WORKSHEET for Evidence-Based Review of Science for Veterinary CPCR

1. Basic Demographics

Worksheet author(s)

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[redacted]

2. Clinical question:

In dogs and cats with ROSC after cardiac arrest (P), does post-CPR care in a specialty center (I) compared to post-CPR care in a non-specialty center (C) provide better outcomes (O) (e.g. survival rates or neurologic outcomes)?

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):

-MEDLINE via PUBMED (1950 to May 2009) (performed on June 17th 2011)

1. cardiac arrest

2. cardiopulmonary arrest

3. cardiopulmonary resuscitation

4. veterinary

5. outcome

6. referral center

7. referral hospital

8. specialty center

9. specialty hospital

1 and 6: 2 relevant hits out of 14 total hits

1 and 8: no additional relevant hits

3 and 6: 4 relevant hits out of 10 total hits

1 and 7: no additional relevant hits

1 and 9: no additional relevant hits

3 and 8: no additional relevant hits

3 and 9: no additional relevant hits

1 and 4 and 5: 0 relevant hits out of 28 total hits

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

3 and 4 and 5: 4 relevant hits out of 9 total hits

CAB abstracts:

Search using the same terms as for Medline yielded no additional hits

4b. Other sources

-Cochrane database

-Review of references from articles obtained in initial search

-Review of references from ILCOR 2010 worksheet EIT-027

4 additional hits

-Search of references in veterinary CPR literature

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

Inclusion criteria

Articles in English

Exclusion criteria

Abstracts only. Editorials. Letters to the editor.

4d. Number of articles/sources meeting criteria for further review: 8

- Five observational studies in humans (Engdahl, Abrahamsson et al. 2000), (Langhelle, Tyvold et al. 2003), (Carr, Goyal et al. 2009), (Liu, Yang et al. 2008), (Helitz, Engdahl. et al. 2009)

-One relevant veterinary case series was identified (Hofmeister, Brainard et al. 2009)

-Two relevant retrospective veterinary study were identified (Waldrop, Rozanski et al. 2004), (Wingfield, Van Pelt. 1992)

5. Summary of evidence

Evidence Supporting Clinical Question

Good						
Fair						
Poor						*Carr, Kahn 2009* C *Carr, Goyal 2009* C,E *Engdahl 2000* C
	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					Hofmeister 2009 C	
Poor						*Liu 2008* C *Langhelle 2003* C,D
	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:

Review of the medical literature for studies regarding referral to a specialty center post cardiac arrest returned no clinical studies using dogs or cats.

Review of the human literature does provide some support in favor of patients being treated at higher volume facilities post cardiac arrest (Carr, Kahn 2009, Carr, Goyal 2009, Langhelle 2003). None of these studies however directly addresses the question of referral of patients post cardiac arrest. The reason for the improved outcomes in these studies is speculative but may be attributable to the increased experience of the providers at the higher volume hospitals. Another human study (Liu 2008) found that outcome was improved at one hospital with a higher nurse to patient ratio. This concept is difficult to address in veterinary medicine as the patient to nurse ratio may in fact be lower at large specialty centers that at smaller hospitals however, smaller hospitals are less likely to be as fully staffed overnight thus reducing the nurse to patient ratio over time. Engdahl (2000) conducted a study in Sweden comparing 3 hospitals in a single municipality and found an improved outcome in patients that were treated at the hospital that was most likely to perform more aggressive investigation and interventions (i.e. electrophysiological testing, Holter recording, and echocardiography). Although not directly applicable to the question being posed, it is probable that patients treated at specialty centers will receive more aggressive observation and interventions than patients that are not managed at a specialty center. Currently, the ability to perform cage side echocardiography, invasive blood pressure and central venous pressure monitoring, and short term therapeutic mechanical ventilation is more largely available in a specialty center setting in veterinary medicine. A single veterinary study (Hofmeister 2009) lends some support to this theory. All of the patients in the study experienced cardiac arrest at a teaching hospital. The authors found that dogs were more likely to survive if they were treated with mannitol, lidocaine, fluids, dopamine, corticosteroids or vasopressin. Cats were more likely to survive if they had more people participate in CPCR.

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 are no clinical trials in the veterinary or human literature that directly address the question of referral to a specialty center following cardiac arrest. Based on evidence from 4 observational human trials and one veterinary study, patients have an improved outcome if they are treated at larger hospitals, have higher nurse to patient ratios and undergo more aggressive monitoring and treatment post cardiac arrest. While transfer of patients to a specialty center post cardiac arrest should be strongly considered, it cannot be definitively recommended.

