UTERUS

I. INTRODUCTION

The uterus is a thick-walled, muscular and hollow organ in the midline between the bladder and rectum. It provides a nidus for the developing embryo and ensures the labor during childbirth. The uterus is a dynamic organ as it undergoes several modifications during the genital life and the menstrual cycle that ends with period.

II. DESCRIPTIVE ANATOMY

A- SITUATION

The uterus is located in the middle part of the pelvis, between the bladder in front, the rectum at the back, the vagina and perineum at the bottom and the peritoneal cavity at the top.

B- SHAPE

The uterus is shaped like a flattened firm pear and possesses a fundus, body, isthmus and cervix. (Figure 1 and 2)

The fundus is the base of the uterus above the entrance of the tubes. It is convex and covered by pelvic peritoneum.

The body tapers downwards from the fundus and is flattened anteroposteriorly. Each upper angle, the cornu, at the junction of fundus and body, receives the uterine tubes and constitutes the origin

of the round ligament of uterus and the ligament of the ovary. The intestinal surface of the body, posterior, faces upwards with coils of intestine lying upon it and the vesical surface, anterior, rests on the bladder.

The cervix tapers below the body and its lower end is clasped by the vault of the vagina. The vault of the vagina is inserted, downwards, on the upper third of the cervix and, forwards, on the lower third. Thus, it is sloping downwards and forwards. Therefore, the cervix has vaginal, lower, and supravaginal, upper, parts. The supravaginal part is continuous with the body. The vaginal part is pierced by the external orifice of the cervix, punctiform in the nulliparous and transverse and irregular in the multiparous with two lips anterior and posterior. The deep sulcus which surrounds the protruding cervix is the fornix of the vagina. Its intestinal surface is covered by peritoneum forming the rectouterine pouch of Douglas and its vesical surface has no peritoneal covering.

The isthmus is a narrowing at the lowest half centimetre of the body and is continuous with the cervix.

