

Physical Restraint & Capture Myopathy



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Physical vs. Chemical Restraint

PHYSICAL

- Avoid risks of anesthesia
- Avoid risks of darting
- Less expensive
- Less time-consuming



CHEMICAL

- Less stressful for animal
- Allows thorough exam, procedures, sample collection
- Lower risk of injury to staff
- Provides analgesia



Basic Principles

- Same for chemical and physical techniques
- Minimize stimuli
 - Reduce noise, cover face
 - Prepare far from cage
- Monitor the animal
 - Respiration
 - Sweating
 - Agitation/mentation
- Always be prepared to abort



Physical Restraint

- Must be safe for animals and personnel
- Size of animal may not correlate with challenge!
 - Tiny animals can be remarkably difficult to restrain
 - Tiny animals can bite!



Physical Restraint

- Know the animal's weapons
- Be aware how the animal can injure him/herself
- Know the animal's primary senses
- Consider stress level



Physical Restraint

- Keep in mind psychological needs of species
 - Prey species may experience greater stress
 - Consider the role of conspecifics
 - May or may not choose to separate from group/family members
 - Highly social or pair-bonded animals

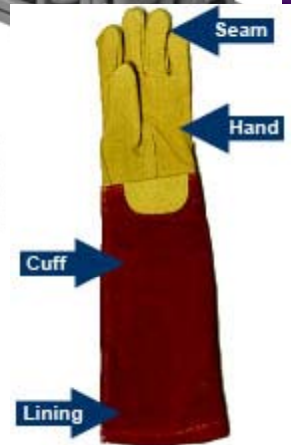
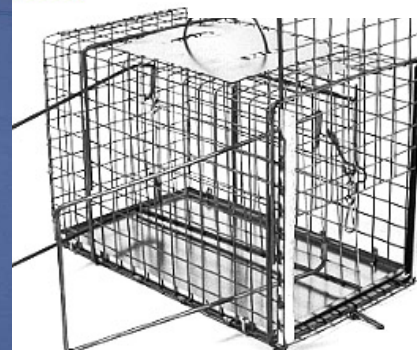


Options

- Manual restraint
 - Towels, gloves
 - Ropes, chains
- Squeeze cage
 - Many sizes & shapes
- Chute
- Nets
- Boards
- Tubes



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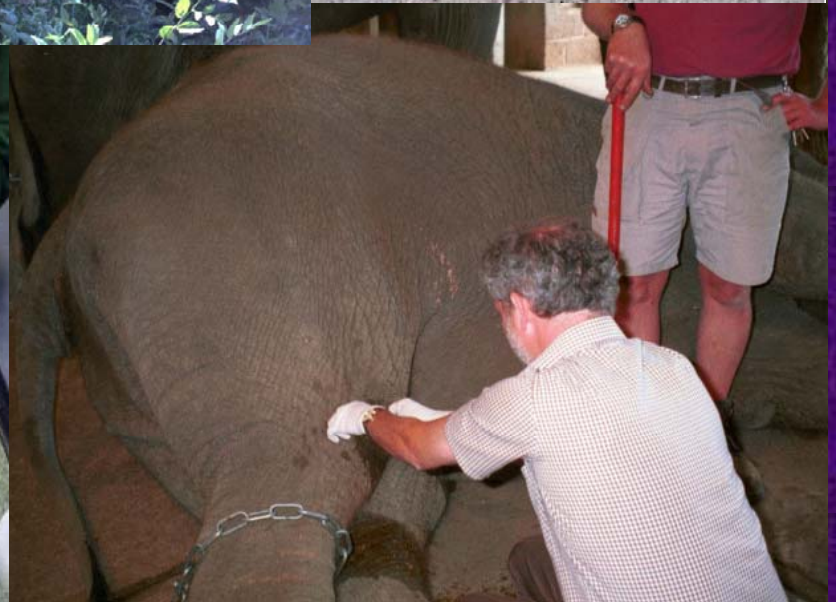
Manual Restraint

- May be one or many people
- Keep procedure as short as possible (< 5 min)
- Keep stimulation to a minimum
 - Blindfolds/Hoods
 - Minimal talking
- Use gloves/towels judiciously
 - May decrease handler's sensitivity, leading to injury



Manual Restraint

- Ropes
- Chains
- Elephant guide
 - “bull hook”
 - “ankus”
- Gloves
 - Primates
 - kevlar
 - Raptor



Squeeze cages

- Good for primates, carnivores
- Use carefully
 - Watch all body parts (tails, feet) while squeezing
 - Squeeze should be rapid
 - Avoid allowing time for animal to bite at bars



Squeeze cages

- Many modifications
- Squeeze box
 - Good for large lizards
- Can use branches
 - Less likelihood of tooth fracture









Avoid tooth fractures!



