

Canine Advanced Life Support: Utah Task Force 1

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1) Introduction

- a) This handout is intended for SAR dog handlers who are trained paramedics
- b) *First aid as presented here should not substitute for care by a veterinarian, and should not delay transport to a veterinarian*

2) General Health Issues for SAR Dogs

- a) Orthopedic problems
 - i) Studies of military working dogs have shown arthritis, hip dysplasia and elbow dysplasia to be leading causes of retirement from service
 - ii) Screening x-rays of hips should be considered
- b) Sense of smell
 - i) Odorants must dissolve in mucus of nasal passages; therefore, drying of the mucus due to a dry environment, dehydration or drugs can decrease scent ability
 - ii) Prevent by encouraging regular drinking, and frequently flushing of eyes and nostrils with sterile eye wash solution
 - iii) Some drugs can decrease the sense of smell: glucocorticoids (prednisone, dexamethasone), doxycycline, possibly others
- c) 9/11 studies
 - i) Problems during deployment (68% of dogs had one or more problems, although all were relatively minor)
 - (1) Gastrointestinal problems (22% of dogs): vomiting, diarrhea, weight loss
 - (2) Cuts, abrasions, punctures (35% of dogs): mostly on feet, few required sutures
 - (3) Fatigue
 - (4) Dehydration
 - (5) Respiratory tract problems: coughing, sneezing
 - (6) Heat exhaustion
 - (7) Lameness
 - (8) Blood test results: mildly elevated liver enzyme levels (toxin exposure)
 - ii) Long term: as of April 2011, no significant differences in behavior or health issues between deployed dogs and control dogs

3) Assessment of Dog's Status

- a) Rectal temperature: 100.0-102.5 (up to 103.5 if excited) Fahrenheit
- b) Heart rate (HR): around 60-80 at rest, up to 120-150 when working
- c) Respiratory rate (RR): around 20-30 at rest, or panting when working
- d) Pulse quality: feel pulse in groin area, get to know the normal pulse feel for your dog; concern if weak or bounding



- e) Mucous membrane (MM) (non-pigmented area of gums) color: pink normal, may be darker pink if working; concerns if pale or white (shock), purple or blue (cyanosis), yellow or orange (jaundice), brownish (certain toxins), petechiae (small purple bruises)



- f) Capillary refill time (CRT): press finger on non-pigmented part of gum, count seconds for blanched area to return to color; normal 1-2 seconds, concern if <1 sec or >3 seconds (shock)
- g) Mentation: alert, lethargic, seizure, stupor, coma

- h) Hydration: lift tent of skin on back of neck, count seconds for skin to flatten back; normal <1 second, concern if >2 sec
 - i) 5-8% dehydrated = slightly slow skin tent, dry gums
 - ii) 8-10% dehydrated = moderately slow skin tent, dry gums, prolonged CRT
 - iii) 10-12% dehydrated = severely slow skin tent, dry gums, sunken eyes, prolonged CRT
 - iv) 12% dehydrated = severely slow skin tent, dry gums, sunken eyes, prolonged CRT, shock (imminent death)
- i) Pupillary light reflex: shine penlight in each eye separately, both pupils should be of the same size and rapidly constrict; concern if pupils uneven sizes, dilated, or not responding to light

4) Field Diagnostic Tests

- a) Vital signs monitor (using human monitor)
 - i) Blood pressure (BP)
 - (1) Normal approximately 120/80, concern if systolic <80, MAP <60 or diastolic <50
 - (2) Most SAR dogs will need a pediatric size 4 or 5 cuff, place around the rear foot between the hock and the toes with the foot at heart level



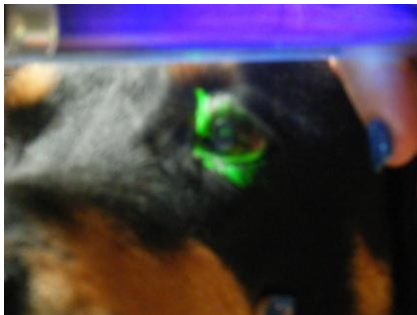
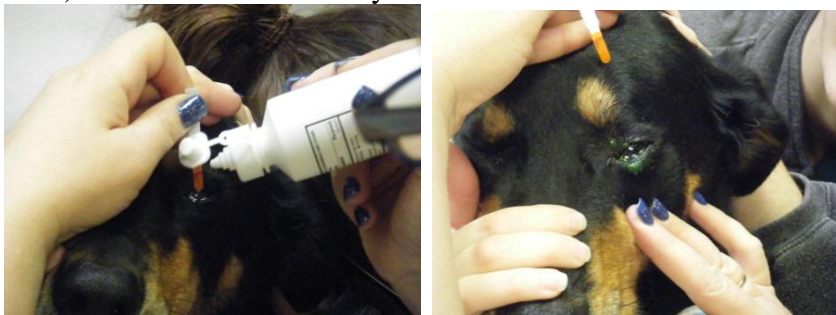
- ii) SpO2
 - (1) Normal 99-100%
 - (2) Place sensor on tongue or ear flap (moisten with water)
- iii) EKG
 - (1) Normal sinus rhythm
 - (2) “Respiratory sinus arrhythmia,” normal in some dogs, heart rate speeds up with inspiration and slows with expiration
 - (3) Place leads on paw pads
- b) Urinalysis: using multi-stix
 - i) Nitrite, leukocytes, specific gravity NOT reliable in dogs
 - ii) Blood, protein, pH, glucose, ketones are reliable and are interpreted as in humans

- c) Blood testing: You can run an I-Stat (or equivalent) on dog blood the same as human blood. Venipuncture of the same veins used for catheters (cephalic on the front leg, saphenous on the rear leg), or the jugular vein. An arterial sample can be obtained (with difficulty) from the femoral artery on the inside of the rear leg.

i) Normal values for I-Stat CG8+ cartridges

pH	7.35-7.45
pCO ₂	34-40
PO ₂	85-100 (arterial)
Na	142-150
K	3.4-4.9
iCa	1.12-1.40
Glu	60-115
Hct	35-50
HCO ₃	20-24
TCO ₂	17-25
BE	0-6
sO ₂	>90 (arterial)
Hb	12-17

d) Fluorescein stain of eye

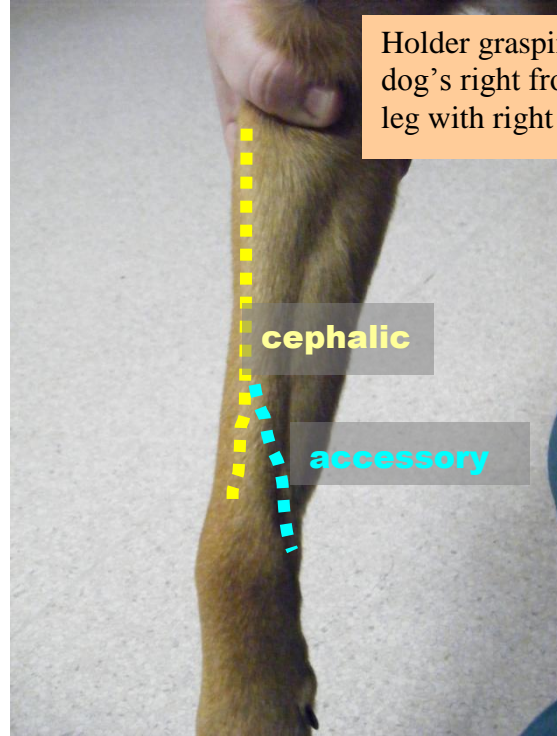


- i) Use eye wash to drip dye onto cornea
- ii) Wood's Lamp (UV light) will show fluorescence
- iii) Ulcers or scratches will retain the dye
- iv) If ulcer or scratch present, do NOT use corticosteroid-containing medication

