Sarcopenia
What is it? What can be done?
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Learning Objectives

- To be able to define Sarcopenia
- To be able to identify Sarcopenia
- Describe proven strategies to delay the onset and or reverse Sarcopenia

Sarcopenia

- the age-associated loss of skeletal muscle mass and function.

- J Am Med Dir Assoc. 2011 May;12(4):249-56. Epub 2011 Mar 4. Sarcopenia: an undiagnosed condition in older adults. Current consensus definition: prevalence, etiology, and consequences.

sar·co·pe·ni·a

- *Taken from the Greek words sarx(flesh) and penia(loss)*
- *In 1988, Professor Irwin Rosenberg, MD, then Director of Tufts- Human Nutrition Resource Center on Aging, decided to put a name to the noticeable decline in lean muscle mass that affects almost all people as they age.*
- *Is withering muscle just a normal part of getting older, or is it a disease? Can we treat it?*

The muscle equivalent of Osteoporosis

- *"Just as our bones tend to become weaker and more brittle as we get older, our muscles are predisposed to wither with age. "*

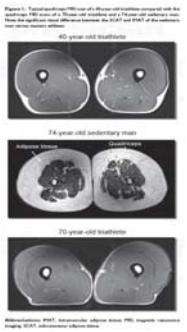
Julie Flaherty, "Power Play", Tufts Nutrition Summer 2011

Sarcopenia and aging

- *Starting in 30's, begin to lose muscle mass and function, a condition known as age-related sarcopenia or sarcopenia with aging.*
- *Physically inactive people can lose as much as 3% to 5% of their muscle mass per decade after age 30.*
- *Muscle mass losses at the age 70 may increase to up to 15% per decade.*

Muscle Aging

- *From 20 to 80 years old- 30% reduction in muscle mass*
- *Decline in muscle fiber size and number*
- *Decline in muscle building process as we get older*
- *Muscle cells also seem to get fattier with age, loss of muscle strength*
- *Low muscle power: Muscle fiber force decreases*



Potential Causes Vary by age

Age	Potential Causes	Effects
20–40	Decreased physical activity, decreased type II muscle fiber size and amount, maintenance of type I fibers	Maintenance of VO2max with exercise training, sprinting capacity is reduced
40–60	Loss of motor units accelerates, decreased physical activity, increased body fatness, decreased androgens	Decreased aerobic and sprinting capacity even with rigorous exercise, increased body fatness, insulin resistance, decreased muscle protein synthesis
60–70	Decreased physical activity, reduced androgen and growth factor levels, menopause, increased total body and visceral fat, chronic disease, impaired appetite regulation	Inflammation (increased cytokine levels), insulin resistance and type 2 diabetes, nutritional deficiencies (protein, vitamin D, and other micronutrients), reduced muscle protein synthesis
70+	Further reduction in physical activity, bouts of enforced inactivity due to illness, hospitalization, depression, increased body fatness	Fear of falling, low functional capacity, mild cognitive impairment, inflammation and increased muscle protein breakdown

Muscle Fiber types

	Type 1	Type 2
Color	Red	White
Speed of Contraction	Slow	Fast
Conduction Velocity	Slow twitch	Fast twitch
Activity	Aerobic	Anaerobic
Duration	Long	Short
Fatigue	Resistant	Fatigue easily
Power of Contraction	Strong	Weak

Major Causes of Sarcopenia

- *Genetic Heritability*
- *Nutritional Status*
  - Protein, energy intake, Vit D status
- *Physical activity*
- *Hormonal Changes*
  - Decline in serum testosterone, growth hormone

Causes: At Molecular Level

Sarcopenia results from

- *An decrease in skeletal muscle protein synthesis and/or increase skeletal muscle protein breakdown*

- *J Am Med Dir Assoc. 2010 May 12(4):252*

Monocyte Derangements Observed in Sarcopenia

- *Monocyte Derangement*
  - Accumulation of damaged mitochondria
  - Increased muscle apoptosis
  - Decreased VO2 Max
  - Increased muscle proteolysis
  - Decreased Muscle protein synthesis
  - Monocyte autophagy and type II fiber loss
- *Etiology*
  - Chronic disuse resulting in excess oxidative free radical production
  - Mitochondrial damage
  - Decreased mitochondrial protein content
  - Muscle unloading, malnutrition
  - Malnutrition, chronic inflammation
  - Malnutrition, starvation

