



- You can use this presentation like a guide during your preparing for final GA exam.
- It does NOT cover all the material of the Gross Anatomy course.
- To complete GA material you have to work with ALL professor's presentations.
- Good Luck and All the best!

Dr. Mawrych

### 1. Lumbar puncture (tap) and Epidural anesthesia



- When a **lumbar puncture** is performed, the needle enters the subarachnoid space to extract cerebrospinal fluid (spinal tap) or to inject anesthetic (spinal block) or contrast material.
- The needle is usually inserted between L3/L4 or L4/L5. Level of horizontal line through upper points of iliac crests.
  - Remember, the spinal cord may end as low as L2 in adults and does end at L3 in young children and dural sac extends caudally to level of S2.
- Before the procedure, the patient should be examined for signs of **increased intracranial pressure** because cerebellar tonsils may herniate through the foramen magnum.



#### 2. Herniated IV disc



 Herniated discs usually occur in lumbar (L4/L5 or L5/S1) or cervical regions (C5/C6 or C6/C7) of individuals younger than age 50.

- Herniations may follow degenerative changes in the anulus fibrosus and be caused by sudden compression of the nucleus pulposus.
- Herniated lumbar discs usually involve the nerve root one number below traversing root (e.g., the herniation L4/L5 will compress L5 root).

## 3. Abnormal curvatures of the spine ■



- Kyphosis is an exaggeration of the thoracic curvature that may occur in elderly persons as a result of <u>osteoporosis</u> (multiply compression fracture of vertebral bodies) or disk degeneration.
- Lordosis is an exaggeration of the lumbar curvature that may be temporary and occurs as a result of pregnancy, spondylolisthesis or potbelly.
- Scoliosis is a complex lateral deviation, or torsion, that is caused by poliomyelitis, a leglength discrepancy, or hip disease.

#### 4. Upper limb fractures: Humerus fractures



Sites of potential injury to major nerves in fractures of the humerus:

- 1. Axillary nerve and posterior humeral circumflex artery at the surgical neck.
- 2. Radial nerve and profunda brachii artery at midshaft.
- 3. Brachial artery and median nerve at the supracondylar region.

4. Ulnar nerve at the medial epicondyle.

### Fracture of distal radius:

Flexion fracture of the radius (Smith's fracture)





- Transverse fracture within the distal 2 cm of the radius. Most common fracture of the forearm (after 50).
- Smith's fracture results from a fall or a blow on the dorsal aspect of the flexed wrist and produces a ventral angulation of the wrist. The distal fragment of the radius is ANTERIORLY displaced.
- Colles' fracture results from forced extension of the hand, usually as a result of trying to ease a fall by outstretching the upper limb. Distal fragment is displaced
   DORSALLY - "dinner fork deformity".
   Often the ulnar styloid process is avulced (broken off)

#### **Scaphoid fracture**

- Occurs as a result of a fall onto the palm when the hand is abducted
- Pain occurs primarily on the lateral side of the wrist, especially during wrist extension and abduction
- Scaphoid fracture may not show on X-ray films for 2 to 3 weeks, but a deep tenderness will be present in the anatomical snuffbox.
- The proximal fragment may undergo **avascular necrosis** because the blood supply is interrupted.





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#### **Boxer's fracture**





- Necks of the metacarpal bones are frequently fractured during fistfights.
- Typically, fractured 2<sup>d</sup> and 3<sup>d</sup> metacarpals are seen in professional boxers, and fractured 5<sup>th</sup> and sometimes 4<sup>th</sup> metacarpals are seen in unskilled fighters.

#### 5 Rotator cuff muscles – SITS



**Support** the shoulder joint by forming a musculotendinous rotator cuff around it

- **Reinforces joint** on all sides except inferiorly, where dislocation is most likely
- Rotator cuff muscles are Supraspinatus, Infraspinatus, Teres minor, Subscapularis: SITS.

Teres minor

### 6. Abduction of the upper limb



- (0°-15°) Abduction of the upper extremity is initiated by the supraspinatus muscle (suprascapular nerve).
  - (15°-110°) Further abduction to the horizontal position is a function of the **deltoid muscle** (axillary nerve).
  - (110°-180°) Raising the extremity above the horizontal position requires scapular rotation by action of the trapezius (accessory nerve CNXI) and serratus anterior (long thoracic nerve).

#### **Subacromial bursitis**





Subacromial bursitis

 (influmution of the subacromial bursa) is often due to calcific supraspinatus tendinitis, causing a painful arc of of abduction.



### 7. Medial (golfer's elbow) and lateral (tennis elbow) epicondylitis





Medial epicondylitis is inflammation of the common flexor tendon of the wrist where it originates on the medial epicondyle of the humerus.



• Lateral epicondylitis: repeated forceful flexion and extension of the wrist resulting strain attachment of common extensor tendon and inflammation of periosteum of lateral epicondyle. Pain felt over lateral epicondyle and radiates down posterior aspect of forearm. Pain often felt when opening a door or lifting a glass

### 8. Arterial anastomoses around the scapula



- Blockage of the Subclavian or Axillary artery can be bypassed by anastomoses between branches of the Thyrocervical and Subscapular arteries:
- Transverse cervical
- Suprascapular
- Subscapular
- Circumflex scapular

#### 9. Cubital fossa



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- Contents from lateral to medial:
  - 1. Biceps brachii tendon
  - 2. Brachial artery
  - 3. Median nerve
  - Subcutaneos structures from lateral to medial:
  - 1. Cephalic vein
  - 2. Median cubital vein: joins cephalic and basilic veins
  - 3. Basilic vein
- Sites of venipuncture is usually median cubital vein because:
  - Overlies bicipital aponeurosis, so deep structure protected
  - Not accompanied by nerves

#### **10. Carpal Tunnel Syndrome**



- Results from a lesion that reduces the size of the carpal tunnel (fluid retention, infection, <u>dislocation of lunate bone</u>)
- **Median** nerve most sensitive structure in the carpal tunnel and is the most affected
- Clinical manifestations:
  - Pins and needles or anesthesia of the lateral 3.5 digits
  - palm sensation is not affected because superficial palmar cutaneous branch passes superficially to carpal tunnel
  - Apehand deformity <u>absent</u> <u>of OPPOSITION</u>

## **11. Test of the proximal and distal interphalangeal joints**





• PIP – FDS

• DID - FDP



#### 12. Lesion of UL nerves Upper Brachial Palsy





- Injury of upper roots and trunk
- Usually results from excessive increase in the angle between the neck and the shoulder stretching or tearing of the superior parts of the brachial plexus (C5 and C6 roots or superior trunk)
- May occur as birth injury from forceful pulling on infant's head during difficult delivery

#### Upper Brachial Palsy (Erb-Duchenne palsy)







- In all cases, paralysis of the muscles of the shoulder and arm supplied by C5 and C6 spinal nerves (roots) of the upper trunk.
- Combination lesions of **axillary**, **suprascapular** and **musculocutaneous** nerves with loss of the shoulder mm and anterior arm.
- As result patient have "waiter's tip" hand:
  - adducted shoulder
  - medially rotated arm
  - extended elbow
  - loss of sensation in the lateral aspect of the upper limb

#### Lower Brachial Palsy (Klumpke paralysis)





- Injury of lower roots and trunk
- May occur when the upper limb is suddenly pulled superiorly: stretching or tearing of the inferior parts of the brachial plexus (C8 and T1 roots or inferior trunk)
- E.g., grabbing support during fall from height or as a birth injury, or TOS – thoracic outlet syndrome

#### Lower Brachial Palsy (Klumpke paralysis)





- All **intrinsic muscles** of the **hand** supplied by the **C8** and **T1** roots of the **lower trunk** affected.
- Combination lesions of ulnar nerve ("claw hand") and median nerve ("ape hand")
- Loss of sensation in the **medial aspect** of the upper limb and medial 1,5 fingers.
- May include a **Horner** syndrome



#### Injury to musculocutaneous nerve



- Usually results from lesions of lateral cord
- Greatly weakens <u>flexion</u> of elbow (biceps and brachialis muscles) and <u>supination</u> of forearm (biceps muscle)
- May be accompanied by anesthesia over lateral aspect of forearm

## Cutaneous innervation of the hand





Dorsum: 1,5-U and 3,5 R

Palm: 1,5-U and 3,5 M

### 13. Avascular necrosis of femoral head



 A common fracture in <u>elderly women</u> with <u>osteoporosis</u> is fracture of the femoral neck.

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 Transcervical fracture disrupts blood supply to the head of the femur via retinacular arteries (from medial circumflex femoral artery) and may cause avascular necrosis of the femoral head if blood supply through the ligament to the head is inadequate.