5) Life Support

a) Intravenous access

- i) Cephalic vein (yellow): runs straight up along front surface of front leg
- ii) Accessory cephalic vein (blue): runs at an angle along wrist (from inside of leg)
- iii) Hold around dog's body, grasp just below the elbow and twist outward



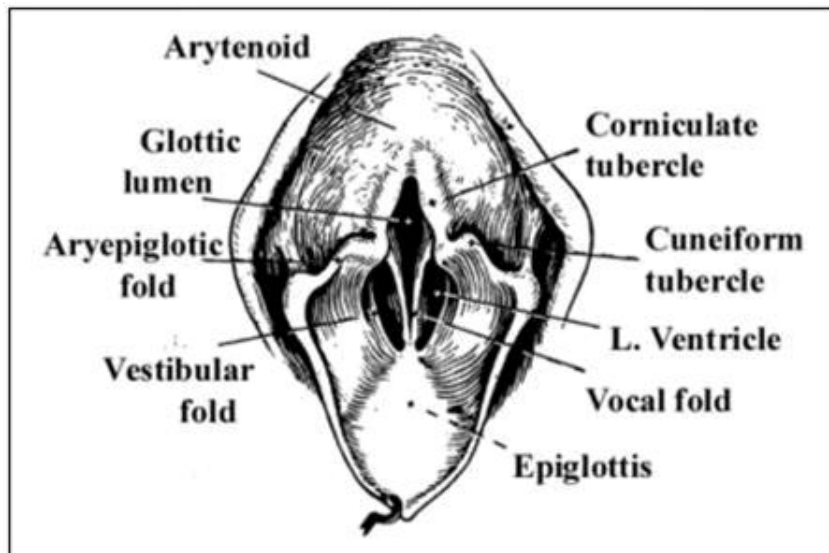
- iv) Lateral saphenous vein (orange): runs at an angle just above hock on outside rear leg; hold around dog's body and grasp the rear leg at level of knee



- v) IV catheterization technique
 - (1) Shave fur over vein, disinfect with Betadine or chlorhexidine
 - (2) Using over-the-needle catheter, insert into vein, remove stylet
 - (3) Use white tape to secure catheter, wrapping around leg

b) Airway access

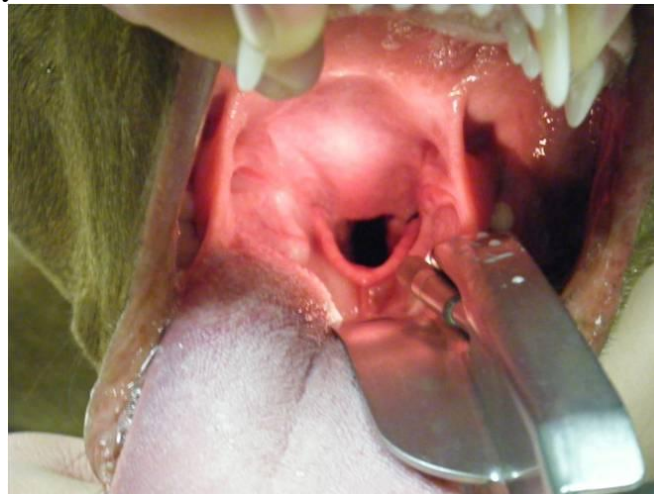
- i) Sweep laryngeal area with fingers for obstruction
- ii) Heimlich maneuver: same as human
- iii) Oxygen administration via mask (100% O₂)
- iv) Intubation
 - (1) Intubation is easier in dogs than people
 - (2) Use laryngoscope with Macintosh #3 or #4 blade
 - (3) Typical SAR dog would need a 8-10 mm tube
 - (a) Length: the tube should extend to the thoracic inlet (you can feel the front of the sternum on the dog's lower neck). This length ensures that it is past the larynx but not so far as to risk bronchial intubation. In dogs, the two main bronchi branch off at the carina at the same angle.
 - (b) Diameter: feel the dog's trachea to guesstimate the size.
 - (4) LMA's not useful in dogs
 - (5) Done in sternal recumbency (dog lying on its chest)
 - (6) Pull tongue down and forward while someone else holds upper jaw
 - (7) Flip down epiglottis with laryngoscope blade and insert tube through larynx
 - (8) Use roll gauze or tape to secure tube
 - (9) Anatomy



- (10) Initial appearance with epiglottis flipped up (sometimes may actually rest above the soft palate)



- (11) Appearance after flipping the epiglottis down, clearly showing the airway lumen



c) Cardiopulmonary resuscitation

- i) Cardiopulmonary arrest: loss of consciousness, not breathing or agonal breathing (intermittent gasps), no heart beat or pulse
- ii) CPR in canines correlates to human pediatric CPR, not adult human CPR
 - (1) Whereas adult humans usually have sudden cardiac arrest with ventricular fibrillation, canine arrest is usually asphyxial as in children.
- iii) ECG rhythms in canines at the time of arrest were 50% asystole, 23% bradycardia, 11% PEA, 7% ventricular fibrillation, 1% ventricular tachycardia, 1% atrial tachycardia, 7% other.
 - (1) Defibrillation would only be useful in the rare cases of ventricular fibrillation, but if you want to try, put the dog on his back with the paddles on either side of the chest.
 - (2) For defibrillation, recommended dose start at 4-6 J/kg with a monophasic defibrillator and 2-4 J/kg with a biphasic defibrillator.
- iv) Success of CPR less than 5% even for arrests in a hospital situation

- v) *Atropine: 1 cc per 20 lb, IV if available, or intratracheal (dilute with saline, squirt down endotracheal tube and blow to disperse), repeat every 5 minutes*
- vi) *Epinephrine: 0.1 cc per 10 lb, IV if available, or intratracheal, repeat 3-5 minutes*
(1) May increase to 1 cc per 10 lb
- vii) Mouth-to-nose breathing (hold mouth closed and breathe into nostrils) or ventilation with Ambu bag and one-way valve until able to intubate, then Ambu bag with room air or up to 100% O₂, to provide *10-12 breaths per minute*



- viii) Chest compressions: lay dog on side, kneel against dog's back, place hands on dog's chest behind elbow, compress chest 30% and allow complete expansion, provide *80-100 compressions per minute continuously*



From ACVECC (American College of Veterinary Emergency and Critical Care) RECOVER (Reassessment Campaign on Veterinary Resuscitation) Initiative, 2011
(<http://www.acvecc-recover.org/>):

Basic Life Support

Chest Compressions

In dogs and cats, chest compressions should be done in lateral recumbency.

