CPR Theory Review

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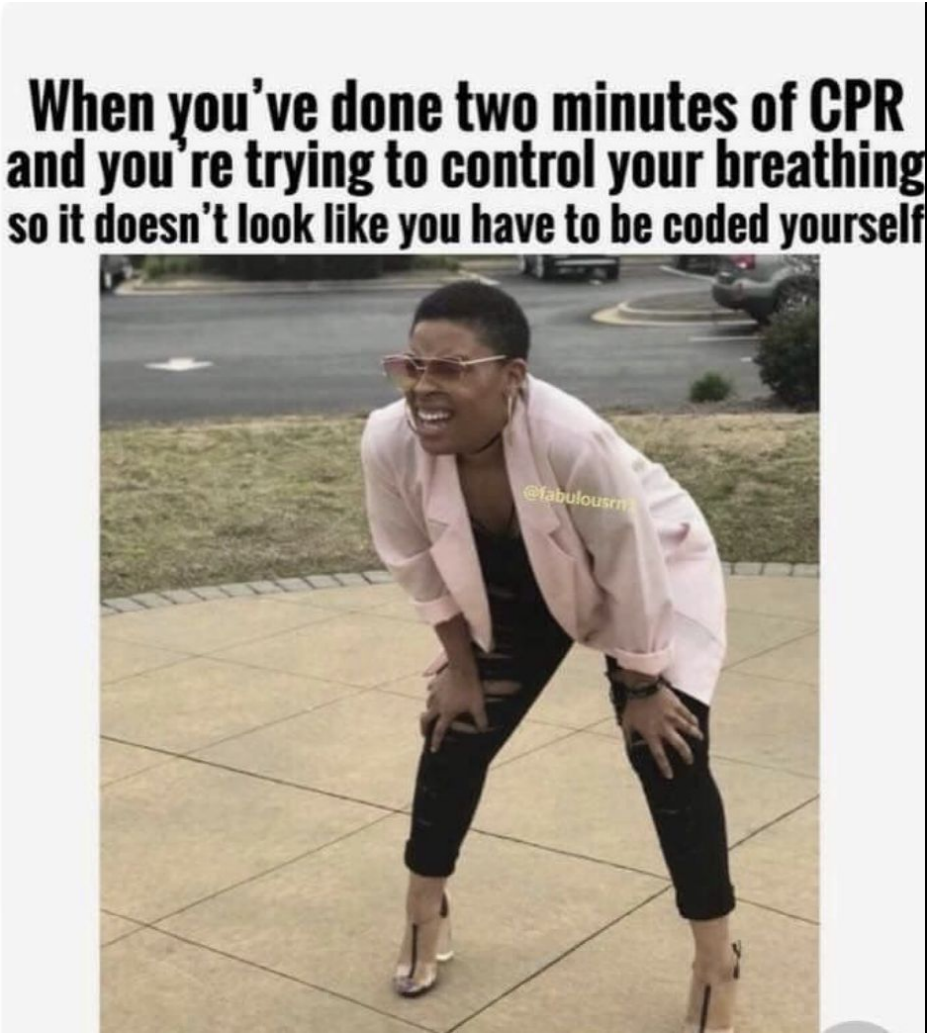
Terminology

1) CPA (cardiopulmonary arrest): when spontaneous circulation (heart) and breathing (lungs) stops
2) CPR (cardiopulmonary resuscitation): technique to replace the functions of the cardiovascular and respiratory system
3) Return of Spontaneous Circulation (ROSC): heart rate and respiratory rate returning

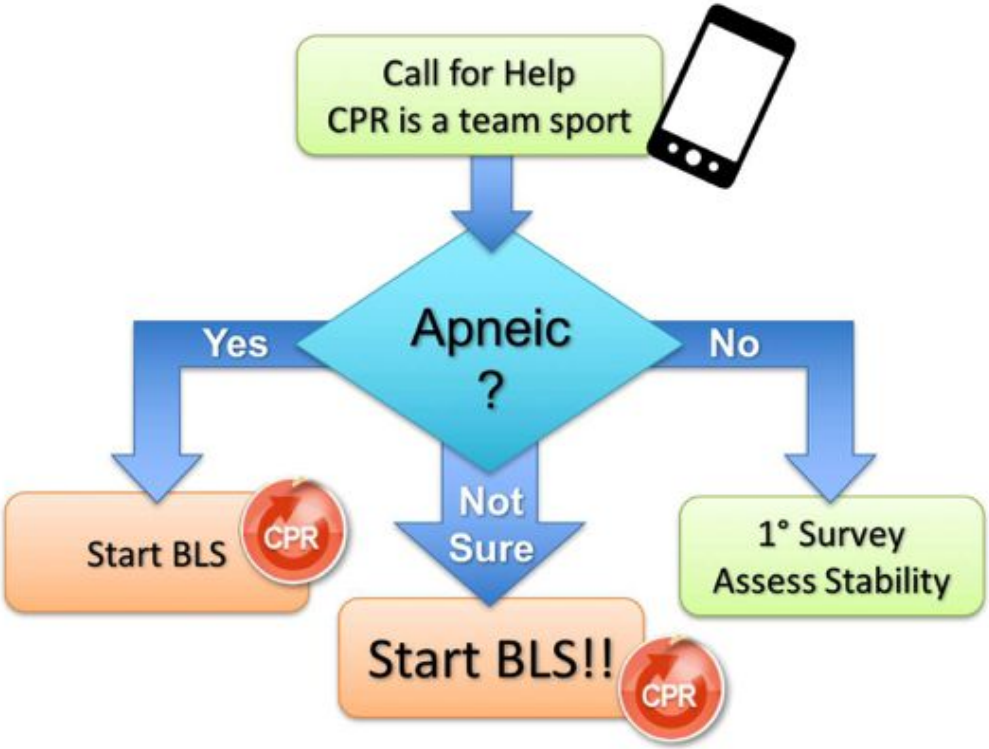


Resuscitation Codes

Initial Assessment

- Call for help when unresponsive patient is found
- ABC assessment
- Start CPR within the first 10-15 seconds

Goal: to quickly identify and initiate CPR in CPA cases and identify life threatening processes in those that have not yet gone into a CPA



BASIC LIFE SUPPORT

CPR Algorithm

RECOVER

Unresponsive, Apneic Patient

Initiate CPR Immediately

Basic Life Support

1 full cycle = 2 minutes

uninterrupted compressions/ventilation

1 Chest Compressions

100-120/min

- Lateral recumbency
- ⅓- ½ chest width

2 Ventilation

10/min

- Intubate in lateral
- Simultaneous compressions

or

C:V 30:2

- Interpose compressions

CHEST COMPRESSIONS

Chest Compressions

- Well executed chest compressions (external) only produce 30% of normal cardiac output
- 100-120 beats per minute
- Depth: ⅓ to ½ the width of the chest
- Allow for full chest recoil
- Full 2 minute cycle

- Patient Position: lateral recumbency (most of the time) approaching from the back of your patient
- Body conformation determines the technique used for compressions (thoracic pump theory vs cardiac pump theory)

Compressor Posture

- Shoulders directly over the hands
- Lock elbows
- Hand position
  - Medium/ Larger dogs: One hand on top of the other
  - Smaller dogs/ cats: single handed compressions
  - Hands should be pointed back toward yourself to direct force through the heel of your hand
- Core muscles engaged

Example of Poor Compression Technique

Example of Good Compression Technique

CPR playlist (110 bpm)

By seigfriedb

Ultimate CPR Playlis...

