Anatomy 420 Blunt Force Injury
21st September, 2008 Bligh-Glover

Blunt Force Injury

I. Definitions

A. Blunt impacts

1. Striking or being struck

2. Severity depends on:

a. Nature of the surface (flat vs. narrow, brittle vs. hard)

b. Amount of body surface (concentration)

c. Amount of force KE= ½ mv^2

d. Time

B. Injuries

1. Abrasions (scrapes)

2. Contusions (bruises)

3. Lacerations (tears)

II. Abrasions

A. Scrape.

1. Destruction of surface skin

a. Rough surface

b. Sliding or compression

2. Heal without scarring

3. Pre-vs.-post mortem

a. Premortem red brown

b. Postmortem yellow

4. Types

a. Scrape (scratches, sliding)

b. Brush burn (road rash) large area

c. Impact force perpendicular crushing skin

d. Patterned pattern of the object

5 Healing

a. Scab-epithelial regeneration-granulation-resolution

III. Contusions

A. Bruise

1. Bleeding into tissue

2. Rupture due to pressure--overstress elastic stress
3. Skin or organs
4. May not be associated with impact
5. May be hard to see in dark skinned individuals

B. Focal collection of blood--hematoma

C. Associated with fracture--ecchymosis
1. Battle's sign
2. Fracture hematoma may be only sign of rib fractures.

D. Factors that influence contusions
1. Age of victim--old people bruise easily
2. Sex Women bruise more easily than men
3. Heath of victim
a. Obese bruise easier
b. Muscular bruise less
c. Bleeding diathesis
d. Loose tissue vs. firm
e. Can be inflicted after death
i Eyebank

E. Colour changes
1. Not reliable for dating.
2. Progression
a. Purple/red/blue minutes to hours
b. Green hours to days
c. Brown
d. Yellow days to months
e. Hemoglobin broken down

IV. Lacerations

A. Laceration is a tear
1. Caused by BLUNT force
2. Tissue stretched, crushed, or sheared
3. Over bony prominence
4. Organs can be lacerated as well as skin
5. Tissue bridges differentiate from incised wound.

6. Long thin objects linear lacs., flat objects irregular lacs.

V. Chest

A. Can have massive injury without external injury

1. Clothing

2. Deformability of the chest

B. Fractures

1. Rib

a. Iatrogenic (CPR)

i. accompanied by sternal fractures

ii. left > right

iii. Check that resuscitation happened

b. Direct

i. Simple, displaced, compounded

ii. Underneath point of impact

iii. May only be seen by hematoma

iv. 1-3 trachea and great vessel injuries

v. 10-12 diaphragm, liver spleen injuries

c. Indirect

i. Squeezing of chest

ii. Front-to-back lateral rib fractures

iii. Back-to-front posterior rib fractures

iv. Side-to-side spine and sternum

v. Big enough everywhere

d. Complications

i. Flail chest

ii. Hemothorax

(a) intercostal arteries

(b) lungs

iii. Pneumonia

iv. Impaling wounds of heart and lungs

2. Sternum

a. Direct trauma

b. Transverse

c. A-P compression

C. Heart & vessels

1. Resulting from

a. Direct force (blows) steering wheel

b. Deceleration

c. Compression (crushing)

d. Blast (over pressure)

e. Indirect force (pressure on abdomen)

2. Severity

a. Nature of trauma

b. Blood in heart

3. Contusions

a. Anterior

4. Laceration

a. Incompressible blood in heart

b. Lead to tamponade

c. Acute 150-300 ml of blood cause death

d. Chronic compensation

e. Increases intra pericardial pressure, inadequate filling

f. Valve lacerations

5. Cardiac concussion

a. *Commotio cordis*

b. Blow mid-anterior chest

c. Ventricular fibrillation

6. Aortic injuries

a. Vehicle

b. Lacerations--transverse rib or vertebral fractures

c. Site-descending aorta distal to l. subclavian artery

d. Tethered above,

e. Acceleration/deceleration

f. Rule out natural disease

i. Syphilis

ii. Cystic medial necrosis

iii. Atherosclerosis

D. Lungs

1. Secondary to rib fractures

a. Punctures of lung tissue

b. Hemothorax, pneumothorax, hemopneumothorax

i. Open under water

c. Emphysema--gas in tissue

i. Tissue crepitus

ii. Pneumomammary

2. Contusions and lacerations

3. Existing disease

a. Makes things worse

b. Decrease elasticity

E. Diaphragm

1. Lacerations due to rupture

2. Associated with other injuries

3. Stuff is where it shouldn't be

4. More common on the left

VI. Abdomen

A. Can have massive internal injury without external injury

1. Clothing

2. Deformability

3. Organ consistency

a. Spleen vs. Stomach

b. Distention

c. Tycho Brahe

4. Disease

a. Enlarged spleen with mononucleosis

5. Kind of injury

a. Diffuse (car)

b. Localized (kick)

c. Homicides localized

B. Liver

1. Most frequently injured
2. Right lobe more common than left
3. Severity
    a. 27-34 ft/lb capsular tears
    b. 106-134 ft/lb crevices of organ
    c. 285-360 ft/lb burst and pulped the liver
    d. Major vessels and ducts intact