In dogs and cats, chest compression depth of between 1/3 and 1/2 the width of the chest is reasonable.

In large and giant breed dogs, chest compressions with the hands placed over the widest portion of the chest is reasonable.

In keel-chested dogs, performing chest compressions with the hands directly over the heart is reasonable.

In barrel chested dogs, sternal chest compressions in dorsal recumbency may be considered.

In cats and small dogs, circumferential compressions rather than lateral compressions may be considered.

Compression rate of 100-120 compressions/minute are recommended for both dogs and cats, independent of size.

Allowing full chest wall recoil between compressions and avoiding leaning on the chest during recoil are recommended.

Ventilation

In non-intubated dogs and cats or single rescuer CPR, a C:V ratio of 30:2 is recommended.

In intubated, multiple-rescuer CPR, continuous chest compressions with simultaneous ventilation are recommended.

Ventilation of dogs and cats with CPA at a rate of 10 breaths per minute with a tidal volume of 10ml/kg and an inspiratory time of 1 sec is recommended.

Rotation of chest compressors every 2 minutes is recommended to reduce lean and compromise of compression efficacy due to fatigue.

It is recommended that CPR be performed in 2 minute cycles without interruption, and duration of pauses between cycles minimized.

Delay in starting CPR

Aggressive administration of CPR in patients suspected of being in CPA is recommended, as the risk of injury due to CPR in patients not in CPA is low.

Interposed Abdominal Compressions

The use of interposed abdominal compressions in dogs and cats with CPA is reasonable when sufficient personnel trained in its use are available.

Advanced Life Support

Epinephrine

The use of low dose (0.01 mg/kg) epinephrine administered every 3-5 minutes early in CPR is recommended.

The use of high dose (0.1 mg/kg) epinephrine may be considered after prolonged CPR.

Atropine

In dogs and cats with asystole or PEA potentially associated with increased vagal tone, use of atropine is reasonable.

In dogs and cats routine use of atropine during CPR may be considered.

Vasopressin

The use of vasopressin (0.8 U/kg) as a substitute or in combination with epinephrine every 3-5 minutes may be considered.

Defibrillation

The use of a biphasic defibrillator is recommended over a monophasic defibrillator.

External defibrillation dosing should start at 4-6 J/kg with a monophasic defibrillator and 2-4 J/kg with a biphasic defibrillator.

Administration of a single shock as opposed to 3 stacked shocks is recommended, with immediate resumption of CPR in the case of non-successful defibrillation.

Defibrillation for treatment of non-perfusing VF/VT is recommended over routine use of anti-arrhythmic drugs.

Immediate defibrillation is recommended in cases of CPA due to VF of duration of 4 minutes or less. Immediate defibrillation may be considered if VF is diagnosed during a rhythm check between cycles of CPR.

A 2 minute cycle of CPR should precede defibrillation in cases of CPA due to VF of known or suspected duration of greater than 4 minutes.

In dogs and cats with VF, defibrillation energy escalation is reasonable if the first countershock is unsuccessful.

Amiodarone

Amiodarone may be considered in cases of pulseless VT/VF resistant to defibrillation.

When amiodarone is not available, lidocaine may be considered in cases of pulseless VT/VF resistant to defibrillation.

Magnesium

Routine use of MgSO₄ is not recommended for cardiac arrhythmias, but may be considered for treatment of torsades de pointes.

Impedance Threshold Device

Use of an Impedance Threshold Device (ITD) to enhance circulation is reasonable in animals > 10kg.

Corticosteroids

The routine use of corticosteroids during CPR is not recommended.

Reversal Agents

In dogs and cats that have received reversible anesthetic/sedative medication, administering reversal agents during CPR may be considered.

Naloxone

In cases of opioid toxicity, naloxone should be used during CPR.

In cases of recent opioid administration, the use of naloxone during CPR may be considered.

Calcium

The routine use of intravenous calcium in dogs and cats during CPR is not recommended.

Intravenous calcium may be considered in dogs and cats with documented moderate hypocalcemia during CPR.

Potassium

Documented hyperkalemia should be treated during CPR.

Treatment of documented hypokalemia during CPR may be considered.

Intratracheal Administration

In animals in which intravenous or intraosseous access is not possible, the use of the intratracheal route for epinephrine, vasopressin, or atropine may be considered.

If the intratracheal route is used for drug administration during CPR, drugs should be diluted with saline and administered via a catheter longer than the endotracheal tube.

Supplemental Oxygen Administration

During CPR in dogs and cats, the use of an FiO₂ of 100% is reasonable.
During CPR in dogs and cats, the use of an FiO₂ of 21% (room air) may be considered.

IV Fluid Administration

During CPR in euvoletic or hypovolemic dogs and cats, routine administration of intravenous fluids is not recommended.

During CPR in dogs and cats with documented or suspected pre-existing hypovolemia, administration of intravenous fluids is reasonable.

