Cardiopulmonary Resuscitation- A Crash Course in Staying Alive

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IDEXX

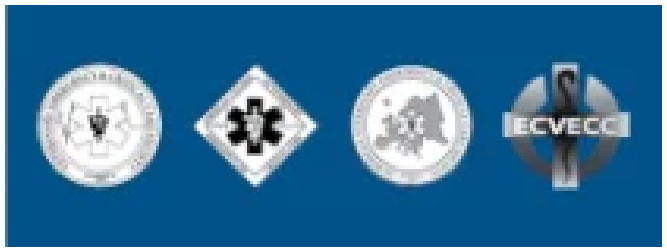
Conflicts of Interest & Disclaimer

- Yvonne McGrotty is an employee of IDEXX Laboratories UK and also an employee of AniCura France.

- *The information contained herein is intended to provide general guidance only. As with any diagnosis or treatment, you should use clinical discretion with each patient based on a complete evaluation of the patient, including history, physical presentation, and complete laboratory data. With respect to any drug therapy or monitoring program, you should refer to product inserts for a complete description of dosages, indications, interactions, and cautions. Diagnosis and treatment decisions are the ultimate responsibility of the primary care veterinarian.*

Resuscitation Campaign on Veterinary Resuscitation (RECOVER)

JOURNAL OF Veterinary Emergency AND Critical Care



SPECIAL ARTICLE | Open Access

2024 RECOVER Guidelines: Updated treatment recommendations for CPR in dogs and cats

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IDEXX

Resuscitation Campaign on Veterinary Resuscitation (RECOVER)

https://recoverinitiative.org/

When, Where and How?

CPR- When?

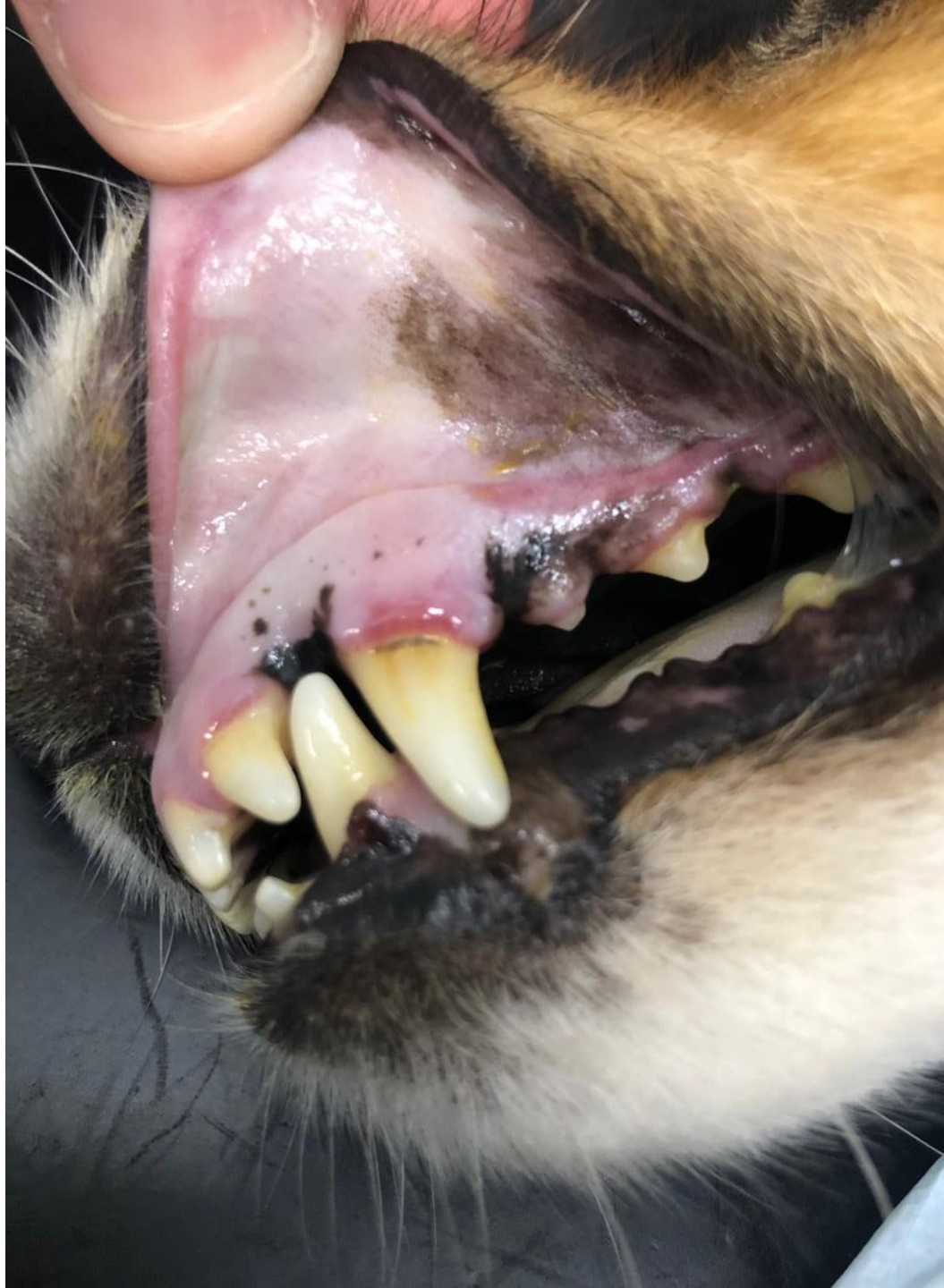
- Should we resuscitate?
- The answer should be no if:
  - Terminal disease
  - Brain damage
  - Owners have issued a D.N.R.