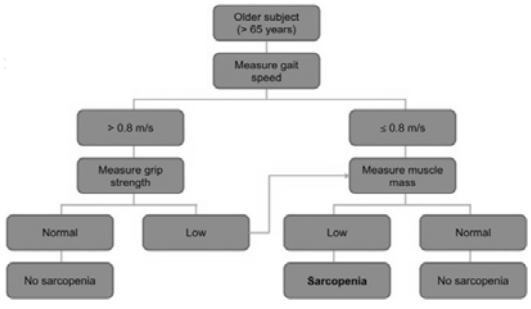
Screening for Sarcopenia

- In clinical settings it is appropriate to use less complex measures of physical findings
  - **Decreased handgrip strength or**
  - **Difficulty arising from a chair or**
  - **Difficulty walking ¼ mile or**
  - **Climbing 10 steps without resting.**
- An accurate was to predict loss of strength

Current Testing Methods To test for Sarcopenia

- ***Direct Methods***
  - **24 hour Urinary Creatinine**
- ***Indirect Methods***
  - **Anthropometry**
  - **Bioelectrical impedance**
  - **Imaging Techniques**
  - **Ultrasound**

Sarcopenia Algorithm



Sacropenia & Disability

- Functional Decline and disability
- Associated with increase mortality
- Predictive of Falls

Sarcopenia and Critical Illness

- *Frailty, resulting from sarcopenia is increasingly recognized as a physiologic trait independently associated with an increased risk of morbidity and mortality.*
- *Highly morbid and lethal injury patterns are encountered in elderly fall victims.*
- *In addition, frailty is associated with an increased incidence of medical critical illness.*

Obese Sacropenia

- Elderly with high body fat and low muscle mass
- Predictor of increased physical disabilities, abnormal gait and falls
- Higher body fat associated with reduced muscle quality and muscle strength
- Higher body fatness may decrease the capacity to generate power (force x speed)
- Muscle power is more closely related to functional capacity than muscle strength

Elderly at Risk for Sarcopenia

- Noted decline in function, strength, "health" status
- Self-reported mobility-related difficulty
- History of recurrent falls
- Recent unintentional weight loss (> 5%)
- Post-hospitalization
- Other chronic conditions (eg: Type II diabetes, CHF, COPD,RA, Cancer)

Elderly at Risk

- *Difficulty in performing ADL*
- *Non-ambulatory or who cannot rise from a chair unassisted.*
- *Habitual gait speed < 1.0 m/sec.*

Can Onset of Sarcopenia be Delayed?

Current Treatment Strategies

- *Correct Nutritional Deficits*
- *Attenuate Muscle Wasting*
- *Stimulate Muscle Anabolism*

Muscle Strength: Use it or Loose it

- ***Exercise does a better job of retaining both size and strength of muscle***
- ***If you lose muscle strength, exercise to get some back***
- ***Research:***
  - **1980: Tufts-HNRCA, Men 60-72 yo improved muscle strength by 120% when they did strength training for 12 weeks**
  - **1990: Group of 50-70 yo women weight trained 2x a week for a year. Increased strength by 75% (M Nelson)**

Muscle Power: Cell Signaling Issue for Seniors

- *Muscle fibers still have their "Pep".*
- *Issue is communication from brain*
  - Big motor neurons are more susceptible to oxidative stress that injures cells with aging and die off faster than small motor neurons.
  - Older people may have fewer fast motor neurons than younger people

Can faster exercises be the antidote? More research is being done to determine ideal intensity and frequency of exercise.

Protein & Sarcopenia

- ***Can Protein prevent or help manage sarcopenia?***
- ***How much protein is recommended at mealtime to preserve skeletal muscle mass***

Aging& Skeletal muscle Protein Synthesis

- *Studies suggest that moderate-to-large serving of protein or amino acids increases muscle protein synthesis*
  (Paddon-Jones)

How much protein is needed?

Adequate protein intake with each meal essential

- *Serve moderate amount of high biological value protein containing EAA during each meal.*
- *Minimum of 20g protein per meal to stimulating muscle protein synthesis and as high as 25-30g.*
- *Greater than 30g at a single meal may be energetically inefficient at stimulating synthesis and may effect GFR in elderly*
  (1.8g/kg body wt protein intake)

Leucine supplementation

- ***Rationale: Will improve net muscle protein synthesis in addition to protein given at meals***
- ***Leucine is an insulin secretagogue***
- ***Increased insulin availability increases muscle protein synthesis.***
- ***Promising study results found leucine effective in one human study and a number of rat studies, but needs to be tested further .***

Aging and Physical Inactivity

- Loss of lean body mass increases during inactivity. Muscle protein synthesis decreases.
- Elderly experience 3 times lean leg muscle mass loss compared to younger individuals when confine to bed rest.