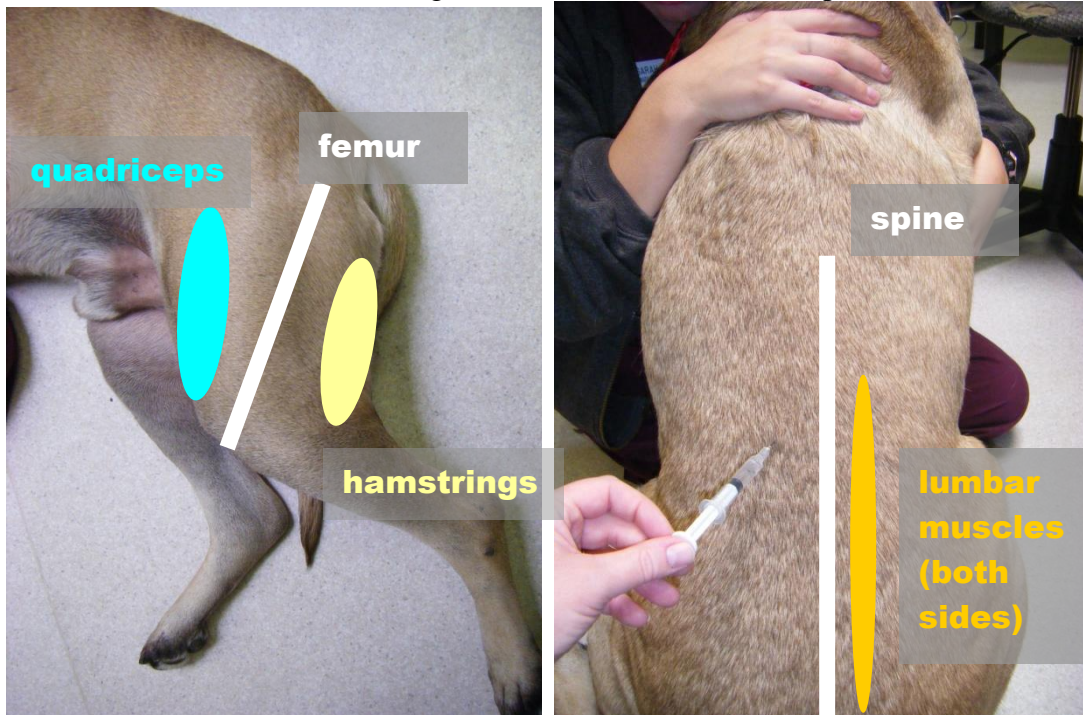
Alkalinization Therapy

Alkalinization therapy after prolonged CPA of greater than 10-15 minutes with administration of 1 mEq/kg of sodium bicarbonate may be considered.

d) Injections

i) Intramuscular (IM)

- (1) Quadriceps muscle: front of rear leg above knee
- (2) Hamstrings: rear of rear leg above knee
- (3) Lumbar muscles: along lower back to either side of spine



- ii) Subcutaneous (SQ)
 - (1) Anywhere along shoulders or back
 - (2) Tent up skin, inject at bottom of tent into fat



- e) Fluids
 - i) IV: via catheter
 - ii) SQ (many 9/11 dogs required): as for SQ injection, use fluid bag, drip set, and 18 ga needle to inject under skin on back of shoulders

6) Analgesia & Sedation Basics

- a) Non-steroidal Anti-Inflammatory Drugs (NSAIDs)
 - i) Rimadyl: good for soft tissue or orthopedic pain, rare kidney or liver side effects, do not use with aspirin, Deramaxx or prednisone, given PO BID
 - ii) Deramaxx: COX-2 selective, a little stronger for orthopedic pain, rare kidney or stomach side effects, do not use with aspirin, Rimadyl or prednisone, can use higher dose for four days only, given PO Q 24 hr
 - iii) Do not give any human-labeled NSAIDs to dogs as toxic
- b) Opioids
 - i) Hydromorphone: strong analgesic, also sedative, given IM, IV or SQ, may cause panting or vomiting
 - ii) Butorphanol: weak analgesic but good sedative for less painful procedures, give IM or SQ
 - iii) Tramadol: partial opioid, good analgesia, given PO, okay to combine with Rimadyl or Deramaxx or prednisone
- c) Sedatives
 - i) Acepromazine: strong sedative, can cause decreased blood pressure so don't use if severe trauma, third eyelids will elevate, lasts about 4-6 hours, given IM or SQ
 - ii) Dexdomitor: strong sedative, usually given in combination with butorphanol IM, will cause slow HR and pale MM (peripheral vasoconstriction but normal blood pressure), reverse after procedure with Antisedan IM
 - iii) Ketamine: combined with midazolam for short-term anesthesia, given IV
 - iv) Midazolam: weak sedative by itself (IM) or combined with ketamine IV for short-term anesthesia, also IM as anticonvulsant for seizures

7) Problems Which May be Encountered in the Field

a) General

i) Shock

(1) Types

- (a) Hypovolemic: decreased circulating blood volume due to internal or external hemorrhage, severe dehydration, trauma, etc.
 - (i) “Compensated” phase: mild to moderate mental depression, increased HR, normal or prolonged CRT, cool extremities, increased RR, normal BP, usually normal pulse quality
 - (ii) “Decompensated” phase: pale MM, weak pulses, depressed mentation, decreased BP
- (b) Distributive: altered circulation due to sepsis, bloat, etc.
 - (i) “Hyperdynamic” phase: increased HR, bounding pulses, fever, red MM
 - (ii) “Hypodynamic” phase: increased HR, pale MM, prolonged CRT, weak pulses, depressed mentation

(2) Treatment

- (a) Place IV catheter if possible
- (b) Intravenous crystalloids (e.g., Normosol, LRS, Plasmalyte, 0.9% NaCl), boluses of approximately 500 ml (for typical SAR dog) until perfusion improves (improvement in HR, BP, MM, mentation)
- (c) Intravenous colloids (e.g., Hetastarch, dextran) if available, boluses of approximately 100 ml (for typical SAR dog) until perfusion improves. Colloids are not often used in human resuscitation but are very helpful in canines. Dogs don’t have the coagulopathy problems seen in humans with some colloids.

ii) Dehydration (common among 9/11 deployed dogs)

- (1) Assess as above (page 3)
- (2) Due to hot dusty environment, long working hours, decreased water intake while working
- (3) May also lead to bloody diarrhea and blood in urine
- (4) Prevent by taking dog away from work area for rest and rehydration every 30-45 minutes
- (5) Consider pre-hydration before working with subcutaneous fluids (approximately 1 liter for average SAR dog)
- (6) If 5-8% dehydrated, SQ fluids OK to correct (approximately 1 liter for average SAR dog)
- (7) If more than 8% dehydrated, IV fluids preferable
 - (a) Example: 50 lb (22.7 kg) dog with 8% dehydration: fluid loss is $22.7 \times 0.08 = 1.8$ liters to replace with fluids

iii) Anaphylaxis

- (1) Reaction to insect sting, foods, vaccines, etc.
- (2) May have vomiting, diarrhea, respiratory distress, pale MM
- (3) Treat with dexamethasone IM, diphenhydramine IM, and epinephrine IM
- (4) Oxygen if necessary