- Try to obtain resuscitation orders in all critical patients

- Make sure the animal has actually arrested!
  - May only be respiratory arrest
  - But if any doubt start compressions

Diagnosis of Cardiopulmonary Arrest

- No spontaneous respiration (often cyanotic)
- No palpable pulse
- No audible heart sounds
- Dilation of pupils
- N.B. CRT can be normal in dead animals!!
- Respiratory arrest will occur prior to cardiac arrest in most cases



Where?

Preparation and Team Work Essential

CPR- Where?

- Requirements
  - Space
  - People
  - Light
  - Oxygen
  - Equipment

- If these are not immediately to hand, then move the patient as quickly as poss!

Crash Equipment (excluding drugs)

+ Laryngoscope
+ ET tubes of various sizes
+ ET Tube ties
+ Cuff inflator
+ Ambu Bag
+ Needles and syringes

+ IV catheters
+ Adhesive tape
+ ECG
+ Capnograph
+ Urinary catheters

+ Oxygen source
+ Suction Unit

+ Defib? Prob not!
+ Mini surgical kit?

Crash Equipment- Drugs

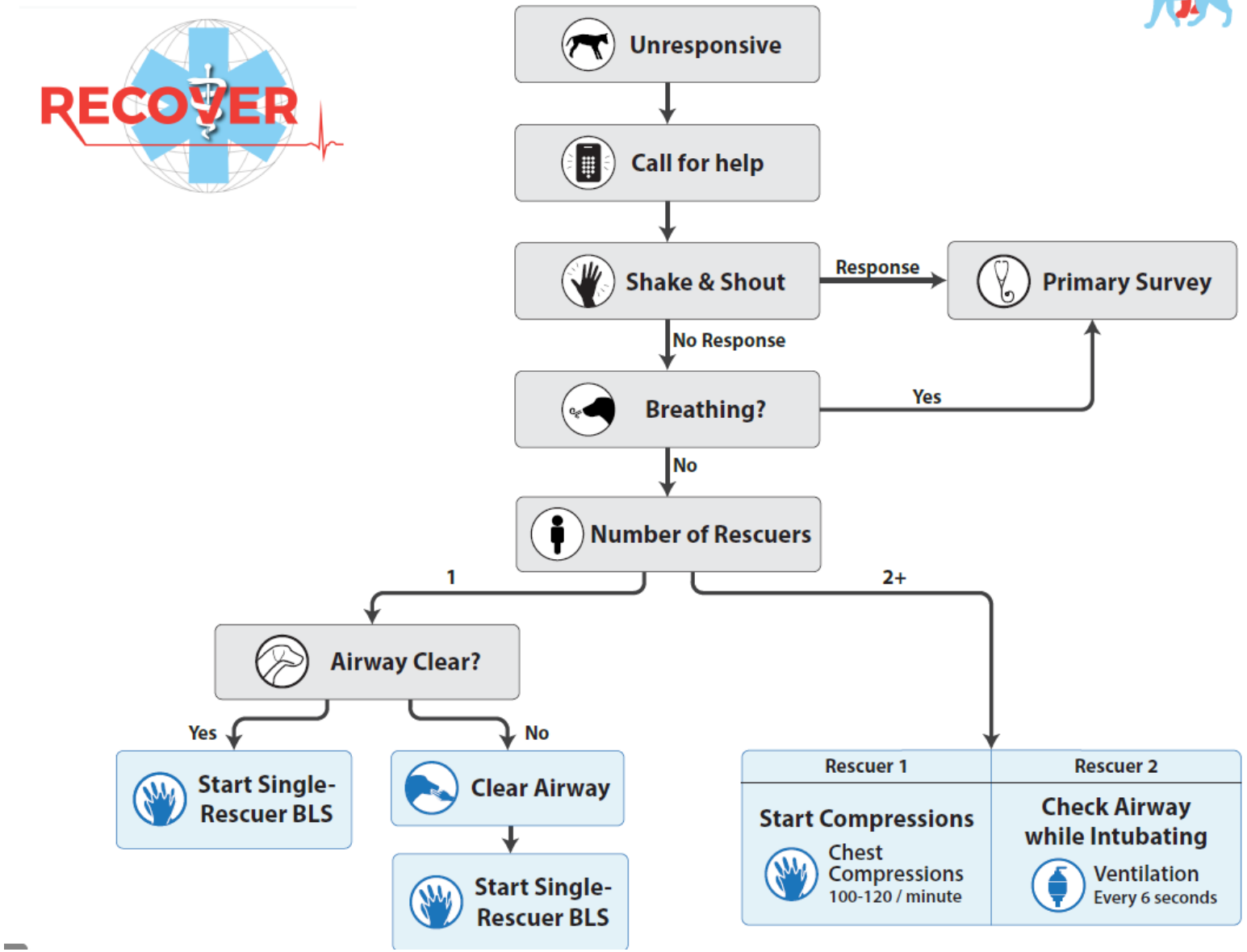
+ Adrenaline 1mg/ml
+ Atropine
+ Lidocaine
+ Glucose 50%
+ Diazepam?
+ Naloxone?

Basic Life Support (BLS)

Basic Life Support

- A = Airway
  - Extend neck & clear obstructions
- B = Breathing
  - Intubate & ventilate with 100% oxygen
- C = Circulation
  - Cardiac compressions
- ABC or CAB??

