KIDNEY& URETER

DESCRIBE KIDNEYS (RIGHT AND LEFT) UNDER THE FOLLOWING HEADINGS

a. **LOCATION, SIZE, BORDERS AND SURFACES (GENERAL FEATURES)**
b. **COVERINGS**
c. **RELATIONS**
d. **BLOOD SUPPLY**
e. **DEVELOPMENT AND CONGENITAL ANOMALIES**
f. **APPLIED ANATOMY**

Location, size, borders and surfaces (general features)

Location

posterior abdominal wall behind the peritoneum one on each side of vertebral column from T12 to L3.

Right kidney is at lower level compared to left because of the liver present in right hypochondrium

Size

length: 11cm,

breadth:- 6cm,

thickness: 3cm

Borders and surfaces

upper pole and lower pole, medial and lateral borders, anterior and posterior surfaces

Coverings

From inside outwards

Fibrous capsule- true capsule formed by the condensation of the fibrous connective tissue

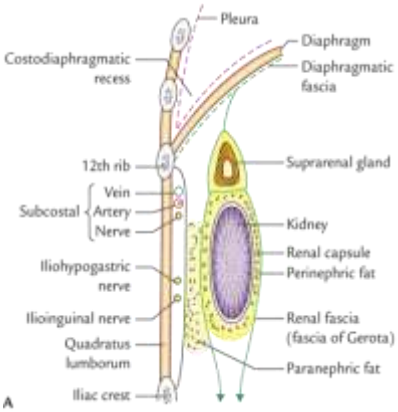
Perinephric fat- present throughout superficial to fibrous capsule, more near the borders and hilum

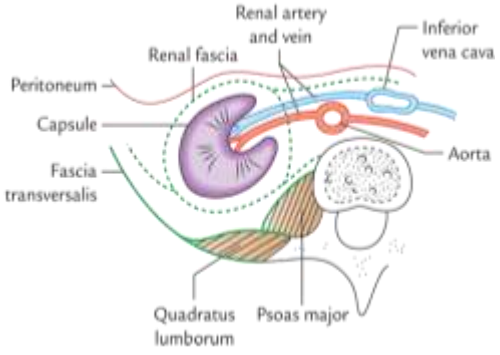
Renal fascia (fascia of Gerota)- false capsule.

The anterior layer is thin (fascia of Toldt) covering the anterior surface of kidney,

The posterior layer is thick (fascia of Zucker-Kandl) covering the posterior surface of kidney.

Paranephric fat- is more on the posterior surface between the renal fascia and anterior layer of thoracolumbar fascia





Relations

Upper poles are nearer to midline and lower poles are away from midline

Lateral border- convex and thick.

Medial border-

convex near upper and lower poles and concave in the middle forming hilum of kidney through which renal vein, renal artery, renal pelvis, branch of renal artery, lymphatics, nerves enter and leave the hilum.

Anterior surface

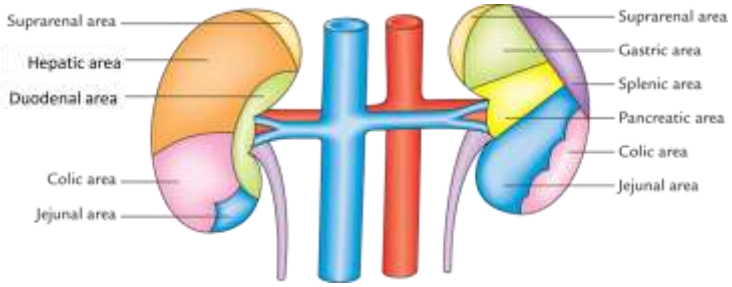
left side- suprarenal gland, spleen, stomach, pancreas, coils of jejunum, left colic flexure.

