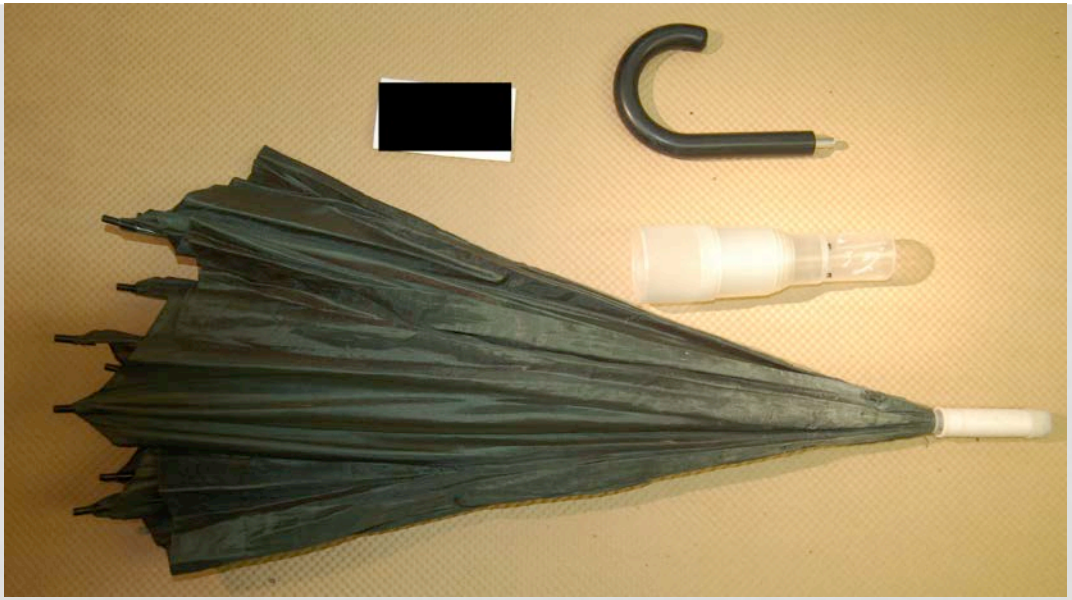


BLUNT & SHARP TRAUMA

JODIE GERDIN DVM DACVP AUSTRALIA 2018

OVERVIEW

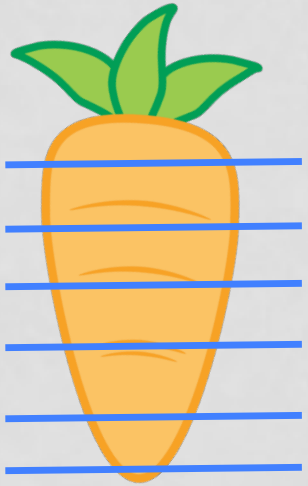
- Trauma: The pathologist's role
  - Documenting wounds
  - Diagrams
- 4 types of **blunt** force wounds (BFW)
  - Abrasions, Contusions, Lacerations, & Fractures
- 3 types of **sharp** force wounds (SFW)
  - Stabs, Incisions (Cuts), Chops

TRAUMA: THE PATHOLOGIST'S ROLE

1. **Document** the nature & extent of the injuries
   - Describe & name the wounds
     - **Use human forensic pathology terms→ best communication in court**
   - Note if injuries are of ~the same or different ages
     - Evidence of multiple episodes of trauma
2. **Determine the type**(s) of trauma (blunt, sharp, gunshot, etc.) responsible for the wounds
3. **Decide** if the reported Hx is consistent with the injuries observed

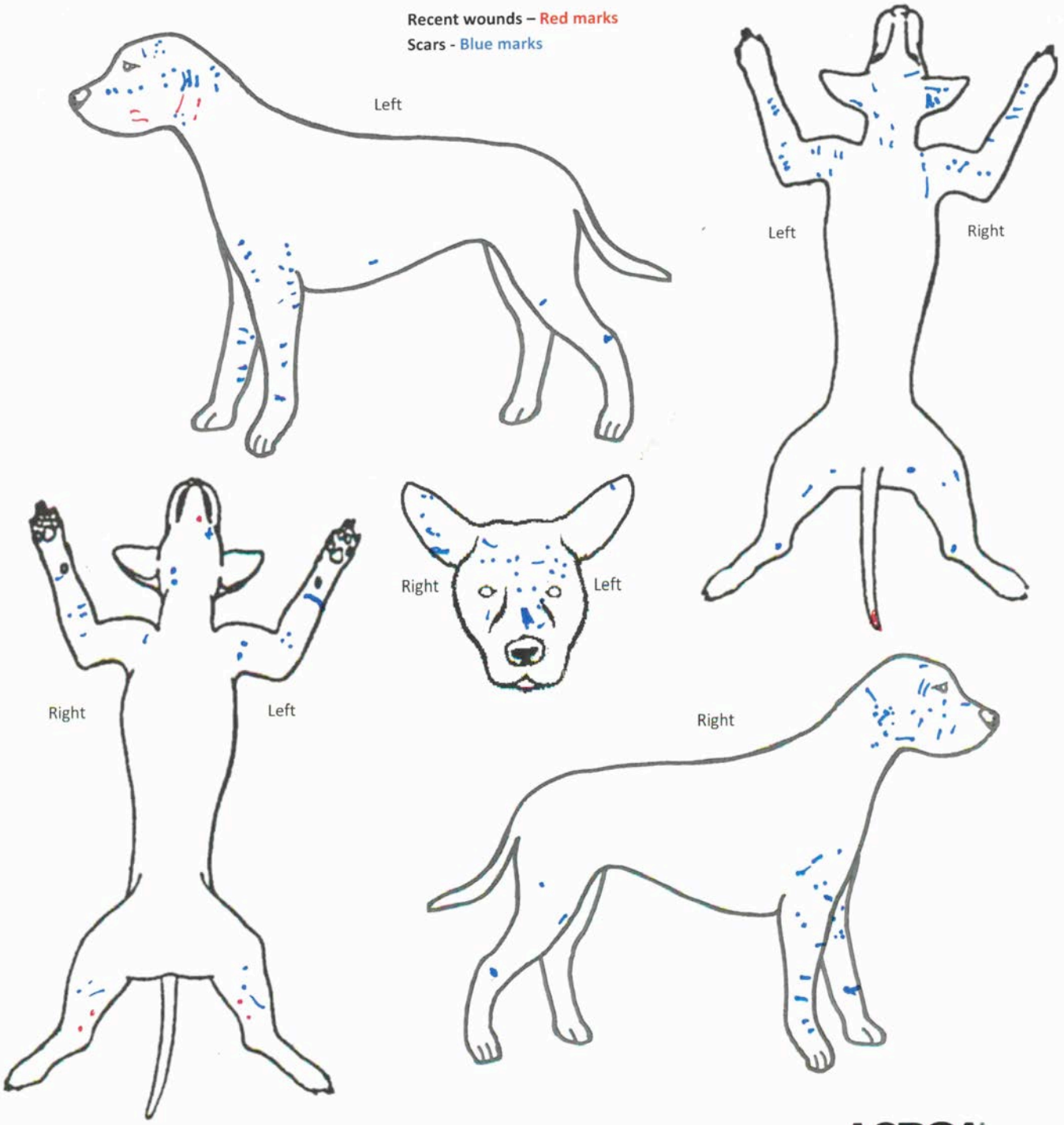
DOCUMENTING WOUNDS

- Location
  - **Distance from anatomic landmarks**
- Size & shape
- **3 Dimensions**
  - **Do NOT probe** wound
  - Cut **transversely** across the wound
- Tissues injured
  - Natural borders usually better than absolute measurements
    - "The dorsal skull has a 4x2cm laceration that penetrates to the frontal bone."