CPR Initial Assessment Algorithm



With permission from RECOVER

A = Airway

- Check airway is clear
  - Don’t get bitten!!
  - May be gasping/choking
- Remove any secretions or debris from mouth
- Have suction available
- Laryngoscope/light source

B = Breathing

- Intubate & inflate cuff
  - Secure in place!
  - Confirm position with capnograph
- Anaesthetic circuit or Ambu bag
  - Peak pressure of 30-40cm H_20
- Use 100% oxygen if possible
- 10 breaths per minute (no more)
  - 1 breath every 6 seconds
  - Inspiration 1 second
  - Expiration 5 seconds

C = Circulation/Compressions

- Lateral recumbency
  - Compress 1/3 to ½ of thoracic width
- Dorsal recumbency
  - Compress ¼ thoracic width
- Allow full recoil between compressions
- UNINTERRUPTED cycles of 2 mins
- Limit pauses to <10 seconds
- 100-120 compressions/min

Body Position for Compressions

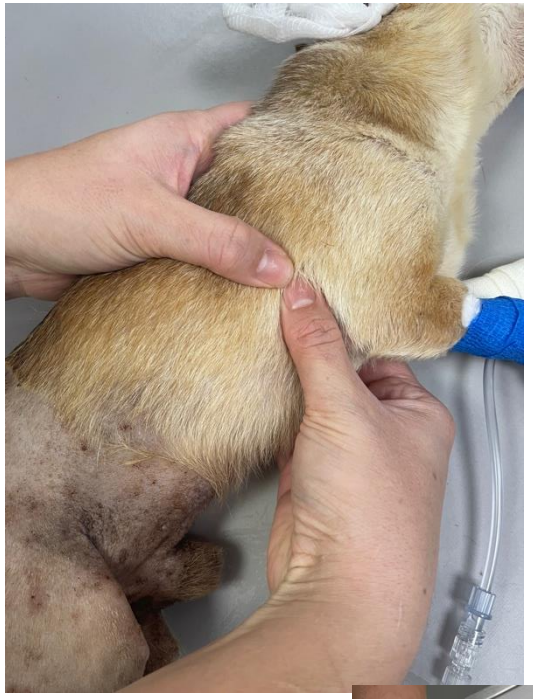
+ Lock elbows in extension
+ Lock wrists in flexion
+ Shoulders directly over the wrists
+ Use core muscles
+ Step stool required in many cases

Hand Placement for Compressions (Medium to Large Dogs)

- Overlap heels of hands
- Fingers interlaced
- Medium to large keel chested dogs
  - Compression directly over heart
  - Cardiac pump
- Medium to large round chested dogs
  - Compression over widest point of thorax
  - Thoracic pump

Hand Placement for Compressions (Small Dogs and Cats)

- Circumferential 2 thumb technique



- 1 handed technique
  - Other hand braces dorsal thorax

- 1 handed heel technique
  - Other hand braces dorsal thorax

Positioning for CPCR

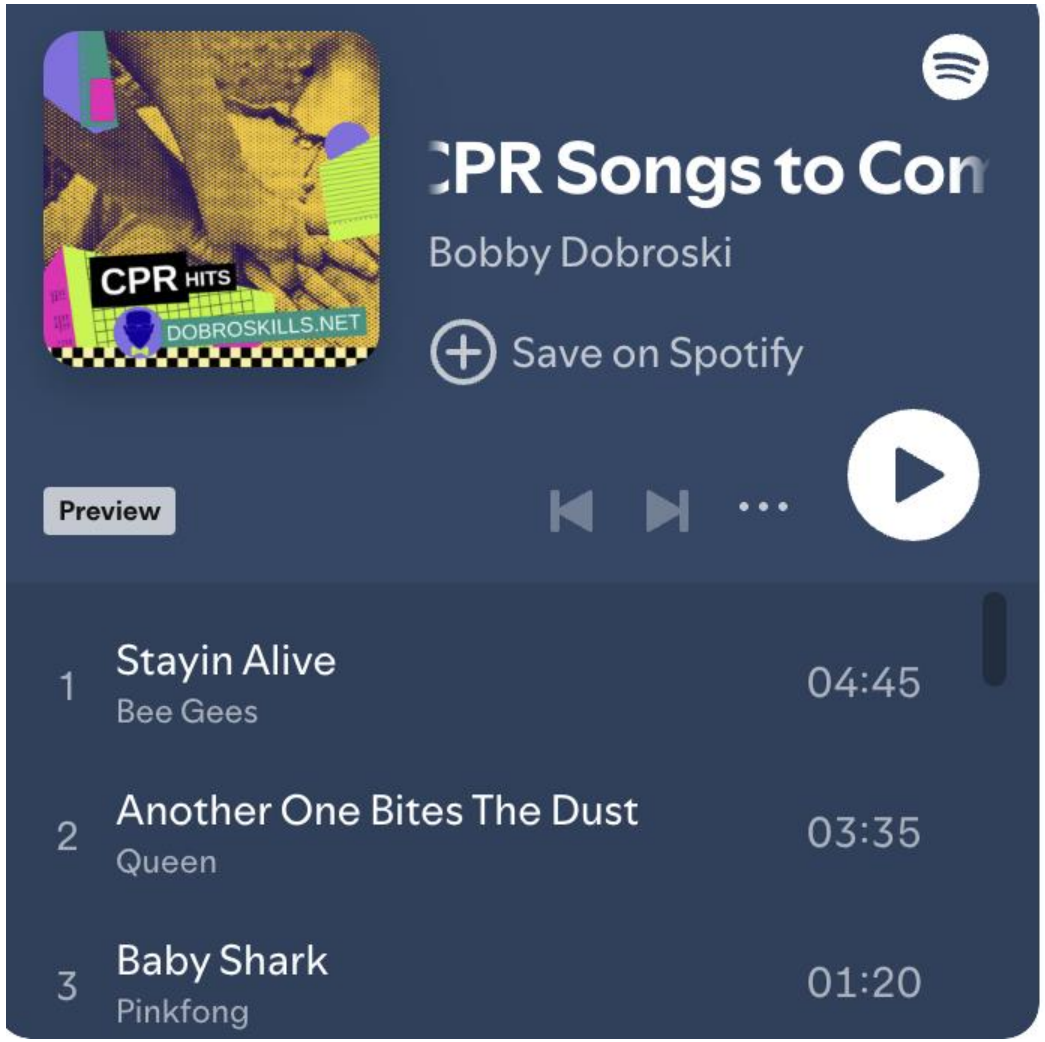
- Lateral recumbency
  - For all non-wide-chested dogs
  - For all cats