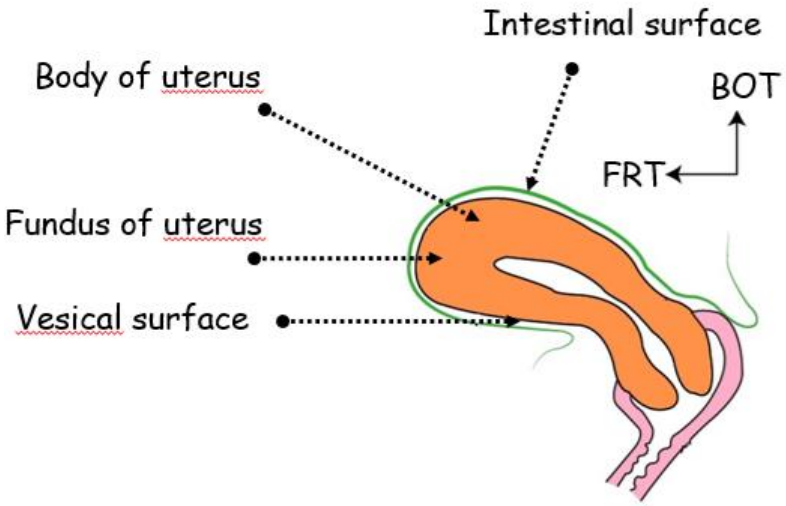

Figure 1: Sagittal view of the uterus

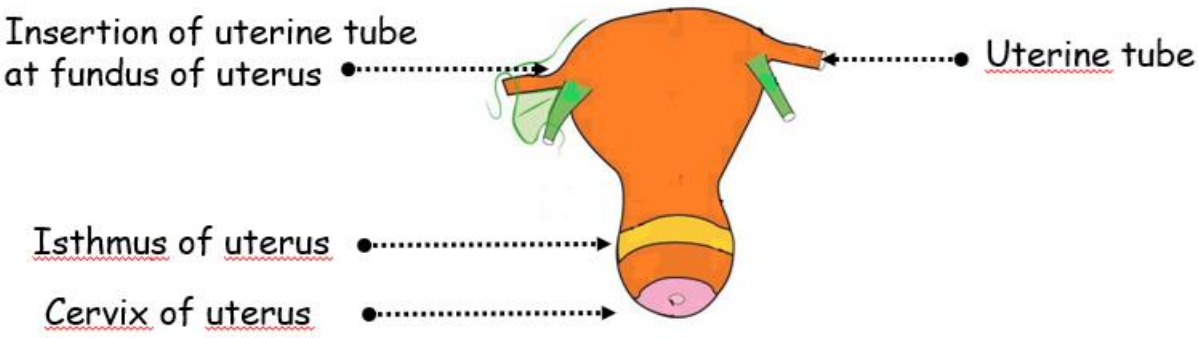

Figure 2: Anterior view of the uterus

C- ORIENTATION

The normal position of the uterus is one of anteversion and slight anteflexion.

The fundus and upper part of the body are bent forward in relation to the long axis of the cervix forming an angle of anteflexion of a hundred twenty degrees.

The whole organ, thus, flexed leans forward from the vagina forming an angle of anteversion of eighty degrees.

The cervix is perpendicular to the posterior wall of the vagina.

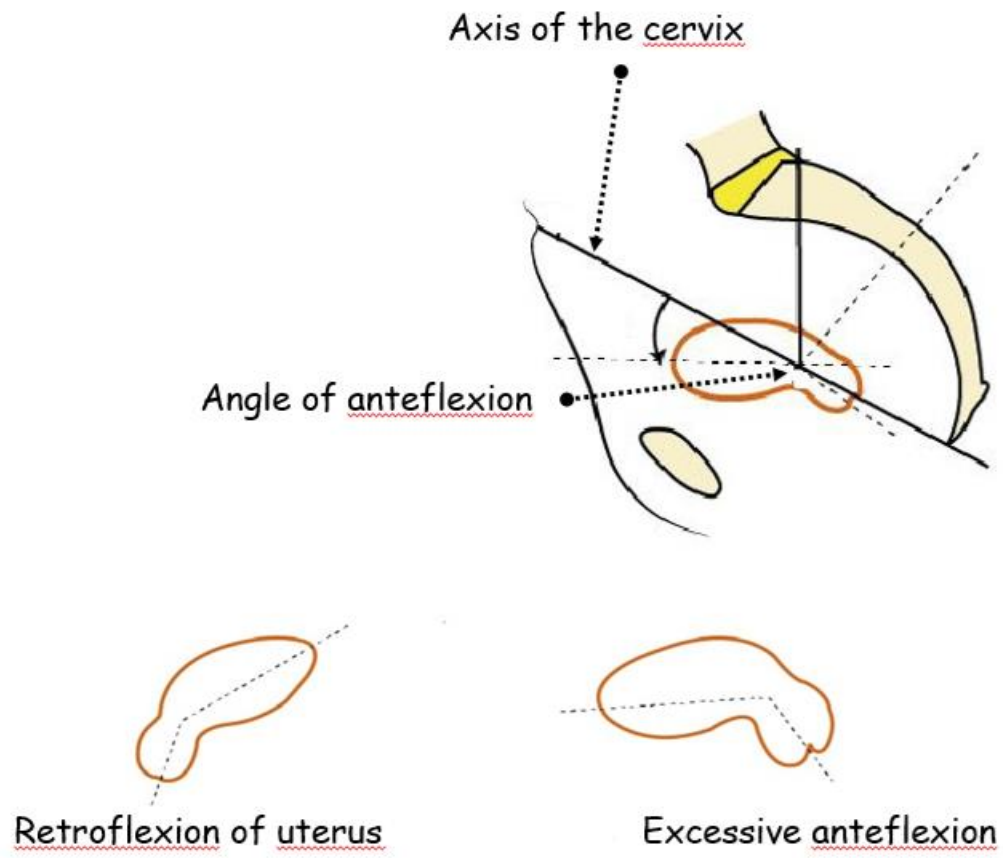

Figure 3: Overview of the orientation of uterus

D- DIMENSIONS

In the virginal state, the uterus is eight centimetres long, five centimetres large and three centimetres thick and weighs fifty grams. In the multiparous, it is ten centimetres long and weighs seventy grams. Its capacity as a hollow organ is virtual and doesn't exceed four millilitres.