By Purple Health and Safety

CPR playlist 100-12...

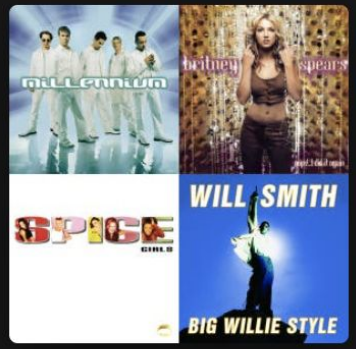
By Conor_Madra

CPR Songs 100-120...

By Luballoon

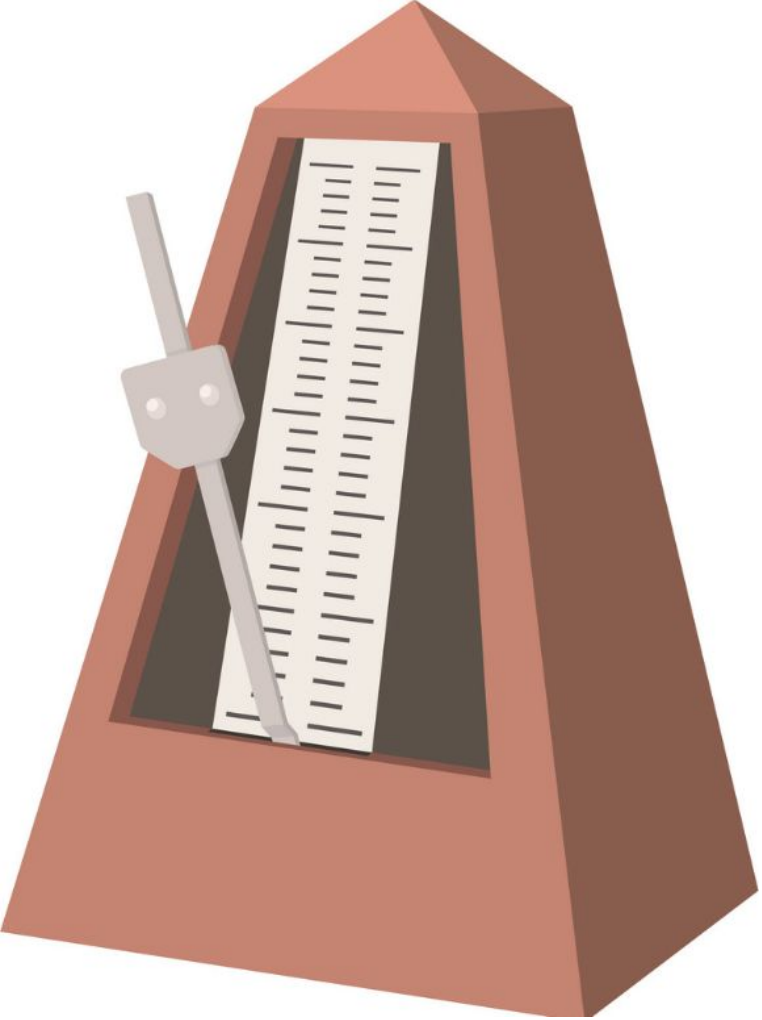
Songs to do CPR to

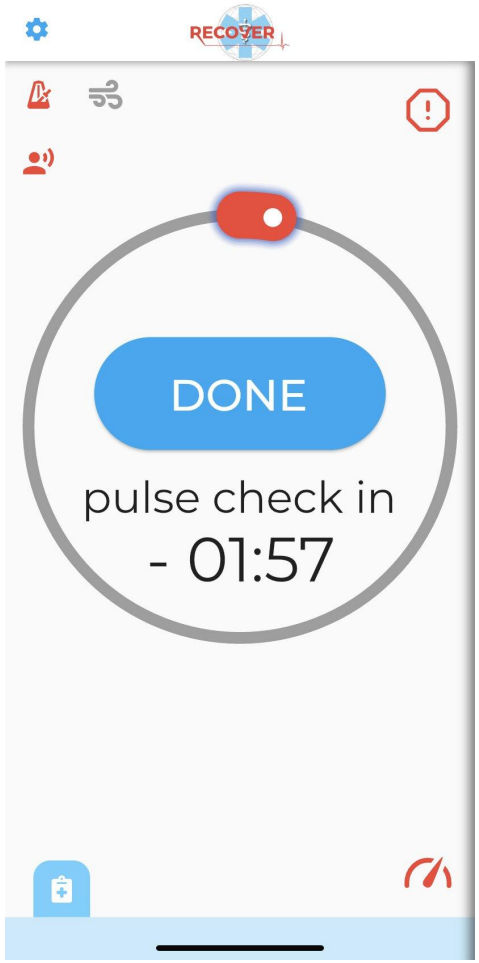
CPR Tempo Playlist ...

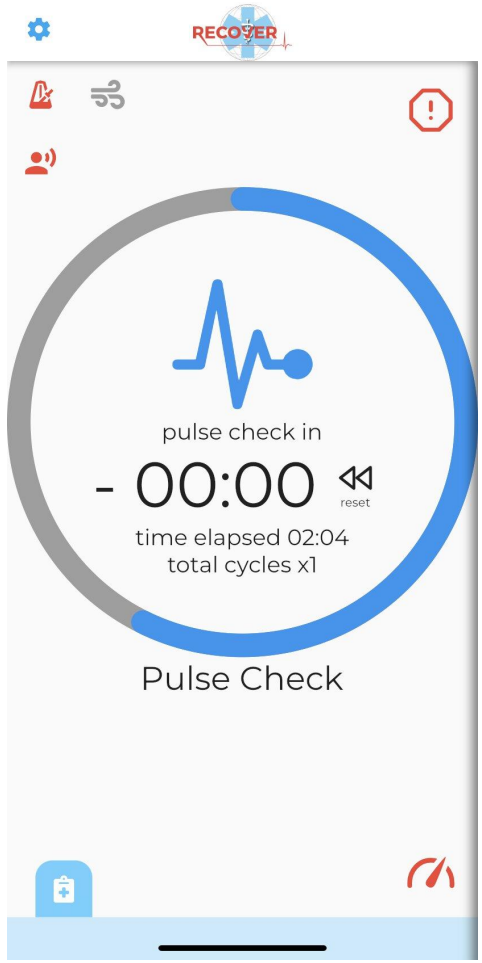


Morgan's CPR Playli...

Hands-Only CPR's '...