- Dorsal recumbency
  - For wide-chested dogs e.g. Bulldogs

Songs to do CPR To

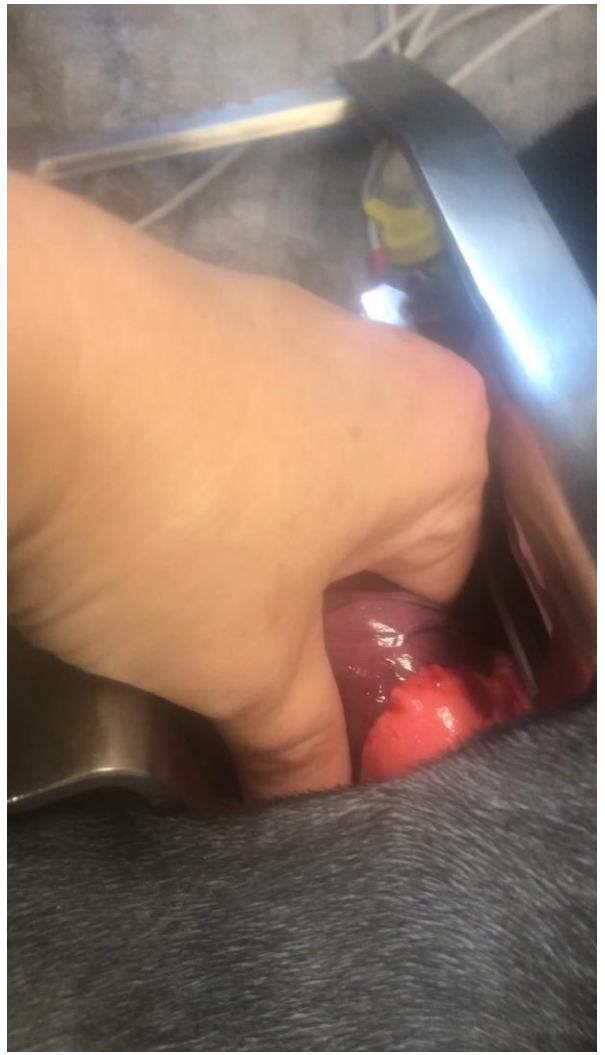
+ Stayin’ Alive
+ I Will Survive
+ Another One Bites The Dust
+ Dancing Queen
+ Eye of The Tiger
+ Thriller
+ Hips Don’t Lie
+ Set Fire to The Rain

+ Baby Shark (please no!!!)