Nets

- Many sizes & configurations
 - Potential for injury
 - Staff and animal
 - Useful for quick procedures
 - injections



Chutes

- Many types on market for large animals
 - Hydraulic
 - Manual
 - Dropped floors
- Animals can be seriously and/or permanently injured in chutes



Chutes

- Still involves some manual restraint
 - Blindfolds
 - Minimal noise
 - Vigilance
- Useful for short procedures
 - Vaccinations, injections
 - TB tests
 - Blood draws
 - Ear, wound cleaning



Boards/Shields

- Same concept as squeeze cage
 - Plastic, wooden or metal
 - Used to herd an animal
- Often used with sea lions, seals, suids, small hoofstock
- Crocodilians often strapped to a board



Tubes

- Clear plastic
 - Venomous snakes
 - Awake procedures
 - Induction of anesthesia



Behavioral Restraint

- Operant conditioning
- Voluntary cooperation
 - Animal can choose to leave at any time
- Suitable for nearly all species
- Removes stress and anesthesia as confounding factors in lab samples



Behavioral Restraint

- Advantages

- **Less stress** for animal & staff
- Fewer logistic challenges
- Usually safe for animals and people
- Promotes bond between animals & keepers
 - Training is form of enrichment
 - No “bad memories” for animal



Behavioral Restraint

- Disadvantages
 - Takes time and dedication from staff
 - Relies on cooperation from animal
 - Response may be different with different trainers
 - Animal may be inconsistent
 - May not be possible in an emergency situation



Behavioral Restraint

- Appropriate uses
 - Initial inject of immobilizing agents
 - Blood, urine collection
 - Targeted exams
 - Feet, oral cavity, body condition
 - Chronic medication administration
 - Insulin, oral drugs, nebulization
 - Monitoring body weight
 - Ultrasound
 - Pregnancy diagnosis/monitoring
 - Chronic illnesses



Protected vs. Free Contact

- Elephant management
 - Protected contact: always a barrier between keeper and elephant
 - Circuses all use free contact
 - ~ 50% AZA-accredited zoos
- Controversial
 - Safer for keepers
 - but still risks!
 - No data on elephant safety or well-being



Stress

- What is it?
 - Adaptive response to anything that hinders the body's ability to compensate and maintain homeostasis
 - Physiologic & hormonal adjustments
- Is it bad?
 - It is necessary for survival
 - Chronic, severe stress



Physiologic stress

- All animals have limited resources
- In the wild and in captivity
 - Territory
 - Food
 - Dens/havens
 - Mates
- Stress is part of life
- Try to minimize stressors



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Sources of stress

- Physiologic
 - Lactation, extreme age, pain
 - Malnutrition, disease, injury
 - Unrelenting noise
 - Noxious stimuli (heat, cold)
 - Chemical
 - Oxygen depletion, anesthesia
 - Intense exercise
 - Hemorrhage, dehydration



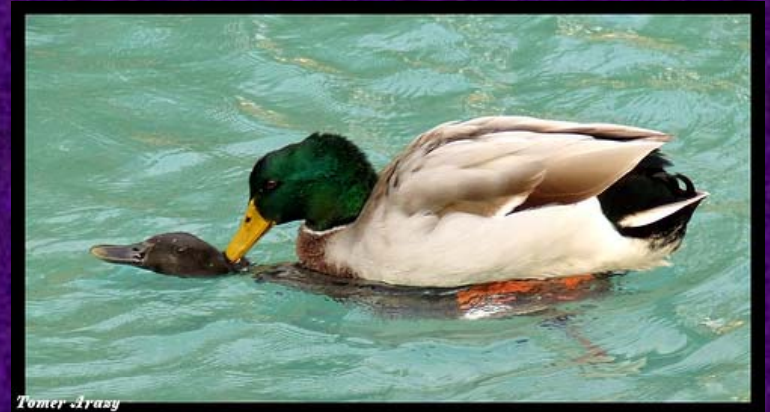
Sources of stress

- Psychologic
 - Social
 - Fear
 - Anxiety
 - Frustration
 - Perception
 - Lack of food, shelter
 - Inability to express full range of behaviors