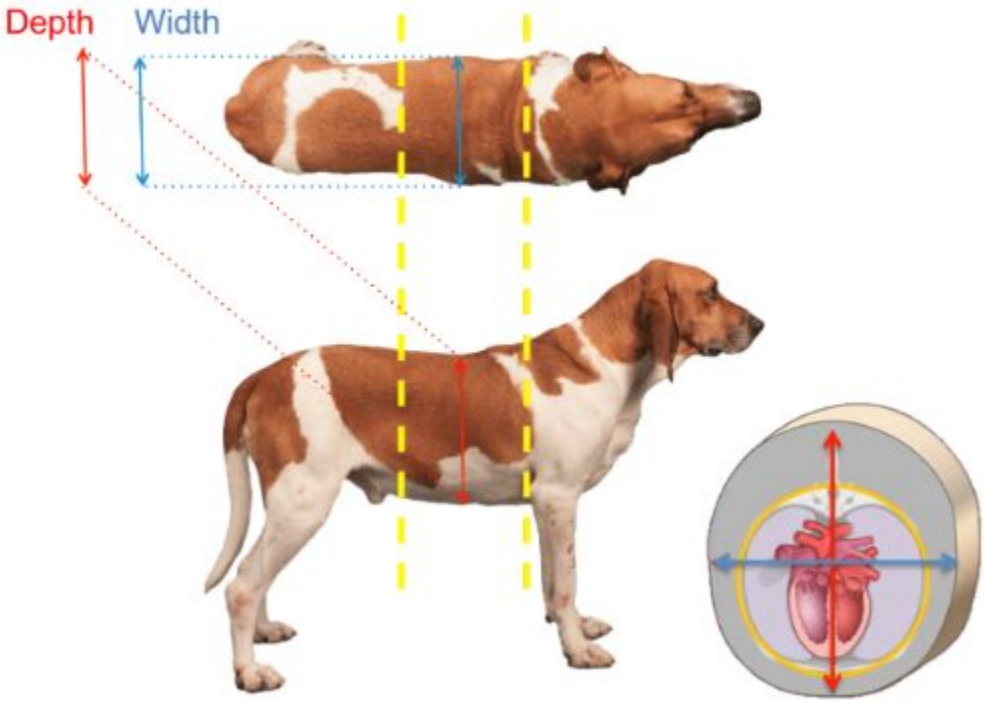


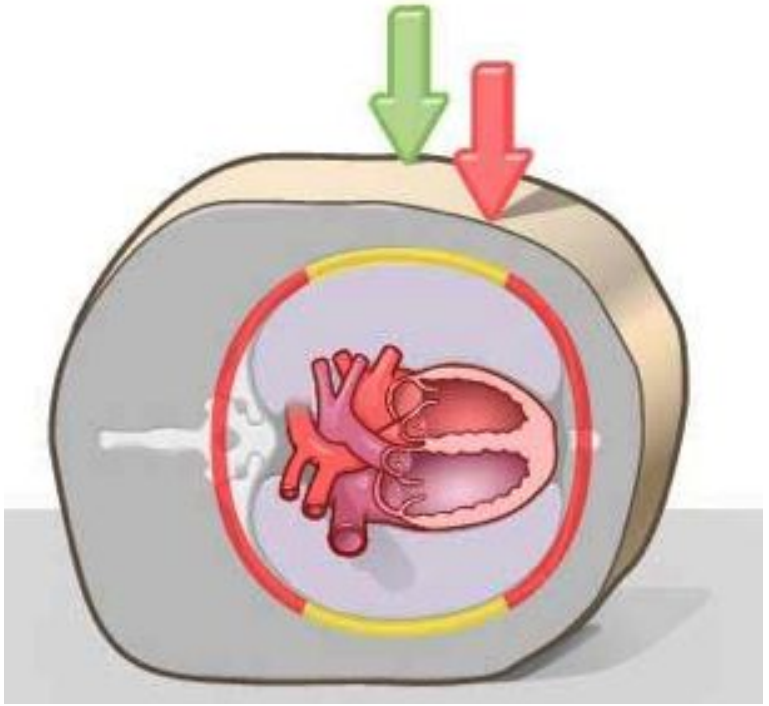

RECOVER
DONE
pulse check in
- 01:57


RECOVER
pulse check in
- 00:00
reset
time elapsed 02:04
total cycles x1
Pulse Check