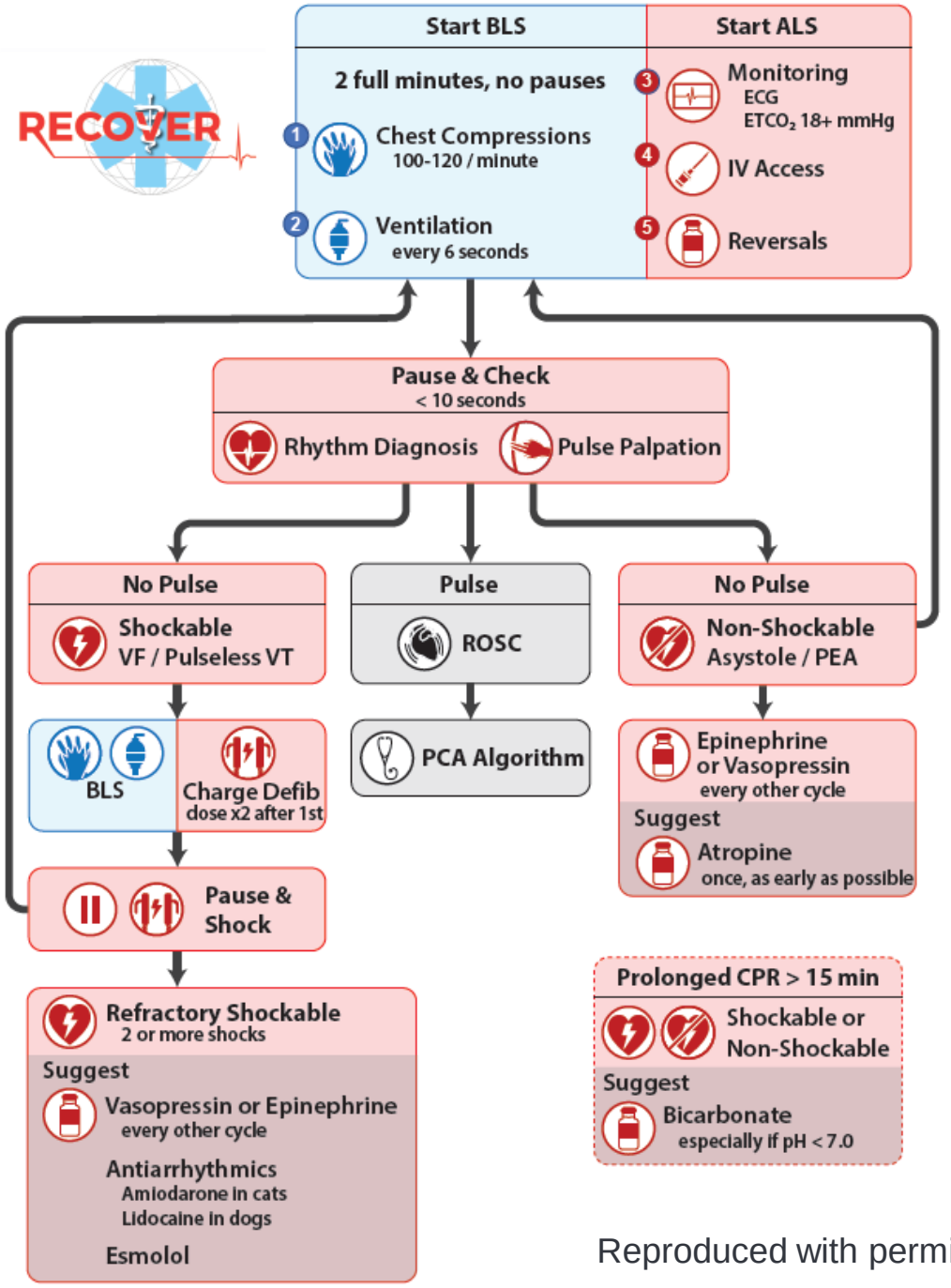


Open Chest CPR (OCCPR)- when?

+ If pleural of pericardial effusion present
+ If animal undergoing abdominal or thoracic surgery
+ If rib fractures present at compression site
+ In medium to large breed dogs with round or deep chests



Advanced Life Support (ALS)



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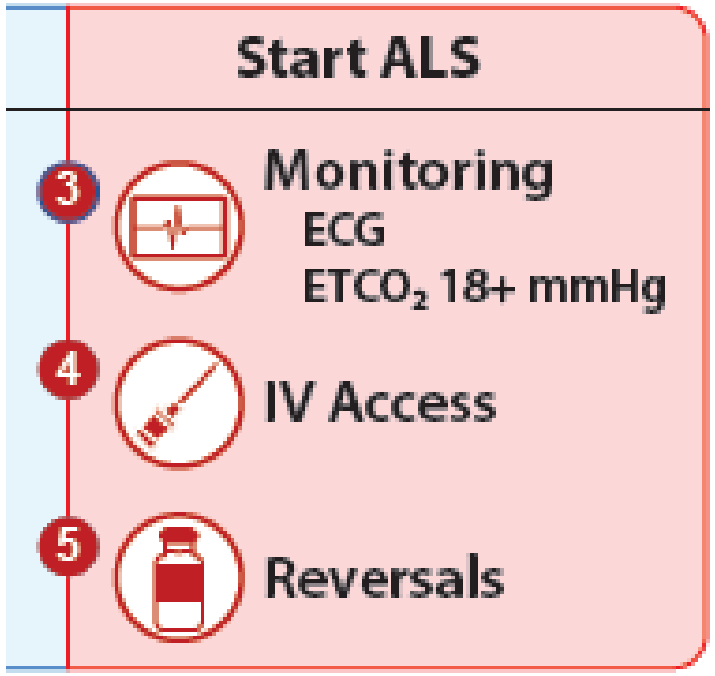
Advanced Life Support (ALS)

+ Attach ECG
+ Attach capnograph
+ Vascular access
+ Reverse any drugs
+ Adrenaline
+ Atropine



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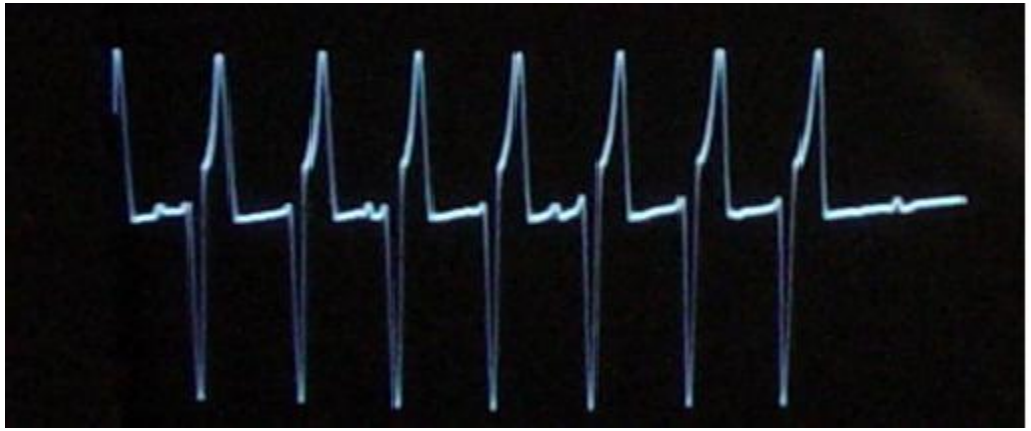
Shockable versus non shockable rhythms