C. Spleen

1. More protected
2. Force against left upper abdomen
3. Disease states
    a. Mononucleosis
    b. Malaria
    c. Typhoid fever
    d. Leukemia

D. Pancreas

1. So very well protected
2. Massive abdominal trauma

E. GI

1. Flexible and floppy
2. Distended by food problem for stomach
    a. Anterior wall
    b. Mostly esophogastromalacia
3. Duodenum
    a. Ligament of Treitz
    b. Contusions
    c. Perforations
4. Colon unlikely

VII. Genito-Urinary

A. Kidneys

1. Rare, location, fat pad
2. Punching

3. Car accidents
4. Train wrecks

B. Bladder
1. Location
2. Pelvic fractures, distention
3. Not a good thing

C. Male genitals
1. External
a. Amputation, crushing
b. Fracture of erectile tissue
c. Cutaneous abrasions, contusions
2. Internal
a. Severity
b. Contusions, lacerations, hematomas
c. Can cause asystole (rarely)
d. Torsion

D. Female
1. External
a. Sexual assault
b. Car crash
2. Internal
a. Rare in non-pregnant
b. Pregnancy
i. MVA
ii. Fall
iii. Assaults
iv. Pelvic fractures

VIII. Skeleton

A. Causes & Kinds
1. Direct trauma
2. Indirect trauma
3. Simple, compound, comminuted

B. Direct

1. Focal fracture

a. Small force striking a small area

b. Transverse

2. Crush

a. Great force striking large area

b. Comminuted

c. Tissue damage

3. Penetrating

a. Great force, small area

b. GSW

C. Indirect

1. Force acting distant from fracture sire

2. Traction-bone pulled apart

3. Angulation-bone bent until snaps

4. Rotational-bone twisted "spiral fracture"

5. Compression fracture

D. Vertebral column

1. Cervical-lumbar-thoracic

2. Where it moves

3. Anterior compression fracture at or near the thoraco-lumbar junction

E. Pelvis

1. Great force

2. Open book spring the symphysis

3. Vertical shear fractures one hemipelvis moves

IX. Extremities

A. Cutaneous

1. Abrasions, contusions, lacerations

B. Deep

1. Muscle, bone, vessels

C. MVA

1. Regular

2. Avulsions

3. Specific to MVA

D. Assault

1. Upper extremity
2. Defense wounds
3. Offensive wounds
    a. Hands
    b. Contusions of knuckles, fractures of metacarpals

X. Head and neck

A. Scalp

1. Contusions, lacerations, or abrasions
2. Need to shave the scalp

B. Subscalpular tissue

1. Potential space
2. See better than the surface

C. Skull

1. Presence or absence does not correlate with cerebral injury or LOC
2. Begin at point distant to impact
3. 33-75 ft/lb required to make linear skull fracture hard
4. 268-581 ft/lb soft surface (29-45 mph)
5. High velocity penetrating or depressed
6. Low velocity linear, nondisplaced

D. Hemorrhages

1. Epidural
    a. Potential space
    b. Fracture
        i. Squamous temporal bone
        ii. middle meningeal artery
    c. Lucid interval
        i. Symptoms 4-8 hours
        ii. Immediate LOC 25%
    d. Increased ICP, herniation

2. Subdural
    a. Actual space between brain and dura
    b. Shearing force on bridging veins
        i. Acceleration-deceleration injuries
        ii. Brain atrophy
        iii. Venous bleeding
        iv. Falls or assaults
    c. Can be chronic
        i. Rebleeding
    d. Increased ICP, herniation
        i. Acute 50 ml
        ii. Chronic weeks
        iii. Organization
        iv. Can be used for tox.
3. Subarachoid
    a. Leakage of blood from capillaries

E. Brain

1. Contusions
    a. Location
        i. Frontal
        ii. Temporal
        iii. Anterior cranial fossae
    b. 6 types
        i. Coup
        ii. Contre-coup
        iii. Fracture
        iv. Intermediary
        v. Gliding
        vi. Herniation
2. Lacerations
    a. Children more often than adults
    b. Usually associated with massive skull trauma

3. Diffuse axonal injury
    a. Immediate prolonged coma (6 hours w/o ICH or mass lesion)
    b. Sudden acceleration-deceleration injury shearing of axons
    c. Rotational injury
    d. Axonal bulbs
4. Concussion
    a. Mild to severe
    b. Severe: LOC, amnesia
5. Cerebral edema
    a. The killer
    b. Herniation