The length of the uterus is greatly modified after puberty and is modelled by the corpo-cervical ratio that equals one point five after puberty, this ratio is reversed before puberty in infants.

III. STRUCTURE

As the uterus is a hollow organ, it has a wall and a virtual cavity.

A- UTERINE CAVITY

The cavity of the body of the uterus is a narrow slit, when viewed laterally, and is shaped like an inverted triangle, when viewed anteriorly.

Each of the superior corners of the cavity is continuous with the lumen of a uterine tube through the uterine os of the tube.

The inferior corner is continuous with the central canal of the cervix.

The canal of the cervix is continuous with the cavity of the body at what is commonly called the internal os. It is a real cavity flattened sagittally containing cervical mucus.

The lower opening into the vagina is the external os. Macroscopically, the mucosa of the canal of the cervix contains two palmate folds, anterior and posterior, made of a longitudinal fold with transverse lateral ramifications.

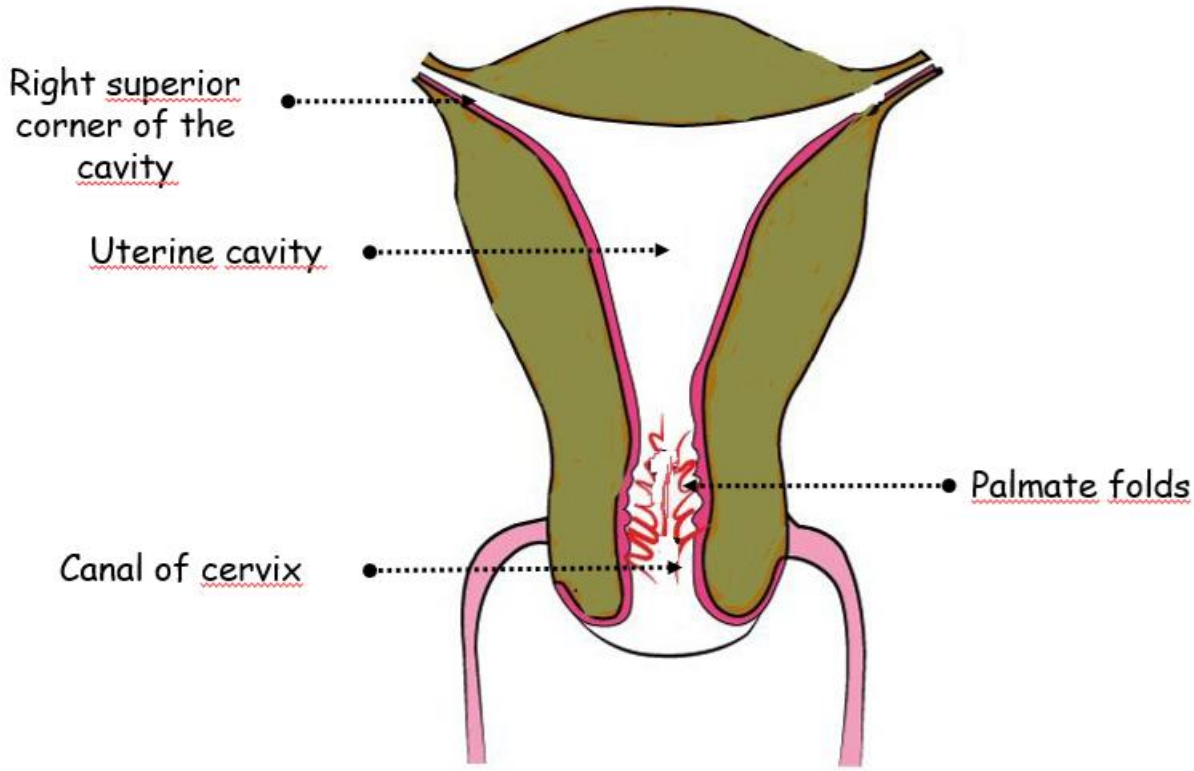

Figure 4: Schematic coronal section of uterus

B- UTERINE WALL

The uterine wall is a thick layered wall made of three layers.