8. Acknowledgement

none

9. Citation list

Hofmeister E, Brainard B, Egger C and Kang S (2009). "Prognostic indicators for dogs and cats with cardiopulmonary arrest treated by cardiopulmonary cerebral resuscitation at a university teaching hospital." J Am Vet Med Assoc 235(1); 50-57.

Abstract:

Objectove: To determine the association among signalment, health status, other clinical variables, and treatments and events during cardiopulmonary cerebral resuscitation (CPCR) with the return of spontaneous circulation (ROSC) for animals with cardiopulmonary arrest (CPA) in a veterinary teaching hospital.

Design: Cross-sectional study.

Animals: 161 dogs and 43 cats with CPA.

Procedures: Data were gathered during a 60 month period on animals that had CPA and underwent CPCR. Logistic regression was used to evaluate effects of multiple predictors for ROSC.

Results: 56 (35%) dogs and 19 (44%) cats had successful CPCR. Twelve (6%) of animals (9 dogs and 3 cats) were discharged from the hospital. Successfully resuscitated dogs were significantly more likely to have been treated with mannitol, lidocaine, fluids, dopamine, corticosteroids, or vasopressin; had CPA while anesthetized; received chest compressions while positioned in lateral recumbency; and had a suspected cause of CPA other than hemorrhage or anemia, shock, hypoxemia, multiple organ dysfunction syndrome, cerebral trauma, malignant arrhythmia, or an anaphylactoid reaction and were less likely to have been treated with multiple doses of epinephrine, had a longer duration of CPA or ad multiple disease conditions, compared with findings in dogs that were not successfully resuscitated. Successfully resuscitated cats were significantly more likely to have had more people participate in CPCR and less likely to have had shock as the suspected cause of CPA, compared with findings in cats that were not successfully resuscitated.

Conclusions and Clinical Relevance: The prognosis was grave for animals with CPA, except for those that had CPA while anesthetized.

Comments:

LOE5

Quality = fair (relates somewhat to the question being asked, prospective cross sectional study)

Neutral to referral to specialty center

No industry funding

Prospective cross-sectional study evaluating factors associated with outcome of cardiac arrest in a teaching hospital. This study is not directly related to the question being asked. Interesting findings include the fact that dogs that survived were more likely to have been treated with mannitol, lidocaine, fluids, dopamine, corticosteroids or vasopressin. Cats were more likely to have survived if they had more people participate in the resuscitation efforts.

Carr B, Kahn J et al (2009). "Inter-hospital variability in post-cardiac arrest mortality." Resuscitation 80; 30-34.

Abstract:

A growing body of evidence suggests that variability in post-cardiac arrest care contributes to differential outcomes of patients with initial return of spontaneous circulation after cardiac arrest. We examined hospital-level variation in mortality of patients admitted to United States intensive care units (ICUs) with a diagnosis of cardiac arrest. Patients with a primary ICU admission diagnosis of cardiac arrest were identified in the 2002-2005 Acute Physiology and Chronic Health Evaluation (APACHE) IV dataset, a multicenter clinical registry of ICU patients. We identified 4674 patients from 39 hospitals. The median number of annual patients was 33 per hospital (range: 12-116). Mean APACHE score was 94 (+/- 38), and overall mortality was 56.8%. Age, severity of illness (acute physiology score), and admission Glasgow Coma Scale were all associated with increased mortality ($P<0.001$). There was no survival difference for patients admitted from the emergency department vs. the inpatient floor. Among institutions, unadjusted in-hospital mortality ranged from 41% to 81%. After adjusting for age and severity of illness, institutional mortality ranged from 46% to 68%. Patients treated at higher volume centers were significantly less likely to die in the hospital. We demonstrate hospital-level variation in severity adjusted mortality among patients admitted to the ICU after cardiac arrest. We identify a volume-outcome relationship showing lower mortality among patients admitted to ICUs that treat a high volume of post-cardiac arrest patients. Prospective studies should identify hospital-level and patient care factors that contribute to post-cardiac arrest survival.

Comments:

LOE 6

Quality = fair (relates to the question being asked in a non-target species)

In favor of referral to specialty center

RMM serves on the BLS subcommittee of the American Heart Association Emergency Cardiac Care Committee as a fellow. AAK is an employee of Cerner Corporation and owns shares of Cerner stock. RWN serves on the ACLS Subcommittee of the American Heart Association Emergency Cardiac Care Committee

This paper describes an improved outcome in patients that are treated post-arrest at a high volume hospital. Although no patients were transported post-cardiac arrest it is relevant in that is suggests experience level of the treating hospital is a contributing factor to the ultimate outcome following cardiac arrest.