- iv) Allergic reactions
 - (1) Usually face and muzzle will swell, hives on body
 - (2) If no vomiting or respiratory distress, treat with corticosteroids (prednisone PO or dexamethasone IM) and/or antihistamines (diphenhydramine PO or IM)
 - (3) If vomiting or respiratory distress, treat as anaphylaxis
- b) Environmental
 - i) **Heat stroke**
 - (1) Overall mortality rate 50%
 - (2) Predisposing factors: strenuous activity, lack of acclimation, confinement, poor ventilation, dehydration, increased humidity, water deprivation, brachycephalic anatomy (smush-faced dogs like bulldogs), laryngeal paralysis, obesity, cardiovascular disease, geriatric age, dark color fur, thick hair coat, large breed (body weight to surface area ratio), drugs (sedatives, beta blockers or diuretics), prior episodes of heatstroke.
 - (3) Poor prognostic indicators: coma, hypoglycemia, ventricular arrhythmias, delay of more than 90 minutes before admission to hospital, obesity, seizures, coagulation abnormalities.
 - (4) Heat exhaustion (weakness, muscle tremors, vomit, diarrhea) progresses to heat stroke (mental depression not always as consistent as in humans); core temp >105.8
 - (a) Human definition includes mental depression but canine brain is intrinsically resistant to heat damage compared to human brain.
 - (5) Signs: increased HR, panting, dry red MM, rapid CRT (< 1 sec), vomiting, diarrhea, mentation normal to comatose, blindness, wobbling, collapse, petechiae (pinpoint bruises on gums, flaps of ears, belly)
 - (6) Causes kidney and liver failure, coagulation disorders (DIC), arrhythmias, brain damage, stomach ulceration, intestinal sloughing, bacterial translocation from intestine, sepsis
 - (7) Treatment:
 - (a) Stop working dog at first signs of heat stress (red MM, vomit, rectal temp over 103.5), get to cooler area out of direct sun
 - (b) Immediate cooling measures: cool water soaking (not cold or ice water!), fans; stop when temp reaches 103 to prevent over-shooting
 - (c) Even if dog looks/acts better after cooling, still take to veterinarian ASAP
 - (d) IV fluids (room temp or cooled fluids) as for shock
 - (e) Oxygen by face mask
 - (f) Check blood glucose if possible (administer 5% dextrose IV fluids if concern of hypoglycemia)
 - (g) Mannitol IV if neurologic deficits
 - (h) Antibiotics: cefazolin or ampicillin IV
 - (i) Antiemetics: Cerenia or Reglan
 - (j) Gastrointestinal protectants: Pepcid, sucralfate
 - (8) Prevention
 - (a) Acclimation to exercise and climate
 - (b) Consider pre-hydration with SQ fluids (500 ml LRS or 0.9% NaCl)

- (c) Cooling vests?
 - (d) Adequate rest in cool shade, adequate drinking water while working
- (9) Animals with a history of heat stroke are predisposed to further episodes, even at lower temperatures and humidity, due to permanent damage to the thermoregulatory center (“thermostat”) in the hypothalamus of the brain.
- ii) Hypothermia
 - (1) Causes slow HR, low BP, arrhythmias, pulmonary edema, unconsciousness, kidney and liver failure, coagulation abnormalities
 - (2) Grades:
 - (a) Mild: rectal temperature 90-99 Fahrenheit
 - (b) Moderate: temp 82-90
 - (c) Severe: temp <82
 - (3) Treatment: warming with blankets, hair dryer or heat lamp (directed at chest/abdomen, not legs), warm IV fluids
- iii) Frost bite: warm affected area with warm water, do not rub, prevent self-trauma, analgesics (tramadol) and antibiotics (cephalexin)
- iv) Near-drowning: CPR, intubation, oxygen
- v) Smoke inhalation
 - (1) Evacuate from area, oxygen by face mask
 - (2) Flush eyes with copious eye wash or saline, apply triple antibiotic ophthalmic
 - (3) Intubate and ventilate if necessary
 - (4) Do not use antibiotics initially, but start if fever develops after 2 days (Augmentin + cipro)
 - (5) Avoid cough suppressants; encourage gentle activity to break up discharge
- c) Gastrointestinal
 - i) Stress- induced gastrointestinal upset
 - (1) Diarrhea very common among 9/11 dogs
 - (a) If not vomiting and still eating, treat with Flagyl (metronidazole) +/- Lomotil; also probiotics may help
 - (2) If vomiting, hold NPO for 12 hours and treat with Cerenia (maropitant) SQ or PO
 - (3) Assess hydration; IV or SQ fluids may be necessary
 - ii) Bloat (GDV, gastric dilatation and volvulus)
 - (1) Stomach fills with air and twists around, cutting off blood flow to itself and spleen; rapidly progressive; fatal without surgery
 - (2) Cause of death in 10% of military working dogs
 - (3) Signs: non-productive retching, abdominal distension, rapid heart rate, shock
 - (4) Treatment: IV catheter (front leg), bolus Normosol 1-2 liters, transport to veterinarian ASAP
 - (5) Prevention: prophylactic gastropexy (stomach tack)
- d) Neurologic
 - i) Seizure
 - (1) Many potential causes: epilepsy (seen especially in Labs), hypoglycemia, liver disease, toxin, brain injury, meningitis, etc.
 - (2) Treat with midazolam IM, transport to veterinarian if more than 2 seizures in 24-hour period or if seizure lasts more than 10 minutes

- ii) Traumatic brain injury (head trauma)
 - (1) Signs: asymmetric pupils, lack of pupillary light reflex, mental depression, bloody nose, bruising of sclera (white part of eye)
 - (2) Treatment: IV fluids, mannitol IV to reduce intracranial swelling (bolus over 5-10 minutes, needs to be warmed to dissolve crystals), O2 by face mask
- iii) Spinal trauma
 - (1) Secure on back board for transport
 - (2) IV fluids, analgesia (hydromorphone IV), Solu-Medrol IV (initial dose, then doses at 2 and 8 hours later) to reduce spinal swelling and compression
 - (3) Transport to veterinarian ASAP for radiographs and further treatment
- e) Respiratory
 - i) Respiratory distress could be due to
 - (1) Airway obstruction from aspiration of debris or airway trauma
 - (2) Aspiration pneumonia
 - (3) Pulmonary contusions
 - (4) Pneumothorax
 - ii) For all, ensure patent airway, intubate if necessary, administer oxygen and IV fluids; antibiotics for aspiration; transport to veterinarian ASAP
 - iii) Kennel cough: contagious upper respiratory infection, hacking cough “like gagging up a hairball,” dogs still active and eating; treat with Robitussin and cephalexin PO
- f) Musculoskeletal
 - i) Fractures
 - (1) Generally non-weight bearing on the leg if there is a fracture (may be weight bearing with pelvic fractures)
 - (2) Very painful: treat with NSAID (Rimadyl or Deramaxx PO) plus opioid (hydromorphone IM or tramadol PO)
 - (3) Splinting techniques
 - (a) May need to sedate dog to allow splint (sedate with Dexdomitor + opioid [butorphanol or hydromorphone] IM, reverse with Antisedan IM; or sedate with acepromazine + opioid)
 - (b) Splint must immobilize the joint below and the joint above the fracture
 - (c) Spoon splints for fractures of front leg below the elbow
 - (d) Quick splints for fractures of rear leg below the knee (stifle)
 - (e) Bandage layers:
 - (i) White tape stirrup adhered to fur and extending 6” down past toes
 - (ii) Cast padding: start unrolling from toes up the leg, overlapping, with consistent tension; wrap a good ¾” thickness
 - (iii) Stretch roll gauze: start unrolling from toes up the leg, overlapping, tighten down to compress cast padding
 - (iv) Splint
 - (v) Fold stirrup back up to incorporate into splint (to prevent slipping)
 - (vi) Vet-rap or Elastikon: start unrolling from toes up the leg, overlapping, very loose
 - (vii) Leave two middle toes exposed to feel for swelling or coolness