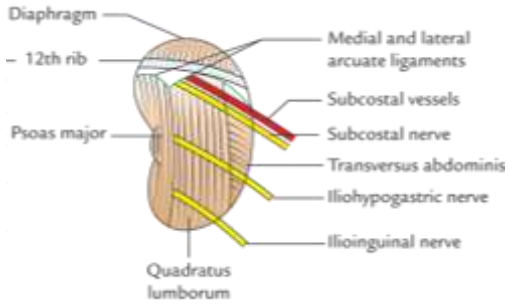
Right side- suprarenal gland, liver, duodenum, coils of jejunum, right colic flexure

Posterior surface-

upper part- diaphragm, 11th and 12th ribs on left, 12th rib on right

lower part- psoas major, quadratuslumborum, transverses abdominus,





subcostal vessels and nerves, iliohypogastric nerve, ilio inguinal nerve

Blood supply

Arterial supply- renal arteries branch of abdominal aorta

Venous drainage- renal veins draining into inferior venacava

Development and congenital anomalies

Development

The secreting part(renal corpuscles, proximal convoluted tubule, loop of Henle, distal convoluted tubule, junctional tubule) develops from the metanephric cap of intermediate mesoderm.

The conducting part (collecting tubules, minor calyces, major calyces, pelvis of ureter) develops from the ureteric diverticulum arising from the distal end of mesonephric duct.

Congenital anomalies

congenital polycystic kidney,
aberrant renal artery,
fetal lobulations,
both kidneys fuse to form round mass (pancake kidney),
unascended kidney (pelvic kidney),
two kidneys on the same side (crossed ectopia),
lower poles of two kidneys fused (horse shoe kidney),
congenital aplasia, hypoplasia

Applied anatomy

Kidney transplant-

it is transplanted in the iliac fossa and vascular anastomosis is done. The renal artery is sutured to internal iliac or external iliac artery and renal vein to external iliac vein. Ureter is sutured into the bladder (ureterocystostomy)

Kidney tumors-

spread along renal vein. The left renal vein receives left testicular vein in males and may rarely be blocked leading to left sided varicocele

Renal cysts

polycystic kidney which is important cause of renal failure

Renal vein entrapment syndrome-

left renal vein crosses midline between superior mesenteric artery and abdominal aorta. Superior mesenteric artery sometimes may compress the vein leading to hematuria / proteinuria, abdominal pain, nausea, vomiting, left testicular pain in men.

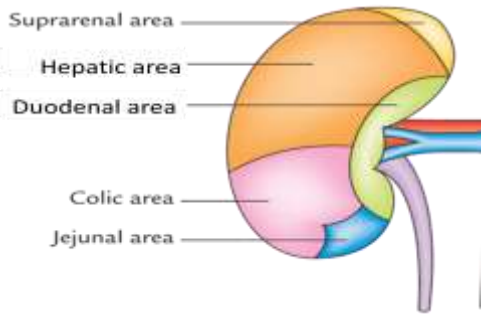
RELATIONS OF RIGHT KIDNEY(SE)

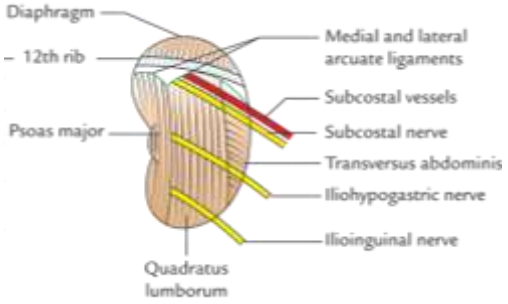
Anterior surface

Suprarenal Gland,
Liver,
Duodenum,
Coils Of Jejunum,
Right Colic Flexure

Posterior surface

Upper part- diaphragm, 12th rib on right;
Lower part- psoas major, quadratuslumborum, transverses abdominus, subcostal vessels and nerves, iliohypogastric nerve, ilio inguinal nerve