Shockable

+ Ventricular fibrillation

+ Pulseless ventricular tachycardia



Non shockable

+ Asystole

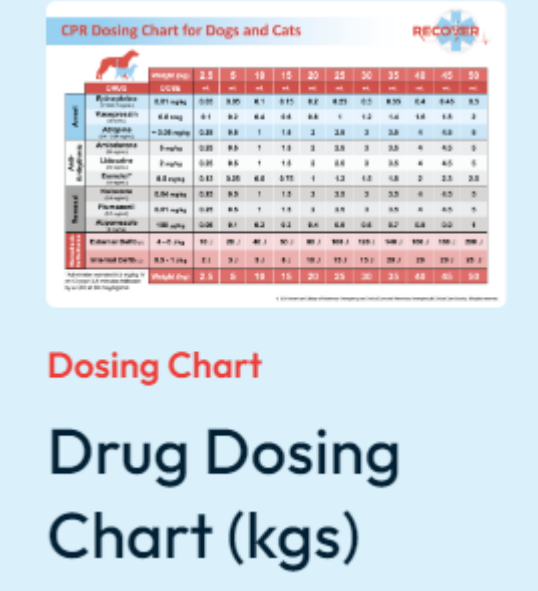
+ Pulseless electrical activity

Drugs- for patients with non-shockable rhythms

+ Induce peripheral vasoconstriction
  + Direct blood to core organs

+ Adrenaline
  + Don’t use in first cycle
  + Only use low dose 0.01mg/kg IV

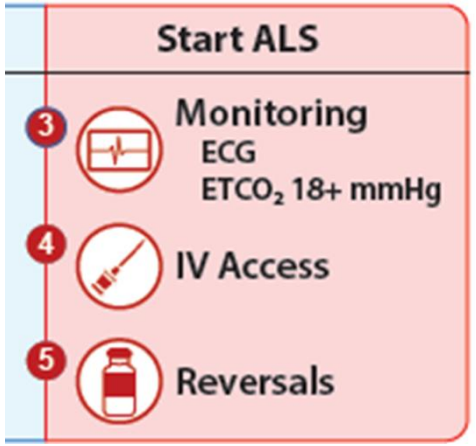
+ Atropine
  + Use once if high vagal tone suspected
  + Use early
  + 0.1ml/kg IV



https://recoverinitiative.org/2024-algorithms-drug-charts/

Assessing Efficacy of Advanced Life Support

- **$ETCO_2$ >18mm Hg**
  - Optimal
- $ETCO_2$ >12
  - Endotracheal tube placement confirmed
- $ETCO_2$ <12mm Hg
  - Check ET tube placement



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Defibrillation

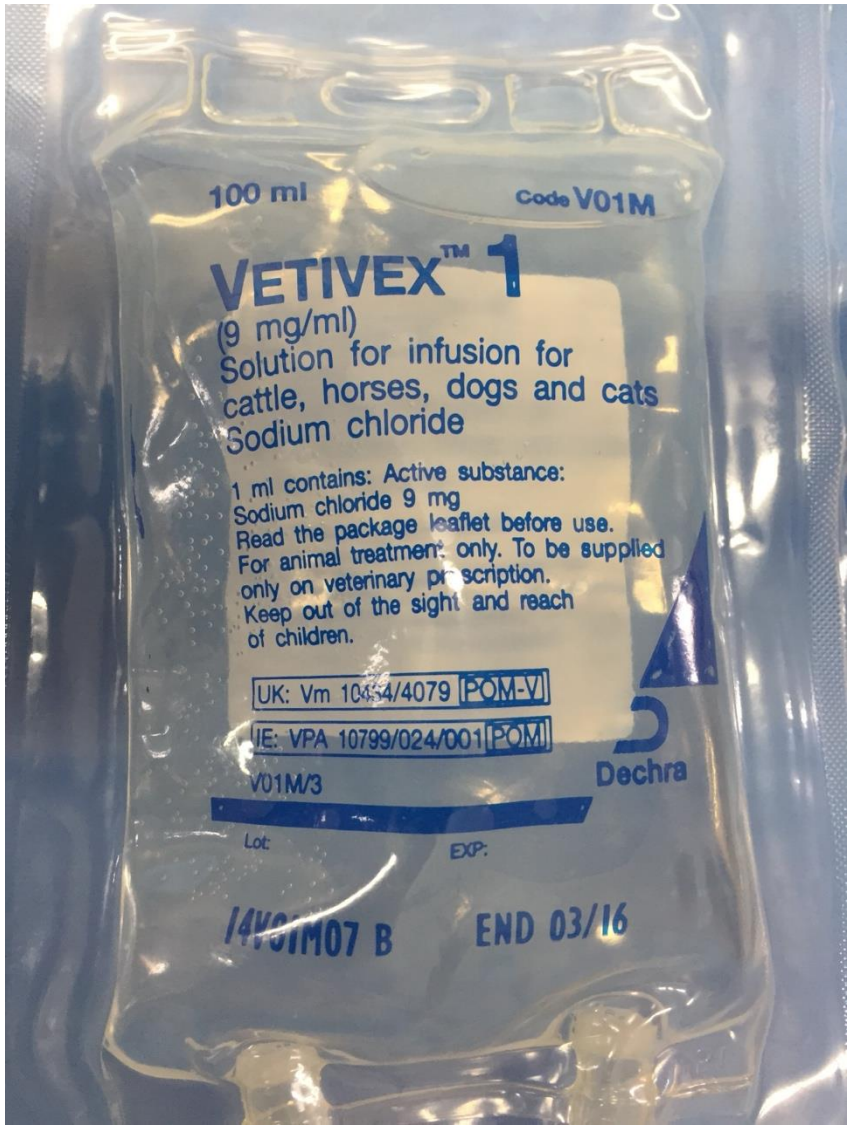
+ Not that many arrests have shockable rhythms!
+ Avoid the use of adrenaline before first shock
+ Start at 4-6/kg for first shock
+ Double the dose to if initial shock not effective
+ Continue compressions between shocks

Defibrillators are dangerous!