Psychologic stress

- Perception of limited resources
 - Behavioral intimidation
 - Ample food available but low-ranking animal can't feed
- Chronic harassment by group members
- Constant attempts by males to breed
- Predators housed nearby
- Exhibits
 - Cheetahs



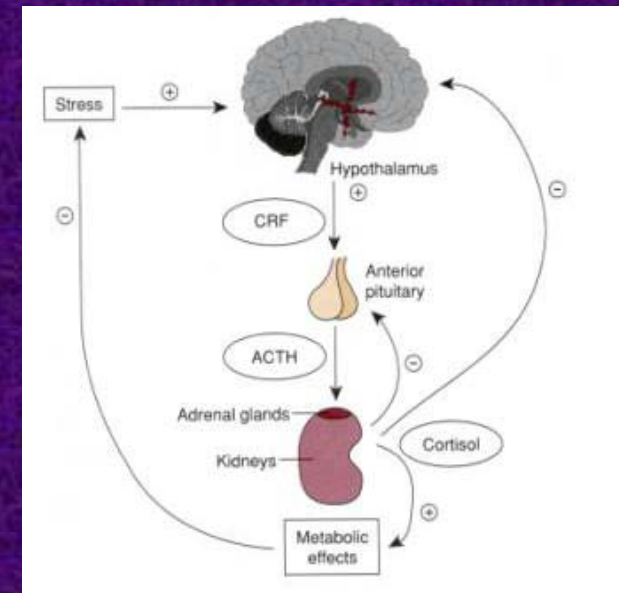
Enclosures

- Size
 - Typical polar bear exhibit is about *one-millionth* of normal home range size
- Proximity to public, traffic, noise
- Proximity to other species
- Position
 - Birds prefer to be high up



Sympathatic nervous system

- Restraint causes fear and often pain
- Activation of hypothalamic-pituitary-adrenal axis
 - Massive release of catecholamines
 - ↑ HR, BP, cardiac output, O₂ demand
 - Vasodilation in muscles
 - Vasoconstriction in organs
 - Behavior- fight or flight



Mitigate stress from restraint

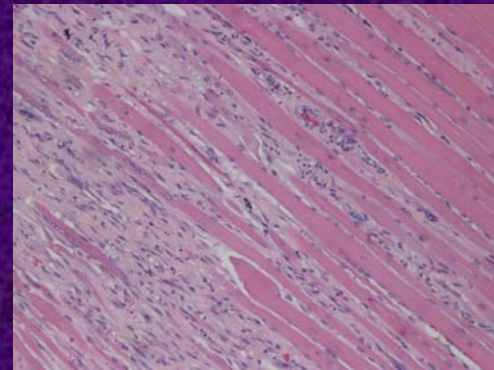
- **Minimize duration**
- Supplement oxygen
- Minimize pain/discomfort
- Monitor carefully, abort if necessary
- Cool an overheated animal





Capture Myopathy

- Iatrogenic
 - Pursuit
 - Capture, restraint
 - Struggling against restraint
- Intense muscle activity
- Occurs in mammals, birds, and potentially other species
- Many synonyms
 - White muscle disease
 - Exertional rhabdomyolysis



Susceptibility

- Ungulates
 - Eland, kudu, roan, hartebeest
 - White-tailed deer, pronghorn
- Birds
 - Cranes
 - Wading birds
 - Storks
- Probably most vertebrates are susceptible to some degree