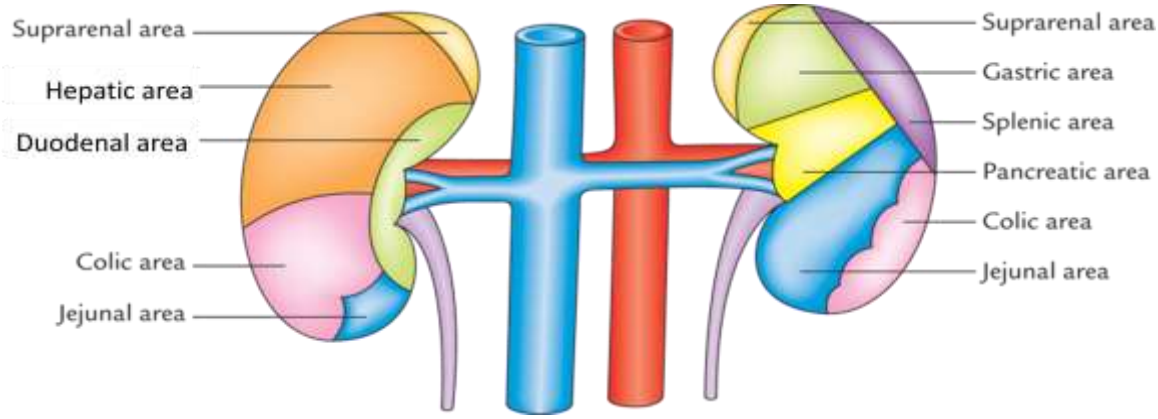




Anterior relations of right and left kidney

Left kidney- suprarenal gland, spleen, stomach, pancreas, coils of jejunum, left colic flexure.

Right kidney- suprarenal gland, liver, duodenum, coils of jejunum, right colic flexure

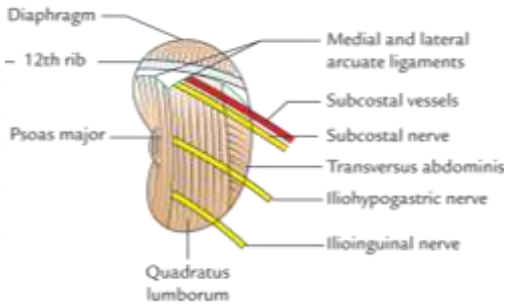


Posterior relations of kidneys

Posterior surface

upper part- diaphragm, 11th and 12th ribs on left, 12th rib on right

lower part- psoas major, quadratuslumborum, transverses abdominus,



subcostal vessels and nerves, iliohypogastric nerve, ilio inguinal nerve

COVERINGS OF KIDNEY(SE)

From inside outwards

Fibrous capsule- true capsule formed by the condensation of the fibrous connective tissue

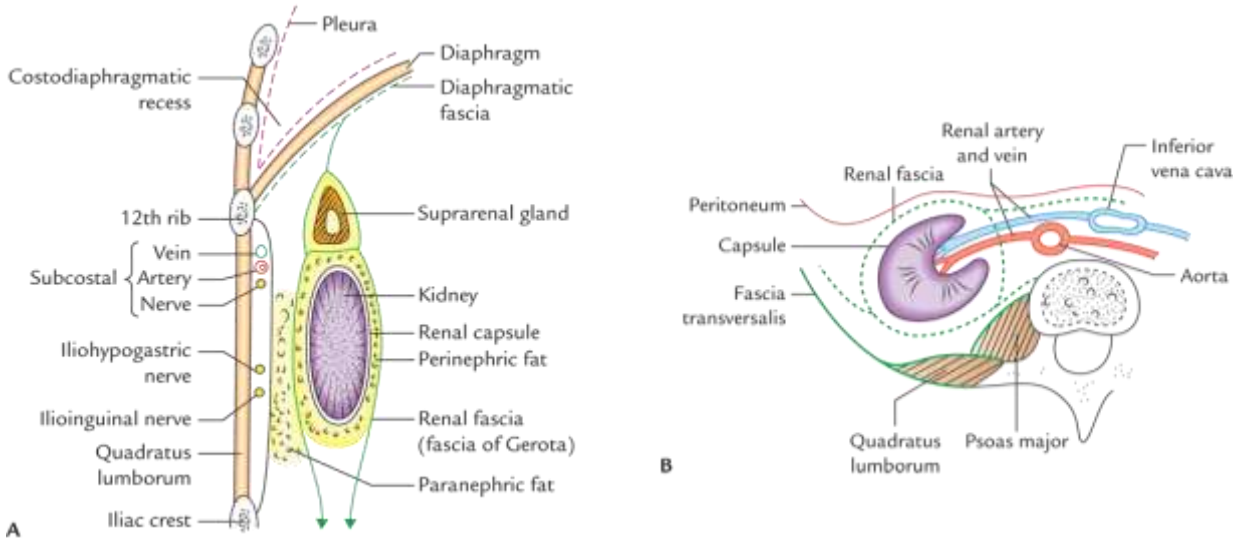
Perinephric fat- present throughout superficial to fibrous capsule, more near the borders and hilum