Solution: Weight bearing/resistant exercise and protein intake

- *Reference: Kortebein, P et al. Effect of 10 days of Bed Rest on Skeletal Muscle in Healthy Older Adults JAMA 2007;297:1772-1774*

Resistant Training and Dietary protein

Iglay et al

- 36 older men and women
- 12 weeks of resistance training
- Low protein diet 0.9g or high protein, 1.2g protein/kg body weight

Resistant training and Dietary protein supplementation

Results

- *Both groups increased strength 28% for low protein and 34% for high protein diet.*
- *Both had increases in fat free mass.*

Findings suggest:

- *Resistance training by older adults can achieve increases in LBM when consuming adequate amounts of total protein slightly above the RDA (0.8g/kg) and additional increases in strength with 1.2 gm./ protein/kg. /d.*

Resistant training and Dietary protein supplementation

Campbell et al

- **Resistance exercise training helps older people treat sarcopenia. The consumption of diets that include sources of high-quality protein and total protein intakes that are moderately above the recommended dietary allowance of 0.8 g/kg/day while regularly performing resistance exercises can help older people retain or increase whole-body fat-free mass and muscle mass.**

Reference: **Synergistic use of higher-protein diets or nutritional supplements with resistance training to counter sarcopenia.** Nutrition Review 2007 Sep;65(9):416-22.

Protein Quality is Important

Difference in in digestibility and bioavailability of certain protein-rich foods may affect muscle protein synthesis

- *Wilkinson et al. 2007: Increase in combination of whey and casein proteins (from milk) may provide a greater increase in muscle protein synthesis than soy beverage*
- *Symons et al. 2007: 113g (4 oz.)serving of lean beef contains sufficient amino acids (30g total, 10g essential aa) to increase mixed muscle protein by 50% in elderly and young*

Protein: Adequate amount at each meal

- Protein distributed evenly across three meals
- 20g/meal minimum: A 20g serving of most animal or plant based proteins contain 5-8g of essential AA which are responsible for stimulating muscle protein synthesis
- ~30 g high quality protein per meal.
  - *Houston DK, et. Al., Amer J Clin Nutr 2008:87:150*

How do we provide all that protein?

- Utilize food sources first
  - **Eggs, cottage cheese, yogurts, Greek yogurt, Keefer, NFDM in soups and cereals**
- Update and revise food preferences
- Use ONS! *There are a variety of flavors and styles on the market*
- Use protein supplements! The benefit far outweighs the cost.
  - **Whey protein powders, liquid protein containing all essential amino acids**

How do we incorporate resistance exercise?

- *Light weight free weights in PT rooms*
- *Exercise Bands*
- *Daily classes-*
  - **Balance**
  - **Strength**
  - **Gait speed**

Anabolic Agents

- *Insulin* — *Wt gain in HIV*
- *Growth Hormone* — *No appetite, Wt gain in HIV and LTC*
- *Testosterone* — *No appetite, wt gain in HIV but not cancer*
- *Oxandrolone* — *No appetite, wt. gain in cancer*
- *Nandorlone* — *No appetite, wt loss in cancer*

Summary

- **Minimum of 0.9g protein/kg body weight/day with recommendations of 1.0-1.2g/kg to improve muscle mass**
- **Protein spread evenly across 3 meals ideal**
- **Resistance Training**

References

- Morganti, C, Nelson, Strength improvements with 1 yr of progressive resistance training in older women. M Journal of the Am College of Sports Science. June 1955, 27:(6)
- Julie Flaherty, "Power Play", Tufts Nutrition Summer 2011
- Volpi E, Kobayashi H, Sheffield-Moore M, Mittendorfer B, Wolfe RR. Essential amino acids are primarily responsible for the amino acid stimulation of muscle protein anabolism in healthy elderly adults.Am J Clin Nutr. 2003;78:250–258
- Wilkinson, SB et al. Consumption of fluid skim milk promotes greater muscle protein accretion than does consumption of isonitrogeneous and isoenergetic soy beverages. AM J Clin Nutr April, 85(4):1031-40
- Symons TB, Schutzler SE, Cocke TL, Chinkes DL, Wolfe RR, Paddon-Jones D. Aging does not impair the anabolic response to a protein-rich meal. Am J Clin Nutr. 2007;86:451–456.
- Campbell, Synergistic use of higher-protein diets or nutritional supplements with resistance training to counter sarcopenia. Nutrition Review 2007 Sep;65(9):416-22.
- Paddon-Jones D, Sheffield-Moore M, et al. Amino acid ingestion improves muscle protein synthesis in the young and elderly. Am J Physiol Endocrinol Metab. 2004;286:E321–328.
- Paddon-Jones D, Short KR, Campbell WW, Volpi E, Wolfe RR. Role of dietary protein in the sarcopenia of aging. Am J Clin Nutr. 2008;87:1562S–1566S.
- Hanna, Joseph S. , MD, PhD. Sarcopenia and Critical Illness: A Deadly Combination in the Elderly. JPEN. Volume 39, Number 3, March 2015 pp. 273-281.