Aging & Disorders of the Skeletal System

Skeletal Changes from Childhood to Adult:

A. infancy & childhood

change size, proportion,
growth in length is cartilage of epiphyseal disc
growing faster than ossification proceeds
growth hormone plays major role
ǂ stimulates cartilage
thyroid hormone
ǂ proper proportions
head becomes proportionately smaller
facial bones more prominent
thorax more elliptical
pelvis larger and wide
legs proportionately longer
vertebral column develops two additional curves
(already had thoracic and pelvic curves)
cervical curve ~3mo; lifts head
lumber ~1 yr; standing, walking

B. Puberty

sex hormones (estrogen & testosterone) stimulate ossification
ǂ epiphyseal closure
facial features develop rapidly
also produce masculinizing and feminizing features of skeleton
male – deep and funnel shaped;
whole skeleton larger and heavier
female – shallow, broader and flaring

C. Adulthood:

Bone maintenance and remodeling

bone destruction is not always a pathological process:
a. bones constantly adapting to stresses
Reaction to mechanical stresses
strengthens weak areas
b. old bone removed to reduce bulk
c. minerals are added or removed from reservoir as Calcium is metabolized
99% of body's Ca^{++} is in bone

two hormones involved - antagonists
PTH
- stim bone destruction (osteoclasts)

Calcitonin
–stim bone formation (osteoblasts)

maintains Calcium homeostasis:
transmission of nerve impulses
muscle contractions
blood clotting
glandular secretions
secretion of neurotransmitters
cell division

Ca^{++} deficiency:
severe neuromuscular problems
hyperexcitability
loss of function
Ca^{++} excess:
Calcium deposits in blood vessels,
kidneys and soft organs

D. Old Age
reabsorption outweighs growth
⇉ bone become brittle
shaggy margins, spurs, joint problems
cartilage keeps growing: big ears

Disorders of Skeletal System

1. Fractures
repairs more slowly than skin; up to 6 months
a. clot (hematoma) formation
hours
broken blood vessels, damaged tissues, bone cells die
b. soft callus (fibrocartilage)
days
growth of new capillaries
disposal of dead tissue
c. bony callus
weeks
spongy bone tissue grows around area and replaces fibrocartilage
join two pieces firmly together
d. remodeling
months
dead portions of original area reabsorbed
compact bone replaces spongy bone
ends are remodeled to blend in

usually thickened area remains
misset bones may heal crooked
but weight bearing bones usually reassume proper shape
elec current speeds calcification and repair

new synthetic materials may soon be useful in replacing missing bone

also bone grafts

2. Vertebral curvature

normally spine has two "S" shaped curves
provides flexibility and resilient support
several types including:

scoliosis – abnormal lateral curvature
may appear spontaneously
or be result of polio, rickets or TB

3. Osteoporosis

bones lose mass and become more brittle
group of diseases in which bone reabsorption outpaces bone deposition
affects entire skeleton but esp spongy bone of vertebrae and neck of femur
esp in post menopausal women
sex hormones
stim bone deposition,
decrease osteoclast activity
menopause – sharp reduction in sex hormones

esp post menopausal women (esp caucasian women)
by 70 yrs the average white woman has lost 30% of her bone mass (some up to 50%)
not as drastic in men
bone loss begins ~60 yrs and seldom exceeds 25% loss
smoking also reduces estrogen levels
low body fat reduces estrogen production by ovaries in young female runners and dancers

most serious consequence is pathologic fractures
esp in hip, wrist and vertebral column
also, as bones become less dense they compress like marshmallows
⇩ results in **kyphosis** ⇩ exaggerated thoracic curve (widow's hump, dowager's hump)

<u>suggestions</u>:
need good bone mass by 35 or 40
plenty of weight bearing exercise, esp before menopause
good calcium uptake (850-1000 mg/d) early in life, esp 25-40

fluoridated water helps harden bones
don't smoke
hormone replacement therapy only slows loss, doesn't replace lost bone
-No longer recommended, too dangerous

4. Rickets

childhood disease: bowed legs, deformed pelvis,
due to Vit D (or Ca^{++}) deficiency during growing years
body unable to absorb calcium from intestine
reduces calcification – bones stay soft

5. Osteoarthritis

most common age change is degeneration of joints
=wear and tear arthritis
rarely occurs before age 40; affects 85% of those over 70
as joints age get gradual softening and loss of articular cartilage
bone formation at margin of articular cartilage
as cartilage becomes roughened by wear, joint movements may be accompanied by crunching or cracking sounds (=**crepitus**)
affects especially fingers, intervertebral joints, hips and knees
bony spurs may form as cartilage wears away ⇉deform joint
interfere with movement, pain

6. Rheumatoid Disease

far more severe than OA
is an autoimmune attack against synovial membrane
inflammation of synovial membranes and degeneration of cartilage
synovial membranes fill with abnormal tissue growth = granulation tissue
may erode articular cartilage, bones and ligaments
mainly small joints of body; wrists, ankles
tends to flare up and subside periodically
affects women far more than men
typically begins between age 30 – 40
no cure, but can be slowed with steroids, cortisone, etc

7. Osteomyelitis

any infection of bone, cartilage or periosteum
localized or general
usually bacterial

8. Ruptured (herneated) disc

intervertebral discs pad vertebrae
with age outer layer thins and cracks; inner layers less firm
extra pressure can cause rupture
= herneated disc: pain, numbness, partial paralysis

9. Gout

group of diseases characterized by elevated **uric acid** in blood
forms sodium urate crystals in synovial fluid causing severe pain
exacerbated by alcoholism

10. Bursitis

inflammation of bursal sacs around joints
fills with fluid
usually caused by blow or friction
="housemaids knee"
="water on the knee"

11. Tendonitis

inflammation, usually due to overuse

12. Achondroplastic Dwarfism

spontaneous mutation of genes, not necessarily from parents
long bones of limbs stop growing in childhood while growth of other bones is not affected
∓ results in short stature but normal sized head and trunk
not same as pituitary dwarfism, only certain cartilage cells are affected

13. Polydactyly & Syndactyly

too many or too few fingers and toes