### 14. Knee joint injury: Unhappy triad





- Because the lateral side of the knee is struck more often (e.g., in a football tackle), the tibial collateral ligament is the most frequently torn ligament at the knee.
- The **unhappy triad** of athletic knee injuries involves:
- 1. Tibial collateral ligament
- 2. Medial meniscus
- 3. Anterior cruciate ligament

# Fibular collateral ligament (lateral collateral ligament)



 Rounded cord between
 lateral epicondyle of femur and head of fibula

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- Does NOT blend with joint capsule and does NOT attach to lateral meniscus
- Limits extension and adduction of leg at knee

## Rupture of the cruciate ligaments





B Anterior drawer sign (ACL)





The anterior cruciate ligament (ACL) prevents the femur from sliding posteriorly on the tibia and hyperextension of the knee and limits medial rotation of the femur when the foot is on the ground and the leg is flexed.



The posterior cruciate ligament (*PCL*) prevents the femur from sliding anteriorly on the tibia, particularly when the knee is flexed.

- With rupture of the anterior cruciate ligament, the tibia can be pulled forward excessively on the femur, exhibiting anterior drawer sign.
- In the less common rupture of the posterior cruciate ligament, the tibia can be pulled backward excessively on the femur, exhibiting posterior drawer sign.

#### Prepatellar bursa Suprapatellar bursa





- Prepatellar bursa: between superficial surface of patella and skin. May become inflamed and swollen (prepatellar bursitis)
- Suprapatellar bursa: superior extension of synovial cavity between distal end of femur and quadriceps muscle and tendon. Usual place for intraarticular injections

#### Knee jerk reflex





- The patellar reflex is tested by tapping the patellar ligament with a reflex hammer to elicit extension at the knee joint. Both afferent and efferent limbs of the reflex arch are in the femoral nerve (L2-L4).
- Knee jerk reflex: tests spinal nerves L2-L4.

#### **15. Ankle joint injury: Ankle sprains**





- Sprains are the most common ankle injuries
- A sprained ankle is nearly always an inversion injury, involving twisting of the weight-bearing plantarflexed foot.
- The lateral ligament (anterior talofibular ligament) is injured because it is much weaker than the medial ligament.
- In severe sprains, the lateral malleolus of the fibula may be fractured.

#### **Pott's fracture**



Pott's fracture



Fracture-dislocations of the ankle (Pott's fracture):

- Forced eversion (abduction) of the foot
- The medial ligament avulses the **medial malleolus** or the **medial ligament tears**, and **fibula fractures** at a higher level
- Forced inversion

   (adduction) avulses the
   lateral malleolus of fibula
   or tears the lateral
   ligament

#### Ankle jerk reflex



- Achilles tendon reflex is tested by tapping the calcaneal tendon to elicit plantar flexion at the ankle joint.
- Both afferent and efferent limbs of the reflex arc are carried in the **tibial nerve** (S1, S2).
- Ankle jerk reflex: tests spinal nerves S1-S2.

### 16. Injury of the gluteal region: Piriformis syndrome



Inflammation or spasm of the piriformis muscle may produce pain similar to that caused by <u>sciatica</u> ("piriformis syndrome").

**Piriformis "Landmark"** of the **gluteal region**: provides key to understanding relationships in the gluteal region; determines names of blood vessels and nerves

action: supination of hip joint

#### Injury to sciatic nerve





- Weakened hip extension and knee flexion
- Footdrop (lack of dorsiflexion)
- Flail foot (lack of both dorsiflexion and plantar flexion)
- Cause of injury: caused by improperly placed gluteal injections but may result from posterior hip dislocation

## Superior gluteal nerve injury



The superior gluteal nerve may be injured during surgery, **posterior dislocation** of the hip or poliomyelitis.

- Paralysis of the gluteus medius and gluteus minimus muscles occurs so that the ability to pull the pelvis up and abduction of the thigh are lost.
- If the superior gluteal nerve on the left side is injured, the right pelvis falls downward when the patient raises the right foot off the ground.
- Note that it is the side <u>contralateral</u> to the nerve injury that is affected.
## Injury to inferior gluteal nerve



- Weakened hip extension (gluteus maximus), most noticeable when climbing stairs or standing from a seated position
- Cause of injury: posterior hip dislocation, surgery in this region

### 17. Avulsion fractures of the hip bone and hamstrings muscles

 Avulsion fractures occur where muscles are attached - <u>ischial</u> <u>tuberosities</u>

Hamstrings muscles:

- **1. Biceps femoris**
- 2. Semitendinosus

nerve)

- 3. Semimembranosus
- Action: extension of hip joint and nexton of knee joint
  Nerve supply – Tibial nerve (short head of biceps femoris is supplied by the common fillular



## 18. Femoral sheath & femoral hernia





- Extension of transversalis fascia and iliacus fascia that enters thigh deep to inguinal ligament
- Divided into three compartments from lateral to medial enclosing:
  - Femoral artery
  - Femoral vein
  - Femoral canal

## **Femoral hernia**



#### Inguinal lig.

- A femoral hernia passes through the femoral ring into the femoral canal to form a swelling in the upper thigh inferior and lateral to the pubic tubercle
- The hernial sac may protrude through the **saphenous hiatus** into the superficial fascia
- A femoral hernia occurs more frequently in females and is dangerous because the hernial sac may become strangulated
- An **aberrant obturator artery** is vulnerable during surgical repair

## 19. Rupture of the Achilles tendon and Triceps surae muscle







In popliteal fossa: loss of plantar flexion of foot (mainly gastrocnernius and soleus muscles) and weakened inversion (tibialis posterior muscle), causing calculoragus.

Inability to stand on toes





21. Breast:

Carcinomas of the breast are **malignant tumors**, usually adenocarcinomas arising from the epithelial cells of the lactiferous ducts in the mammary gland

1. It enlarges, attaches to **suspensory** (**Cooper's**) **ligaments**, and produces shortening of the ligaments, clasing depression or **dimpling** of the overlying **skin**.

## Lymphatic drainage or the breast



- It is important because of its role in the **metastasis of cancer cells**.
- Most lymph (> 75%), especially from the **lateral breast quadrants**, drains to the **axillary lymph** nodes, initially to the **anterior (pectoral) nodes** for the most part.
- Most of the remaining lymph, particularly from the **medial breast** quadrants, drains to the **parasternal lymph** nodes or to the

opposite breast.

## Mastectomy





- Radical mastectomy, a more extensive surgical procedure, involves removal of the breast, pectoral muscles, fat, fascia, and as many lymph nodes as possible in the axilla and pectoral region.
- During a radical mastectomy, the long thoracic nerve may be lesioned during ligation of the lateral thoracic artery. A few weeks after surgery, the female may present with a winged scapula and weakness in abduction of the arm above 90° because serratus anterior m. paralysis.
- The intercostobrachial nerve may also be damaged during mastectomy, resulting in numbress of the skin of the medial arm.

## **Breast infection**





- Mastitis is an infection of the tissue of the breast that occurs most frequently during the time of breastfeeding (1 to 3months after the delivery of a baby).
- This infection causes pain, swelling, redness, and increased temperature of the breast.
- It can occur when bacteria, often from the baby's mouth, enter a milk duct through a crack in the nipple.
- It can occur in women who have not recently delivered as well as in women after menopause.





It can be detected radiologically.

#### Paradoxical movement: dome of diaphragm of injured side pushed superiorly by abdominal viscera during inspiration instead of descending

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Resting (normal expiration)

Resting

inspiration

Paralyzed

inspiration

(B) Paralysis of right

hemidiaphragm

Normal

Inspiration

(A) Normal inspiration

## **Diaphragmatic** ruptures



- Diaphragmatic injuries are relatively rare and result from either blunt trauma or penetrating trauma.
- Presently, 80-90% of blunt diaphragmatic ruptures result from motor vehicle crashes.
- The majority (80-90%) of blunt diaphragmatic ruptures have occurred on the **left side**.
- Blunt trauma typically produces large radial tears measuring 5-15 cm, most often at the posterolateral aspect of the diaphragm.



## 23. Cardiac hypertrophy



Left atrial enlargement

(hypertrophy) secondary to mitral valve failure may compress on the esophagus and manifest as dysphagia (difficulty in swallowing).