Renal fascia (fascia of Gerota)- false capsule.

The anterior layer is thin (fascia of Toldt) covering the anterior surface of kidney,

the posterior layer is thick (fascia of Zucker-Kandl) covering the posterior surface of kidney.

Medially when traced anterior layer continues in front of aorta, inferior venacavaand blends with opposite renal fascia,
posterior layer blends with psoas fascia and bodies of lumbar vertebrae.
The two layers are connected by a septum which passes medial to hilum of kidney.
Laterally both layers are continuous with each other.
Above the two layer fuse, resplits to enclose suprarenal gland in a separate compartment.
Below the layers run separately around the ureter and merge with fascia iliaca.
Paranephric fat- is more on the posterior surface between the renal fascia and anterior layer of thoracolumbar fascia



RENAL FASCIA(SE)

Renal fascia (fascia of Gerota)- false capsule.

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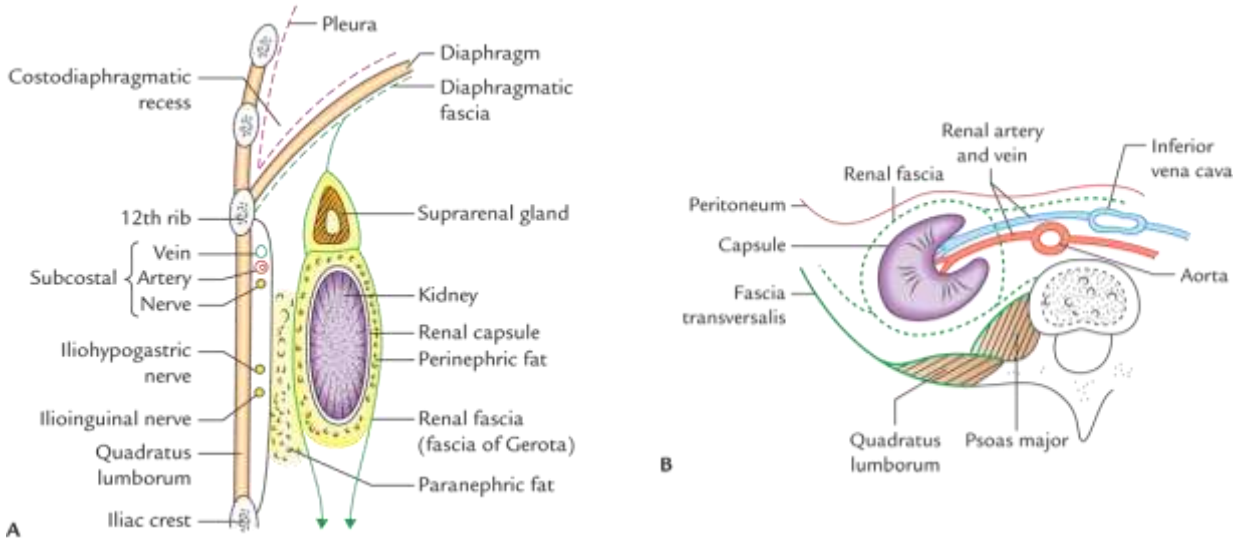
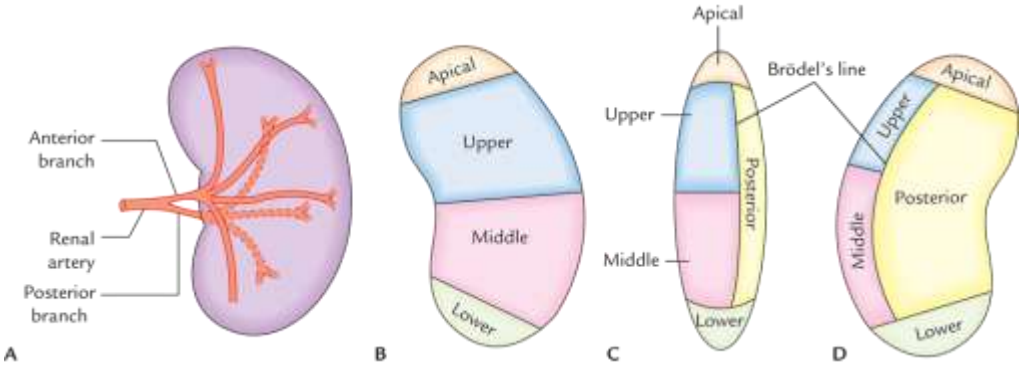