+ Only trained personnel
+ Avoid use of surgical spirit on patient
+ Ensure no-one is touching the patient or the table

Fluid Therapy?

+ Indicated in hypovolaemic patients
+ May be detrimental in euvolaemic patients
+ Isotonic crystalloids preferred
+ Colloids not recommended
+ Only use IVFT if there are specific indications during CPR



Fletcher DJ, Boller M. Fluid Therapy During Cardiopulmonary Resuscitation. Front Vet Sci. 2021 Jan 28;7:625361. doi: 10.3389/fvets.2020.625361. PMID: 33585610; PMCID: PMC7876065.

Return of Spontaneous Circulation (ROSC)

+ Any of the following sustained for more than 30 seconds:

+ Palpable pulse

+ Systolic BP > 60mmHg (Direct)

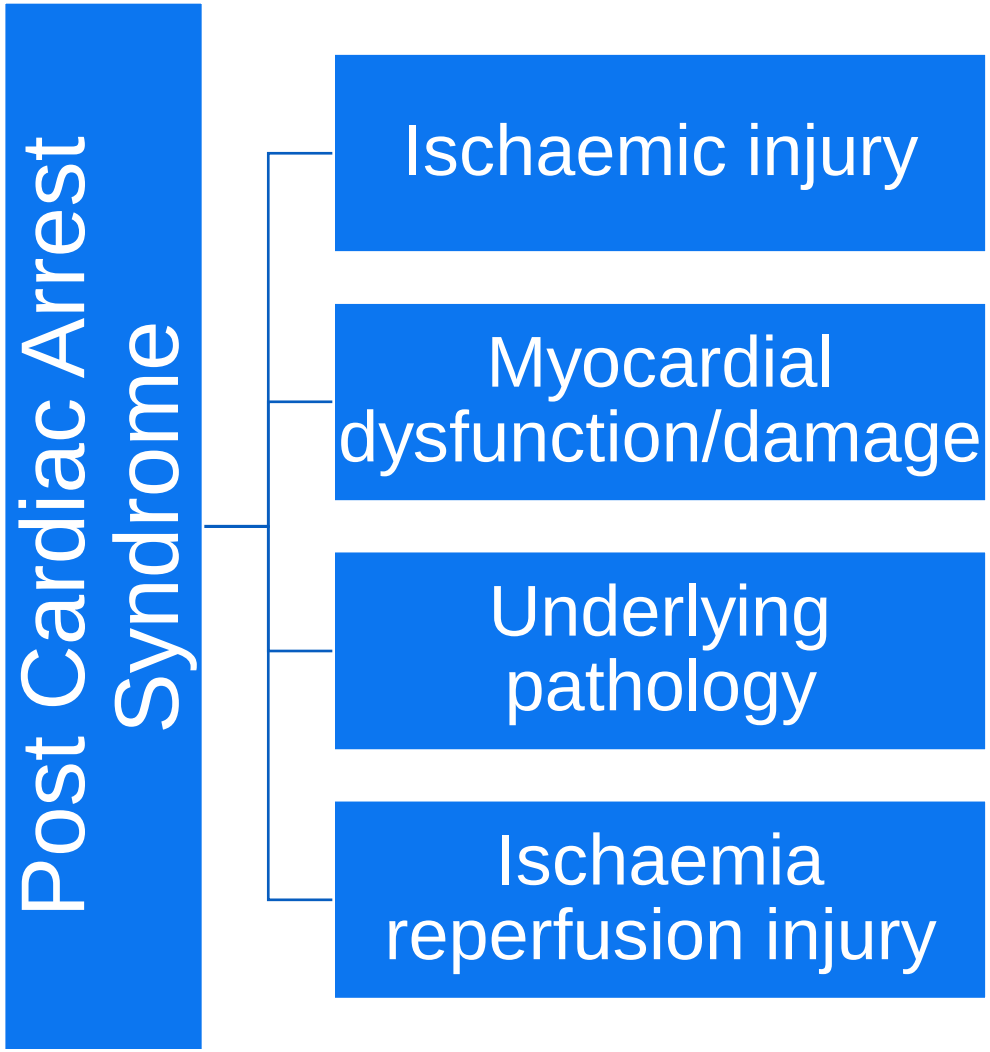
+ Marked increase in $ETCO_2$

CPR Outcome

- Survival with CPR
  - 5-7% in dogs
  - 1-19% in cats
- Of those that achieve ROSC, 80% die or are euthanased
- Higher survival when associated with arrest under anaesthesia
  - Around 50%

McIntyre RL, Hopper K, Epstein SE. Assessment of cardiopulmonary resuscitation in 121 dogs and 30 cats at a university teaching hospital (2009-2012). *J Vet Emerg Crit Care*. 2014;24(6):693-704.

Post Cardiac Arrest Care



- Ischaemia
  - Lack of oxygen to tissues
  - Leads to cell death
- Myocardial damage/dysfunction
  - Ischaemia
  - Physical damage to heart during compressions
- Co-morbidities
  - Underlying cause of arrest?
- Ischaemia reperfusion injury
  - Restoration of perfusion can cause further damage due to free radical production
  - Worsened by high 0_2 levels

So What Comes Next?