- ii) Lameness
 - (1) Careful physical exam: look for foreign objects, abrasions, lacerations, torn toe nails; feel each joint for range of motion
 - (2) Soft tissue injuries (sprains or strains) common
 - (3) Treat with NSAID (Rimadyl or Deramaxx PO) and rest
- iii) Paw injuries
 - (1) Foreign object in paws: manual extraction, bandage paw, cephalexin and NSAID
 - (2) Torn toe nail: cut at base of nail, stop bleeding with KwikStop or silver nitrate stick, bandage paw, cephalexin and NSAID
- g) Eyes
 - i) Fluorescein staining
 - (1) Do NOT use steroid-containing medications if ulcer present
 - ii) Irritation from smoke and dust
 - (1) Copious and frequent eye flushing
 - (2) Triple antibiotic with steroid for irritation if fluorescein stain negative
 - iii) Foreign objects, particularly behind third eyelid
 - (1) Proparacaine to anesthetize eye to remove object
 - (2) Triple antibiotic ointment
 - iv) Corneal ulcers
 - (1) Triple antibiotic ointment
 - (2) Atropine ointment for relief of papillary spasms
 - (3) Rimadyl or Deramaxx PO
- h) Skin
 - i) Burns
 - (1) Clip surrounding fur
 - (2) Gentle flushing with saline
 - (3) Apply silver sulfadiazine cream, bandage with non-adherent (Telfa) dressing
 - (4) Antibiotics: cephalexin or Augmentin PO
 - (5) Pain relief: NSAID (Rimadyl or Deramaxx PO) plus tramadol PO if necessary
 - ii) Lacerations, abrasions
 - (1) Shave surrounding fur, gently irrigate wound with saline
 - (2) Skin staples for smaller lacerations, or for temporary treatment of larger lacerations until a veterinarian can do surgery
 - (3) Lidocaine local anesthesia: inject into skin around wound (caution – lidocaine stings!)
 - (4) Bandaging techniques
 - (a) White tape stirrup adhered to fur and extending 6” down past toes
 - (b) Cast padding: start unrolling from toes up the leg, overlapping, with consistent tension; wrap a good ¾” thickness
 - (c) Stretch roll gauze: start unrolling from toes up the leg, overlapping, tighten down to compress cast padding
 - (d) Fold stirrup back up to incorporate into bandage (to prevent slipping)
 - (e) Vet-rap or Elastikon: start unrolling from toes up the leg, overlapping, very loose

- (f) Leave two middle toes exposed to feel for swelling or coolness
- (5) Arterial hemorrhage
 - (a) Apply pressure and bandage
 - (b) If bleed-through, do not remove bandage but apply more layers
 - (c) If able to visualize artery, clamp with hemostat
- iii) Skin infections
 - (1) Signs: hair loss or dandruff, redness, pimples, itching, “hot spot”
 - (2) Treatment: cephalexin PO, can use diphenhydramine PO for itching
- iv) Ear infections
 - (1) Signs: shaking head, scratching ear, odor from ear
 - (2) Treatment: Otomax or Otibiotic (combination antibiotic, antifungal, steroid) in ear canal
- i) Animal encounters
 - i) Wild or loose animals
 - (1) Bite wounds likely to become infected; flush wound and start Augmentin or cephalexin
 - (2) If bitten by skunk, bat, raccoon or fox there is potential for rabies exposure; report to local animal control
 - (3) Porcupine quills: sedate with butorphanol and Dexdomitor IM, pull quills with hemostat (grasp at base and apply steady traction)
 - ii) Bees and wasps: corticosteroids (prednisone or dexamethasone), IV fluids and epinephrine if anaphylaxis
 - iii) Spiders
 - (1) Black widow: causes muscle cramping, respiratory distress, pain, paralysis; possible antivenin?
 - (2) Brown recluse: causes slow-healing necrotic wound; treat with antibiotics
 - iv) Snakes
 - (1) Pit vipers (rattlesnakes, copperheads, cottonmouth water moccasins; Western diamondback rattlesnake in this area)
 - (a) Venoms vary in strength and effects; rattlesnake most toxic
 - (b) Cause bleeding, swelling, inflammation, pain, tissue necrosis
 - (c) Prognosis worse if bite on tongue, in eye, or intravascular, or to a small dog; give antivenin ASAP
 - (d) Do not use tourniquets, ice, suction, etc.
 - (e) Keep dog calm, with bite wound lower than heart level
 - (f) Treatment
 - (i) IV fluids
 - (ii) Benadryl IM or SQ
 - (iii) CroFab antivenin
 - (iv) Pain management: hydromorphone or tramadol
 - (v) Broad-spectrum antibiotics (Augmentin or cephalexin + cipro)
 - (g) Rattlesnake vaccine available but still need antivenin if bitten
 - (h) Snake “aversion training” or “snake proofing,” where the dog is trained with aversive stimuli to avoid rattlers.
 - (2) Coral snakes
 - (a) Bites not common but may be fatal

- (b) Neurotoxic venom causes respiratory paralysis
 - (c) Antivenin generally not available
 - (d) Treatment: antibiotics, analgesia, transport to veterinarian ASAP to monitor for respiratory paralysis
- v) Scorpions: cause pain, hypersalivation, spasms, urination, defecation; treat with dexamethasone
- j) Toxic exposure
 - i) Dogs enter disaster site without personal protection equipment worn by humans
 - ii) Try to identify the exact chemical whenever possible
 - iii) Acute or chronic effects (including carcinogenic)
 - iv) Classifications of toxins
 - (1) Solids and liquids, e.g., hydrocarbons, toxic metals, soaps, detergents, acids, solvents
 - (2) Particulates, e.g., fiberglass, asbestos; even non-toxic dust and particulates can cause inflammation as SAR dogs can't wear respiratory protection
 - (3) Gases, e.g., hydrogen sulfide (heavier than air so settles in depressions where dog may be exposed), hydrogen cyanide, carbon monoxide
 - v) Routes of exposure
 - (1) Ingestion
 - (a) Also including inhaled toxins that are coughed and then swallowed, or from licking the nose while searching, or from grooming fur
 - (b) Can cause local injury, inflammation, ulceration (acids, alkalis, cationic detergents)
 - (c) Systemic absorption from GI tract (alcohols, heavy metals)
 - (d) Induction of vomiting for certain ingested toxins
 - (i) NOT with corrosives or petroleum-based toxins
 - (ii) Apomorphine: place tab in conjunctival sac, then flush out after vomiting occurs
 - (e) Administration of activated charcoal
 - (2) Respiratory
 - (a) Causes asphyxiation, pulmonary edema, bronchitis, pneumonia, chronic inflammation, cancer
 - (b) SAR dogs at high risk due to constantly sniffing and being closer to the ground
 - (c) Dogs recovering from respiratory illness (e.g., kennel cough) may be more susceptible to inhaled toxins
 - (3) Skin
 - (a) Dogs at increased risk because larger surface area to body mass than humans, and because they may walk through puddles
 - (b) Direct corrosive injury: acids and oxidizing agents usually cause initial pain so the dog can be removed from the area, but alkalis and cationic detergents do not cause initial pain so there may be prolonged exposure resulting in more severe injury
 - (c) Contact dermatitis
 - (d) Systemic absorption through skin, especially solvents and hydrocarbons, or if skin is abraded