DOCUMENTING WOUNDS

- **Wounds may warrant their own section** in the report, separate from the internal & external exam findings
  - Especially if Non-Accidental Injury is CoD
  - Especially if many wounds
- **Use a diagram & Number the wounds**
- Consider a summary paragraph
  - "The body has multiple stab, incised & blunt impact wounds. 14 stab wounds are located as follows: Left thorax (3), Left lateral abdomen (4)…"



Diagrams

- Part of the report
- Must signed & dated
- Free on the web

  -- or --
- Make your own

WOUNDS

- **Wounds** = Tissue damage caused by **external force**
  - Categorized by distinguishing features
  - Features reflect the type of **forces &/or weapon**

1. **Sharp-force** wounds
   - **Linear** breaks in the skin & assoc tissue
   - All tissue in wound path similarly affected
   - No damage to surrounding tissue
   - Minimal bruising
2. **Blunt-force** wounds
   - **Bruising**
   - +/- Superficial breaks of the skin
   - +/- Damage to surrounding tissue

TYPES OF WOUNDS

Blunt force wounds

- **Abrasions**
- **Contusion**
- **Laceration**
- **Fracture**
- **Combinations**

Sharp force wounds

- **Cut (Incision)**
- **Stab**
- **Chop**
- **Combinations**

- These are the basic components ("building blocks") of all wounds
- These are the terms familiar to the court (used in human forensic path)
- **Proper use → Lucid reports understood by the court**

BLUNT FORCE WOUNDS

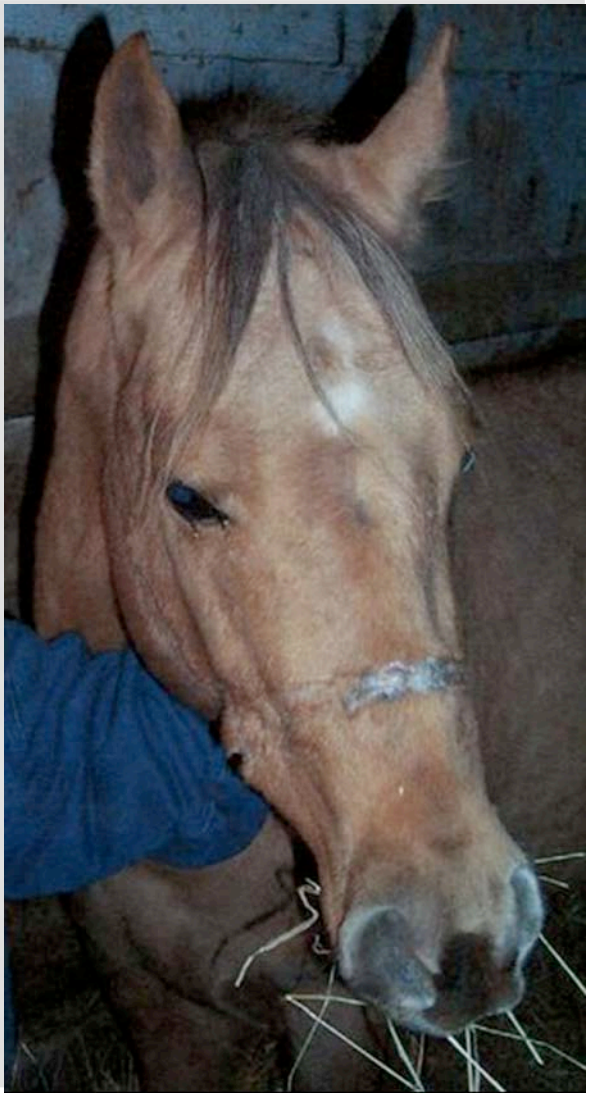
Blunt Force Wounds: **Abrasions**

ABRASIONS

- **Friction** removes epidermis +/- superficial dermis
- By definition ***superficial*** wounds; Heal without scars
- Occur with:
  - Blows, Falls, Dragging, Scratching, Scraping
  - Rubbing / Chafing
    - Too-tight restraints-- collars, harnesses, etc.
  - Whipping
    - Belts, crops, etc.
  - **Indenting** the skin by objects
    - Projectiles-- bullets, etc.
    - Teeth-- bite wounds

ABRASIONS

- **Hair protects the skin**
  - No / few abrasions may result where abrasions would be expected in people



4 TYPES OF ABRASIONS

- 4 types based on the injuring forces
  - **Scratches**
  - **Grazes**
  - **Pressure/ Imprint / Crush**
    - inc. patterned abrasions
  - **Friction** → Broken hair, white hair, dermatitis, lichenification, hyperpigmentation

Oozing of serum & blood → **scab**

SCRATCH

- A sharp or pointed object moves **across** the skin
- Direction of movement is indicated by the pile of epidermal cells ("tag") at the end- if present (delicate!)
  - Ex: Cat claw scratch


Epidermal
Tags

GRAZE

- A **wide scratch** due to sliding across a surface.
  - Direction indicated by epidermal tags

"**Road rash**"

A graze with dirt / tar in the wound

Graze with dirt in the wound (“road rash”) and blue spay tattoo.

IMPRINT/ PRESSURE /CRUSH ABRASION

- **Imprint** (aka **Pressure** or **Crush**)- an blunt impact **crushes** the epidermis +/- dermis
  - Often assoc. with **contusions**
  - **+/-** assoc. with deeper tissue damage

Photo courtesy Dr. Rob Reisman

Dog, hit by car, with **imprint abrasions** with red-black scabs & associated SQ contusion.