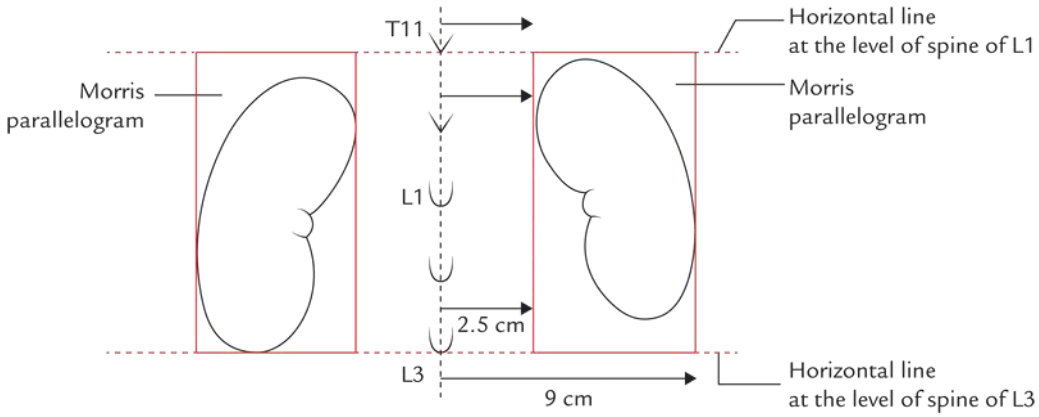
VASCULAR SEGMENTS OF KIDNEY(SE)

Renal artery on entering hilum divides into 5 segmental branches supplying a definite segment of kidney. So in each kidney there are 5 vascular segments- apical, lower/ basal, anterior upper, anterior middle, posterior. The branches which supplies anterior and posterior halves of kidney do not anastomose with each other. Thus there is bloodless zone (Brodel's line) through which interior of kidney can be approached without bleeding which can be used in surgical procedures.



STEPS OF DISSECTION FOR EXPOSURE OF KIDNEY FROM BACK(SE)

Incisions for the exposure of kidney from back is called Morris parallelogram.
The two horizontal incisions are made at the level of T11 and L3 vertebrae.
The lateral vertical incision is made at 9cm from median plane.
The layers which will be reflected from outside inwards before reaching the kidney are- skin, superficial fascia, posterior layer of thoracolumbar fascia, erector spinae, middle layer of thoracolumbar fascia, quadratuslumborum, anterior layer of thoracolumbar fascia.
Should be careful not to injure the subcostal vessels and nerves, iliohypogastric nerve and ilioinguinal nerves which pass mediolaterally.



HILUM OF KIDNEY(SA)

Hilum of kidney is the concave part present in the middle of the medial border of kidney.

