WORKSHEET for Evidence-Based Review of Science for Veterinary CPCR

1. Basic Demographics

Worksheet author(s)

Kate Hopper	**Date Submitted for review:**
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2. Clinical question:

In medium and large sized dogs with cardiac arrest (P), does placing hands over the highest point of the chest for chest compressions (I), compared to placing hands over the heart for chest compressions (C), improve outcome (eg. ROSC, survival)(O)?

3. Conflict of interest specific to this question:

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet?
No

4. Search strategy (including electronic databases searched):

4a. Databases

Pubmed (NLM) (no date restriction) (performed on April 28, 2011) textword search:

1. Chest compressions
2. Hand position
3. Thoracic pump
4. Cardiac pump
5. Dog
6. Cat

1 and 2: 0 relevant hits out of 23 total hits
1 and 3: 0 relevant hits out of 7 total hits
1 and 4: 1 relevant hits out of 7 total hits
3 and 5: 0 relevant hits out of 27 total hits
3 and 6: 0 relevant hits out of 12 total hits

2 and 3:

CAB Abstracts (1910 to X) performed on April

1. Chest compressions
2. Hand position
3. Thoracic pump
4. Cardiac pump
5. Dog

6. Cat
7. CPR

1 and 2: 0 total hits
1 and 3: 0 total hits
1 and 4: 0 total hits
3 and 5: 0 total hits
3 and 6: 0 total hits
5 and 7: 0 relevant hits out of 1 total hit
6 and 7: 0 relevant hits out of 4 total hits

4b. Other sources

-GOOGLE SCHOLAR (performed on August 5th 2010)
Report as for Medline

In addition references of the following articles were searched for relevant articles.
Feneley 1987
0 relevant articles were identified

4c. State inclusion and exclusion criteria for choosing studies and list number of studies excluded per criterion

Inclusion criteria

Studies evaluating chest compressions in animals in lateral recumbency

Exclusion criteria

Articles without a comparison group, non English language articles, review articles or abstracts only.

4d. Number of articles/sources meeting criteria for further review: 13

One relevant animal experimental study was identified (Feneley 1987)

5. Summary of evidence

Evidence Supporting Clinical Question

Good						
Fair						
Poor						
	1	**2**	**3**	**4**	**5**	**6**
Level of evidence (P)						

A = Return of spontaneous circulation
B = Survival of event
C = Survival to hospital discharge
D = Intact neurological survival
E = Other endpoint
Italics = Non-target species studies

Evidence Neutral to Clinical question

Good						
Fair						
Poor			**Feneley 2003;** E=echocardiographic effects of compressions			
	1	**2**	**3**	**4**	**5**	**6**
Level of evidence (P)						

A = Return of spontaneous circulation
B = Survival of event
C = Survival to hospital discharge
D = Intact neurological survival
E = Other endpoint
Italics = Non-target species studies

Evidence Opposing Clinical Question

Good						
Fair						
Poor						
	1	**2**	**3**	**4**	**5**	**6**
Level of evidence (P)						

A = Return of spontaneous circulation
B = Survival of event
C = Survival to hospital discharge
D = Intact neurological survival
E = Other endpoint
Italics = Non-target species studies

6. REVIEWER'S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:

In clinical veterinary medicine chest compressions in dogs and cats is most commonly performed with the animal in lateral recumbency. Compressions are performed directly over the heart in an attempt to generate blood flow via the cardiac pump mechanism or over the highest point of the chest in an effort to utilize the thoracic pump mechanism. There were no studies identified that directly compared performance of lateral chest compressions by placing hands over the highest point of the chest with placing hands directly over the heart. One experimental dog study was identified that used echocardiography to evaluate how external chest compressions impacted mitral valve motion in dogs of 18-26kg (Feneley 1987). This study reported that when lateral chest compressions were performed directly over the heart the mitral valve closed and the left ventricle was deformed supporting the cardiac pump theory for the mechanism of blood flow for this type of compressions. When lateral chest compressions were performed on regions of the chest wall not directly over the heart the mitral valve leaflets did not oppose suggesting that the effects of external compressions varies with compression technique so it is possible that one technique has superiority over the other. No recommendations regarding where on the thorax lateral chest compressions should be performed can be made at this time.

7. Conclusion

DISCLAIMER: Potential possible wording for a Consensus on Science Statement. Final wording will differ due to other input and discussion.

CONSENSUS ON SCIENCE:

There is no evidence to address this question so no conclusions can be drawn. One experimental dog study (LOE3) used echocardiography to show that the physiology of lateral chest compressions directly over the heart is different than lateral chest compressions performed on regions of the chest wall not directly over the heart (Feneley 1987). This would suggest that one approach maybe superior to the other for CPR and future studies are warranted.

8. Acknowledgement

None

9. Citation list

Sequence of mitral valve motion and transmitral blood flow during manual cardiopulmonary resuscitation in dogs.

Feneley MP, Maier GW, Gaynor JW, Gall SA, Kisslo JA, Davis JW, Rankin JS.
Circulation. 1987 Aug;76(2):363-75.

Abstract

According to the thoracic pump model of cardiopulmonary resuscitation (CPR), the heart serves as a passive conduit for blood flow from the pulmonary to the systemic vasculature, necessitating an open mitral valve and anterograde transmitral blood flow during chest compression. To assess the applicability of this model to manual CPR techniques, two-dimensional echocardiograms were recorded from the right chest wall and/or the esophagus in nine dogs (18 to 26 kg) during manual CPR. The aortic valve opened with chest compression and closed with release, while the pulmonary and tricuspid valve leaflets closed with compression and opened during release. The mitral valve remained open during ventilation alone and during abdominal compressions. With the onset of brief, high-velocity (high-impulse) chest compressions, the mitral valve closed rapidly and the left ventricle was deformed, whether compressions were applied to the sternum or the left mid-chest wall. The mitral valve reopened with release of each compression. Left atrial echocardiographic contrast injections confirmed the absence of anterograde transmitral blood flow during high-impulse compression and its presence during release. Failure of mitral leaflet approximation during chest compression was observed only when a very low-velocity, prolonged (low-impulse) compression technique was used, or when regions that did not directly overlie the heart were compressed. Consistent with these observations, simultaneous recordings of the left ventricular and left atrial pressures

during high-impulse sternal compressions in five dogs (19 to 25 kg) demonstrated peak and mean left ventriculoatrial pressure gradients of 38.5 +/- 4.0 and 13.5 +/- 2.9 mm Hg, respectively, and these pressure gradients declined with less impulsive compressions. The observations made during all but low-impulse chest compressions are inconsistent with the thoracic pump model, and support direct cardiac compression as the primary mechanism of forward blood flow with more impulsive manual chest compression techniques.
Key point: This study of CPR in dogs (LOE 3, neutral, poor) used echocardiography to demonstrate the valve motion during different compression techniques. It showed that mitral valve motion was different during chest compressions directly over the heart versus chest compressions elsewhere on the chest (exact location not described).