IMPRINT ABRASION

- Made by perpendicular impact (~ a stamp)
- May be **patterned,** leaving an specific, distinct impression of the wounding object
- **Rare in animals** (likely due to protective hair)

FRICTION ABRASION

- Produced by pressure with some sliding
  - Assoc. with ligatures, muzzles, ropes, harnesses

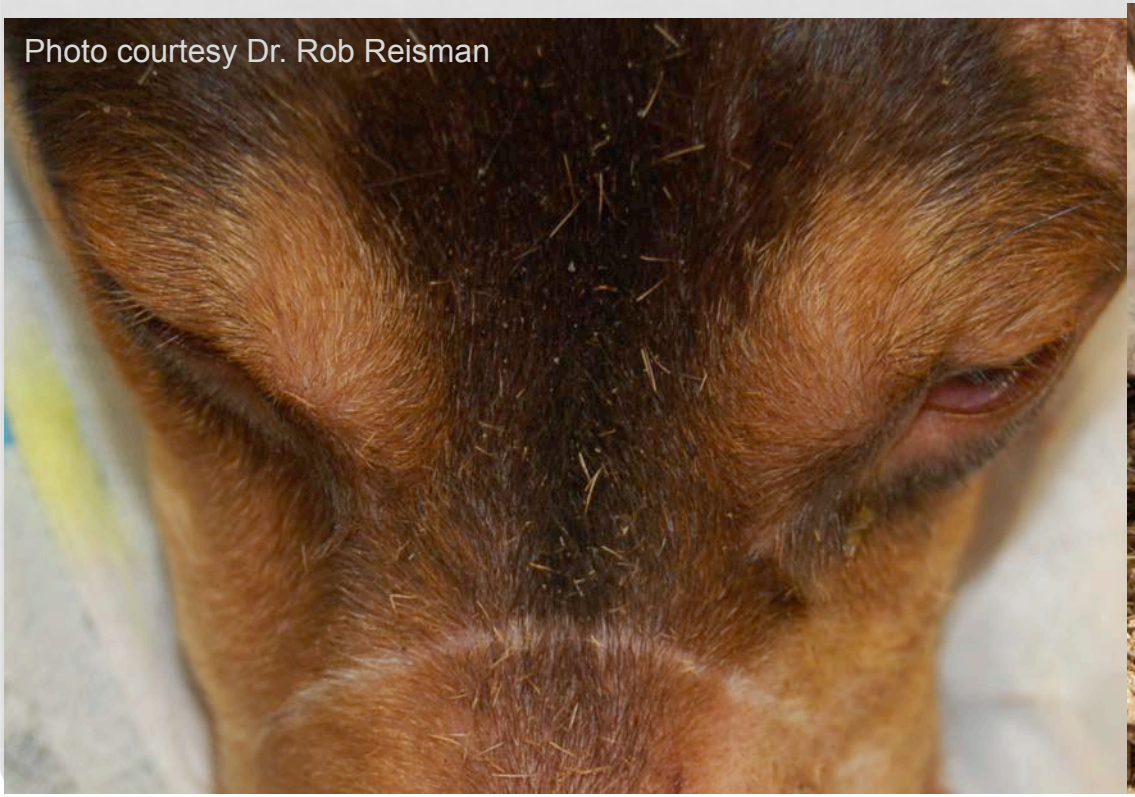


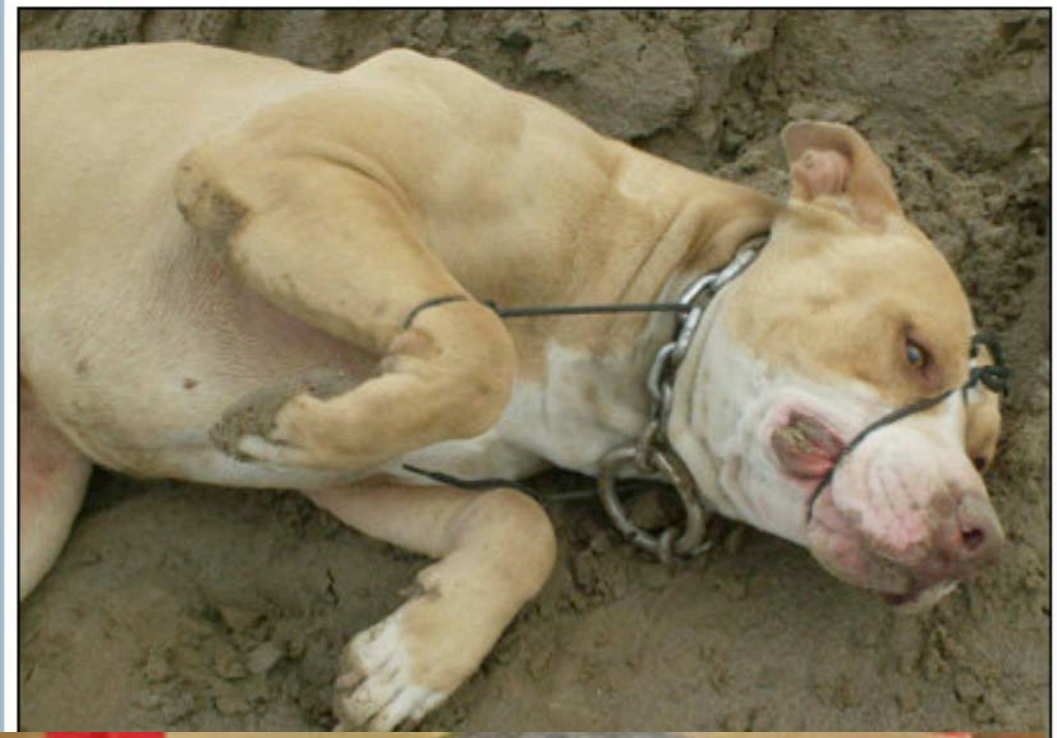
Photo courtesy Dr. Rob Reisman

Friction abrasion

Ex: Hair loss & erythema d/t chronic collar chafing.

Dog. Unusual friction abrasions of the carpus & axilla (d/t ligatures– JG personal opinion).

Photos courtesy Dr. Rob Reisman



AM VS. PM ABRASIONS

Antemortem (AM)

- **Red** to brown
- **Moist**; Scab
- Indistinct margins
- Hemorrhage +/- inflammation ("**vital reaction**") at gross &/or histo

Postmortem (PM)

- **Yellow** & translucent ("parchment-paper"), may turn brown & leathery
- **Dry**; No scab
- Distinct margins
- No **vital reaction** grossly or histologically

Forehead, trapped cat. **AM abrasion**: Red, indistinct margins

Raccoon trapped alive (live / humane trap).
AM abrasion: Red, indistinct margins, & small scab (arrow).

Cow

PM abrasion due to transport of the body.

Yellow center with distinct margin, dry, no scab (no vital reaction).