Carr B, Goyal M et al (2009). "A national analysis of the relationship between hospital factors and post-cardiac arrest mortality." Intensive Care Med 35; 505-511.

Abstract:

We sought to generate national estimates for post-cardiac arrest mortality, to assess trends, and to identify hospital factors associated with survival. We used a national sample of US hospitals to identify patients resuscitated after cardiac arrest from 2000 to 2004 to describe the association between hospital factors (teaching status, location, size) and mortality, length of stay, and hospital charges. Analyses were performed using logistic regression. A total of 109,739 patients were identified. In-hospital mortality was 70.6%. A 2% decrease in unadjusted mortality from 71.6% in 2000 to 69.6% in 2004 (OR 0.96, P<0.001) was observed. Mortality was lower at teaching hospitals (OR 0.58, P=0.001), urban hospitals (OR 0.63, P=0.004), and large hospitals (OR 0.55, P<0.001). Mortality after in-hospital cardiac arrest decreased over 5 years. Mortality was lower at urban, teaching and large hospitals. There are implications for dissemination of best practices or regionalization of post-cardiac arrest care.

Comments:

LOE 6 (retrospective observations study in humans)

Quality fair (relates to the question being asked in a non-target species)

In favor of referral to a specialty center

No institutional funding

Documented improved survival to discharge in teaching hospitals, urban hospitals and large hospitals. The study was not designed to elicit the reasons for the differences in the improved survival statistics. The authors speculate that the patients treated at the teaching hospitals, urban hospitals and large hospitals benefitted from different patient-management styles, higher intensity service and/or more rapid adoption of new technology and evidence based practice.

Engdahl J, Abrahamsson P et al (2000). "Is hospital care of major importance for outcome after out-of-hospital cardiac arrest? Experience acquired from patients with out-of-hospital cardiac arrest resuscitated by the same Emergency Medical Service and admitted to one of two hospitals over a 16-year period in the municipality of Goeteborg. Resuscitation 43; 201-211.

Abstract:

To describe patient characteristics, hospital investigations and interventions and early mortality among patients being hospitalized after out-of-hospital cardiac arrest in two hospitals. Municipality of Goeteborg, Sweden. All patients suffering out-of-hospital cardiac arrest who were successfully resuscitated and admitted to hospital between 1 October 1980 and 31 December 1996. All patients were resuscitated by the same Emergency Medical Service and admitted alive to one of the two city hospitals in Goeteborg. Of 579 patients admitted to Sahlgrenska Hospital, 253 (44%) were discharged alive and of 459 patients admitted to Oestra Hospital 152 (33%) were discharged alive (P,0.001). More patients in Sahlgrenska Hospital were still receiving cardiopulmonary resuscitation (CPR) treatment (P=0.03), but patients in Oestra had a lower systolic blood pressure and higher heart rate on admission. A larger percentage of patients admitted to Sahlgrenska Hospital underwent coronary angiography (P,0.001), electrophysiological testing (P<0.001), Holter recording (P<0.001), echocardiography (P<0.004), Percutaneous Transluminal Coronary Angioplasty (PTCA, P=0.009), implantation of Automatic Implantable Cardioverter Defibrillator (AICD, P=0.03) and exercise stress tests (P=0.003). Inhabitants in the catchment are of Oestra hospital had a less favourable socio-economic profile. Survival after out-of-hospital cardiac arrest may be affected by the course of hospital management. Other variables that might influence survival are socio-economic factors and cardiorespiratory status on admission to hospital. Further investigation is called for as more patients are being hospitalized alive after out-of-hospital cardiac arrest.

Comments:

LOE 6 (observational study in humans)

Quality = poor (relevant to the question being asked)

In favor of referral to specialty center

No industry funding

Evaluated outcomes of 1038 patients suffering out-of-hospital cardiac arrest and documented different outcome between two hospitals in Sweden. There was very little difference between the patients at the time of admission to the respective hospitals and it is speculated that a difference in hospital treatment was responsible for the difference in survival rates. Patients admitted to Sahlgrenska Hospital were more likely to undergo investigations and interventions after hospital admission. No definitive conclusions regarding the difference in survival rates were reached.

Liu J, Yang Q et al (2008). "Hospital variability of out-of-hospital cardiac arrest survival." Prehosp Emerg Care 12(3); 339-346.