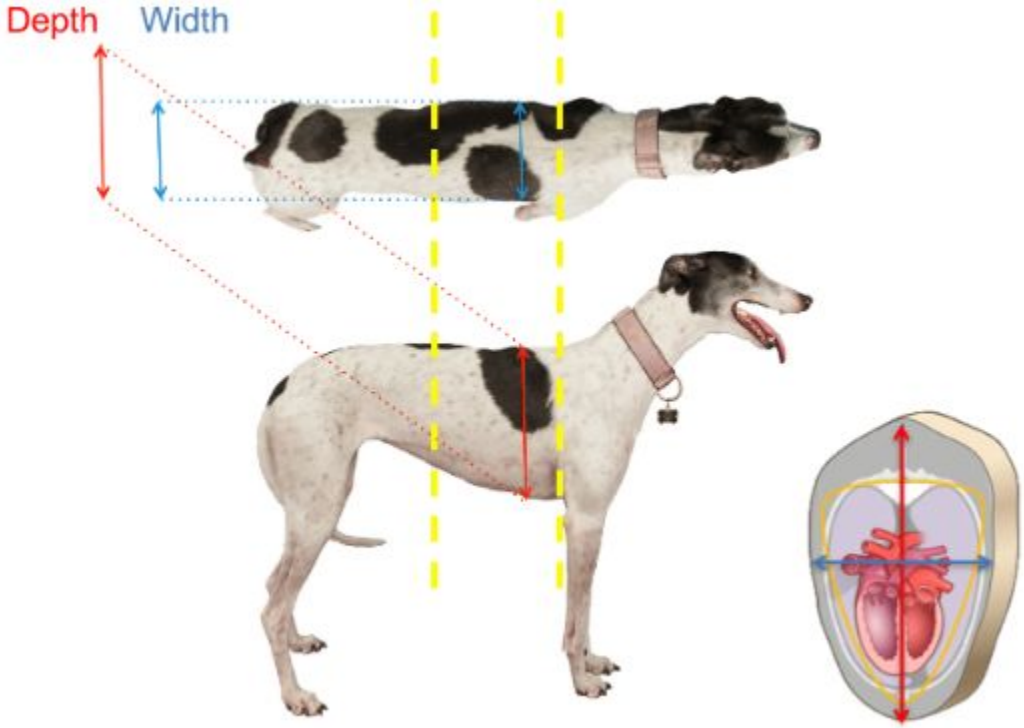
HAND POSITIONS/ CONFORMATION CONSIDERATIONS

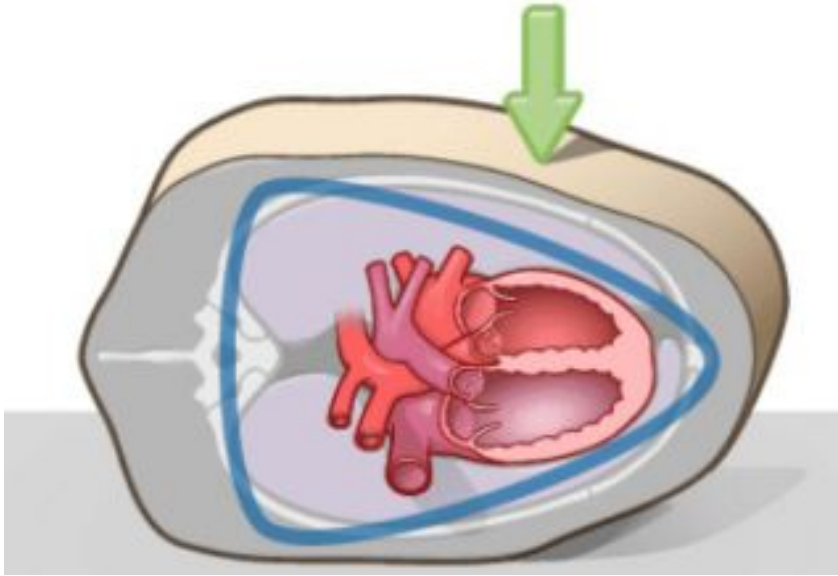
Round Chested Dogs



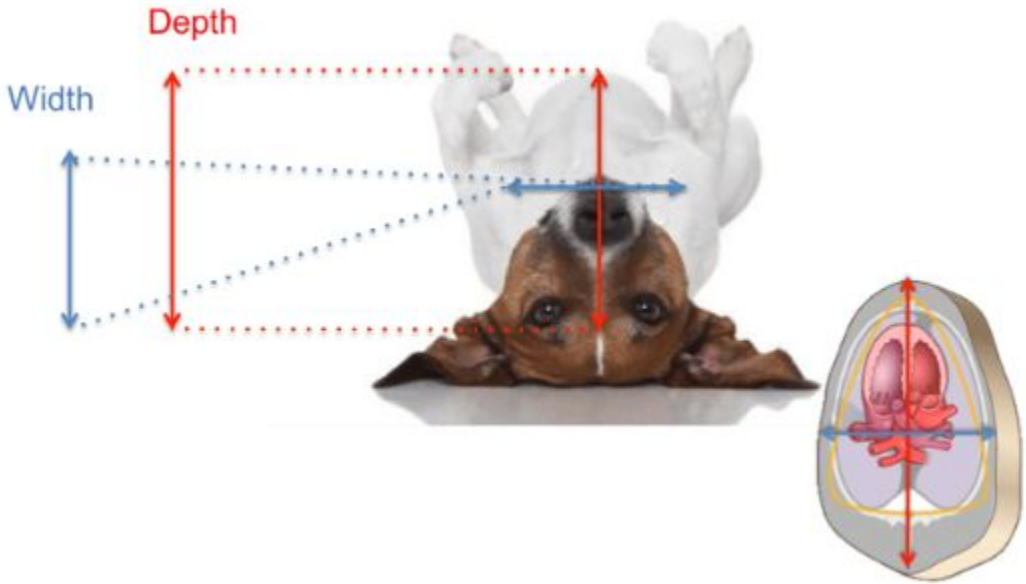


Keel Chested Dogs

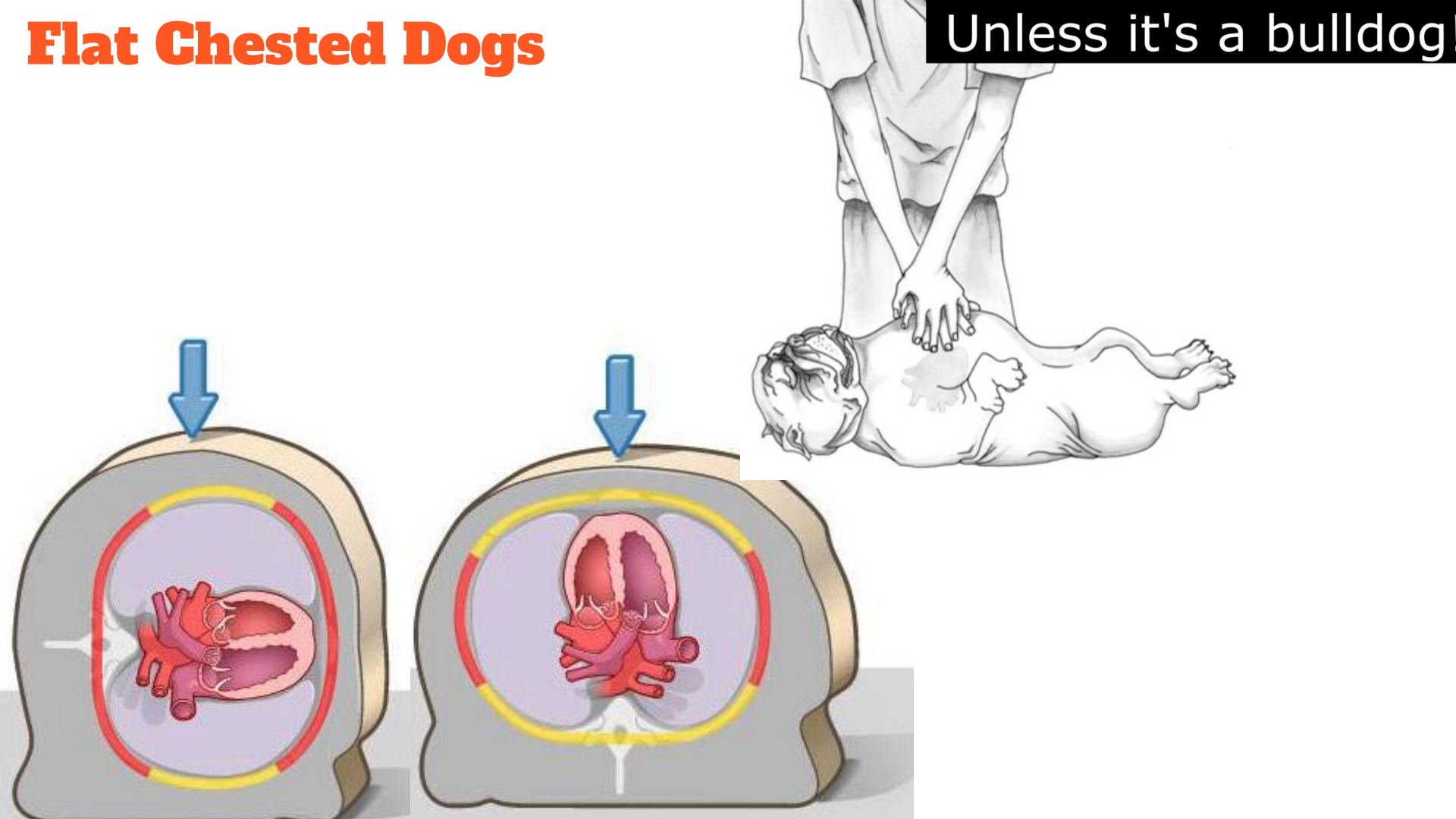




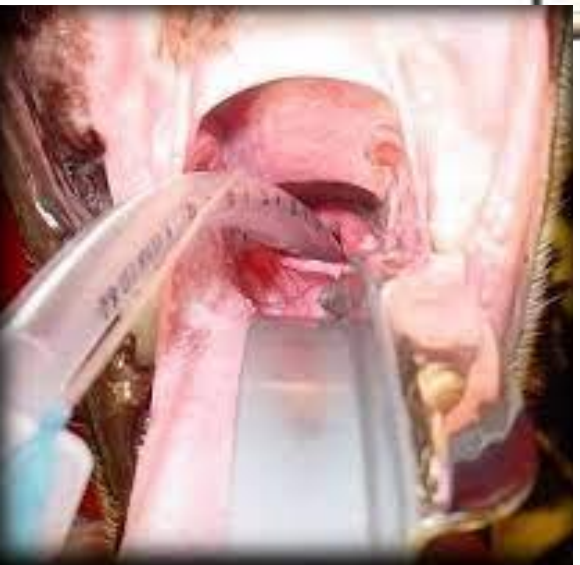
Small Dogs and Cats



Flat Chested Dogs



AIRWAY MANAGEMENT



Ventilations

- Most dogs and cats suffer from a primary respiratory arrest
- Positive pressure ventilation via a cuffed endotracheal tube
- Do not stop compressions to place the ET tube!!
- Need to get that fine balance between hypoventilation and hyperventilation
- 10 breaths per minute (1 every 6 seconds)

INITIATION OF ALS

Advanced Life Support

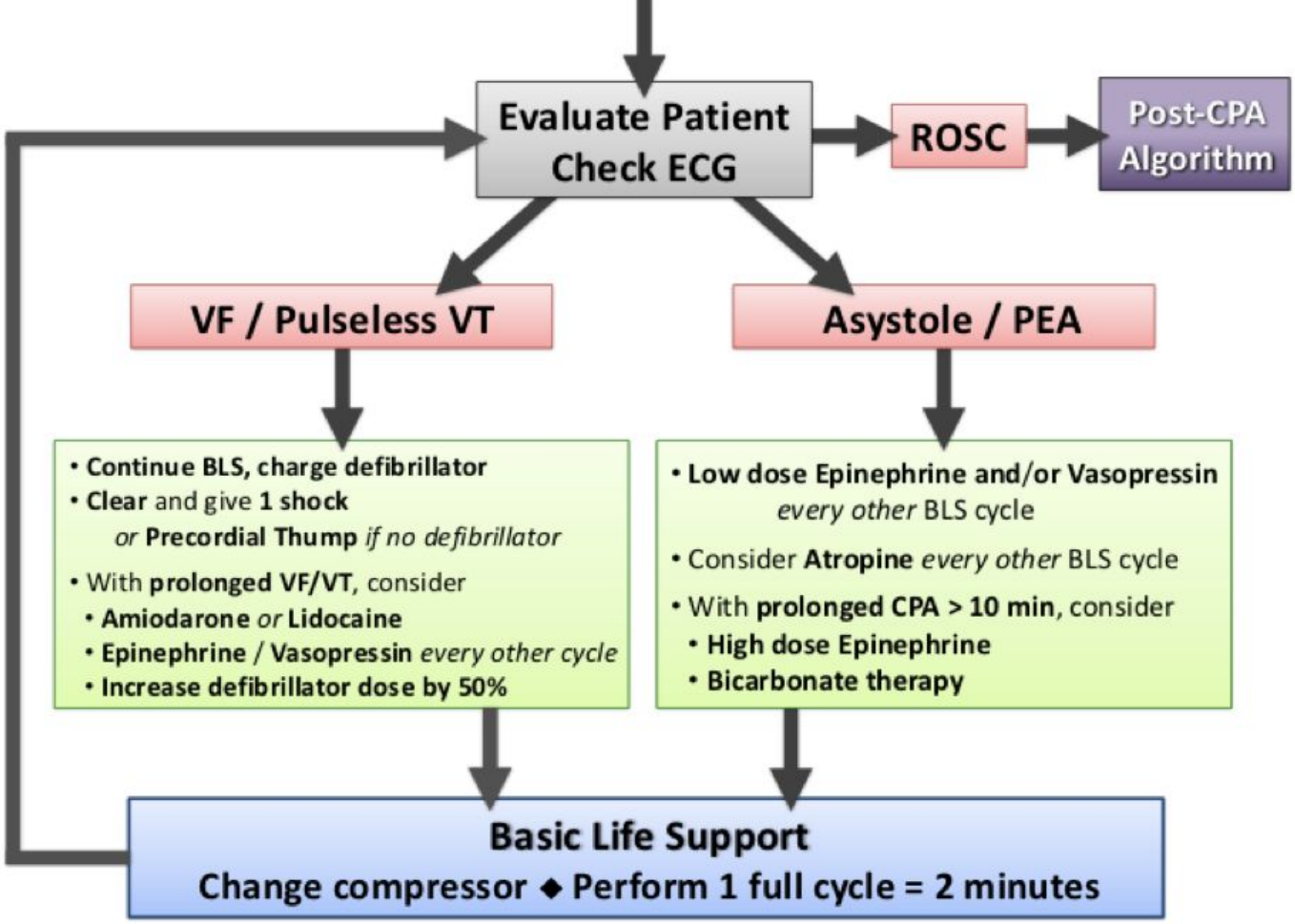
3 Initiate Monitoring

- Electrocardiogram (ECG)
- End Tidal CO_2 ($ETCO_2$)
  - >15 mmHg = good compressions

4 Obtain Vascular Access

5 Administer Reversals

- Opioids – Naloxone
- α2 agonists – Atipamezole
- Benzodiazepines – Flumazenil



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MONITORING AND ECG INTERPRETATION

STEP 3: ATTACH MONITORING EQUIPMENT

- Electrocardiogram (ECG)
  - **White** - Right front
  - **Black** - Left front
  - **Red** - Left rear
- Capnography/ End Tidal CO2
  - Amount of CO2 exhaled
  - >15mmHg= good CPR
  - >30mmHg= ROSC

STEP 4: VASCULAR ACCESS

- Closest to the heart for drug delivery
- IVC placement (ideally before CPA)
  - Try a 20-22G needle
- Venous cutdown
- IO catheter

INTRATRACHEAL DRUG ADMINISTRATION

- If IV and IO not possible

STEP 5: ADMINISTER REVERSAL AGENTS (if applicable)