Blunt Force Wounds: **Contusions**

Photo courtesy Dr. Rob Reisman

CONTUSIONS

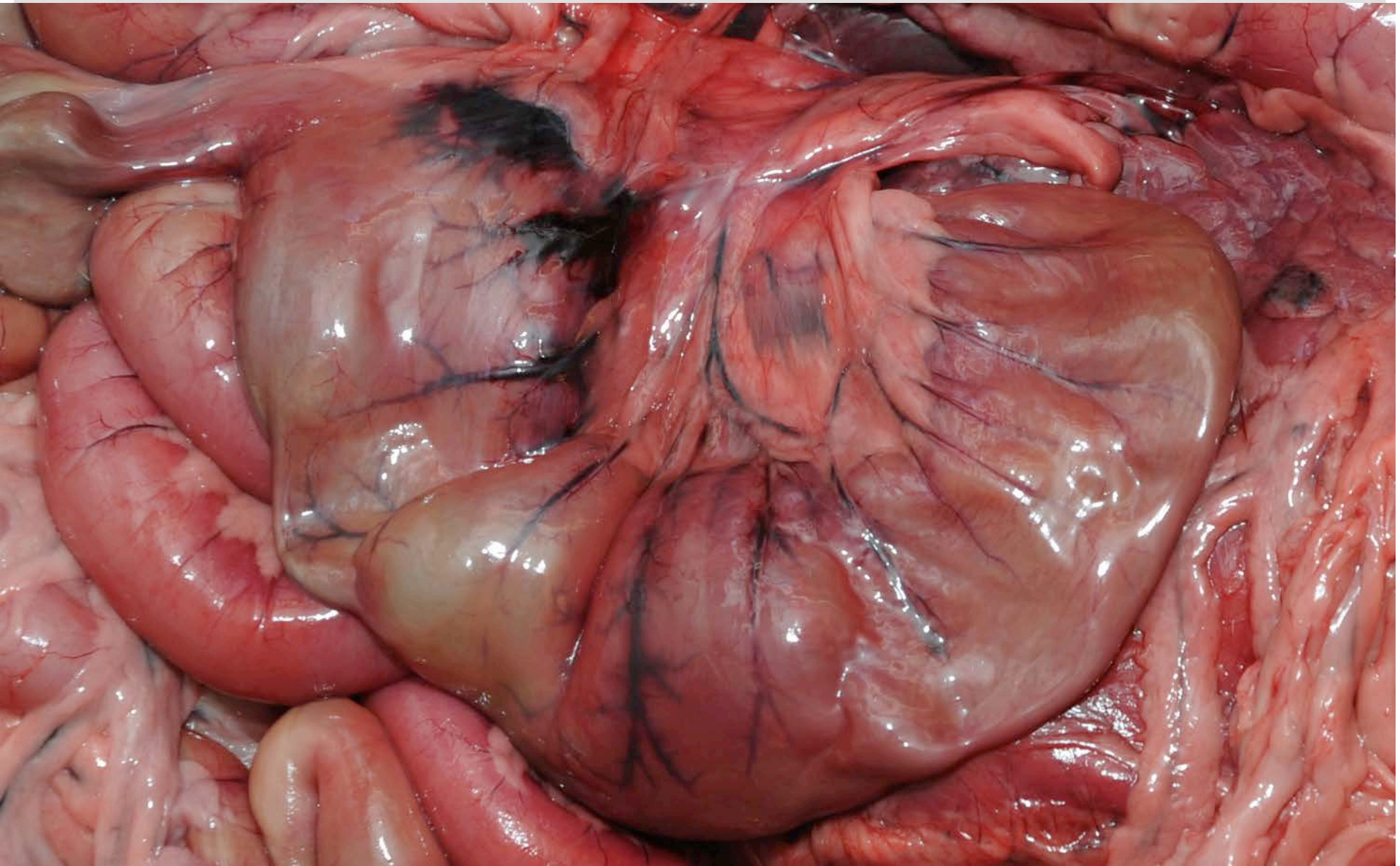
- Blood vessels tear, RBCs leak out due to ***blunt impact***
  - Any organ may be contused
  - **Dermal & SQ** capillaries most common
  - Usually **≥1 cm diameter**
- **Animals do not bruise as readily as people**
  - Hair coat
  - Less capillary-rich papillary dermis compared to humans


Photo courtesy Dr. Rob Reisman

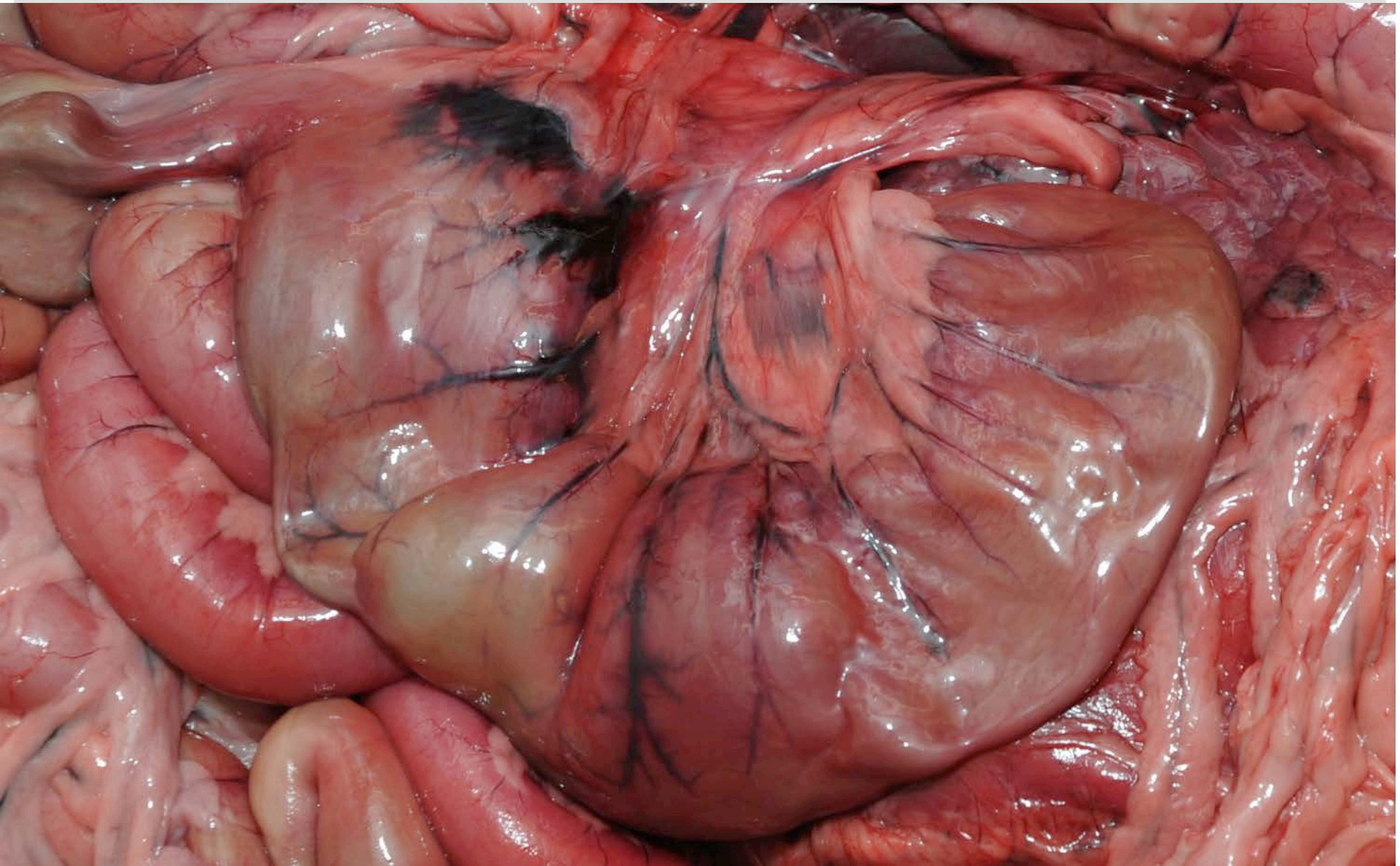
TISSUE HEMORRHAGE TERMS

- Definitions of "**bruise**" vary
  - May or may not imply blunt force trauma
- **Hematomas** = area of hemorrhage containing a blood clot, due to **trauma** *or* **disease**
  - Ex: Aural hematomas
- Hemorrhages ***due to disease*** named according to size
  - **Petechia**: < 3 mm
  - **Purpura**: 3 mm to 1 cm
  - **Ecchymosis**: >1 cm

Contusion or hemorrhage?
Anything can cause hemorrhage, but contusions, *by definition,* are caused by blunt force trauma.