Abstract:

Previous literature has identified patient and emergency medical services (EMS) system factors that are associated with survival of out-of-hospital cardiac arrest patients. To determine variability in rates of survival to discharge of resuscitated adult out-of-hospital cardiac arrest patients and to identify hospital-related factors associated with survival. This was a retrospective, observational study f all adult (21 years or older) out-of-hospital Utstein criteria cardiac-etiology arrests treated by Milwaukee County EMS during the period 1995-2005 and surviving to hospital intensive care unit admission.The primary outcome measure was survival to hospital discharge. Logistic regression analysis was used to compare the odds of survival between hospitals, patient factor, and hospital factors. 1702 patients at eight receiving hospitals were included in the study analyses. Hospital survival rates ranged from 29% to 42%. Patient and case factors associated with increased survival included younger age, male gender, nonwhite race, witnessed arrest in a public location, bystander cardiopulmonary resuscitation (CPR), a modest number of defibrillations, and initial cardiac rhythm of ventricular tachycardia. The only hospital characteristic correlated with survival was the number of beds per nurse. Patients admitted to a hospital with a ratio of beds to nurse less than 1.0 were over 1.5 times more likely to survive. Survival to discharge of resuscitated adult out-of-hospital cardiac arrest patients may vary by receiving hospital. A hospital's ratio of beds to nurse and several patient/case factors are correlated with survival. Further research is warranted to investigate how this may affect resuscitation care, EMS transport policy and research design.

Comments:

LOE 6 (retrospective observational study in humans)

Quality = poor (non-target species and minor relevance to question asked)

Neutral for referral to specialty center

No institutional funding or conflict of interest

This study suggests that lower patient to nurse ratios improves outcome. Currently there is no data available that evaluates patient to nurse ratio in veterinary medicine. It is probable that during normal business hours the inpatient to nurse ratio is lower in non-specialty practices however, the level of training and experience in managing critically ill patients is likely higher in a specialty center. Additionally, many non-specialty centers are not staffed 24 hours per day in which case the benefit of having a lower patient to nurse ratio would be negated.

Langhelle A, Tyvold SS et al (2003). "In-hospital factors associated with improved oucome after out of hospital cardiac arrest. A Comparison between four regions in Norway." Resuscitation 56; 247-263.

Abstract:

While pre-hospital factors related to outcome after out of hospital cardiac arrest (OHCA) are well known, little is known about possible in-hospital factors related to outcome. Some in-hospital factors are associated with outcome in terms of survival. An historical cohort observational study of all patients admitted to hospital with a spontaneous circulation after OHCA due to a cardiac cause in four different regions of Norway 1995-1999; Oslo, Akershus, Ostfold and Stavanger. In Oslo, Akersus, Ostfold and Stavanger 98, 84, 91 and 186 patients were included, respectively. Hospital mortality was higher in Oslo (66%) and Akersus (64%) than in Ostfold (56%) and Stavanger (44%), P=0.002. By multivariate analysis the following pre-arrest and pre-hospital factors were associated with in-hospital survival: age <71 years, better pre-arrest overall performance, a call-receipt-start CPR interval <1 min, and no use of adrenaline (epinephrine). The in-hospital factors associated with survival were: no seizures, base

excess > -3.5 mmol/L, body temperature <37.8 C, and high serum glucose <10.6 mmol/L 1-24 h after admittance with OR (95% CI) 2.72 (1.09 - 8.82, P=0.033), 1.12 (1.02 - 1.23, P=0.016), 2.67 (1.17 - 6.20, P=0.019) and 2.50 (1.11 - 5.65, P=0.028), respectively. Pre-arrest overall function, whether adrenaline was used, body temperature, the occurrence of hypotensive episodes, and the degree of metabolic acidosis differed between the four regions in parallel with the in-hospital survival rates. Both pre-arrest, pre-and in-hospital factors were associated with in-hospital survival after OCHA. It seems important also to report in-hospital factors in outcome studies of OCHA. The design of the study precludes a conclusion on causability.

Comments:

LOE 6 (retrospective observational study in humans)

Quality = poor (non-target species and minor relevance to the question being asked)

Neutral for referral to specialty center

Funded by grants from the Norweigian Air Ambulance Foundation

Despite the finding that there were regional differences in outcome in 4 regions of Norway it was found that there were pre-hospital factors that may have impacted the ultimate outcome of OHCA survivors. No conclusions could be drawn regarding a specific cause for the differences in outcome that was documented however, the hospital that had the lowest in-hospital mortality rate also had twice the patient volume of the other 3 hospitals suggesting that experience may be a contributing factor.