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
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

[Images showing different tools and restraints used in manual restraint]
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
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
Symptomatic 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