Laboratory Testing in the Elderly

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What is “Elderly”? 

- No defining event such as puberty or menopause
- Usually thought to be age over 65
- “Age is just a number” (well.....not always.....)
Case for Thought

- 78 yr. old woman brought to M.D. by her daughter
- C/O tiredness, dry skin, forgetfulness
- M.D. found no striking physical findings—felt normal signs and symptoms for age
- Routine blood profile—normal
Pre-Analytical Variability

- Exaggerated in the elderly
- Greater between-individual variability
- Less homogeneous population at the older ages
Physiologic Aging

- Decreased level of activity leading to loss of muscle mass
- Less food intake
- Different posture than when younger
Physiologic Aging

- Reduction of cardiac output
- Reduction of renal blood flow
- Decrease in vital lung capacity
- Decreased immunity
Variables

- Body Composition
- Genetics
- Gender
- Geography
- Temperature
Variables

- Body Habitus
- Diet
- Malnutrition
- Muscle Mass
- Season
Variables

- Blindness
- Circadian Variation
- Posture
Body Composition

- Body mass increases until ~ age 60, then decreases @3kg/decade
- Height decreases by 5-6 mm/5 yrs. in men
- Height decreases by 7-8 mm/5 yrs. in women
Age 90:

- 4’ 11 1/2” tall
- 74 pounds
Body composition

- Decrease in absolute body water (wrinkles!) and elastin (more wrinkles!)
- Decreased BMR
- Decreased $O_2$ consumption
- Decreased Ca, P, Na, K, cortisol, thyroid hormone, sex hormones
Genetics

- Blacks—lower albumin, higher gamma globulin than white counterparts
- Pima Indians—very high incidence of adult-onset diabetes
Gender

- Differences lessen after menopause
- Women—decreased estrogen, increased chol.
- Men—testosterone 1/2 at age 80 what it was at 50
Geography

- **Hard water**—higher cholesterol than soft water
- **Mining areas**—increased trace elements
- **Urban**—increased lead from water pipes and gasoline from traffic
Temperature — Heat

- Increased blood volume by 5% after 30 mins.; 27% after several days
- Resulting hemodilution reversed by increased sweating with dehydration, decreased plasma volume, glucose, hgb., electrolytes
Temperature — Cold

- Decreased blood volume
- Increased plasma proteins
- Increased thyroid secretion
Diet

- High Protein – increase in end-products of metabolism (urea, phosphate, uric acid)
- High fat – increased plasma cholesterol, although only slightly altered by dietary cholesterol
Diet

- High carbohydrate – increase in LDH, alk. Phos.
- Vegetarian – decreased lipoprotein cholesterol, decreased triglycerides
Malnutrition – causes

- Decreased sense of taste and smell → decreased appetite
- Dental problems
- Decreased visual and auditory acuity → less eating in public
Malnutrition (Cont’d)

- Decreased activity $\rightarrow$ decreased caloric intake
- Decreased acid secretion
- Low income
Blindness

- Diurnal variation of plasma cortisol is lost in some
- Features of hypoadrenalism
- Reduced plasma sodium and chloride
- Impaired renal function
Circadian Variation

- Similar to young adults
- Peak cortisol concentration: 6:00 – 8:00 AM (earlier than in younger persons)
- Growth hormone rise during sleep is often blunted
Posture — Supine to Upright

- Decrease in blood volume by 600 - 700 ml.
- Increase in plasma proteins by 10% because small molecules pass through the capillary press
- Increase in elements bound to protein (cholesterol, triglycerides)
Liver Enzymes

- Increase in alkaline phosphatase by 20% between the third and eighth decade
- Sometimes marked increase in GGT
- LDH-slight increase with age
Creatinine

- Unchanged until age 90, then slight increase because of decreased renal blood flow

- Creatinine clearance decreases by 10 mL/min/1.73 m² per decade. Serum creatinine may not change noticeably due to deceasing muscle mass

- Creatinine clearance may decline by as much as 50% between the third and ninth decades of life
Proteins

- Increased urine protein
- Slight decrease in serum total protein and pre-albumin
- Albumin-slight decrease normally, but significantly decreased with malnutrition
Lipids

- **Cholesterol**—Increased in women age 60-90
- **HDL**—Increased age 60-90, but decreased in very old (by as much as 30%)
- **Triglycerides**—Increased in 60-90, then decreased in the very old, possibly from decreased absorption
Other Lab Values

- Gastrin levels increase because of hypochlorhydria
- Mg decreases by 15%
- PSA levels increase
- \( \text{PaO}_2 \) decreases by 25% between the 3\(^{rd}\) and 8\(^{th}\) decade
- Sed rate up to 40 may be normal
Nutrients

- Folate — decreased 60-90
- Vitamin $B^{12}$ — decreased 60-90 but increased in population in nursing homes
CBC

- Hgb. and Hct. – sometimes slightly decreased because of increased plasma volume with aging (secondary to less time spent in upright position?)

- WBC – Usually some decrease; if elevated, check for CLL
Danger Signs in Underwriting

- Cholesterol < 175mg / dL
- Albumin < 3.6 g / dL
- Combo of above is especially significant
- Elevated hs - CRP
Hypothyroidism

- TSH not a part of routine insurance lab testing
- Seniors are most likely to have undiagnosed thyroid disease
- Reason: some of the symptoms are common in seniors (feeling cold when it’s hot out, depression, dry skin, fatigue, forgetfulness, insomnia)
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Several years of undiagnosed thyroid failure can increase the risk for elevated cholesterol levels and heart disease for seniors.
Anemia in the Elderly

- Affects 13% of older Americans

- Doubles the risk of serious physical declines*

- Not yet anemic, but just above the lower cut off – 1.5 times more likely to develop physical declines than those with values well within normal limits

*American Journal of Medicine, August 1, 2003; Funded by the National Institute on Aging and through support from Ortho Biotech products, L.P.
The Study:

- 1,146 people, ages 71 and older
- Followed more than 4 years
- Assessed ability to perform:
  - Timed 8-ft. walk
  - Standing balance
  - Ability to rise from a chair
The Study:

- Each activity scored on a 5-point scale: 0 = inability to do the test;
  4 = top performance; points added together to create 0 to 12 overall score
- Scores correlated with blood samples
Anemia – Definition - WHO

- Women – Hgb < 12 gm / dL
- Men – Hgb < 13 gm / dL
- Borderline anemia: 12 -13 gm / dL in women and 13 -14 gm/dL in men
The Study:
End of 4 Years

- 2/3 of the participants had at least modest declines in physical performance scores.
- 30% had substantial decreases.
Conclusions

- No anemia: Avg. 1.4 points decline on the 12-point scale
- Borderline anemia: Avg. 1.8 points decline
- Anemia: Avg. of 2.3 points decline
Conclusions

- Of all the categories, women with anemia showed the greatest physical decline, followed by women with borderline anemia.

- Excluding people with ailments associated with anemia (cancer, renal disease, infections) did not change the findings.
Underwriting —
Lab values to watch

- Routine blood profile
- Include albumin on older ages if not on all ages
- CBC with differential if no recent one in APS
- Watch for signs/symptoms of hypothyroidism in APS since not a routine insurance lab test