It may be observed as a filling delect in the esophagus by barium

swallow on the lateral thoracic X-Ray

#### **P-A projection**





### Cardiac Shadow Right border is formed by:

- 1. SVC,
- 2. Right atrium

#### Left border is formed by:

- 1. Aortic arch
- 2. Pulmonary trunk
- 3. Left auricle
- 4. Left ventricle





#### A heart murmur is heard **downstream from the valve**:

- **stenosis** is **orthograde** direction from valve
- **insufficiency** is **retrograde** direction from valve

## 25. Blood supply of the Heart: Right coronary artery (RCA)



## Left coronary artery (LCA)





#### Branches:

#### **1.** Anterior interventricular artery

descends in the anterior interventricular sulcus and provides branches to the (1) **anterior heard wall**, (2) **anterior 2/3 of IV septum**, (3) **bundle of His**, and (4) **apex** of the heart.

2. Circumflex artery – winds around the left margin of the heart in the atrioventricular groove to anastomose with the right coronary artery posteriorly; supplies the left atrium and left ventricle

# Blood supply of the conducting system





## 26. Aspiration of Foreign Bodies & Bronchopulmonary segments



#### **Aspiration of Foreign Bodies:**

- Inhalation of FB's (e.g. pins, parts of teeth, screws, nuts, bolts, toys) into the lower respiratory tract is common, especially in children
- More likely to enter the right primary bronchus and pass into the middle or lower lobe bronchi
- If the vertical position of the body, the foreign body usually falls into the posterior basal segment of the right inferior lobe.

## **Right lung: 10** bronchopulmonary segments

#### **Superior lobe:**

- 1. Apical
- 2. Anterior
- 3. Posterior

#### Middle lobe:

- 4. Lateral
- 5. Medial

#### Inferior lobe:

- 6. Superior
- 7. Anterior basal
- 8. Posterior basal
- 9. Lateral basal
- 10. Medial basal





## Left lung: **9** bronchopulmonary seaments

#### **Superior lobe:**

- 1. Apicoposterior
- 2. Anterior
- 3. Superior lingular
- 4. Inferior lingular

#### **Inferior lobe:**

- 5. Superior
- 6. Anterior basal
- 7. Posterior basal
- 8. Lateral basal
- 9. Medial basal





## 27. Lung diseases: Pneumonia









- Pneumonia is an inflammation of the lung, caused by an infection or chemical injury to the lungs.
- Three common causes are bacteria, viruses and fungi.
- Symptoms: cough\_chest pain, rever, and difficulty in breathing.
- Chest x-rays: areas of opacity (seen as white) of the lung parenchyma and enlargement of bronchomeolasunal lymph nodes (mediastinal widening).

## **Bronchogenic Carcinoma**





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large bronchi

hemoptysis

nodes

syndrome

## Qs about Auscultation and penetrated wounds



• To listen to **breath sounds** of the **superior lobes** of the right and left lungs, the stethoscope is placed on the superior area of the anterior chest wall (above the 4<sup>th</sup> rib for the **right** lung & above 6<sup>th</sup> for the **left** 

**P1**...).

- For breath sounds from the middle lobe of the right lung, the stethoscope is placed on the anterior chest wall between the 4<sup>th</sup> and 6<sup>th</sup> ribs
- For the inferior lobes of both lungs, breath sounds are primarily heard on the posterior chest wall.

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Horizontal fiss

**Oblique** fissure

Parietal pleura

recess

Costodiaphragmatic

Superior lobe

TIV spine

Rib V

Rib VI.

Rib VIII

Rib X

Middle lobe

Inferior lobe

Midaxillary line



## 28. Open pneumothorax



- It is entry of **air** into a pleural **cavity** causing **lung collapse**.
- Open pneumothorax due to stab wounds of the thoracic wall which pierce the parietal pleura so that the pleural cavity is open to the outside air via the lung or through the chest wall.
- Air moves freely through the wound during inspiration and expiration. During inspiration, air enters the chest wall and the mediastinum will shift toward other side and compress the opposite lung. During expiration, air exits the wound and the mediastinum moves back toward the affected side.



## Nerve supply of the pleura



Pariotal Pleura Sensitive to general sensitionales (pain, temperature, touch, and pressure) - somatic sensory innervation:

• costal pleura – intercostal nerves

- mediastinal pleura phrenic nerve
- diaphragmatic pleura phrenic nerve over the domes and lower 6 intercostal nerves around the periphery

Visceral Pleura – sensitive to stretch but insensitive to general sensibilities; autonomic nerve supply from the pulmonary plexus

## 29. Anterior abdominal wall



 The liver and gallbladder are in the right upper quadrant;

- The stomach and spleen are in the left upper quadrant;
- The cecum and appendix are in the right lower quadrant;
- The end of the descending colon and sigmoid colon are in the left lower quadrant.

## **Referred abdominal pain**





Coronal planes

#### Transversalis fascia is the FIRST STRUCTURE which is crossed by any abdominal hernia





## **Indirect Inguinal Hernia**



- Indirect inguinal hernia is the most common form of hernia and is believed to be congenital in origin (boys 0-3 years).
- It passes through the deep inguinal ring lateral to the inferior epigastric vessels, inguinal canal, superficial inguinal ring and descend into the scrotum.
- An indirect inguinal hernia is about **20 times more** common in males than in females, and nearly 1/3 are bilateral.
- It is more common on the right (normally, the right processus vaginalis becomes obliterated after the left; the right testis descends later than the left).

## **Direct Inguinal Hernia**



- Direct inguinal hernia composes about 15% of all inguinal hernias.
- During a direct inguinal hernia, the abdominal contents will protrude through the weak area of the posterior wall of the inguinal canal medial to the inferior epigastric vessels in the inguinal [Hesselbach's] triangle and after that through superficial inguinal ring. It never descends into the scrotum.
- It is a **disease of old men** with weak abdominal muscles. Direct inguinal hernias are rare in women, and most are bilateral.

## **30. Peritoneal structure:** Lesser omentum





#### Consist of 2 ligaments:

- hepatogastric
- hepatoduodenal

#### Contents :

- Right & Left gastric vessels
- Connective and fatty tissue

#### and Portal triad:

- Bile duct
- Portal vein
- Proper hepatic artery



## Epiploic (winslow's) foramen



- Anteriorly: The free border of the hepatoduodenal ligament, containing portal triad (DVA).
- Posteriorly: IVC
- **Superiorly:** Caudate lobe of the **liver**.
- Inferiorly: The 1<sup>st</sup> part of the duodenum.

## **Douglas (rectouterine) pouch**



Rectouterine pouch (pouch of Douglas): deeper point of peritoneal space in vertical position of the female body between the rectum and the uterus. It is space of the pelvic abscess location.

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• Vesicouterine pouch: it is deepness between the uterus and the urinary bladder.
#### Culdocentesis





## 31. Everything about Foregut, Midgut & Hindgut



FOREGUT	MIDGUT	HINDGUT
Esophagus Stomach Duodenum (1 <sup>st</sup> and 2 <sup>nd</sup> parts) Liver Pancreas Biliary apparatus Gallbladder	Duodenum (2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> parts) Jejunum Ileum Cecum (with Appendix) Ascending colon Transverse colon (proximal 2/3)	Transverse colon (distal 1/3) Descending colon Sigmoid colon Rectum (anal canal above pectinate line)

FOREGUT	MIDGUT	HINDGUT
Artery: CA	Artery: SMA	Artery: IMA
Parasympathetic innervation: vagus nerves, CNX	Parasympathetic innervation: vagus nerves, CNX	Parasympathetic innervation: pelvic splanchnic nerves, S2-S4
Sympathetic innervation: •Preganglionics: greater splanchnic nerves, T5-T9 •Postganglionics: celiac ganglion	Sympathetic innervation: •Preganglionics: lesser splanchnic nerves, T10- T11 •Postganglionics: superior mesenteric ganglion	Sympathetic innervation: •Preganglionics: lumbar splanchnic nerves, L1-L2 •Postganglionics: inferior mesenteric ganglion
Sensory Innervation: DRG T5-T9	Sensory Innervation: DRG T10-T11	Sensory Innervation: DRG L1-L2
Referred Pain: Epigastrium	Referred Pain: Umbilical	Referred Pain: Hypogastrium

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- Posterior gastric ulcer may erode through the posterior wall of the stomach into the pancreas resulting in referred pain to the back.
- 2. Erosion of <u>splenic artery</u> is very common in posterior gastric ulcers because of the proximity of the artery to this wall.

## 33. Congenital diaphragmatic hernia







Intestine protruding through hole in diaphragm

- Hernia of stomach or intestines through a posterolateral defect in diaphragm (foramen of Bochadalek).
- It is seen <u>in infants</u> and the mortality rate is high because of left lung hypoplasia.

#### 34. Sliding hiatal hernia



- A sliding hiatal hernia which occurs in individuals <u>past</u> <u>middle age</u> is caused by the hernia of cardia of the stomach into the thorax through the <u>esophageal</u> <u>hiatus</u> of the diaphragm.
- This can damage the vagal trunks as they pass through the hiatus and resulting in hyposecretion of gastric juice.