In this example, the overlying skin, SQ, & muscle would need to be examined for evidence of assoc. injuries (contusions, abrasions, etc.) in order to determine the cause.



Dog. Contusion or Ecchymosis?

Contusion

Scleral hemorrhage ***WITH*** lateral canthus abrasion.

Bleeding diatheses do not cause abrasions; BFT does.

WARNING: Bruising (inc. contusions) often **NOT** appreciable from external surface. The SQ aspect ***MUST*** be examined.

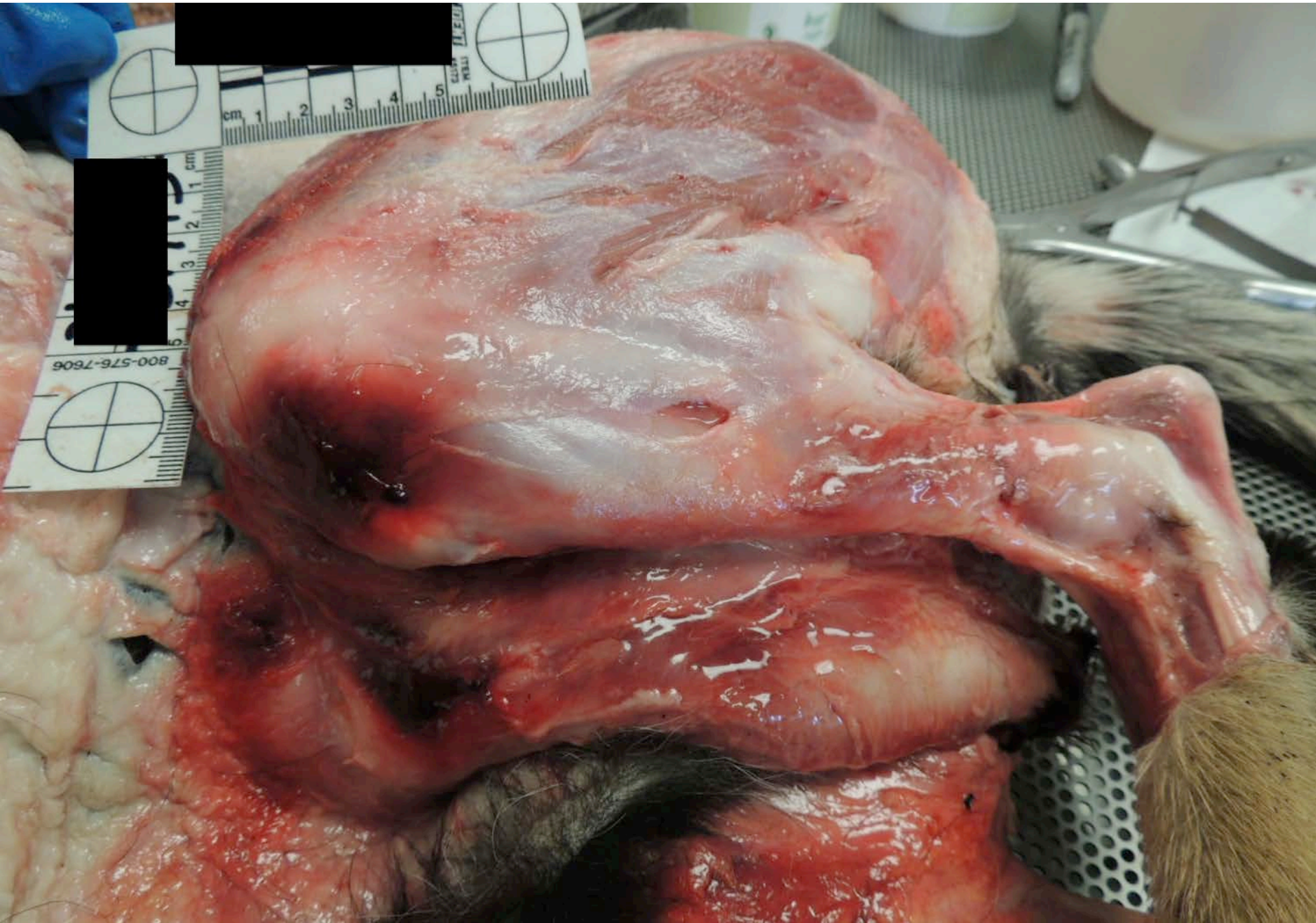
Dog. Skin around an the IV catheter site.

WARNING: Bruising (inc. contusions) often **NOT** appreciable from external surface. The SQ aspect ***MUST*** be examined.

Locally extensive hemorrhage w/ blood clot (= hematoma).

German Shepherd puppy suspected of being physically traumatized. No apparent wounds on external exam.