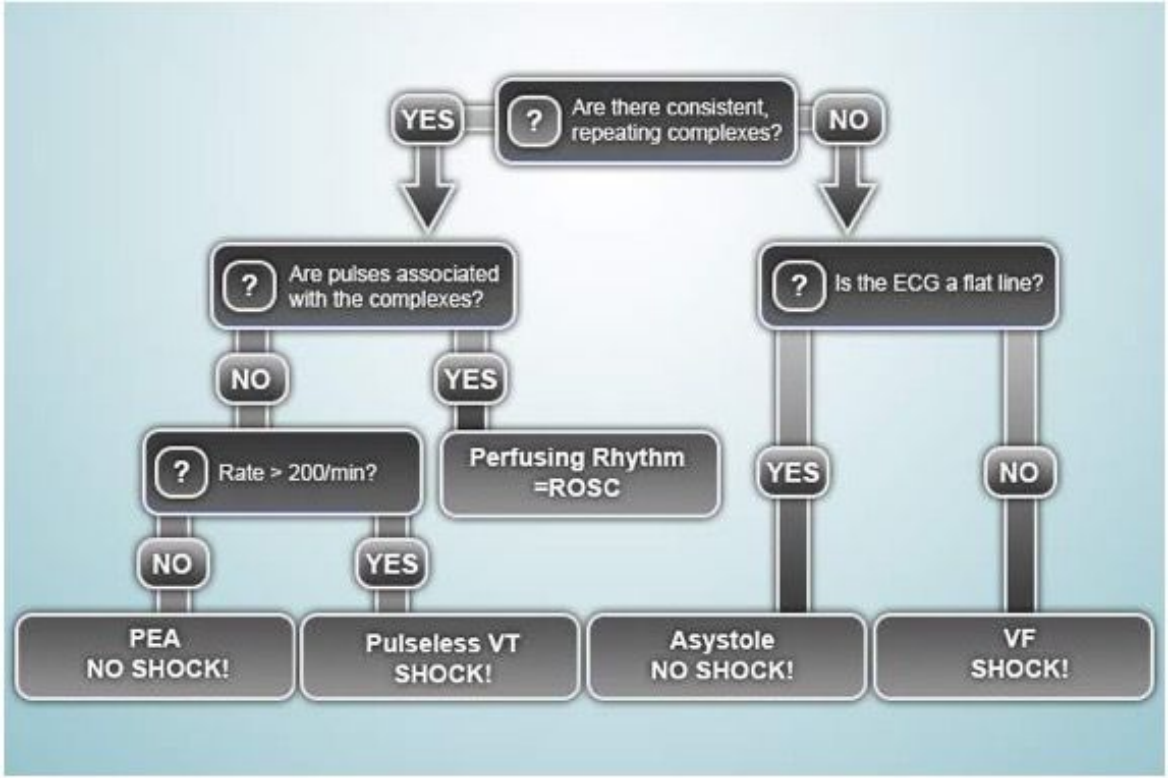
****ALWAYS: flush with isotonic crystalloid solution for flow to the heart and tissues (Non-heparinized)**

- Cats: 3-5cc
- Small/ med: 5-10cc
- Large: 10-15cc

- Naloxone - for opioids
  - Butorphanol
  - Hydromorphone
  - Buprenorphine
  - Fentanyl
  - Morphine
  - Methadone
- Flumazenil - for benzodiazepines
  - Diazepam
  - Midazolam
- Antisedan - alpha 2
  - Dexmedetomidine

ECG Rhythms

1) Asystole
2) Pulseless electrical activity
3) Ventricular fibrillation
4) Pulseless ventricular tachycardia



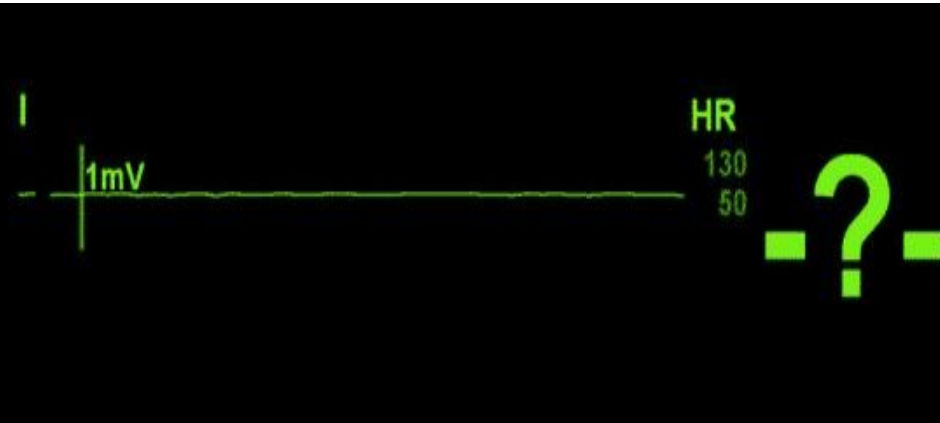
NON-SHOCKABLE RHYTHMS

Pulseless electrical activity (PEA)

- Narrow QRS complex
- Repeated waveform without pulse

Asystole

- (Almost) flat line
- No electrical or mechanical activity



Non-shockable rhythm treatments

Vasopressors: first line treatment; peripheral vasoconstriction to direct blood to the core and raise aortic diastolic pressure to direct blood flow from periphery to center

- **Epinephrine**: peripheral vasoconstriction via A1, A2, B1, and B2 receptors
  - Low dose: 0.01mg/kg (0.1ml/10kg)
  - High dose: 0.1mg/kg
- **Vasopressin:** hormone involved in water balance via V2 receptors
  - 0.8U/kg
- Every other BLS cycle

Parasympatholytic/ Atropine:

- Especially helpful in vagally mediated arrests or prevent CPA!!
- Repeat every other cycle. ONLY REPEAT ONCE!!
- Dose: 0.04mg/kg

Prolonged Non-Shockable Arrests

>10 minutes

High dose epinephrine: 0.1mg/kg

Bicarbonate: only if confirmed severe metabolic acidosis diagnosed by blood gas analysis

Electrolyte therapy

- Hyperkalemia and hypocalcemia: 10% calcium gluconate IV (0.5ml/kg) to normalize resting membrane potential and improve cardiac contractility and vascular tone

