Introduction to abdomen

Cylindrical chamber extending from diaphragm to the base of the pelvis, comprising of abdomen proper & the lesser pelvis
• Abdomen proper & lesser pelvis communicate with each other at the plane of inlet into lesser pelvis (upper border of pubic symphysis, pubic crests, arcuate line of innominate bones, sacral promontary)
- Contents of Abdomen proper: Most of the digestive tube, Liver, pancreas, spleen, kidneys, ureters (in part), supra renal gland & various blood & lymph vessels, lymph nodes & nerves
- Contents of lesser pelvis: Terminal parts of ureters, urinary bladders, the sigmoid colon, rectum, some coils of ileum, internal genitalia, blood & lymph vessels, lymph nodes & nerves
Functions

• Houses & protects major viscera
Assists in breathing

- Contraction of diaphragm
- Relaxation of abdominal muscles

Inspiration

Expiration

Diaphragm

Relaxation of diaphragm

Contraction of abdominal muscles
Changes in the intra abdominal pressure

- Laryngeal cavity closed
- Air retained in thorax
- Fixed diaphragm
- Contraction of abdominal wall
- Increase in intra-abdominal pressure
- Micturition
- Child birth
- Defecation
Component parts

- Wall-
  - Skeletal elements
  - Muscles
• Muscles:-
• Anteriorly a segmented muscle Rectus abdominis
• Anterolateraly External oblique, internal oblique & trasversus abdominis
• Posteriorly-
  Quadratus lumborum, psoas major & iliacus
Abdominal regions
Regions on anterior abdominal wall
• Transpyloric plane-
  midway between suprasternal notch & symphysis pubis, cuts the tip of ninth costal cartilage, vertebral level L₁ lower border

• Trans tubercular plane-
  Passes from 5TH Lumber vertebra near its upper border
Transpyloric plane
Some other lines and planes

- Subcostal plane-
  Lower margin of rib cage, passes thru upper border of L\textsubscript{3}

- Supracristal plane-
  Joins the highest point of iliac crest, passes thru body of L\textsuperscript{5}
Vertical planes

- Midline
- Midclavicular line: passes thru the midpoint of the clavicle, crosses the costal margin just lateral to the tip of ninth costal cartilage & passes thru a point midway between the anterior superior iliac spine & the pubic symphysis
Abdominal cavity

- Cavity is lined by Peritoneum-
  - Parietal peritoneum
  - Visceral peritoneum

Abdominal viscera can be
- Intraperitoneal structures
- Retroperitoneal structures
Anterior abdominal wall

- Includes both the front and side of the wall
- Made up of the skin, superficial fascia, muscles, fascia transversalis, extra peritoneal connective tissue & parietal layer of peritoneum
• Skin - highly stretchable, show following feature
  • A midline vertical furrow
  • Umbilicus
  • Linea semilunaris
  • Three transverse furrows
Umbilicus

- Normal scar
- Normally lies at the junction between the third & fourth vertebra
- Supplied by T10 segment
- Marks the water shed line of the body
- Important site of portocaval anastomosis
- Meeting point of four folds in embryo
- Meeting point of three systems
Superficial fascia

- A layer of fatty connective tissue
- Single layer up to umbilicus
- Below umbilicus splits into:
  - superficial fatty layer
  - deep membranous layer
- **Superficial layer**
  - Contains fat & varies in thickness
  - Continues over inguinal ligament with the superficial fascia of thigh
  - In men continues over penis, loses fat & fuses with deeper layer & forms dartos fascia of scrotum
  - In women, it retains fat & becomes content of labia majora
• Deep membranous layer
• Contains fat
• continues into thigh
• In men in midline forms fundiform ligament of penis
• continues inferiorly with superficial fascia of perineum. The line of attachment pass over holden’s line, pubic tubercle, body of pubis, margins of pubic arch & posterior border of perineal membrane
4.26 Continuity of membranous layer of superficial fascia into other areas.
Cutaneous nerves