It is around 5cm away from the median plane. the structures passing through hilum from anterior to posterior are- renal vein, renal artery, renal pelvis, a branch of renal artery

POSTERIOR RELATIONS OF KIDNEY(SA)

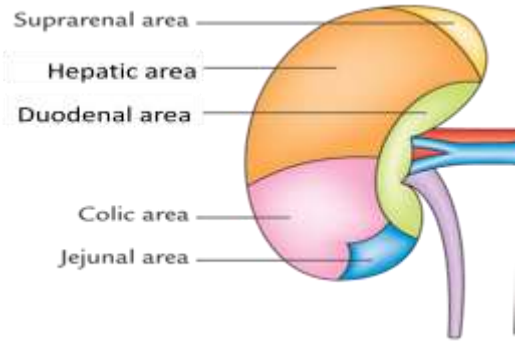
Upper part- diaphragm, 11th and 12th ribs on left, 12th rib on right;

Lower part- psoas major, quadratuslumborum, transverses abdominus, subcostal vessels and nerves, iliohypogastric nerve, ilio inguinal nerve

Muscles related to posterior surface of right kidney

psoas major, quadratuslumborum, transverses abdominus from medial to lateral in the lower of kidney

LABELED DIAGRAM OF ANTERIOR SURFACE OF RIGHT KIDNEY(SA)



COVERINGS OF KIDNEY(SA)

From within outwards

From inside outwards

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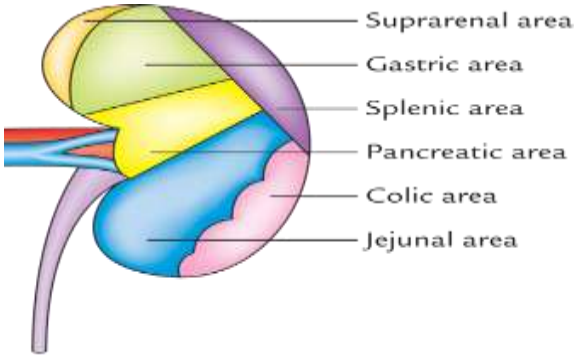
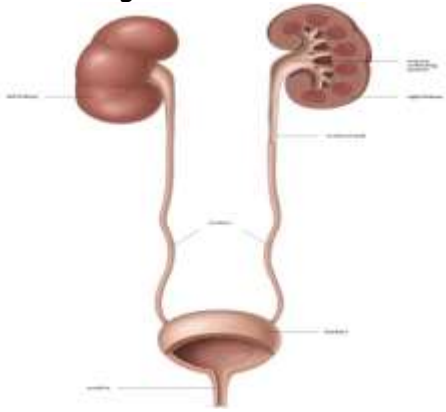
ANTERIOR RELATIONS OF LEFT KIDNEY(SA)



URETER-FORMATION,COURSE,CONSTRICTIONS.(SE)

The two ureters are muscular tubes that extend from the kidneys to the posterior surface of the urinary bladder
The urine is propelled along the ureter by peristaltic contractions
Each ureter measures about **25** cm long,3mm in diameter.



Course:

The renal pelvis is the funnel-shaped expanded upper end of the ureter

It lies within the hilum of the kidney and receives the major calyces

It enters the pelvis by crossing the bifurcation of the common iliac artery in front of the sacroiliac joint

It runs downward & forward on the lateral wall of the pelvis to enter the lateral angle of the bladder

Constrictions:

The ureter is slightly constricted at 3 places.

At the pelviuretric junction.

At the brim of lesser pelvis.

At the passage through the bladder wall (intra-mural part).

LEFT URETER(IN FEMALES)(SE).

The left ureter extends from the left renal pelvis to the left side of the base of the urinary bladder.

The relations are different in males and females.

It consists of 3 parts.

Pelvis of ureter.

Abdominal part.

Pelvic part.

Relations:

Renal pelvis:

Outside the kidney:

Anteriorly-on right side,renal vessels & second part of duodenum.

On left side-renal vessels,pancreas,peritoneum&jejunum.

Posteriorly-psoas major.