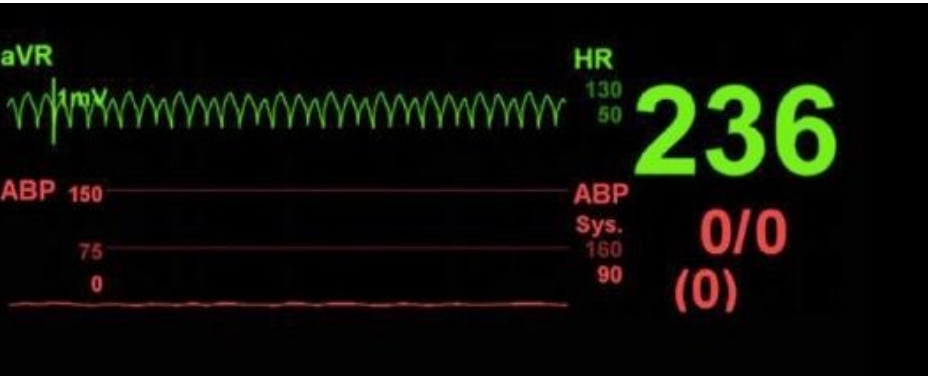
SHOCKABLE RHYTHMS

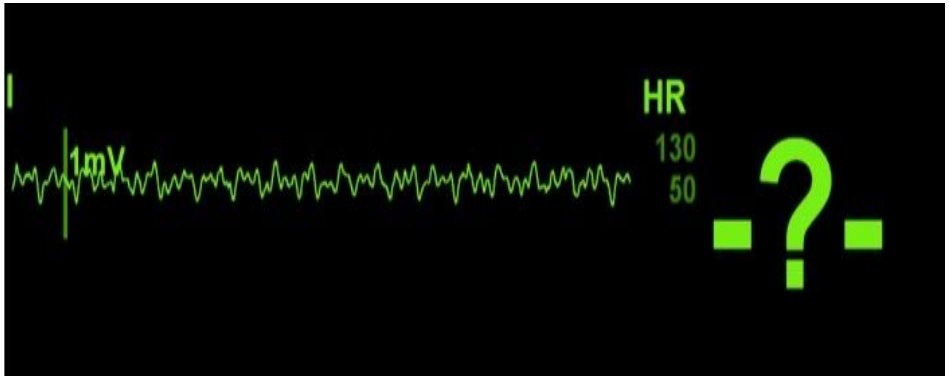
Pulseless Ventricular Tachycardia (VT)

- Wide QRS complex
- Repeated wave without pulse
- Greater than 200bpm

Ventricular Fibrillation (VF)

- Non-repeatable random activity
- Random electrical and mechanical activity from the ventricles causing a “quiver”





Shockable rhythm treatments

Electrical Defibrillation: depolarize as many cells as possible to drive them into a refractory period and stop ineffective activity

- Allows natural pacemaker cells to re-initiate normal perfusing rhythm
- Paddles on opposite sides of the chest over the costochondral junction directly over the heart
- Patient in dorsal recumbency

CAUTION!

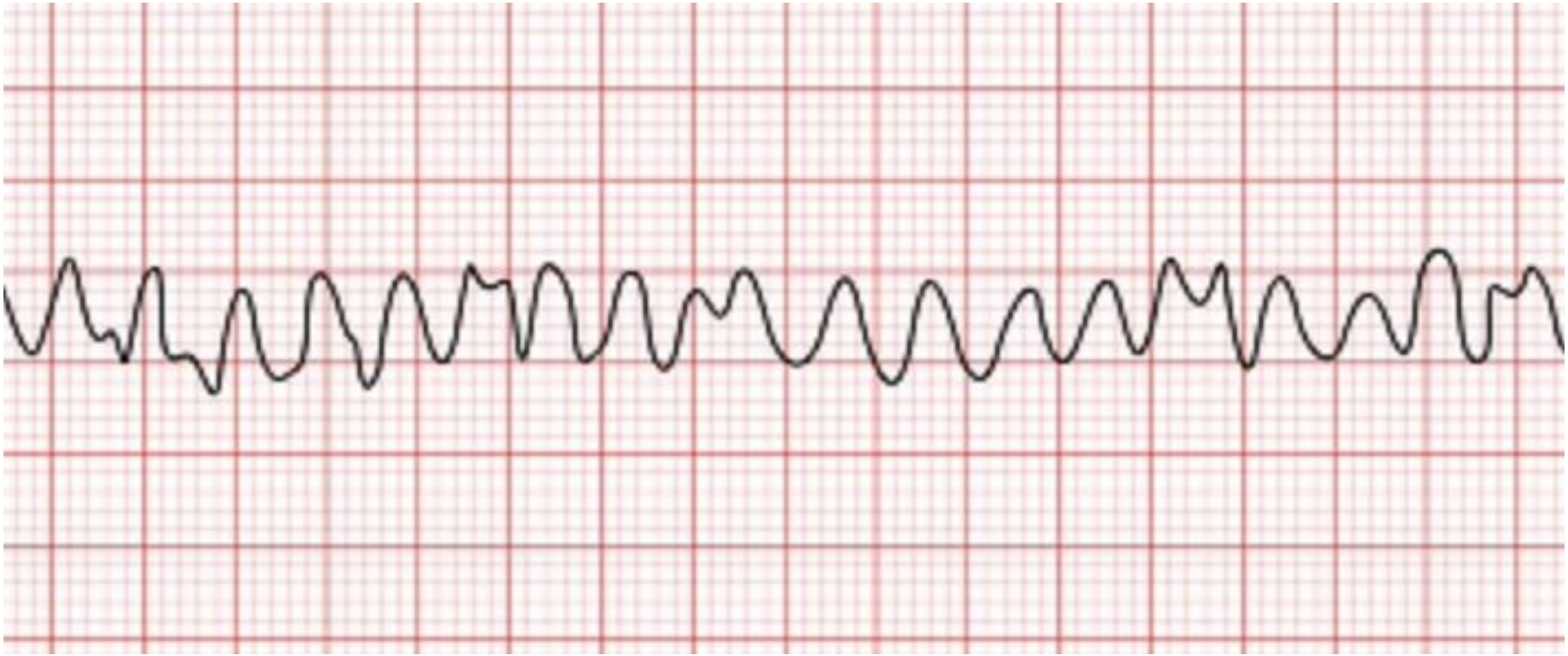
- Do **NOT** touch the patient (all “CLEAR”)
- Do **NOT** use alcohol (flammable)
- Do **NOT** have free-flowing O_2 (flammable)
- Do **NOT** be on a conductive surface (metal)
- Do **NOT** have patient wet/in water (conduction)

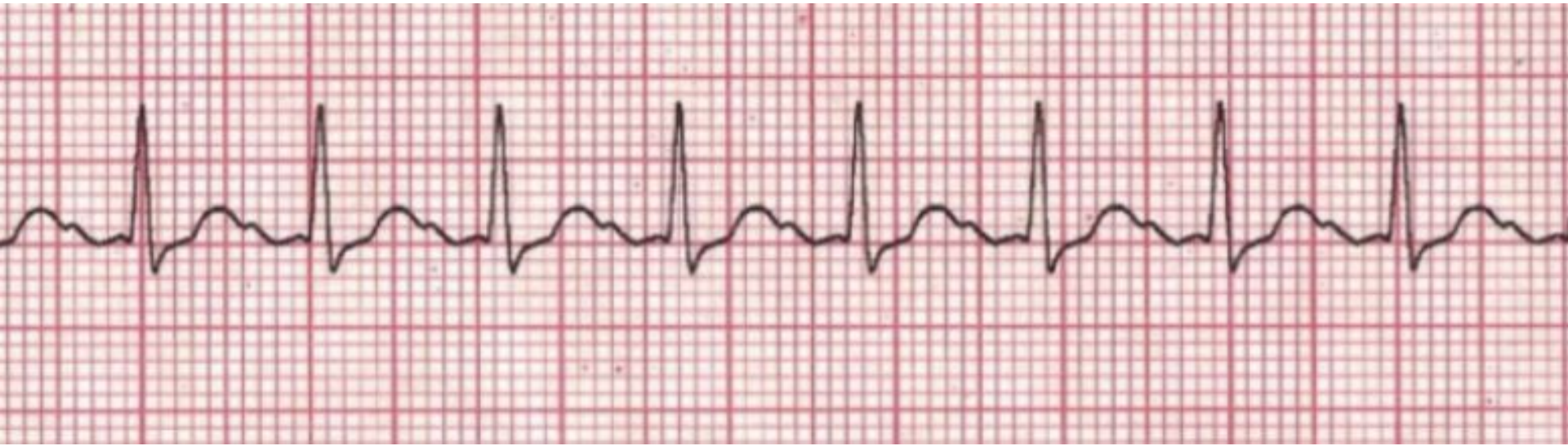
Prolonged Shockable Arrests

>10 minutes (5 cycles of CPR)