#### 35. Meckel's diverticulum





- **Meckel's diverticulum** is a congenital anomaly representing a persistent portion of the **vitellointestinal duct**.
- This condition is often asymptomatic but occasionally becomes inflamed if it contains **ectopic** gastric, pancreatic, or endometrial **tissue**, which may produce ulceration.
- It occurs in 2% of patients, is located about 2 feet (61 cm) before the ileocecal junction, and is about 2 inches (5 cm) long.
- The diverticulum is clinically important because **diverticulitis**, liberation, bleeding, perforation, and obstruction are complications requiring surgical intervention and frequently **mimicking the symptoms of acute appendicitis**.

# **36. Features of the large intestine**





Features of the large intestine:

- 1. Appendices epiploic
- 2. Sacculations (haustrations)
- 3. Taeniae coli
  - The taeniae coli meet together at the base of the **appendix** where they form a complete longitudinal muscle coat for the appendix.

#### **37. Pain of Appendicitis**





 In appendicitis, first pain is referred around the umbilicus.
 Visceral pain in the appendix is produced by distention of its lumen or spasm of its muscle.

- The afferent pain fibers enter the spinal cord at the level of T10 segment, and a vague referred pain is felt in the region of the umbilicus.
- Later if parietal peritoneum gets involved, and then the pain is shifted laterally to the Mc Burney's point. Here the pain is precise, severe, and localized (second pain)



 This point indicates the surface marking of the base of the appendix.

It is a point at the junction between the **lateral 1/3** and **medial 2/3** of a line joining the right anterior superior **iliac spine** with the **umbilicus**.

#### **38. Volvulus**



- Because of its extreme mobility, the small intestine and sigmoid colon sometimes rotates around its mesentery.
- This may correct itself spontaneously, or the rotation may continue until the blood supply of the gut is cut off completely.

#### **39. Hirschsprung's Disease**



- It is a rare congenital abnormality that results in obstruction because the intestines **do not work normally**.
- It is commonly found in **Down Syndrome** children.
- The inadequate motility is a result of an **aganglionic section** (congenital **absents** of **postganglionic parasympathetic** neurons inside of the intestinal wall) of the intestines resulting in **megacolon**.
- In a newborn, the main signs and symptoms are failure to pass a meconium stool within 1-2 days after birth, reluctance to eat, bile-stained (green) vomiting, and abdominal distension.
- Treatment is **removal** of the aganglionic portion of the colon.



#### 40. Branches of Abdominal aorta



- Celiac trunk (CA) originates from the aorta at the lower border of T12 vertebra
- Superior mesenteric artery originates at the lower border of L1 vertebra
- **Renal arteries** originate at approximately **L2** vertebra
- Inferior mesenteric artery originates at L3 vertebra
- Two terminal branches are common iliac arteries at the level of L4 vertebra

#### **CELIAC ARTERY (TRUNK)**





- **Origin:** T12-L1, just below the aortic opening of the diaphragm.
- The CA passes above the superior border of the pancreas and then divides into three retroperitoneal branches:
- Left gastric artery (1)
- Common hepatic artery (2)
- Splenic artery (3)

#### Left gastric artery





• The left gastric artery (1) courses upward to the left to reach the lesser curvature of the stomach and may be subject to erosion by a penetrating ulcer of the lesser curvature of the stomach.

#### **Branches:**

- Esophageal branches (2) to the abdominal part of the esophagus
- Gastric branches (3) supply the left side of the lesser curvature of the stomach and make anastomosis with right gastric artery.

#### **Common hepatic artery**





The common hepatic artery
 (1) passes to the right to

reach the superior surface of the first part of the duodenum, where it divides into its two terminal branches:

- Proper hepatic artery (2)
- Gastroduodenal artery (3)

#### **Proper hepatic artery**



- Proper hepatic artery (1) gives off right gastric artery (2) and then ascends within the hepatoduodenal ligament of the lesser omentum to reach the porta hepatis, where it divides into the right (4) and left (3) hepatic arteries.
  - The right and left arteries enter the two **lobes of the liver**, with the right hepatic artery first giving rise to the **cystic artery (5)** to the **gallbladder**.
- Right gastric artery (2) supplies the right side of the lesser curvature of the stomach where it anastomoses the left gastric artery.

#### **Gastroduodenal artery**



- Gastroduodenal artery (1) descends posterior to the first part of the duodenum (may be subject to erosion by a penetrating ulcer in this place) and divides into two branches:
- Right gastroepiploic artery (2) (supplies the right side of the greater curvature of the stomach where it anastomoses the left gastroepiploic)
- Superior pancreaticoduodenal arteries (3) (supplies the head of the pancreas, where it anastomoses the inferior pancreaticoduodenal branches of the SMA).

#### Ligature of the hepatic artery:



- The hepatic artery may be ligated proximal to the origin of its gastroduodenal branch, a collateral circulation to the liver is established through the left and right gastric arteries, left and right gastroepiploic and gastroduodenal arteries.
- The right hepatic artery may be <u>mistakenly ligated</u> during holecystectomy in Calot triangle together with the cystic artery, right lobe hepatic necrosis commonly occurs.

#### **Splenic artery**





- Splenic artery (1) runs a <u>tortuous</u> horizontal course to the left along the upper border of the pancreas, behind the peritoneum of the posterior wall of the lesser sac, forming a part of the stomach bed.
- The splenic artery may be subject to erosion by a penetrating ulcer of the posterior wall of the stomach into the lesser sac.
- N.B. The splenic vein runs a more straight course below the artery and behind of the pancreas.

#### **Splenic artery**





Splenic (1) a. is retroperitoneal until it reaches the tail of the pancreas, where it enters the splenorenal ligament to enter the hilum of the spleen.

Branches:

- Branches to the spleen (2)
- Branches to the neck, body, and tail of pancreas (3)
- Left gastroepiploic (4) artery that supplies the left side of the greater curvature of the stomach where it anastomoses the right gastroepiploic
- Short gastric (5) branches that supply to the fundus of the stomach







#### 41. Mesenteric ischemia



- Ischemia occurs when your blood cannot flow through arteries as well as it should, and intestines do not receive the necessary oxygen to perform normally. Mesenteric ischemia usually involves the small intestine.
- Mesenteric ischemia usually occurs in **people older than age 60**. You may be more likely to experience mesenteric ischemia if you are a *smoker* or have a *high cholesterol* level.
- Atherosclerosis, which slows the amount blood flowing through arteries, is a frequent cause of chronic mesenteric ischemia.

#### 42. Abdominal aortic aneurysm



- It is a localized dilatation of the aorta. It is typically happened just above of the bifurcation at level of L4 and crossed by 3<sup>rd</sup> part of duodenum.
- Pulsations of a large aneurysm can be detected to the left of the midline at the umbilical region.
- Acute rupture of an abdominal aortic aneurysm is associated with severe pain in the abdomen or back (mortality rate is nearly 90%).
- Surgeons can repair an aneurysm by opening it and inserting a **prosthetic graft**.

#### 43. Biliary system



- Bile is secreted by the liver cells, stored, and concentrated in the gallbladder and later it is delivered to the duodenum.
- The **gallbladder** lies in a fossa on the visceral surface of the liver to the right of the quadrate lobe.
- It stores and concentrates bile, which enters and leaves through the cystic duct
  - The cystic duct joins the **common hepatic (from left** and **right hepatic)**due to form the **common bile duct.**

### **Biliary system**

Bile duct

Minor duodenal papilla

Accessory pancreatic duct

Major duodenal

 Main pancreatic duct

The <u>common bile duct</u> descends in the **hepatoduodenal ligament**, then passes **posterior** to the **first part of the duodentm** 

It penetrates the head of the pancreas where it joins the main pancreatic duct and forms the hepatopancreatic ampulla (sphincter of Oddi), which drains into the second part of the duodenum at the major duodenal papilla.

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Hepatopancreatic ampulla



### 44. Cholelithiasis (gallstones)



Main pancreatic duct

The distal end of the <u>hepatopancreatic</u> <u>ampulla</u> is the narrowest part of the biliary passages and is the common site for impaction of gallstones. As result of <u>common hepatic (1)</u>, <u>bile</u> <u>duct (2)</u>, or <u>hepatopancreatic ampulla</u> (3) obstruction patient will have yellow eyes and jaundice

Gallstones may also lodge in the cystic duct. A stone lodged in the cystic duct
 (4) causes biliary colic (intense, spasmodic pain in the gallbladder ) but doesn't produce jaundice.