The middle layer, the myometrium, is the bulk of uterus and is made of three ill-defined layers of smooth muscle. The outer muscle fibres tend to be longitudinal and expulsive in function, those more deeply placed are circular and act as sphincters round the larger blood vessels, the openings of the uterine tubes and the internal os. The muscle of the cervix is less developed and is continuous with the vagina.

The inner layer, the endometrium, is lined by columnar epithelium forming the endometrial glands. The lamina propria of the endometrium is made of the basal layer, rich of arteries, and the functional layer containing the spiral arteries. The thickness of this layer changes during the menstrual cycle (under the influence of oestrogen and progesterone) in order to prepare the endometrium to host an embryo. Just inside the external os, the epithelium changes to the stratified squamous variety of the vagina.

The outer layer is made of serosa, the perimetrium, it covers the fundus and the vesical and intestinal surfaces of the body. It is also made of adventitia, it covers the supravaginal part of the cervix and is continuous with the parameter and the paracervix.

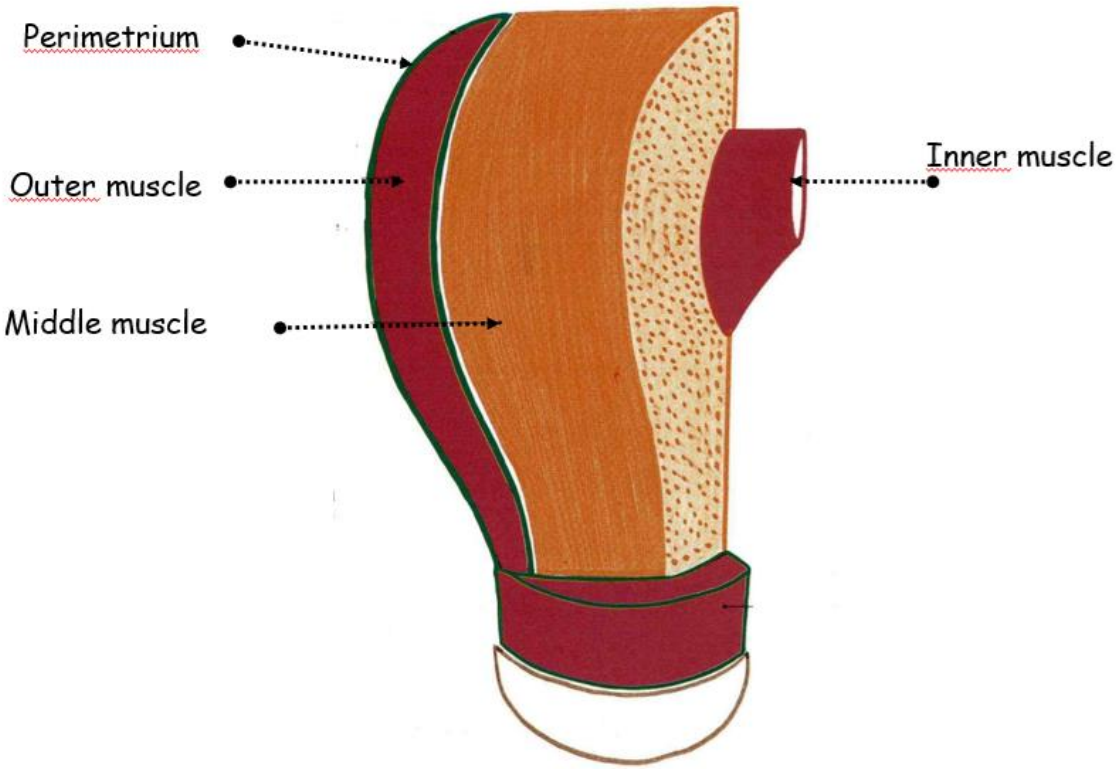

Figure 5: Schematic view showing the structure of uterine wall

IV. SUPPORTS

A- BODY

The body of the uterus is supported by six paired ligaments. In front, the round ligament and the vesico-uterine ligament, backwards, the uterosacral ligament and, laterally, the broad ligament, the parameter and the paracervix. (Figure 6)

The round ligament extends from the junction of the uterus and tube to the fibrofatty tissue of the labium majus of the vulva and mons pubis after travelling the inguinal canal. It is ten to fifteen centimetres long and has two parts, pelvic and inguinal. The pelvic part heads upwards and forwards and lifts the anterior fold of the broad ligament, passes through the paravesical fossa and crosses laterally the inferior epigastric vessels before entering the deep inguinal ring.

