obvious disease present. Animal with moderate systemic disease or disturbances, mild clinical signs; for example, anaemia, moderate dehydration, fever, low-grade heart murmur or cardiac disease.
Class IV	High risk, significantly compromised by disease. Animals with pre-existing systemic disease or disturbances or a severe nature; for example, severe dehydration, shock, uraemia, or toxaemia, high fever, uncompensated heart disease, uncompensated diabetes, pulmonary disease, emaciation.
Class V	Extreme risk, moribund. Surgery often performed in desperation on animal with life-threatening systemic disease; for example, advance cases of heart, kidney, liver or endocrine disease, profound shock, sever trauma, pulmonary embolus, terminal malignancy.

efficacy of CAB vs. ABC. There has to be consideration of the cause of the arrest when deciding which approach to take. If the arrest was of cardiac origin, then compressions first is advocated.[5&9]

However, if the arrest was not witnessed, or the arrest was the consequence of a non-cardiac cause, then there is still an argument to continue using ABC, providing that compressions are not significantly delayed.[5]

Ideally, the veterinary team should be well-versed in dealing with a patient in CPA, and a teamwork approach of a minimum of one person for compressions, one for ventilation and one team leader should be used so that compressions, airway and ventilation can all be supported at the same time.[4]

Currently survival rates for veterinary patients are poor; with a one week survival rate post CPCR of less than four per cent.[11] Those that initially have ROSC have a re-arrest rate of 60 to 70 per cent.[8]

Conclusion

There is no definitive research to suggest that either CAB or ABC should be the sole protocol used. It is most important for the whole veterinary team to be well rehearsed in what to do should CPA occur, with a practice session periodically to analyse performance.

Patients with higher ASA scores are obviously at higher risk owing to underlying illness, so emergency drug doses should be pre-calculated prior to GA where possible (**Table 1**). Recognising the signs of impending CPA and acting quickly and efficiently can only help to improve the chances of recovery. vnj

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