Methods for Muscle Sampling

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Outline:

- Muscle Biopsy procedures
  - Open muscle biopsies
  - Needle muscle biopsies: Bergstrom, UHD, Conchotome
  - Fine needle biopsies
- Safety and tolerability of procedures
- Processing muscle samples
- Advantages and disadvantages of each method
- Improving yield, safety
Open Muscle Biopsy:

- Setting: Outpatient surgical suite
- Anesthesia: Local/Conscious sedation for adults, conscious sedation in pediatric patients

Procedure:
- Incision: 1-4 inches depending on size of patient
- Direct visualization after incision of muscle fascia
- Yield: 100%; sample size: whatever is needed
- Requires suturing to close fascia and skin

Safety: well tolerated, direct visualization allows assurance of hemostasis
Needle Muscle Biopsy:

- Setting: Bedside procedure
- Anesthesia: Local for adults, conscious sedation in pediatric patients
- Procedure:
  - Incision: 3-5 mm (0.1-0.2 inches) depending on needle size
  - Success: variable (95%); sample size: variable (30-75mg/pass)
- Safety: well tolerated, low incidence of painful hematomas
Bergstrom Needle


UHC Needles:

- Sizes:
  - Infant 11 G (3 mm)
  - Small 8 G (4 mm)
  - Medium 7 G (4.5 mm)
  - Large 6 G (5 mm)

- Luer lock attachment to inner cannula for suction
Conchotome

Needle Biopsies: Success Rates and Complications

- Potential complications: allergic reaction of local anesthesia, infection, hematomas, localized numbness
- Restrospective of >13,500 needle biopsies (Tarnopolsky et al.):
  - 99.9% success rate*
  - Complications:
    - Arterial bleed: 1, Ecchymosis/hematoma: 2, Local skin infections: 8, Localized numbness: 5, Pain lasting more than 3 days: 5
- University of Rochester Experience, about 4000 biopsies:
  - Success rate about 95% (90% by adequacy of sample)
  - Complications:
    - Painful hematomas: 5 patients (none since more stringent procedures were put in place)
Spring-Loaded Fine needles

- Setting: Bedside
- Anesthesia: local

Procedure:
- May need a nick in the skin for larger gauge needle
- Success rate: 95% (Cote et al. 1992) using 14 gauge needles; other references yield 4-10mg of tissue
Processing of Muscle Sample

- For muscle enzyme histochemistry and immunohistochemistry: *(requires experienced and skilled lab tech)*
  - Sample to remain fresh wrapped in moist gauze and cooled
  - Should be mounted and frozen within an hour
  - Sample oriented and mounted on chuck under a dissecting scope to insure orientation of fibers and frozen in isopentane cooled in liquid nitrogen

- For protein, RNA, enzyme assays:
  - Sample immediately wrapped in foil and flash frozen in liquid nitrogen

- Myoblast culture
  - Fresh sample place in culture media
Advantages and Disadvantages of Various Approaches: Open Muscle Biopsy

- **Advantages:**
  - Success rate close to 100%
  - Yield: adequate sample for any analysis
  - Many muscle accessible for sampling

- **Disadvantages:**
  - Most invasive
  - Scarring
  - Additional risk of conscious sedation
Advantages and Disadvantages of Various Approaches: Needle Muscle Biopsy

- **Advantages:**
  - Less invasive, no scarring
  - Bedside procedure
  - More amenable to repeated sampling

- **Disadvantages**
  - Success rate 90-95%
  - Fewer accessible muscles
  - Smaller samples**
  - Not optimal for quantitative IHC
Advantages and Disadvantages of Various Approaches: Fine Needle Biopsy

- Advantages:
  - Least invasive
  - Bedside procedure
  - More amenable to repeated sampling

- Disadvantages
  - Success rate?
  - Smallest samples
  - Cannot be used for histochemistry/IHC
Improving Yield and Safety of Needle Biopsies

- Imaging-guided muscle biopsies:
  - CT and MRI:
    - Useful for targeting deeper muscles or parts of muscles with specific imaging changes (eg: MRI STIR positive muscle).
  - Ultrasound guided:
    - With the advent of portable ultrasound units, ultrasound guidance should help improve the yield of needle muscle biopsy.

- Improving safety:
  - Ultrasound guidance can potentially help access more muscles with a needle more safely
  - Hematomas are a risk. A more conservative approach to establishment of hemostatis helps reduce the risk: 1. insure absence of bleeding before closing incision, 2. Wrap biopsied limb in ace bandage, 3. keep patient supine with limb elevated for 20 minutes at end of procedure.
Medicine of the Highest Order