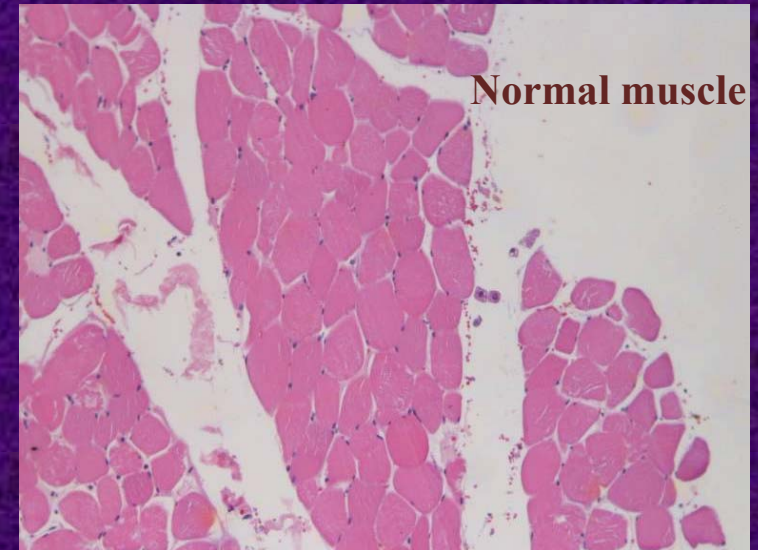
Predisposing factors

- High ambient temperature
- Underlying vitamin E or selenium deficiency
- Extremes of age
- Pregnancy
- Opioids
 - Carfentanil, etorphine, thiafentanyl



Pathogenesis

- Altered blood flow to tissues
- Hyperthermia & metabolic acidosis → lactate
- Edema → ischemia
- Electrolyte imbalances
- Exhaustion of ATP
- Eventually get necrosis, hypotension, pulmonary congestion, cardiac failure



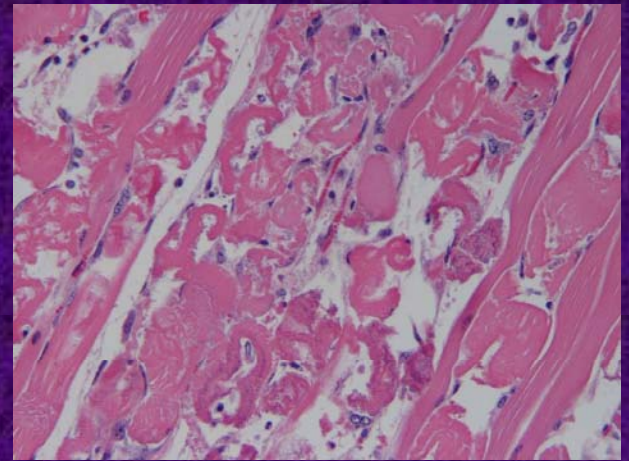
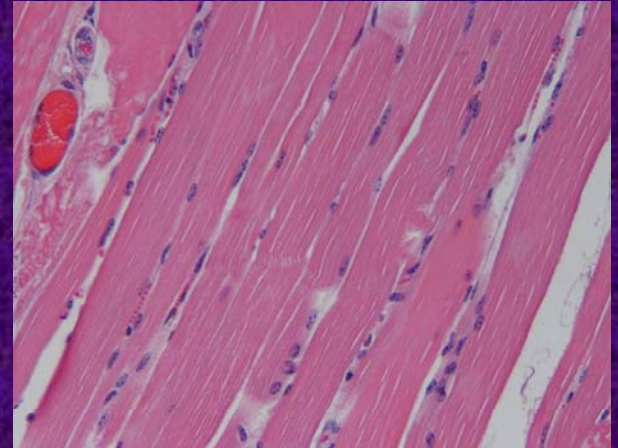
Clinical syndromes

- Capture shock
 - Acute death
- Ataxic myoglobinuric
 - Most common
 - Often fatal
- Ruptured muscle
 - Few survive long-term
- Delayed-peracuted
 - Usually fatal



Capture shock syndrome

- Occurs during or shortly after immobilization
- Clinical signs
 - Depression, hyperthermia
 - ↑ HR, RR, weak pulses
- Clin Path
 - ↑ CK, AST, LDH
- Lesions
 - Severe hepatic, intestinal congestion
 - Pulmonary edema