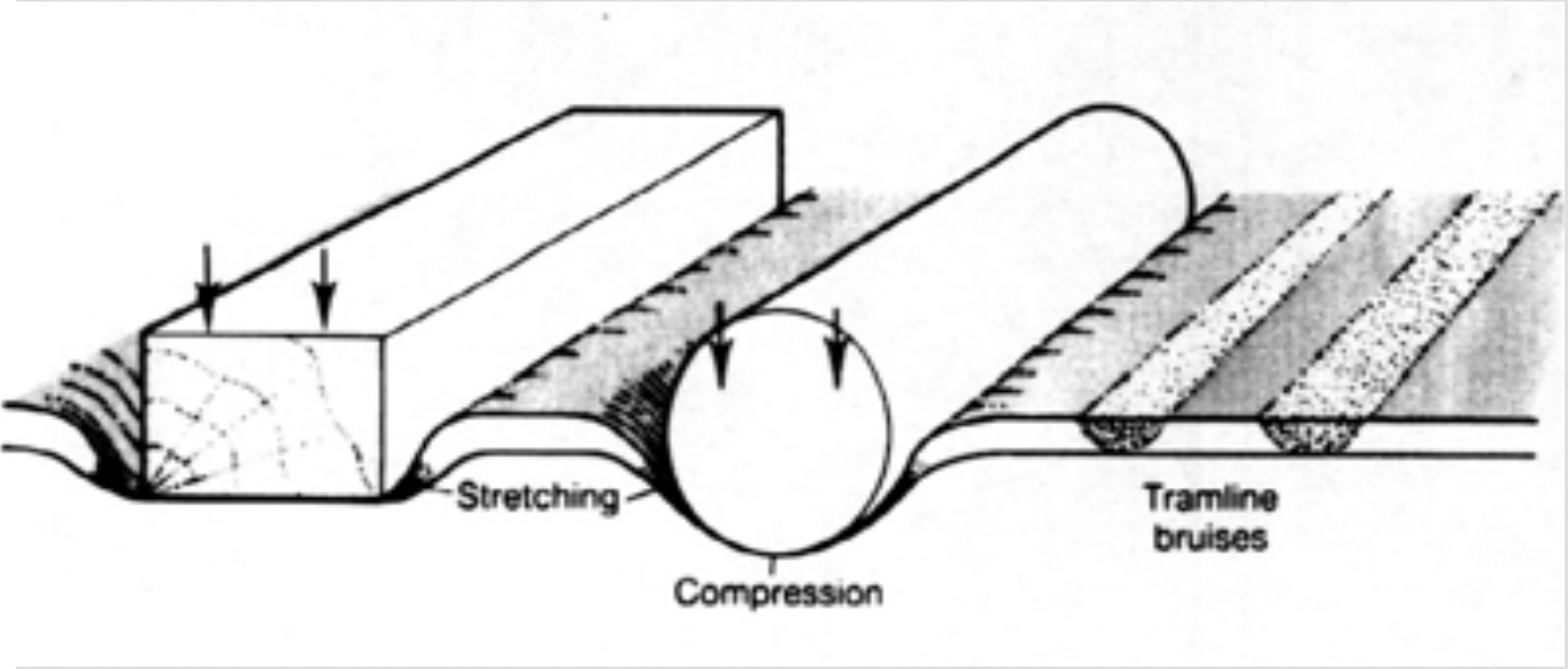
Locally extensive acute moderate hemorrhage over both stifles.



High-rise syndrome cat. Bruising not apparent externally.

CONTUSIONS: FORENSIC ASPECTS

- Abrasions **only** occur at site of impact (friction)
- Contusions (vessel damage) ***may*** *or* ***may not*** occur at ***exact*** point of impact
  - Contusions (hemorrhage) follows **path of least resistance** between tissue planes, & is affected by **gravity**
- Generally, **more force = bigger contusion**, but tissue vascularity & integrity strongly influence hemorrhage
- In people, **contusions may not manifest for 12-48 hr** after injury, *including postmortem period*.
- Small contusions can be produced with great force in the first few hours postmortem
- **Patterned contusions** reflect the shape of the object



"**Tramline**" contusion
Solid objects may cause **parallel linear bruises**.
Similarly, spherical objects may cause "donut" contusions with less-affected centers.

PATTERNED CONTUSION

- **Patterned = Consistent & unique**, reflecting a known object
- **Patterned contusion** = impression of the object on the skin
- Not uncommon in people; **Rare in animals**

Photo courtesy Dr. Rob Reisman

Pattered contusion & abrasion. Also an example of a "**tramline**" **contusion**: Parallel contused (red) margins with normal skin between.


cm
1
2
3
4
5
6
7

Blunt Force Wounds: **Lacerations**

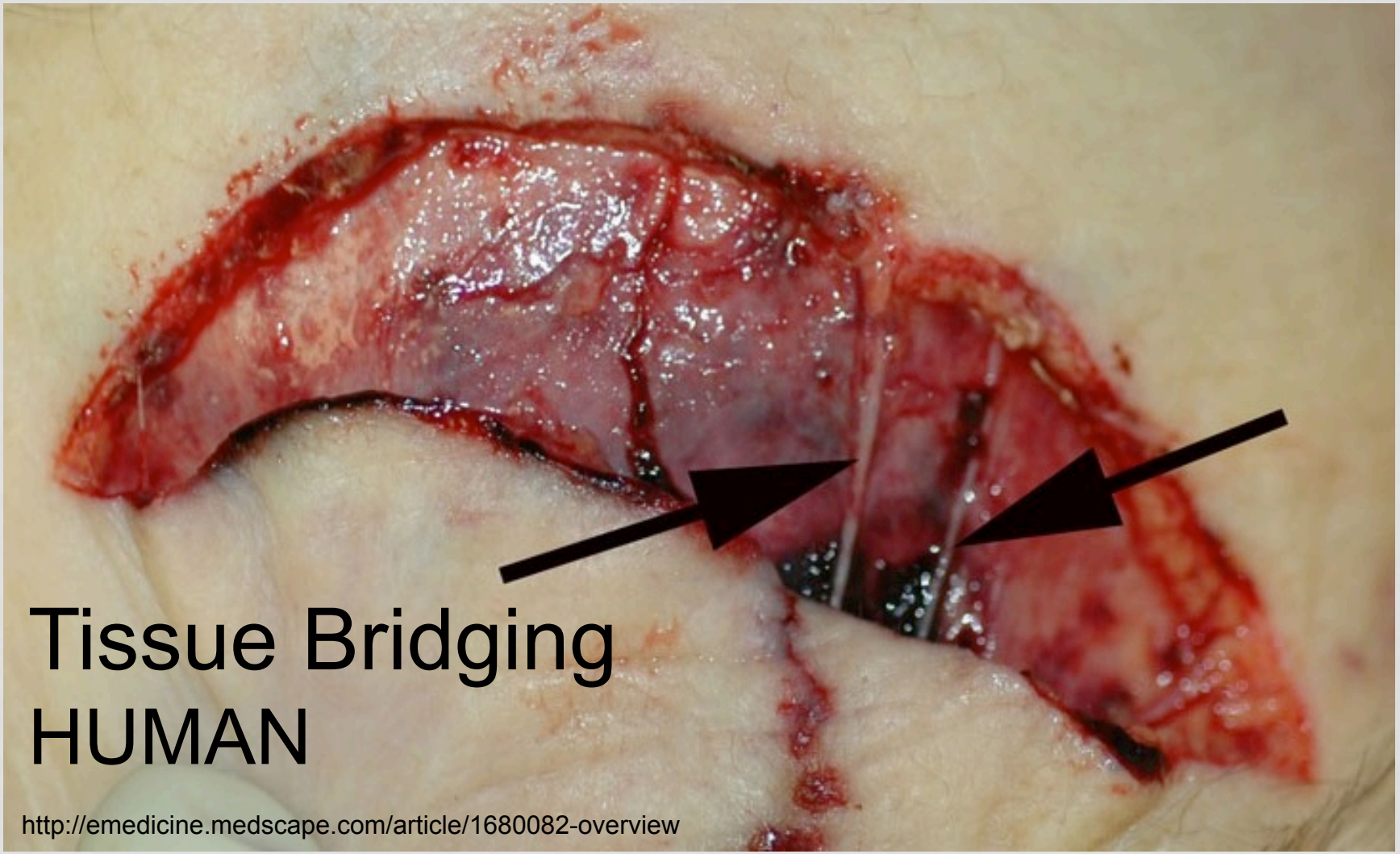
LACERATIONS

- Common use = wound created by a sharp implement
- Forensic pathology= a ***blunt force*** injury due to **tearing, splitting, stretching, crushing, shearing**
  - "**Busting open**" of the skin
  - Skin over bony prominences is frequently affected
  - Consider stating "***blunt force laceration***" in reports
- Lacerations have **irregular**, often **abraded** &/or **contused margins**
- Internal organs can be lacerated
  - Ex: Liver laceration (or fracture… either acceptable)

Dog hit by car with carpal **laceration.** The skin over the carpus is split open. Skin margins are contused & abraded.