- (e) Dog can expose humans to chemical from handling
- (4) Ocular
 - (a) Causes irritation and corneal ulceration
- vi) Specific toxins
 - (1) Concerns in 9/11 dogs: asbestos, concrete dust, dioxins, PCBs, lead
 - (2) Hydrocarbons (kerosene, gasoline, jet fuel, benzene, etc.)
 - (a) Exposure through inhalation or vapors, dermal (slow) or ingestion
 - (b) Can cause skin, eye, respiratory, GI, liver, kidney, cardiac or neuro signs; carcinogenic
 - (c) Seizures worse if epileptic
 - (d) Don't induce vomiting (risk of aspiration)
 - (e) Activated charcoal not useful
 - (f) Administer oxygen if concern of aspiration
 - (3) Polychlorinated biphenyls (PCBs)
 - (a) May still be present in older buildings
 - (b) Exposure through dermal, ingestion or inhalation
 - (c) Can cause liver, GI, anemia, reproductive, neuro signs; carcinogenic
 - (d) Don't induce vomiting (risk of aspiration)
 - (e) Activated charcoal not useful
 - (4) Heavy metals (lead, mercury, chromium, arsenic, etc.)
 - (a) Exposure through inhalation mainly
 - (b) General supportive care (IV fluids, anticonvulsants, stomach protectants)
 - (c) Specific treatment (if metal known) in veterinary hospital
 - (5) Asbestos
 - (a) Still present in older buildings
 - (b) SAR dogs at risk from sniffing
 - (c) Can cause pulmonary fibrosis, bronchitis, lung cancer (less common in dogs than people)
 - (6) Gases (hydrogen sulfide, hydrogen cyanide, carbon monoxide, Freon, chlorine, fluorine)
 - (a) Move to fresh air, give oxygen by mask
 - (b) IV fluids
 - (c) Corticosteroids (dexamethasone or Solu-Medrol)
 - (d) Cyanide antidote kit
 - (e) Carbon monoxide
 - (i) There is not a lot of info on pure CO poisoning in animals (most cases have concurrent smoke inhalation). Symptoms: recumbent, stiff, with difficulty breathing, paddling the limbs, often will NOT have typical "cherry-red" mucous membrane color.
 - (ii) A standard pulse oximeter will overestimate O₂ saturation because it cannot distinguish between OHb and COHb. The Rad57 measures oxyhemoglobin, carboxyhemoglobin and methemoglobin. It should be useful for dogs. The normal range of carboxyhemoglobin (COHb) is not known for dogs but assumed to be 0-4%.
 - (iii) Treatment is oxygen, as high a percentage as possible. Nasal cannulas will deliver around 40% O₂. Intubation would allow 100% O₂.

Hyperbaric O2 would be ideal, if a chamber could be located that would allow a dog.

- (7) Soaps and detergents
 - (a) If ingested, dilute with milk or water by mouth
 - (b) Don't induce vomiting (corrosive)
 - (c) Activated charcoal not useful
- (8) Acids and alkalis
 - (a) If ingested, dilute with milk or water by mouth
 - (i) Don't induce vomiting (corrosive)
 - (ii) Activated charcoal not useful
 - (b) If dermal exposure, bathe with Dawn dish detergent
 - (i) Symptomatic care with anti-inflammatories and analgesics
- (9) Antifreeze (ethylene glycol)
 - (a) Causes "drunken" behavior then acute kidney failure
 - (b) Minimum lethal dose is 6.6 ml/kg (approximately 5 oz for 50 lb dog).
 - (c) Induce vomiting if ingestion within 15 minutes
 - (d) Activated charcoal not useful
 - (e) Veterinary emergency clinics will usually have an in-house blood test to determine if the dog ingested a toxic amount of EG (the test is valid from 30 minutes to 14 hours after ingestion), or an EG level can be run at a human hospital.
 - (f) Treatment IV fluids (high rates) and fomepizole (Antizol-Vet, in the veterinary cache box). Antizol-Vet is effective up until 12 hours after ingestion, but should be given as soon as possible for maximum effect. The dosing is IV and repeated at 12, 24 and 36 hours (complete dosing instructions are in the package).
 - (g) Antizol is safe to give even if ingestion of EG is not confirmed, and should be started as soon as possible after suspicion of ingestion.
- (10) Illicit drugs
 - (a) Amphetamines: apomorphine and activated charcoal if ingestion less than 30 minutes, IV fluids
 - (b) Barbiturates: apomorphine and activated charcoal if ingestion less than 30 minutes, IV fluids, intubation and ventilation if necessary
 - (c) Benzodiazepines: apomorphine and activated charcoal if ingestion less than 30 minutes
 - (d) Cocaine: midazolam for seizures, IV fluids, prevent hyperthermia
 - (e) LSD: midazolam for seizures/agitation, prevent hyperthermia
 - (f) Marijuana: apomorphine and activated charcoal if ingestion less than 30 minutes, midazolam for seizures, prevent hypothermia
 - (g) Opioids: naloxone, intubation and ventilation if necessary
 - (h) PCP: midazolam for seizure/agitation
- (11) Organophosphates
 - (a) Duo-Dote contains atropine 2.1 mg and pralidoxime (2-PAM) 600 mg. The suggested dose of atropine for organophosphate toxicity in dogs would be equivalent to one auto-injector per 20 lbs body weight.