The vesicouterine ligament extends from the supravaginal part of the cervix to the base of the bladder above the retrovesical ureter.

The uretrosacral ligament is a condensation of very variable size that extend backwards from the cervix below the peritoneum, embracing the rectouterine pouch and rectum and becoming attached to the fascia over piriformis. They are best palpated on rectal (not vaginal) examination. They keep the cervix braced backwards against the forward pull of the round ligaments on the fundus and so maintain the body of the uterus in anteversion.

The broad ligament is a lax double fold of peritoneum lying lateral to the uterus. Its medial edge is attached to the side wall of the uterus and its lateral edge is attached to the side wall of the pelvis and contains the uterine artery and its corporeal branches.

The lateral ligaments consist of thickenings of connective tissue in the base of each broad ligament, the parameter extends laterally from the supravaginal part of the cervix and contains the uterine artery and the paracervix extends laterally from the vaginal fornix and contains the vaginal arteries. They both end in the side wall of the pelvis and are separated by the ureter.

B- CERVIX

The most fixed part of the uterus is the cervix, because of its attachment to the back of the bladder and to the vaginal fornix, and a number of structures help directly or indirectly to maintain the normal position. These include the pelvic diaphragm, condensations of pelvic fascia and to a lesser extent some peritoneal attachments. The pubovaginalis part of levator ani and the perineal body with its inserted muscles support the vagina and so assist indirectly in holding the cervix up. If these muscles are unduly stretched or damaged during childbirth the posterior vaginal wall sinks downwards (prolapses), and this is often followed by prolapse or retroversion of the uterus.