Photos courtesy Dr. Rob Reisman

Dog, hit by car, with skin **laceration** over L scapula. The skin is split open & the skin margins are contused & irregular.



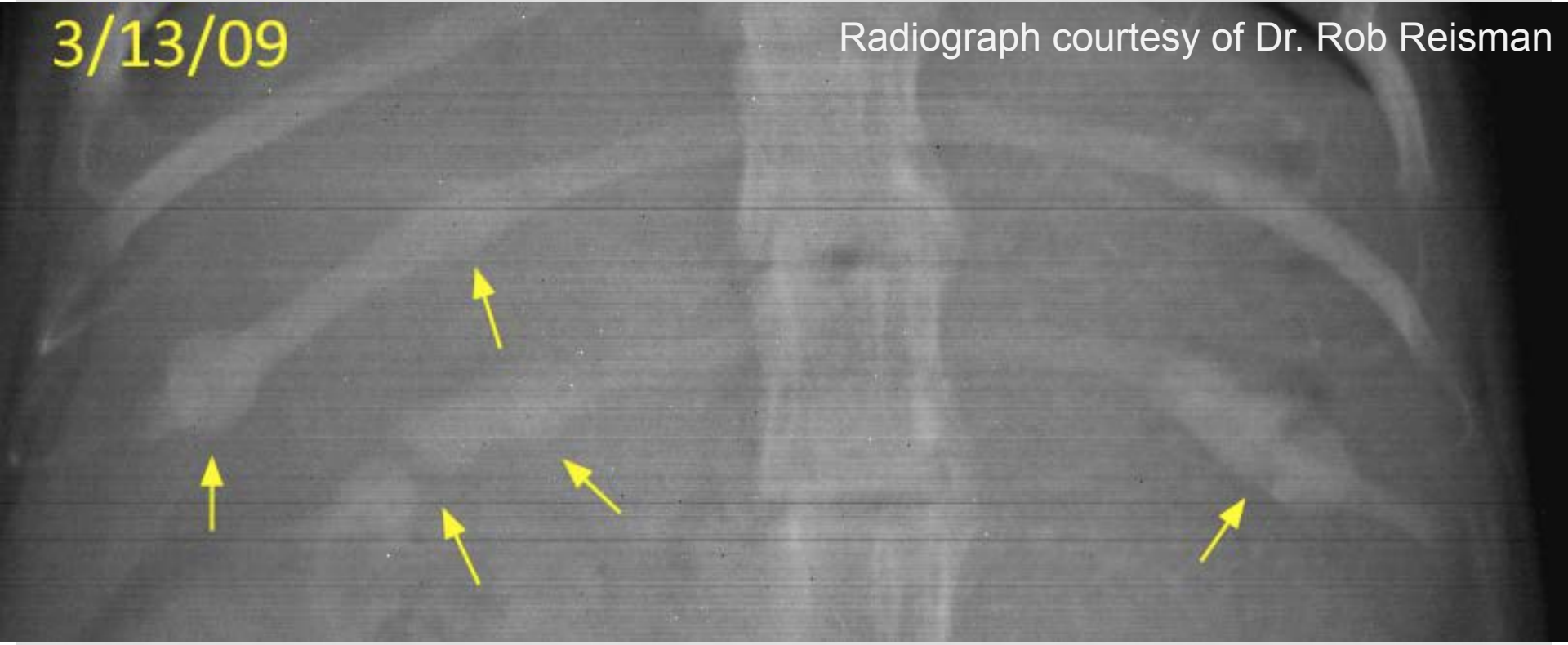
- More elastic components of the tissue (vessels, nerves) may remain intact, “bridging” the wound edges.
- **Tissue bridging** is pathognomonic for a laceration.
- Rare in most veterinary species

	Laceration	Cut / Incision
Cause	**Blunt forces**	**Sharp forces**
Margins	Usually **Ragged** & irregular; Sometimes Smooth & regular	**Always Smooth**
Associated contusions or abrasions?	**Yes, often**	**No***
Tissue bridging	Possible	***Never***

* Except for knife hilt impacts & chop wounds (mix of sharp & blunt forces)

	Laceration	Cut / Incision
Location	Often over **bony prominences**	Any location
Clean	**No** Often contaminated (dirt, grit)	**Yes** Fairly clean
Hairs	**Intact hairs** around the wound	**Hairs are cut** or parted
Bone damage	**+/- Fractures associated**	NO fractures Possible scoring or chipping. (except chop wounds)

Blunt Force Wounds: **Fractures**



FRACTURES (Fx)

- ***Rads are #1 best way to discover & document Fx***
- **External exam**– palpate for instability, abnormal range of motion, & crepitus
  - Orthogonal (2V) rads
- **Some Fx** are **not palpable**
  - Skull, greenstick & healed Fx (calluses)
- **Photos** of **bones** (boiled out) are OK if rads unavailable

Dog. Inner aspect of rib cage showing an acute non-displaced transverse fracture of ribs 9 & 10.

Dog with scapular Fx due to gunshot wound.
The unaffected scapula included for comparison.

DESCRIBING FRACTURES

- #1 task-- accurately & fully describe the Fx
- Mnemonic "**OLD ACID**"
  - **O: Open vs. closed**
  - **L: Location**
  - **D: Degree** (complete vs. incomplete, aka"greenstick")
  - **A: Articular involvement?**
  - **C: Comminuted?** (fragments- #, how small)
  - **I: Intrinsic bone quality** (osteopenic?)
  - **D: Displacement**