#### **Gallstones**

- The <u>fundus</u> (1) of the gallbladder is in contact with the <u>transverse colon</u> and thus gallstones erode through the posterior wall of the gallbladder and enter the transverse colon. They are passed naturally to the rectum through the descending colon and sigmoid colon.
- Gallstones lodged in the <u>body</u> (2) of the gallbladder may ulcerate through the posterior wall of the body of the gallbladder into the <u>duodenum</u> (because the gallbladder body is in contact with the duodenum) and may be held up at the ileocecal junction, producing an intestinal obstruction.



# 45. Nerve supply of the liver and gallbladder





Sensory innervation of the liver is done by the right phrenic nerve (C3-C5). Pain may radiate to the right shoulder.

The liver receives parasympathetic innervation from the vagi nerves (CNX), reaching it through the celiac plexuses around the supplying arteries. The preganglionic fibers synapse on the cells of the uxtaramural plexuses in hilum of the liver and shot postganglionic fibers supply organs.

• Sympathetic fibers of preganglionic neurons T5-T9 segments (IML) come through the sympathetic trunk and form greater splanchnic nerves. They contribute to the <u>celiac plexus</u>, where **postganglionic neurons** are located. Branches of celiac plexus reach the liver wrapping around the branches of the celiac artery.

#### 46. Portal Hypertension



- Portal hypertension is a common clinical condition, and for this reason the list of portal-systemic anastomoses should be remembered.
  Enlargement of the portal-systemic connections is frequently accompanied by congestive enlargement of the spleen.
- Portacaval shunt for the treatment of portal hypertension: the splenic vein may be anastomoses to the left renal vein after removing the spleen.



#### **Portocaval anastomosis**



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- If there is an obstruction to flow through the portal system (portal hypertension), blood can flow in a <u>retrograde direction</u> (because of the absence of valves in the portal system) and pass through anastomoses to reach the caval system.
- Sites for these anastomoses include the (1) esophageal veins, (2) thoracoepigastric veins, and (3) rectal veins.
- Enlargement of these veins may result in (1) esophageal varices,
  (2) a caput medusae and (3) internal hemorrhoids.





#### **Umbilical anastomosis**



- Anastomosis between the paraumbilical vein (portal vein) and the superior and inferior epigastric veins (SVC and IVC) of the anterior abdominal wall around the umbilicus.
- In portal hypertension, this anastomosis gets enlarged and dilated veins form "caput Medussae" around the umbilicus.

#### **Rectal anastomosis**





Anastomosis between the superior rectal vein (inferior mesenteric vein and then into portal vein) and inferior rectal vein which drains into the internal iliac vein (from

#### IVC System).

In portal hypertension this anastomoses gets dilated resulting in **internal hemorrhoids** and bleeding per anus.

#### 47. Pancreas: Head and uncinate process





The head of the pancreas rests within the C-shaped area formed by the duodenum and is traversed by the common bile duct.

It includes the **uncinate process** which is crossed by the <u>superior</u> <u>mesenteric vessels</u>.
## Cancer of the head of the pancreas





Cancer of the <u>head of the</u> <u>pancreas</u> compresses the <u>bile duct</u> and it results in OBSTRUCTIVE TYPE OF JAUNDICE.

usually **associated with** pain or **fever**.

 Hepatitis also causes jaundice but is associated with the fever.





**Posterior** to the **neck** of the pancreas is the site of formation of the **PORTAL VEIN**.

(1)Splenic vein joins with (2) superior mesenteric vein to form (3) portal vein.

#### **Body of the pancreas**





- The body passes to the left and passes anterior to the (1) aorta and the (2) left kidney.
- The (3) splenic artery undulates <u>along the</u> <u>superior border</u> of the body of the pancreas with the splenic vein coursing <u>posterior to the body</u>.

#### Tail of the pancreas





- The tail of the pancreas enters the splenorenal ligament to reach the hilum of the spleen.
  - It is the only part of the pancreas that is **intraperitoneal.**
- Tail of the pancreas may be <u>mistakenly removed</u> during spleenectomy and resulting in sugar diabetes because it contains a lot endocrine cells.



#### **Ducts of the pancreas**



#### **Annular Pancreas**



- Annular pancreas is caused by malformation during the development of the pancreas, before birth.
- Occurs when the ventral and dorsal pancreatic buds form a ring around the duodenum, thereby causing an obstruction of the duodenum and polyhydramnios
- Symptoms:
- 1. Feeding intolerance in newborns
- 2. Fullness after eating
- 3. Nausea and vomiting
  - Half of cases are not diagnosed until symptoms occur in adulthood.

### 48. Spleen: Two borders

spleen comes from -dorsal mesogastrium and liver comes from vental mesogastrium





- The spleen is a **peritoneal** organ in the upper left quadrant that is deep to the left **9**<sup>th</sup>, **10**<sup>th</sup>, **and 11**<sup>th</sup> **ribs**.
- The spleen follows the contour of rib 10 (axis of the spleen).
- Because the spleen lies above the costal margin, a normal-sized spleen is not palpable.
- The spleen may be lacerated with a fracture of the 9<sup>th</sup> and 10<sup>th</sup> ribs.

## Relations of the Spleen and Left Kidney



- The spleen follows the contour of **10<sup>th</sup> rib** and extends from the superior pole of the left kidney to just posterior to the midaxillary line.
- The border between spleen and upper pole of the left kidney is 11<sup>th</sup> rib.





#### **Peritoneal connections**



 Gastrosplenic ligament (1) connects the spleen with the upper end of the greater curvature of the stomach. It contains the short gastric vessels, left gastroepiploic (gastroomental) vessels and accompanying lymph vessels

• Splenorenal (lienorenal) ligament (2) connects the spleen with the left kidney. It contains the tail of the pancreas, splenic vessels, accompanying lymph vessels and nerves.

### 49. Kidney: Dimensions and position



- During life, the kidneys are reddish brown and measure approximately 11-12 cm in length, 5-6 cm in width, and 2.5-3 cm in thickness.
- They are extending from the level of T12 to the level of L3, the right kidney lying about 2-3 cm lower than the left one.
- The lateral border of the kidney is convex. Its medial border is convex at both ends but concave in the middle where there is the hilum of the kidney.



#### **Position of the kidneys**



- The upper end of the left kidney (XI rib) is a little higher than the right one (XII rib).
- The **lower** ends of the kidneys occur around the level of the IV disc L3/L4.
- N.B. The border between left kidney and spleen is XI rib
- The hila of the kidneys and the beginnings of the ureters are at approximately the L1 vertebra.
  - The **ureters** descend vertically anterior to the tips of the transverse processes of the lower lumbar vertebrae and enter the pelvis and <u>lies on the psoas</u> <u>major</u> muscle.

# Anterior relations of the right kidney





- 1. Right suprarenal gland
- 2. <u>2<sup>nd</sup> part of the</u> <u>duodenum</u>
- 3. Right lobe of the liver
- 4. Right colic flexure
- 5. Small intestine

# Anterior relations of the left kidney



#### Renal (Gerota) fascia



- Enclosing the perinephric fat is a membranous condensation of the extraperitoneal fascia the **renal fascia (3)**.
- The suprarenal glands (4) are also enclosed in this fascial compartment, usually separated from the kidneys by a thin septum.
- N.B. The renal fascia <u>must</u> <u>be incised</u> in any surgical approach to this organ.

#### **50. Nephrolithiasis**





- Renal calculi are solid concretions (crystal aggregations) formed in the kidneys from dissolved urinary minerals.
- There are several types of kidney stones. The majority are calcium oxalate stones, followed by calcium phosphate stones.
- Kidney stones typically leave the body by passage in the urine stream, and many stones are formed and passed

without oddoing symptoms.

 If stones grow to sufficient size before passage (at least 2-3 mm), they can cause obstruction of the ureter (renal colic).



#### **Staghorn calculi**



- Renal stone that develops in the pelvicaliceal system, and in advanced cases has a branching configuration which resembles the antlers of a stag.
- Staghorn calculi are composed of magnesium ammonium phosphate, which forms in urine that has an abnormally high pH (above 7.2).
- This high pH usually develops because of recurrent urinary tract infection with microorganisms such as Proteus mirabilis.

#### 51. Renal veins





- The **right renal (1)** vein is much **shorter** than the left. Both veins lie anterior to the corresponding artery in hilum of kidneys.
- The long left renal vein (2) is joined by the left suprarenal (3) and left gonadal (4) (testicular or ovarian) veins before it reached IVC.
- The left renal vein crosses anterior to the aorta, just inferior to the origin of the SMA.

#### 52. Varicocele







It is **engorgement** of the **pampiniform plexus** that produces a **wormlike scrotal mass** and enlargement of the spermatic cord. Formation is usually on the <u>left side</u>.