- Respiratory optimisation
  - Is there spontaneous breathing?
  - Ventilate as required
  - Monitor using capnograph
  - Avoid hypercapnia/hypocapnia
  - Titrate oxygen therapy to SPO_2 of 94-98%
  - Sternal recumbency

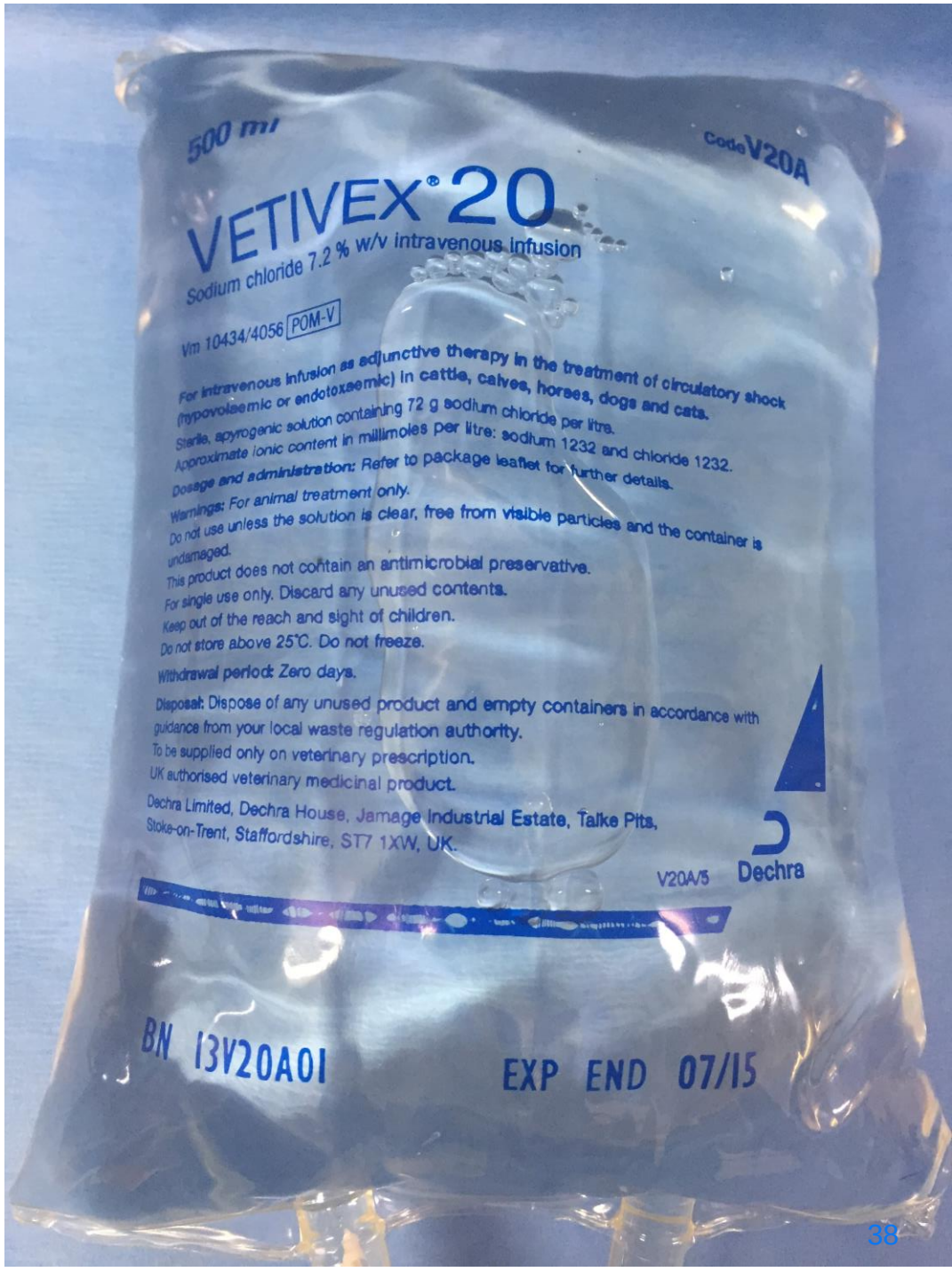
Haemodynamic Optimisation

- Hypotension
  - Systolic <100mmHg
  - MAP <80mmHg
- Causes of hypotension
  - Hypovolaemia
  - Vasodilation
  - Myocardial dysfunction
- Treatment
  - Fluid boluses (hypovolaemia)
  - Vasopressors (vasodilation)
  - Dobutamine (myocardial dysfunction)

Neuroprotection

- Neuronal damage due to
  - Neuronal excitotoxicity
  - Cerebral acidosis
  - Reperfusion injury
-
- Results in cerebral oedema

- Treatment
  - Hypertonic saline
  - Mannitol
  - Hypothermia
  - Seizure prophylaxis



Summary- Stayin' Alive

- Compressions 100-120/min
  - 1/3 to ½ of thoracic width in lateral recumbency
  - ¼ of thoracic depth in dorsal recumbency
- 2-minute uninterrupted cycles
  - Check rhythm only between operator changeovers
- Ventilate 10 times per minute (every 6 seconds)
  - Inspiration 1 second, expiration 5 seconds
- ECG and capnograph
  - Aim for $ETCO_2$ >18mmHg
- Low dose adrenaline only
- Use atropine early and only once
- The care doesn't stop at ROSC

Any questions?

Questions?