- k) Urinary tract infection
 - i) Signs: frequent urination, discomfort while urinating, blood in urine
 - ii) Use multi-stix from human medical cache for urinalysis
 - iii) If positive for blood, treat with antibiotic such as cephalexin or amoxicillin/clavulanic acid

8) General preventive care while deployed

- a) Bathing at end of shift to eliminate dust and hazardous materials (or sooner if known contamination)
 - i) Water for dust
 - ii) Dawn dish detergent if oil-based contaminants
- b) Frequent flushing of eyes and nose with saline or eye wash
- c) Wiping nose and mouth frequently
- d) Inspect feet for cuts
- e) Wash and dry feet
- f) Prevent dehydration
 - i) May consider pre-hydrating with SQ fluids before working
 - ii) Frequent rests for drinking will also decrease chance of dog drinking from standing water that may be contaminated

9) Euthanasia

- a) I sincerely hope this is never necessary, but could be required in certain cases of major trauma (e.g., open spinal fracture).
- b) The veterinary cache box contains euthanasia solution (brand names are Beuthanasia-D, Somnasol, Sleepaway, etc.). This is to be used to euthanize animals (deployed dogs, wildlife, or animal victims of disaster) in case of severe illness or injury and suffering. **Be extremely careful! It will cause death when administered to any animal.**
- c) Beuthanasia-D contains 390 mg/ml pentobarbital and 50 mg/ml phenytoin. The solution is bright pink to prevent accidental administration. The solution is quite thick and syrupy, so dilution with saline or tap water will ease administration. The pentobarbital first causes unconsciousness, then respiratory and cardiac arrest. When animals are euthanized, they may go through a brief excitement stage, stiffen the legs or vocalize. They may also lose bladder or bowel control. The eyes will not close.
- d) After euthanasia, the cadaver must be properly disposed of by deep burying or incinerating. If the cadaver is left where scavengers can chew on it, the scavengers can ingest enough barbiturate to become comatose or die.
- e) This euthanasia solution must be administered intravenously. The dose is roughly 1 cc per 10 pounds, rounded up. In a nervous or painful animal, sedation with midazolam (Versed) is recommended at 0.5 cc per 10 pounds intramuscularly prior to IV injection. In rare cases if a vein cannot be located, the solution can be given intracardiac *after sedation*. Palpate the apex heart beat on the side of the chest behind the left elbow.
- f) Typical doses: cat: 2 cc, small dog: 3-5 cc, large dog: 7-12 cc, horse or cow: 100 cc

References/ Suggested Reading

Veterinary Disaster Medicine: Working Animals, WE Wingfield, SL Nash, SB Palmer, JJ Upp, Wiley-Blackwell, 2009.

- Book that specifically addresses working animals. Includes information on working horses as well as dogs. Covers first aid, bandaging, common illnesses and injuries, triage, treatment of blast injuries, preparation against WMD, specific treatment of chemical, radiological and biological attacks, infectious diseases including zoonoses (diseases transmissible from animals to humans), and euthanasia.

Veterinary Disaster Response, WE Wingfield, SB Palmer, Wiley-Blackwell, 2009.

- Book that addresses many aspects of disaster planning as it relates to animals, including triage, zoonoses, public health, hazardous materials, veterinary decontamination, handling, sheltering and first aid of domestic and wild animals, and community disaster planning.

Emergency Procedures for the Small Animal Veterinarian 2nd Ed, SJ Plunkett, Saunders, 2000.

- Cookbook-style manual for first aid and treatment of common dog and cat emergencies.

“Assessment of acute injuries, exposure to environmental toxins, and five-year health surveillance of New York Police Department working dogs following the September 11, 2001 World Trade Center terrorist attack,” PR Fox, B Puschner, JG Ebel, *J Am Vet Med Assoc*, 2008.

- Study of 27 NYPD dogs; first phase 9/11/01-5/30/02, second phase 5/31/02-9/21/06. No deaths or critical illness or injury. At least one health problem in 22 of 27 dogs during the first two weeks: fatigue 70%, conjunctivitis 63%, respiratory irritation (sneeze, cough, gag, nasal discharge) 59%, decreased appetite 59%, dehydration 48%, cuts and abrasions 52%, vomit and/or diarrhea 44%. One dog had a corneal laceration and one had pneumonia. Blood work showed mildly increased liver enzymes, lead, arsenic, and various environmental toxins but none at a toxic level. Long-term: six dogs died during the study period and were necropsied, cause of death not related to deployment.

“Deployment morbidity among search-and-rescue dogs used after the September 11, 2001 terrorist attacks,” KA Slensky, KJ Drobatz, AB Downend, CM Otto, *J Am Vet Med Assoc*, 2004.

- Study of 96 SAR dogs (FEMA or otherwise) at WTC, Pentagon and landfill; period Oct 2001-June 2002. No deaths or critical illness or injury. At least one health problem in 65 of 96 dogs: cuts and abrasions 35%, vomit and/or diarrhea 22%, weight loss 23%, fatigue 24%, respiratory irritation 8%, lameness 8%. Six dogs had heat exhaustion.

“Pathology and toxicology findings for search-and-rescue dogs deployed to the September 11, 2001, terrorist attack sites: initial five-year surveillance,” SD Fitzgerald, WK Rumble, WE Braselton, et al, *J Vet Diagn Invest*, 2008.

- Study of 95 deployed SAR dogs compared to 55 non-deployed SAR dogs as controls; period 9/11/01-9/10/06; any dogs that died were necropsied (18 deployed and 5 non-deployed). No differences of mortality rate or age of death. Anthracosis (inhaled carbonaceous black pigment) in lungs of both deployed and non-deployed. No significant respiratory disease, and no lung tumors. One dog positive for PCBs, one had mild iron elevation. Cause of death: many inflammatory or cancer, but not abnormal for age and breed. One dog had carcinoma of the tonsils, which could be related to deployment.

“Medical and behavioral surveillance of dogs deployed to the World Trade Center and the Pentagon from October 2001 to June 2002,” CM Otto, AB Downend, JA Serpell, et al, *J Am Vet Med Assoc*, 2004.

- Study of 97 deployed SAR dogs and 55 non-deployed SAR dogs as controls; period 9/11-10/6/01. Compared blood work: slightly elevated liver enzymes (toxins?) and glucose (stress), and decreased lymphocytes (stress) among deployed. Chest x-rays: no difference. Behavioral questionnaire of handlers: no evidence of PTSD-type problems in the dogs.

“Field treatment of search dogs: lessons learned from the World Trade Center disaster,” CM Otto, MA Franz, B Kellogg, et al, *J Vet Emerg Crit Care*, 2002.

- Summary of disaster planning, preventive care and field treatment of SAR dogs during a disaster. Specific discussion of airway obstruction, pneumothorax, dehydration, hemorrhage and toxic exposures.

“General toxicologic hazards and risks for search-and-rescue dogs responding to urban disasters,” SM Gwaltney-Brant, LA Murphy, TA Wismer, JC Albretsen, *J Am Vet Med Assoc*, 2003.

- Classes of toxins and routes of exposure that may be encountered by SAR dogs.

“Toxicologic agents of concern for search-and-rescue dogs responding to urban disasters,” LA Murphy, SM Gwaltney-Brant, JC Albretsen, TA Wismer, *J Am Vet Med Assoc*, 2003.

- Symptoms of specific toxins: PCBs, hydrocarbons, heavy metals, gases, acids, detergents, etc.

“Management and prevention of toxicoses in search-and-rescue dogs responding to urban disasters,” TA Wismer, LA Murphy, SM Gwaltney-Brant, JC Albretsen, *J Am Vet Med Assoc*, 2003.

- Treatment of specific toxins: PCBs, hydrocarbons, heavy metals, gases, acids, detergents, etc.