FX & NON-ACCIDENTAL INJURY

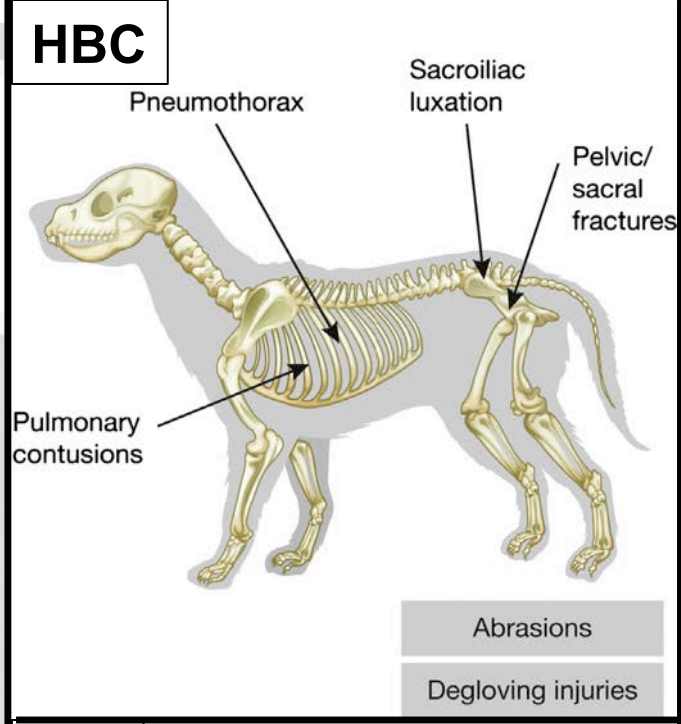
5 features → Suspect NAI (Tong LJ, 2014)

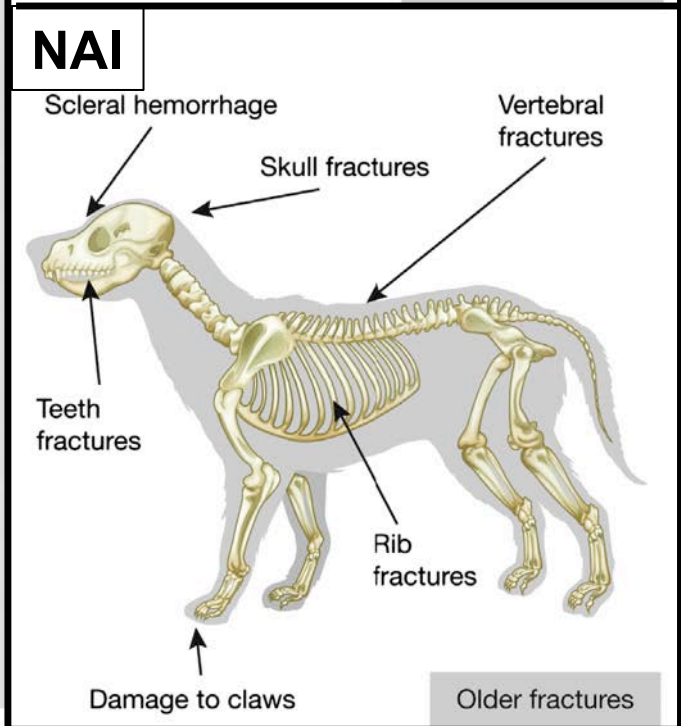
1. **Multiple FX**
2. **FXs of > 1 body region**
   - Forelimb, hindlimb, or axial
3. **Multiple FX at different stages of healing**
4. **Transverse FX**
   - FX at right angle to long axis
5. **Partially healed FX** (delayed presentation)

NON-ACCIDENTAL INJURY

Intarapanich et al. 2016: Dogs

- **HBC**: Pelvic FX, Pneumothorax, Pulmonary contusion, Abrasions, & Degloving wounds.
- **Rib FX** usually **on 1 side of the body**; Cranial ribs usually FX
- **NAI**: FX of the **skull, teeth, vertebrae, & ribs,** scleral hemorrhage, claw damage & **previous FX**.
- **Rib FX** often **bilateral**; Equally likely cranial or caudal





SHARP FORCE WOUNDS

(INCISED WOUNDS)

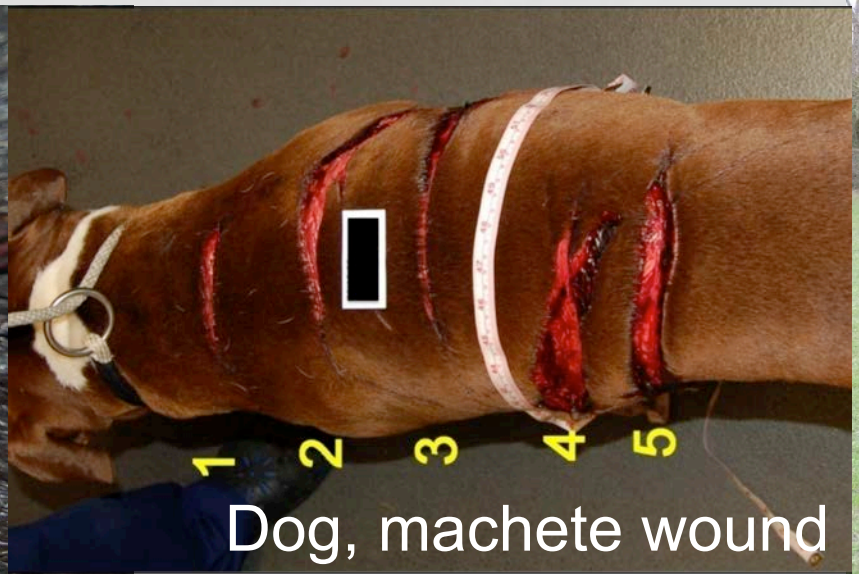
SHARP FORCE WOUNDS (SFW)

- SFW = ***Straight edges*** with NO damage to surrounding tissue.
  - **No abrasions & contusions**
  - Dull or heavy weapons & knife hilts may cause minor contusions & abrasions
- Any & all tissue in the plane of injury is equally affected
- **No tissue bridging**

SHARP FORCE WOUNDS

- 3 types
  - **Stabs**: Depth >> Length
  - **Incisions (cuts)**: Length >> Depth
  - **Gash**: Length = depth
- **Chop wounds**: Large &/or heavy objects→ concurrent **blunt & sharp** wounds
  - Ex: Machetes, axes, propeller blades


Dog, stab wound



Dog, machete wound


Horse, cut

Do NOT probe the wound to determine depth, which can artifactually deepen it. Cut across *transversely*.

Dog, **stab** wound over lumbar spine.

Dog, abdomen. **Deep cut** (gash).
Straight, clean skin margins, as deep at it is wide.

Manatee: Old **chop wounds** (2 sets) due to propellers.

Guidelines for describing propeller wounds: Rommel 2007

Dog, **chop wound** caused by a machete. 3 Thoracic vertebra & adjacent ribs were **fractured** & the spinal cord was transected

Wound healing obscures features.

Contraction & re-epithelialization→ margins less regular. Subtle associated abrasions & contusions heal.

Anatomic location (bony prominence?) & **history** may need to be relied upon to make a (less-confident) Dx.

SUMMARY

- The pathologist's duty is to **describe, name** (diagnose) **& interpret the significance** of the wounds
- Use proper human forensic pathology terminology
- Blunt force wounds: **Abrasions, Contusions, Lacerations, Fractures**
- 4 kinds of abrasions: **Scratch, graze, imprint, & friction**
- Ante- & post-mortem abrasions are distinctly different
- Sharp force wounds: **Stabs, Incisions / Cuts, Chop wounds**
- **Incisions/ cuts (SFT)** should not be confused with **lacerations (BFT)**

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