- Lower six thoracic & first lumbar nerves
Cutaneous vessels

Arteries of Anterior Abdominal Wall

- Anterior cutaneous art are branches of Superior & inferior epigastric artery
- Lateral cutaneous art are branches of posterior intercostal artery
- Below umbilicus supply is from three superficial branches of femoral artery
  - Superficial epigastric
  - Superficial external pudendal
  - Superficial circumflex iliac
Cutaneous veins

- Accompany arteries
- Below the umbilicus they drain into the great saphenous vein, eventually into the inferior vena cava
- Above the umbilicus they pass to the axilla and into the superior vena cava
- Both groups anastomose through small veins, which open up in case of obstruction in the liver, giving an appearance called caput medusae
- Lymphatics also respect the water shed line
Anterolateral muscles

- 5 muscles
- Three flat muscles whose fiber begin posterolaterally, are replaced anteriorly by an aponeurosis as they continue towards midline. These are external oblique, internal oblique & transversus abdominis muscle
- Two vertical muscles, enclosed within tendinous sheath, rectus abdominis & Pyramidalis
Fig. 4.32 Rectus abdominis and pyramidalis muscles.
External oblique (EO)
• Nerve supply – lower 6 thoracic nerves
• Has three free borders. Inferior free border forms inguinal ligament
• Has one opening superficial inguinal ring
Inguinal ligament

- Lower border of external oblique aponeurosis which is rolled backwards on itself
- Fascia lata is attached inferiorly to give it convexity
- Gives origin to IO & TA from its superior surface
• Upper grooved surface in medial half forms inguinal canal
Extensions of inguinal ligament

- Lacunar ligament
- Pectineal ligament or ligament of cooper
- Reflected part of inguinal ligament
Internal oblique (IO)

Fig. 39.8. Lateral view of the trunk to show attachments of the internal oblique muscle of the abdomen.
• Nerve supply- Lower 6 thoracic nerve & first lumbar nerve

• Conjoint tendon is formed by the fusion of Lowest aponeurotic fibers of the IO& TA & is attached to pubic crest & median part of pecten pubis. Guards the week point of superficial inguinal ring
Transversus Abdominis (TA)

- Nerve supply: Lower 6 thoracic nerve & first lumbar nerve
Rectus abdominis (RA)

Trunk—anterior view

Note that the upper end of the muscle is the insertion.

Insertion into:
5th, 6th & 7th costal cartilages (along a transverse line)

Tendinous intersection

Origin from:
Pubic symphysis & pubic crest

Umbilicus

Pyramidalis (of opposite side)

Fig. 39.16. Scheme to show the attachments of the rectus abdominis
• Nerve supply- lower 6 or 7 thoracic nerves
• Enclosed in rectus sheath
• Upper Part Is Crossed With 3 Tendinous Intersection
Pyramidalis

- Small triangular rudimentary muscle
- Nerve supply – sub costal nerve (T12)
Cremaster

- Nerve supply- Genital branch of Genitofemoral nerve
Action of muscles

- Support of abdominal viscera
- Movement of trunk
- Help in forcefulful respiration
- Expulsive acts
- Pyramidalis tenses the linea alba
- Cremaster helps to suspend the testis. Plugs superficial inguinal ring when intra abdominal pressure rises
Deep nerves of anterior abdominal wall

- Lower Six thoracic & first lumbar
Deep arteries of anterior abdominal wall

- Superior epigastric artery
- Musculophrenic artery
- Inferior epigastric artery
- Deep circumflex artery
Rectus sheath

- Aponeurotic sheath formed by aponeurosis of EO, IO & TO.
- Checks Bowing Of rectus muscle during contraction
- Maintains the strength of the anterior abdominal wall
- Anterior wall of sheath is complete, covering RA, Pyramidalis from end to end
- Firmly Adherent To Tendinous Intersections Of RA
• Posterior wall above the costal margin- deficient, RA lies directly on costal cartilages
• Midway between umbilicus & pubic symphysis posterior wall ends in a curved margin known as Arcuate line
• Below the Arcuate line- posterior wall is deficient. RA lies directly on fascia transversalis
**Anterior Aspect**

- Skin
- Costal cartilage
- Diaphragm
- Rectus abdominis
- Aponeurosis of external oblique m.
- Anterior lamina of aponeurosis of internal oblique m.