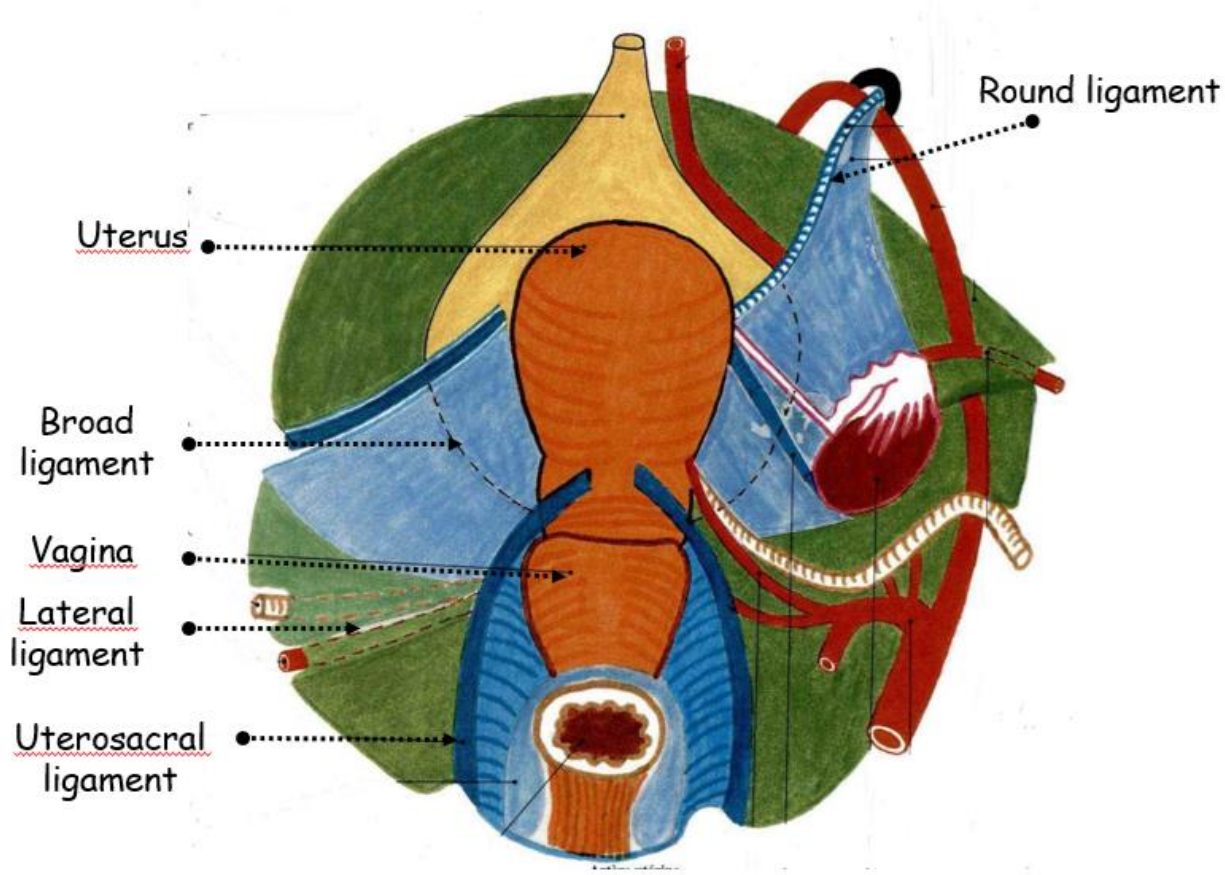

Figure 6: Posterior view of the female internal genital organs

V. ANATOMICAL RELATIONS

A- SUPRAVAGINAL PART

The fundus possesses a serous coat of pelvic peritoneum which continues downwards over the front and back of the body. The intestinal surface is covered by peritoneum that continues from the body on to the upper part of the fornix, forming the anterior wall of the rectouterine pouch (of Douglas). The vesical surface has no peritoneal covering, being deep to the vesicouterine pouch and attached to the bladder above the trigone

by rather dense connective tissue, the vesicouterine septum. Laterally, the peritoneum forms the broad ligament.

Through the lateral ligament about one to two centimetres from the fornix of vagina, the ureter, uterine artery and inferior hypogastric plexus lie on the upper surface of this tissue and the cervical branch of the uterine artery passes through it. Through perimetrium, the uterus is in contact with urinary bladder, forwards, ampulla of rectum backwards and intestinal coils and greater omentum at the top.

B- VAGINAL PART

In front, it is in contact, laterally, with the vaginal arteries, the cervico-vaginal artery, posterior uterine veins, lymphatics and nerves of the uterus in the paracervix, forwards, with the base of the bladder and the retrovesical portion of pelvic ureter and, backwards, with the rectum.

VI. BLOOD SUPPLY; LYMPH DRAINAGE AND NERVE SUPPLY

A- ARTERIES

The arteries of the uterus are the uterine, ovarian and round ligament arteries.

The uterine artery arises from the internal iliac artery and is fifteen centimetres long. Its course in the pelvis is arched and is divided into three parts.

The parietal and retro-ligamentary part passes medially against the pelvic wall until the ischiatic spine and across the pelvic floor and is in contact with, forwards and laterally, the umbilical and obturator arteries, backwards, the vaginal arteries and, medially, the ureter.

The sub-ligamentary part is transverse in the parameter forming a coil in front of the ureter two centimetres outside the supravaginal part of the cervix and one centimetre and half above the vaginal fornix.

The intra-ligamentary part turns upwards between the layers of the broad ligament to run alongside the uterus as far as the entrance of the tube.

The uterine artery gives several branches, before crossing the ureter, five to six vesico-vaginal branches, at the point of the intersection with the ureter, one ureteric branch and, after crossing the ureter, the cervico-vaginal artery, five to six cervical branches, ten corporeal branches, the round ligament artery and one branch for the fundus.

It anastomoses with the ovarian artery through its ovarian and tubal branches, the inferior epigastric artery through the round ligament artery, and between the right and left arteries and the cervical and corporeal branches.