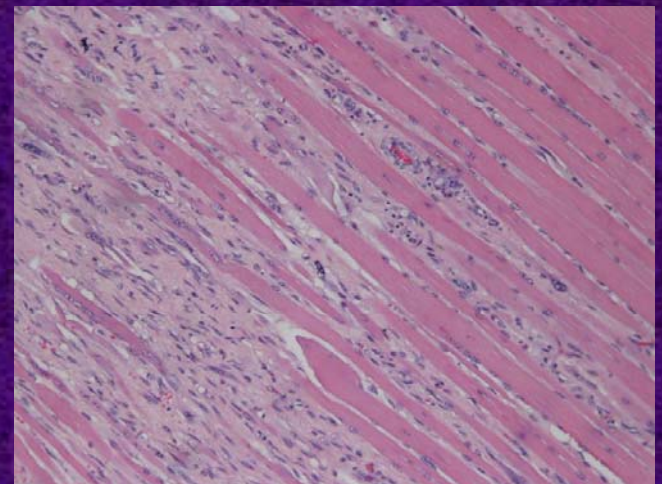
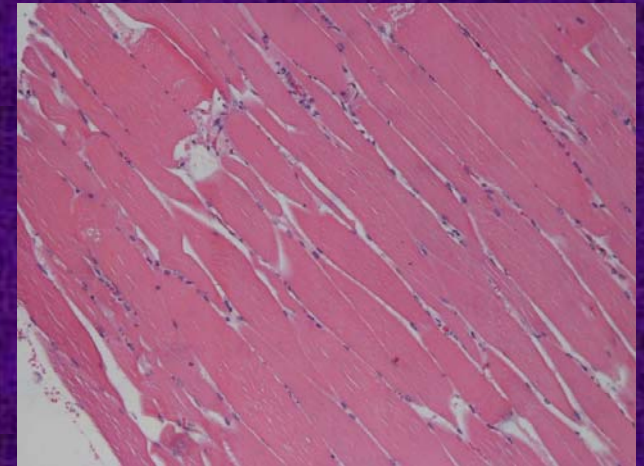
Ataxic myoglobinuric syndrome

- Occurs hours to days after capture
- Clinical signs
 - Ataxia, myoglobinuria, torticollis
 - Animals with mild signs may recover
- Clin path
 - ↑CK, AST, LDH, BUN
- Lesions
 - Swollen, dark kidneys
 - Tubular necrosis
 - Pale, soft, dry limb muscles



Ruptured muscle syndrome

- Occurs 24-48 hours after capture
 - Initially appear normal
- Clinical signs
 - Drop in hindquarters
 - Hyperflexion of hock
- Clin path
 - ↑↑ CK, AST, LDH
- Lesions
 - Massive hemorrhage in rear limbs
 - Severe muscle necrosis



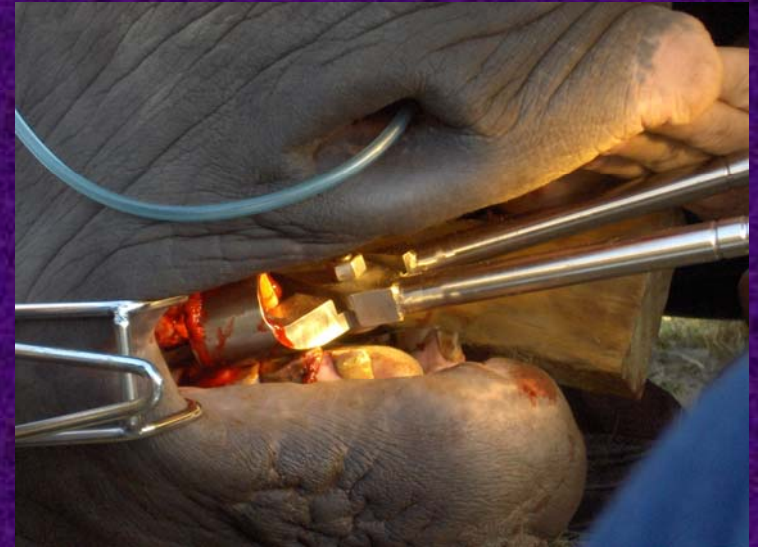
Delayed-peracute syndrome

- Animals kept in captivity after capture
- When stressed again, acute death ensues
- Lesions
 - Pale foci in skeletal muscles
 - Necrosis of hind limb muscles
- Cause?
 - Hyperkalemia and acidosis from ongoing rhabdomyolysis
 - Surge of epinephrine followed by ventricular fibrillation



Treatment

- Usually unrewarding
- Oxygen, fluids to treat acidosis
- IV Sodium bicarbonate
- Aggressive cooling
- Analgesia (NSAIDS, opioids)
- Corticosteroids to stabilize membranes
- Vitamin E/selenium
- Muscle relaxants



Prevention

- Way better than treatment!
- Minimize exertion during capture
- Avoid captures on hot days
- Vitamin E/selenium
- Provide oxygen supplementation
- Tranquilizers where indicated
- Flunixin meglumine
- Check and correct electrolyte imbalances