Variancelo on aither side

may indicate <u>kidney</u> <u>disease</u> or may signal a retro peritoneal malignancy **obstructing the testicular vein.** 

## Pampiniform plexus





- Each testicular or ovarian vein is formed by coalescence of a pampiniform plexus: the testicular at the deep inguinal ring, the ovarian at the margin of the superior aperture of the pelvis.
  - The veins run accompany the corresponding arteries. The left pampiniform plexus enters the left renal vein; the right one enters directly the IVC inferior to the renal vein.
  - That is why **varicocely** (engorgement of the pampiniform plexus that produces a scrotal mass) is more often located on the **left**.

## 53. Hemorrhoids: Venous drainage from rectum



- Above pectinate line: superior rectal vein [1] into portal system [2].
- Below pectinate line: inferior rectal vein [3] into inferior vena cava [4].



#### **External hemorrhoids**





- Hemorrhoids are masses that typically protrude from anus during defecation.
- Hemorrhoids are commonly associated with constipation, extended sitting and straining at the toilet, pregnancy, and disorders that binder vencus return
  - 1. External hemorrhoids are dilated tributaries of the <u>inferior</u> <u>rectal veins (IRV)</u> below the pectinate line and are **painful** because the mucosa is supplied by somatic afferent fibers of the inferior rectal nerves.

#### Internal hemorrhoids



2. Internal hemorrhoids are dilated tributaries of the superior rectal veins (SRV) above the pectinate line and are not painful because the mucosa is supplied by visceral afferent fibers.

 Internal hemorrhoids frequently develop during pregnancy because of pressure on the <u>superior</u> rectal veins.

## 54. Perineal pouches: Contents of the deep pouch



The deep perineal pouch is formed by the fasciae and muscles of the urogenital diaphragm. It contains:

- 1. Sphincter urethrae muscle
- 2. Deep transverse perineal muscle

#### 3. Bulbourethral (Cowper) glands (in the <u>male only</u>) - ducts perforate perineal membrane and enters bulbar urethra.



#### 55. Superficial perineal pouch



#### **Urine leaks**





- After a crushing blow or a penetrating injury, the <u>spongy</u> <u>urethra</u> commonly ruptures within the bulb of the penis, and urine leaks into the <u>superficial</u> <u>perineal pouch</u>.
- The superficial perineal fascia keeps urine from passing into the thigh or the anal triangle, but after distending the scrotum and penis, urine can pass over the pubis into the anterior abdominal wall deep to the deep layer of superficial abdominal fascia.

## 56. Cystocele (hernia of bladder)





- Loss of bladder support in females by damage to the <u>pelvic floor</u> during childbirth (e.g., laceration of perineal muscles or a lesion of the nerves supply) can result in protrusion of the bladder onto the <u>anterior vaginal wall</u>.
- When intrabdominal pressure increases (as when "bearing down" during defecation), the anterior wall of the vagina may protrude through the vaginal orifice into the vestibule

## 57. Ureter

- Ureter [1] crosses pelvic brim near bifurcation of common iliac artery
- In male, crossed superiorly by ductus deferens [2] near
  - DIadaer
- In female, crossed anteriorly and superiorly by uterine artery
  [3] in base of broad ligament
- N.B. The <u>ureter can be</u> <u>damaged</u> during a <u>hysterectomy</u> or surgical repair of a prolapsed uterus because it lies posterior and inferior to the uterine artery.



## 58. Nerve supply of pelvic viscera

#### **Parasympathetic innervation:**

- <u>Preganglionic</u> neurons are located in sacral parasympathetic n. (S2-S4) in the spinal cord.
- Their processes run into <u>pelvic</u> splanchnic nerves and relay with postganglionic neurons located inside of pelvic organs in the intramural plexus.

#### Sympathetic innervation:

- Sympathetic fibers of <u>preganglionic</u> neurons T12-L2 segments (IML) come through the sympathetic trunk and form <u>sacral</u> splanchnic nerves.
- They contribute to the **inferior hypogastric plexus**, where **postganglionic** neurons are located. Branches of inferior hypogastric plexus reach organs wrapping around the branches of the internal iliac artery.

#### **Sensory innervation:**

• The sensory fibers from **S2-S4 dorsal root ganglions** comes together <u>with parasympathetic</u> and carry pain sensations from the organs.

#### **Micturition reflex**





#### Facilitating emptying:

- Parasympathetic fibers (pelvic splanchnic nn.) stimulate detrusor muscle [1] contraction and involuntary relax internal sphincter [2].
- Somatic motor fibers (pudendal nerve) cause voluntary relaxation of external [3] urethral sphincter.

#### Inhibiting emptying:

• Sympathetic fibers (sacral splanchnic nn.) inhibit detrusor muscle [1] and stimulate internal sphincter [2].

## 59. Paracentesis of urinary bladder





#### Suprapubic aspiration:

- Urine can be removed from the bladder without penetrating the peritoneum by inserting a needle JUST ABOVE the pubic symphysis.
- The needle passes successively through skin, superficial and deep layers of superficial fascia, linea alba, transversalis fascia, extraperitoneal connective tissue, and wall of the bladder.

#### 60. Prostate tumors Prostate cancer



- It usually begins in the posterior lobe of the gland, and early stages are often asymptomatic.
- Later malignant enlargement of the prostate can narrow or occlude the prostatic urethra.
- N.B. Prostatic malignancies tend to metastasize to vertebrae and the brain because the prostatic venous plexus has numerous connections with the vertebral venous plexus via sacral veins.

## Benign hypertrophy of the prostate (BHP)





#### muule aye.

- Prostate adenoma (benign hypertrophy) usually involves median lobe.
  - RHP is a common cause of

**urethral obstruction**, leading to **nocturia** (need to void during the night), **dysuria** (difficulty and/or pain during urination), and **urgency** (sudden desire to void).

The **prostate is examined** for enlargement and tumors by <u>DIGITAL RECTAL</u> examination.

#### Prostatectomy





- A prostatectomy may be performed through a **suprapubic** [1] or **perineal** [2] incision or transurethrally.
- Because damage to nerves in the capsule of the prostate and around the urethra (cavernous nerves) <u>can cause impotence</u> and/or urinary incontinence.

transurethral resection of the

### 61. Male urethra Prostatic part

- It is the <u>widest</u> and the most dilatable part.
- It is spindle shaped (middle part is dilated)
- Its posterior wall presents the following features:
  - Urethral crest vertical ridge in the midline
  - Seminal colliculus- a spherical swelling in the middle of the urethral crest
  - Openings of the 2 ejaculatory ducts are seen on each side on the seminal colliculus
  - Ducts of the prostate gland open into the male urethra





#### Membranous part





- Passes through the urogenital diaphragm to enter the bulb of the penis
- It is the shortest, <u>narrowest</u> and the least dilatable part
- It is surrounded by the external sphincter urethra
- Bulbourethral glands lie posterolateral to this part inside of urogenital diaphragm (deep perineal pouch)

## Spongy part



- Average 15 cm in length.
- Passes through the bulb and corpus spongiosum of the penis to open at the external urethral orifice on the tip of the glans penis.
- There are two dilatations

   bulbar fossa (in the beginning) and navicular fossa (in the glans penis)
  - Ducts of the bulbourethral glands open into the floor of the spongy part in its beginning
#### Sphincters of the urethra



- 1. <u>Internal</u> urethral sphincter is made of **smooth** muscles in the neck of the **bladder** and has **sympathetic** innervation
- 2. <u>External</u> urethral sphincter has skeletal muscle fibers and surrounds the membranous part of urethra, supplied by the perineal branch of the pudendal nerve

## 62. Hydrocele & hematocele





The **tunica vaginalis** testis or other remnants of the processus vaginalis may form a **hydrocele** or **hematocele**.

With transillumination, a hydrocele produces a reddish glow, whereas light will not penetrate other scrotal masses such as a hematocele, solid tumor, or herniated bowel.

### 63. Cryptorchism





- Undescended testes

   (cryptorchism) occurs when the testes fail to descend into the scrotum. This normally occurs within 3 months after birth.
- The undescended testes may be found in the abdominal cavity or in the **inguinal canal**.
- If neglected, malignant transformation may occur in the undescended testis.
- N.B. In case of cryptorchism, spermatogenesis is arrested and the spermatogenic tissue is damaged leading to permanent sterility in bilateral cases.