**Tendinous Intersection**

- Ext. oblique
- Fas. transversalis
- Peritoneum

**Posterior Wall Formed by:**
- Aponeurosis of external oblique m.

**Anterior Wall Formed by:**
- Aponeurosis of ext. oblique
- Ant. lamina of aponeurosis of internal oblique

**Posterior Aspect**

- Skin
- Ext. oblique
- Int. oblique
- Transversus abdominis
- Peritoneum

**Anterior Wall Formed by:**
- Aponeurosis of external oblique
- Ant. & post. laminae of aponeurosis of internal oblique

**Posterior Wall Formed by:**
- Costal cartilage & intercostal muscles

**Internal Oblique**

- Pubis
- Umbilicus
- Arcuate line

**Anterior Wall Formed by:**
- Aponeurosis of transversus abdominis

**Posterior Wall Formed by:**
- Fascia transversalis
Contents of rectus sheath

- Rectus abdominis & Pyramidalis
- Superior epigastric & inferior epigastric arteries
- Superior epigastric & inferior epigastric veins
- Lower Six Thoracic Nerves
Applied anatomy of Rectus sheath

Diverication of recti
Epigastric hernia
Planning of incision on anterior abdominal wall
Fascia transversalis

• Fascia deep to transversus abdominis muscle
• Main arteries lie inside but nerves lie outside the fascia
• Continue above with the fascia under diaphragm
• Inferiorly continue with the endopelvic fascia
• Posteriorly cover muscle of posterior abdominal wall
• Anteriorly joins the fascia of the other side
• Deep inguinal ring is an oval opening in fascia
• Prolongation over the femoral Vessel in to the thigh forms anterior wall of femoral sheath
• At the deep inguinal ring, fascia forms internal spermatic fascia over spermatic cord
Inguinal canal

- Slit like passage, which extends downward & medially, just above & parallel to lower half of inguinal ligament
- Begins at deep inguinal ring
- About 4 cm long
- Ends at superficial inguinal ring
Fig. 4.43 Deep inguinal ring and the transversalis fascia.
Boundaries of inguinal canal

• Anterior wall- EO aponeurosis, reinforced in its lateral part by fleshy fibers of IO
• Posterior wall- Transversalis fascia, reinforced in medial 1/3 by conjoint tendon, reflected part of inguinal ligament support at the medial end
• Roof- Arched fibers of IO & TA
• Floor- Medial half of inguinal ligament, Lacunar ligament reinforces the medial part
Contents

• Spermatic cord in men
• Round ligament of uterus in women
• Ilioinguinal nerve
Spermatic cord

- Ductus deferens
- Artery to Ductus deference
- Testicular artery
- Pampiniform plexus of veins
- Cremasteric artery & vein
- Genital branch of genitofemoral nerve
- Sympathetic plexus around the artery
- Lymphatics
- Remnants of processus vaginalis
Fascial coverings of spermatic cord

- External Spermatic Fascia- EO aponeurosis
- Cremasteric fascia- IO muscle, contains Cremasteric muscle
- Internal spermatic fascia- Transversalis fascia
Inguinal hernias

- Protrusion or passage of a peritoneal sac, with or without abdominal contents thru a weekend part of the abdominal wall in the inguinal region.
- Indirect inguinal hernia
- Direct inguinal hernia
Indirect inguinal hernia, Direct inguinal hernia
• The weakness in the anterior abdominal wall is compensated by the following factors:
  • Obliquity of canal
  • Deep inguinal ring is guarded from ant side by IO
  • Superficial ring is guarded by conjoint tendon & reflected part of ligament
  • IO forms ant post wall & roof
  • Cremaster plugs the superficial ring when intra abdominal pressure increases
  • Contraction of EO result in closure of two crura of superficial ring
Development of inguinal canal

- Gonads develop in inguinal region
- They descend into scrotum during intrauterine life
- Inguinal canal represents passage of gubernaculum through the abdominal wall
- Gubernaculum extends from caudal end of developing gonad to labioscrotal swelling