The ovarian artery arises from the abdominal aorta at L2 and ends at the tubal extremity of the ovary giving two branches, the tubal branch anastomoses with the uterine artery and the ovarian branch anastomoses with the ovarian branch of the uterine artery.

The round ligament artery is provided from the inferior epigastric artery.

1.Branches for the ureter
2.Ureter
3.Branches for the bladder
4. Branches for the vagina
5.Branches for the cervix
6.Branches for the body
7.Uterine artery
8.Vaginal azygos artery

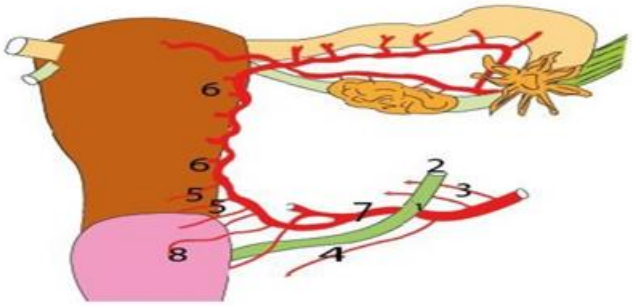

Figure 7: Overview of the branches of uterine artery

B- VEINS

The veins of the uterus course below and behind the artery at the lower edge of the broad ligament where they form a wide plexus across the pelvic floor. This communicates with the vesical and rectal plexuses and drains to the internal iliac veins. The tubal veins join the ovarian veins.

C- LYMPH DRAINAGE

The body and fundus of the uterus normally drain mainly to external iliac nodes, but it is also possible for lymph to reach the inguinal nodes via the round ligament and the inguinal canal. There is only scanty lymphatic drainage along the tube and ovarian vessels to aortic nodes. The cervix drains to external and internal iliac nodes by lymphatic channels that run respectively in front of or behind the ureter, and also to sacral nodes via the uterosacral ligaments.

Note that while lymph from the body of the uterus may reach inguinal nodes, that from the cervix does not. The lymph drainage of uterus is ensured through broad and lateral ligaments.

D- NERVES

The nerves of the uterus are branches from the pelvic plexus, formed by the right and left hypogastric plexuses. Little is known of motor pathways to this organ, whose muscle is so sensitive to hormonal influences. There is evidence that the vasoconstrictor sympathetic supply may also be motor to uterine muscle, but division of all uterine nerves or high transection of the spinal cord does not affect uterine contractility, even in labour. Sensory pathways are better understood although there are still discrepancies. Pain from the cervix is usually considered to be carried by the pelvic splanchnic nerves, although from the upper cervix it appears to run with sympathetic nerves as does pain from the body of the uterus including labour pains). The cord segments concerned are T10-L1, and pain can be referred to the corresponding dermatomes. However, presacral neurectomy (cutting the hypogastric nerves from the superior hypogastric plexus) does not abolish labour pain, although it may improve dysmenorrhoea. The abolition of uterine sensation requires the division of all nerves, or transection of the cord, above T10 level. As with most hollow viscera, distension causes pain, but both the cervix and body are relatively insensitive to cutting and burning; in contrast, the uterine tube is sensitive to touching and cutting.

VII. SURGICAL APPROACH

For total hysterectomy (removal of body and cervix) the broad, round and ovarian ligaments and the uterine tubes are divided on each side near the uterus. The peritoneum of the vesicouterine pouch is incised transversely so that the bladder and lower ends of the ureters can be pulled away from the body of the uterus, cervix and fornix, and the uterine arteries are divided. The uterosacral ligaments are transected and the anterior and posterior vaginal walls are cut across below the cervix. For subtotal hysterectomy the cervix is cut across at the level of the lateral ligaments without opening into the vagina. In any pelvic operation, the ureters are the structures at greatest risk, especially when disease has distorted the normal anatomy.

VIII. CONCLUSION

The uterus is a hollow muscular organ that occupies the middle part of the pelvis, it plays a major role in reproduction, has several peritoneal and visceral relations and rich blood supply. Its lymph drainage is ensured mainly by the external iliac nodes and its motricity is neurohormonal mediated.