#### 64. Lymphatic drainage of the male viscera

#### Lymph nodes:



Internal iliac

External iliac

Superficial inguinal

Deep inguinal



- Testis & epididymis lumbar lymph nodes
- Scrotum superficial inguinal nodes
  - skin superficial inguinal nodes
  - glans deep inguinal nodes
  - body and roots internal iliac nodes
- Prostate gland & bladder internal iliac nodes
- Anal canal:
  - above pectinate line internal iliac
  - below pectinate line superficial inguinal nodes

## 65. Lymphatic drainage from the female viscera ■

#### Lymph nodes:



- Ovary and uterine tubes to lumbar lymph nodes
- Uterus:
  - lateral angle and teres ligament superficial inguinal lymph nodes
  - fundus and upper part of the body
     lumbar lymph nodes
  - lower part of the body external iliac lymph nodes
  - cervix external & internal iliac
- **Vagina**:
  - Superior to hymen to external & internal iliac
  - Inferior to hymen to superficial inquinal podes
- All external genitalia (with exception glans clitoris) - superficial inguinal lymph nodes

## 66. Arterial supply of the uterus



The **uterus** is almost exclusively supplied by the **uterine arteries** [1] (from internal iliac artery):

- Crosses pelvic floor in transverse cervical ligament on the base of broad ligament [2]
- Near uterus, passes superior and anterior to **ureter [3]**
- Ascends along lateral wall
   [4] of uterus within broad ligament
- Vaginal branch anastomoses with vaginal artery [5]
- Ovarian branch anastomoses with **ovarian artery [6]**

### 67. Parts of the uterine tube



- Uterine part
  - Pierces uterine wall to open into uterine cavity
- Isthmus
  - <u>Narrowest</u> part of tube just lateral to uterus
- Ampulla
  - Medial continuation of infundibulum comprising about half of uterine tube
  - Usual site of <u>fertilization</u>

#### Infundibulum

- Funnel-shaped expansion of lateral end, fringed with fimbriae
- Overlies ovary and receives oocyte at ovulation

#### Hysterosalpingography





The instillation of viscous iodine through the external os of the uterine cervix allows the lumen of the cervical canal, the uterine cavity, and the different parts of the uterine tubes to be visualized on Xray.

## 68. Foramina of the base of the skull



Ē



## 69. Fracture of the anterior cranial fossa



Fracture of the anterior cranial fossa (cribriform plate of the Ethmoid bone) is suggested by anosmia, periorbital bruising (raccoon eyes), and CSF leakage from the nose (rhinorrhea).



## 70. Development of skull Sutures of neurocranium



- <u>Coronal suture</u>: lies
   between the frontal bone
   and the two parietal
   bones.
- <u>Sagittal suture</u>: lies
   between the two parietal
   bones.
- Squamous suture: lies between the parietal bone and the squamous part of the temporal bone.
- Lambdoid suture: lies between the two parietal bones and the occipital bone.

#### **Cranial Malformations**



- [A] Scaphocephaly: premature closure of the <u>sagittal suture</u>, in which the anterior fontanelle is small or absent, results in a <u>long, narrow</u>, wedge-shaped cranium.
- [C] Oxycephaly: premature closure of the coronal suture results in a high, tower-like cranium.
- When premature closure of the coronal or the lambdoid suture occurs on **one side only**, the cranium is twisted and asymmetrical, a condition known as **plagiocephaly [B].**

#### **Fontanelles**





#### **Anterior fontanelle**

- present at birth; closes at age 9 to 18 months
- diminished size or absence at birth may indicate

#### craniosynostosis or microcephaly.

#### **Posterior fontanelle**

- present at birth; usually closes by age 2 months
- Persistence suggests underlying hydrocephalus or congenital hypothyroidism.

#### 74. Epidural hematoma



Skull fracture near **pterion** often causes epidural hematoma from torn **middle meningeal artery**.

- **rapid** because the bleeding dissects a **wide space** as it strips the dura from the inner surface of the skull, which puts pressure on the brain.
- An epidural hematoma forms a characteristic biconvex pattern on computed tomography images.

# 75. Infection of the Cavernous sinus





Lateral to body of sphenoid bone and sella turcica, forming lateral wall of hypophyseal fossa

#### **Related structures:**

- Structures that pass through sinus:
  - Internal carotid artery and internal carotid plexus

Abducens nerve (CN VI)

- Structures on lateral wall of sinus:
- . Oculomotor nerve (CN III)
- . Trochlear nerve (CN IV)

#### **Ophthalmic Veins**



- Superior ophthalmic vein communicates anteriorly with the facial (angular) vein
- Inferior ophthalmic vein communicates through the inferior orbital fissure with the pterygoid plexus of veins
- Both veins pass posteriorly through the superior orbital fissure and drain into the Cavernous sinus

### 76. Layers of the scalp

Connective tissue (dense)

Aponeurotic layer

STATAT TA

Pericranium

Loose connective tissue

Skin



epicranial aponeurosis connecting frontalis and occipitalis parts of occipitofrontalis muscle

#### 4. Loose areolar tissue -Allows 3 more superficial layers to move over skull surface; somewhat like a sponge because it contains innumerable potential spaces capable of being distended with fluid resulting from injury or infection

5. Pericranium -periosteum covering the outer surface of the skull bones



### 78. Facial nerve (CN VII)



- FACIAL NERVE (CN VII) sole motor supply to the muscles of facial expression and certain
   other muscles derived from the embryonic 2nd pharyngeal arch
- Sensory to the taste buds in anterior 2/3 of the tongue through the chorda tympani

#### Secretomotor

(parasympathetic) to the **submandibular**, **sublingual**, palatine salivary glands, glands of nasal cavity and **lacrimal** gland

### **Bell's palsy**



- It is idiopathic **unilateral facial paralysis** (constitutes **75%** of all facial nerve lesions)
- Terminal branches of CN VII may be injured by parotid cancer or by surgery to remove a parotid tumor.
- An infant's facial nerve may be injured during a forceps delivery because the mastoid process has not yet developed and the stylomastoid foramen is relatively superficial.

### Lesions of CN VII



- Symptoms associated with lesions of CN VII are determined by the location of the lesion in the nerve.
- Bels Manifestations:
  - unable to **close** lips and eyelids on affected side
  - eye on affected side is not lubricated (dry eye)
  - unable to **whistle**, blow a wind instrument, or chew effectively
  - facial distortion due to contractions of unopposed contralateral facial muscles
- A lesion within the facial canal will also affect taste from the anterior 2/3 of the tongue carried by the chorda tympani and loss of secretion from submandibular and sublingual glands ipsilateral to the lesion

# 79. Communication of the paranasal sinuses





 Receives opening of nasolacrimal duct

### **80. Epistaxis**





#### 81. Sphenoiditis





- Relationships of the sphenoidal sinus are clinically important; because of potential injury during pituitary surgery and the possible spread of infection.
- Infection can reach the sinuses through their ostia from the nasal cavity or through their floor from the nasopharynx.
- Infection may erode the walls to reach the cavernous sinuses, pituitary gland, optic nerves, or optic chiasma

#### 82. Cheeks



	_
	v



- Form the lateral, movable walls of the oral cavity and the zygomatic prominences of the cheeks over the
- Buccinator principal muscle of the cheek

Lygomano Donoo

encapsulated collection of fat superficial to buccinator

 Parotid duct opens in inner surface of the cheek right opposite 2<sup>nd</sup> upper molar tooth





medial pterygoid



Depression

- gravity
- digastric, geniohyoid, and mylohyoid muscles

All 4 muscles of mastication are innervated by V3:

- 1. Temporalis elevation & retraction
- 3. Medial pterygoid elevation
- 4. Lateral pterygoid protrusion

### 84. Lesion of CN XII



A lesion of CN XII allows the contralateral, unparalyzed <u>genioglossus muscle</u> to pull the protruded tongue toward the paralyzed side (deviation of the tongue).



#### 83. Gag reflex



Throat is swabbed in the area of the tonsils

- Touching the posterior part of the pharynx results in muscular contraction of each side of the pharynx - gag reflex:
  - Afferent limb: CN IX
  - Efferent limb: CN X
- Injury to the **glossopharyngeal** nerve (CN IX) will result in a negative gag reflex

### 84. Tonsillitis





- During palatine tonsillectomy, the peritonsillar space facilitates tonsil removal, except after capsular adhesion to the superior constrictor.
- If the glossopharyngeal nerve is injured, taste and general sensation from the posterior 1/3 of the tongue are lost.
- Hemorrhage may occur, usually from the tonsillar branch of the facial artery; if the superior constrictor is penetrated, a high facial artery or tortuous internal carotid artery may be injured.