Abdominal part:

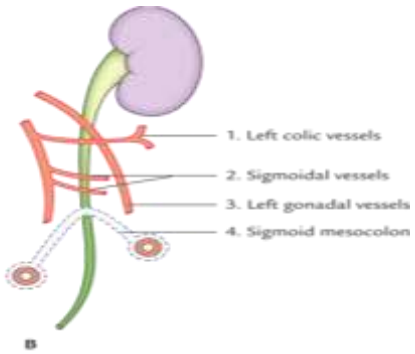
Anterior:

Parietal peritoneum.

Left gonadal vessels.

Left colic &sigmoid branches of the inferior mesenteric vessels.

Apex of inverted attatchment of sigmoid mesocolon.



Posterior:

Left psoas muscle,

Bifurcation of left common iliac artery

Pelvic part:

Above:

Lowerattatched margin of the broad ligament of uterus.

Uterine artery-crosses above and infront of the ureter from lateral to medial side.

Below:

Meckenrodt's ligament.

Lateral fornix of vagina.

Levatorani muscle.

RIGHT URETER(IN FEMALES)(SE).

The left ureter extends from the right renal pelvis to the left side of the base of the urinary bladder.

The relations are different in males and females.

It consists of 3 parts.

Pelvis of ureter.

Abdominal part.

Pelvic part.

Relations:

Renal pelvis:

Outside the kidney:

Anteriorly-on right side,renal vessels & second part of duodenum.

On left side-renal vessels,pancreas,peritoneum&jejunum.

Posteriorly-psoas major.

Abdominal part:

Anterior:

Peritoneum.

Right gonadal vessels.

Second& third part of duodenum.

Right colic &ileo-colic branches of superior mesenteric vessels.

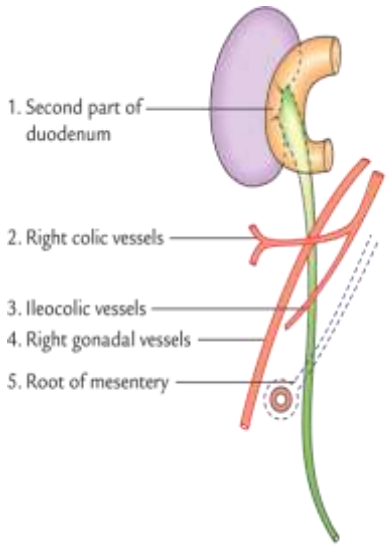
Root of the mesentery.

Terminal part of ileum.

Posterior:

Left psoas muscle,

Bifurcation of left common iliac artery



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Above:

Lowerattatched margin of the broad ligament of uterus.

Uterine artery-crosses above and infront of the ureter from lateral to medial side.

Below:

Meckenrodt's ligament.

Lateral fornix of vagina.

Levatorani muscle.

CONSTRICTIONS OF URETER(SA)

The ureter is slightly constricted at 3 places.

At the pelviuretric junction.

At the brim of lesser pelvis.

At the passage through the bladder wall (intra-mural part).

These constrictions are developmental rather than mechanical.

The ureteric diverticulum presents two fusiform dilatations in embryonic life,pelvic and lumbar.

Later,the enlargements cannot be seen externally due to growth of the ureteral muscle,but their ends persists as 3 constrictions.

Applied anatomy:

The renal calculi are more commonly lodge in these constrictions.

PELVIC PART OF THE URETER(SA)

Pelvic part of the ureter extends from the pelvic brim to the base of the bladder.

It is divisible into three parts.

First part extends from the pelvic brim to ischial spine.

Second part extends from ischial spine to base of the bladder.

Third part is inside the bladder that is intravesical part.

Intravesical part:

Has valvular action.

Prevents regurgitation of urine.

Ureteric openings lie 5cm apart.

The pelvic part is supplied by branches from the vesical,middlerectal,or uterine vessels.

POSTERIOR RELATIONS OF KIDNEYS(SE)

MUSCLES RELATED TO POSTERIOR SURFACE OF KIDNEY(SA)

Posterior surface-

upper part- diaphragm, 11^{th} and 12^{th} ribs on left, 12^{th} rib on right

lower part- psoas major, quadratuslumborum, transverses abdominus, subcostal vessels and nerves, iliohypogastric nerve, ilio inguinal nerve