Grave prognosis with severe metabolic derangements

1) Amiodraone: prolongs repolarization phase of action potential
    - Dose: 0.5mg/kg diluted in a 1:10 solution over 1-2 minutes
    - Side effects: anaphylaxis
    a) Lidocaine (alternative to amiodarone)
        - Dose: 2mg/kg slowly over 1-2 minutes
2) Vasopressors (Epinephrine or Vasopressin)
    - Peripheral vasoconstriction to divert blood to the core
    - Same dose as non-shockable rhythms





Crash Cart

- ECG machine and leads with defibrillator
- Suction machine with tubing and red rubber catheters
- Squeeze bag for fluids
- ET tube gauze ties
- Prepared IVC set up
- Alcohol, Hydrogen Peroxide, and Ultrasound Gel
- Cognitive Aids and Algorithms Reference Sheets

Crash Cart

- Endotracheal (ET) tubes
- Laryngoscopes and blades

- Syringes, Needles
- Flushes
- Blades
- IV catheters, IVC supplies
- Emergency Drugs
  - Atropine
  - Epinephrine
  - Sodium Bicarbonate
  - Dextrose 50%

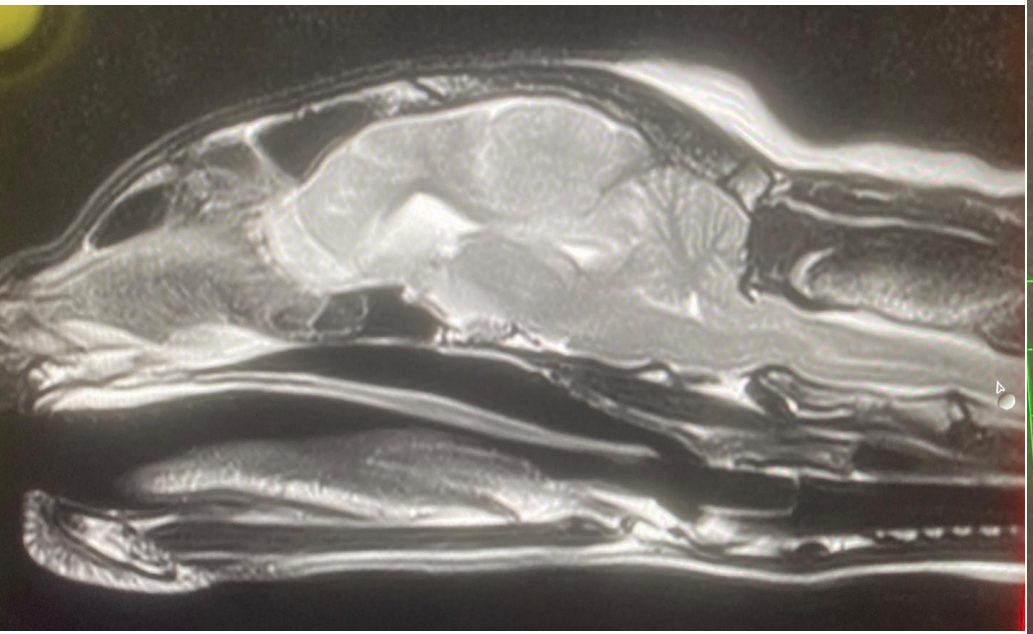
Crash Cart

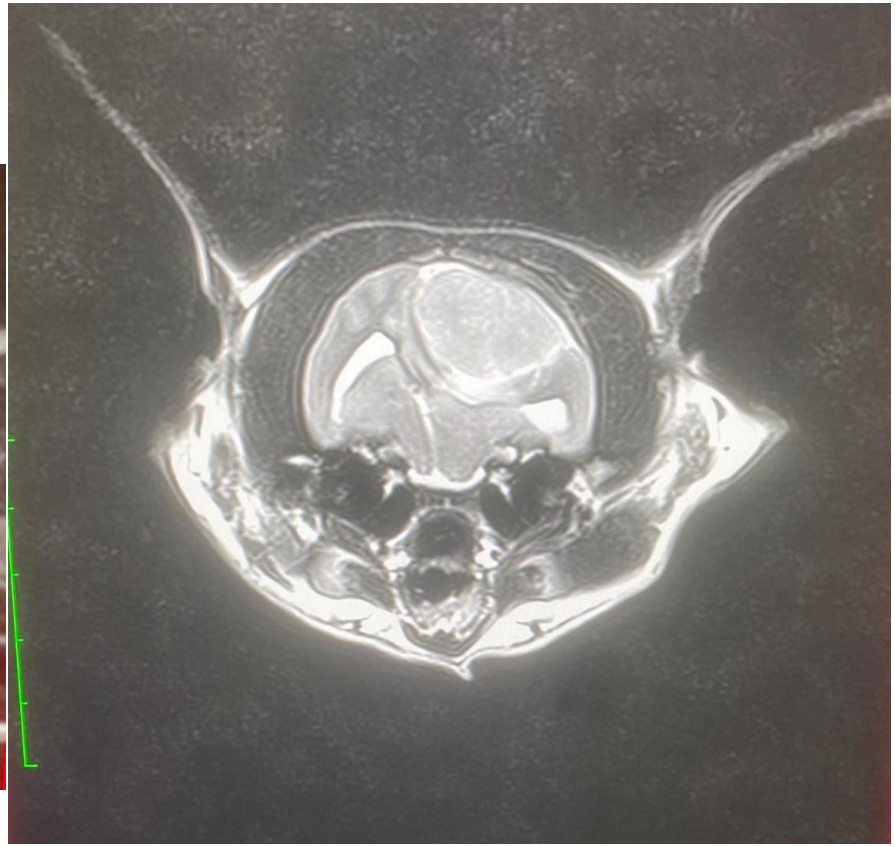
- Butterfly catheters
- Blood tubes
- Bandage material
- Sterile and non-sterile lube
- ECG pads
- Red rubber catheters, connectors
- Fluid bag
- Bulb syringe
- Hypertonic NaCl
- EMMA - capnograph

Crash Cart

- Bag valve mask (Ambu bag)
- Extra tubing
- Large syringes
- Chest tap kits
- Hetastarch bag
- Extra hypertonic NaCl
- Reserve stock of other items


NAF





And Lastly…..

Thank you!

Videos courtesy of The Royal (Dick) School of Veterinary Studies Emergency and Critical Care Department

All information found in the RECOVER Guidelines Part 1-7

(https://onlinelibrary.wiley.com/toc/14764431/2012/22/s1)