#### **Palatine tonsils**



- Receives main blood supply from tonsillar branch of <u>facial artery</u>
- Drained by lymph vessels mainly to jugulodigastric lymph node, which is body's most frequently enlarged lymph node
- Nerve supply: tonsillar plexus of nerves formed by branches of <u>CN IX</u> and CN X

# 85. Lymph drainage from face structures



After submandibular & submental  $\rightarrow$  drain lymph to Deep cervical

Submandibular lymph nodes receive lymph from:

- front of scalp
- nose and adjacent cheek
- upper lip and lower lip (except central part\*)

- frontal, maxillary, and ethmoid air sinuses
- upper and lower teeth (except lower incisors\*)
- anterior 2/3 of tongue (except tip\*)
- floor of mouth ,gums and vestibule

\*to Submental lymph nodes

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### 86. Blow-out fracture





- A blow-out fracture of the orbital floor typically is not involve the orbital rim and is caused by blunt trauma to the orbital contents (e.g., by a handball).
- Blow-out fractures may damage: <u>inferior rectus</u> <u>muscle</u>, infraorbital nerve and artery (hemorrhaging).
- Blow-out fractures are rare in young children because the maxillary sinus is small and the orbital floor is not a weak point.

## 87. Muscles of the orbit





#### Clinical Testing Actions of Extraocular Muscles





• **Medial rectus** – ask the patient to look directly medially

- Lateral rectus ask the patient to look directly laterally
- Superior rectus ask the patient to look laterally, then superiorly
- Inferior rectus ask the patient to look laterally, then inferiorly
- **Superior oblique** ask the patient to look medially, then

#### ппенону

 Inferior oblique – ask the patient to look medially, then superiorly

testing for eye movements where the single a tion of each muscle predominates

# 88. Oculomotor Nerve Palsy (external squint)

Symptoms consistent with palsy of third cranial nerve: A) Complete right upper lid ptosis in primary position and B) complete limitation of adduction of the right eye on left gaze.



- It affects most of the extraocular muscles
- Manifestations:
  - ptosis,
  - fully dilated pupil,
  - and eye is fully depressed and abducted ("down and out") due to unopposed actions of superior oblique and lateral rectus, respectively.
## 89. Trochlear Nerve Palsy



- Lesions of this nerve or its nucleus cause paralysis of the superior oblique and impair the ability to turn the affected eyeball infero-medially (pupil look superio-laterally)
- The characteristic sign of trochlear nerve injury is diplopia (double vision) when looking down (e.g., when going down stairs)
  - The person can compensate for the diplopia by inclining the head anteriorly and laterally toward the side of the normal eye.

# 90. Abducens Nerve Palsy (internal squint)





- Injury to abdacens here
   paral, sis of lateral rectus →
   inabil v to abduct the affected
   eye
- Affected eye is fully adducted by the unopposed action of the medial rectus that is supplied by CN III

### 91. Corneal reflex



- **Corneal reflex** (blinking) in response to touching the cornea
- It involves reflex connections between sensory afferent fibers in the ophthalmic nerve (CN V1) that make synaptic connections with motor fibers of facial nerve (CN VII) which supply orbicularis oculis muscle.

## 92. Horner syndrome



- Penetrating injury to the neck, Pancoast tumor, or thyroid carcinoma may cause Horner syndrome by interrupting ascending preganglionic sympathetic fibers anywhere between their origin in the upper thoracic spinal cord and their synapse in the superior cervical ganglion.
- It includes the following signs:
  - Constriction of the pupil (**miosis**)
  - Drooping of the superior eyelid (ptosis),
  - Redness and increased temperature of the skin (vasodilation)
  - Absence of sweating (**anhydrosis**)

## 93. Otitis Media





- Hearing is diminished because of pressure on the eardrum and reduced movement of the ossicles.
- Taste may be altered because the chorda tympani is affected.
- Infection spreading posteriorly cause mastoiditis.
- Infection that spreads to the middle cranial fossa can cause meningitis or temporal lobe abscess, and infection moving through the floor may produce sigmoid sinus thrombosis.

## Perforation of the Tympanic Membrane



- May result from **otitis media** and is one of several causes of middle ear (conduction) **deafness**
- Causes: **foreign bodies** in external acoustic meatus, excessive pressure

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Because chorda tympani directly relates to the posterior surface of the tympanic membrane it may be damaged and resulting in loss of taste over anterior 2/3 of the tongue and secretion of the sublingual and submandibular glands

large ones require surgical repair

## 94. Thyroid and parathyroid glands



#### Hormones:

- The thyroid gland is the body's largest endocrine gland. It produces thyroid hormone, which controls the rate of metabolism (increase the temperature of the body), and calcitonin, a hormone controlling calcium metabolism (reduce blood calcium Ca2+). The thyroid gland affects all areas of the body except itself and the spleen, testes, and uterus.
- The hormone produced by the parathyroid glands, parathormone (PTH), controls the metabolism of phosphorus and calcium in the blood (<u>increase Ca2+ level</u>). The parathyroid glands target the skeleton, kidneys, and intestine.

# Anatomical relations of the thyroid gland





- Anterolateral infrahyoid muscles
- Posterolateral <u>common carotid</u> <u>artery</u> [1]
  - Medial larynx, <u>trachea</u> [2], pharynx, esophagus, cricothyroid muscle, recurrent laryngeal nerve [3]
- Posterior –
   parathyroid glands
   [4]

## Median cervical cyst





- Usually presents as a painless midline mass on the anterior aspect of the neck at the level of the hyoid bone and moves during swallowing.
- Remanent of the **thyroglossal canal** (thyroid gland originally from epithelium of the tongue).
- Must be differentiated from a thyroid mass
- Treatment: **surgical excision**

## Variation of parathyroid glands position





- The **superior parathyroid** glands, more constant in position than the inferior ones.
- The inferior parathyroid glands are usually near the inferior poles of the thyroid gland, but they may lie in various positions
- In 1-5% of people, an inferior parathyroid gland is deep in the superior mediastinum <u>within the thymus</u> because of common embryonic origin.

## 95. Larynx:





- Cavity of the Larynx 2 Folds:
- Vestibular folds (false vocal cords)
- Vocal folds (true vocal cords)
- **Rima vestibuli** gap between the vestibular folds
- Rima glottidis gap between the vocal folds anteriorly and vocal processes of the arytenoid cartilages posteriorly



## **Muscles of the Larynx**



#### **Abductors**

 Posterior cricoarytenoid – abducts vocal folds (the only abductors of the vocal folds)





## Vagus Nerve (CN X)



#### **Superior laryngeal nerve:**

divides into internal and external laryngeal nerves

- Internal laryngeal nerve sensory; supplies floor of piriform recess and mucous membrane of larynx above of the vocal folds
- External laryngeal nerve motor; supplies the cricothyroid muscle

## Vagus Nerve (CN X)





#### **Recurrent laryngeal nerve:**

- supplies all muscles of larynx, except cricothyroid; mucous membrane of larynx below vocal fold; mucous membrane of upper trachea
  - right recurrent laryngeal nerve → hooks around the right subclavian artery
  - left recurrent laryngeal nerve
     → hooks around the arch of the
     aorta posterior to the
     ligamentum arteriosum
  - ascends in the neck in a groove between the trachea and esophagus

## 96. Cricothyrotomy





- A cricothyrotomy is an emergency procedure that relieves an airway obstruction.
- In case of swallowed foreign bodies or abnormal tissue growths.
- A hollow needle is inserted into the midline of the neck, just below the thyroid cartilage

More frequently, a small incision is made in the skin over the <u>cricothyroid membrane</u>, and another one is made through the membrane **between the cricoid and thyroid cartilage**. A **tube** that enables breathing is inserted through the incision.

surgical **tracheosotomy**, if there is need for a prolonged use of a breathing tube.

## 97. Retropharyngeal space





above thyroid, it is only internal carotid, and below is common carotid

## 98. Carotid sheath



internal larygeal accompany superior larygenal artery

Dr. Mavrych, WiD, PhD, DScompany S. Superior throader all.com

- Derived from all 3 layers.
- Encloses :
- 1. Common and internal carotid arteries,
- 2. Internal jugular vein
- 3. Vagus nerve
  - some deep cervical lymph nodes, carotid sinus nerve, sympathetic nerve fibers (carotid periarterial plexuses)



## 99. Axillary sheath



- Derived from the **prevertebral fascia**
- Encloses the axillary vessels and brachial plexus as they emerge in the interval between the scalenus anterior and medius muscles – Interscalenus space
- Extends into the axilla

## 100. Posterior Triangle of the Neck



#### Summary:

- Scalene muscles
- Veins external jugular vein, subclavian vein
- Arteries –occipital artery
- Nerves <u>accessory nerve (XI)</u>, trunks of the brachial plexus, branches of cervical plexus, phrenic nerve
- Lymph nodes superficial cervical nodes along external jugular vein

## **Good Luck!**



