Introduction

Uterine fibroids (also referred to as myoma, leiomyoma, leiomyomata, and fibromyoma) are benign tumours that grow within the muscle tissue of the uterus. Between 20-50% of women of childbearing age have uterine fibroids. Fibroid tumors can occur in several different locations within the uterus and are often multiple. Submucosal fibroids are fibroids that grow and bulge into the inner lining of the uterus. Intramural fibroids occur within the muscular wall of the uterus Subserosal fibroids develop on the outside of the uterus *(Houston et al., 2001)*.

While many such tumors are asymptomatic, some are associated with significant and disabling symptoms, ranging from prolonged menstrual periods to urinary frequency, lower back and pelvic pain .The symptoms caused by fibroids can vary significantly depending on the size, number and location of the fibroid tumors. These factors may also affect the best treatment options available to a patient with fibroids *(Arleo et al., 2003)*.

Surgery was the predominant method of treatment for uterine fibroids .By now, interventional radiologists had developed new techniques for

management of uterine fibroids such as uterine artery embolization and high intensity focused ultrasound surgery (HIFU) *(Andrews et al., 2004)*.

Uterine fibroid embolization (UFE) (or uterine artery embolization) shrinks or destroys a uterine fibroid by injecting tiny particles into arteries, closing off the blood supply to the fibroid. It is a minimally-invasive, non-surgical treatment option for many women with uterine fibroid tumor. The procedure is associated with less complications, requires shorter hospitalization during recovery, and allows for preservation of the uterus *(Konez, 2006)*.

High Inenisty Focused ultrasound (HIFU) is one of the newest treatment options available for uterine fibroids. It does however provide an exciting and completely non-invasive treatment option for fibroids. This technology uses an MRI machine to focus ultrasound energy into the fibroid tumors thus heating and killing the tissue *(Kennedy et al., 2003)*.

High Inenisty Focused ultrasound (HIFU) called MR imaging-guided focused ultrasound (MRI-FUS), has become a safe and effective means of performing probe-delivered thermal ablations and minimally invasive surgery *(Jolesz et al., 2005)*.

Aim of the Work

Uterine artery embolisation and HIFU represents a fundamental new approach to the treatment of fibroids.The aim of this study is to compare between these two techniques in treatment of uterine fibroids.

Anatomy of the uterus

Gross anatomy

The uterus is a pear shaped muscular organ, located inside the pelvis immediately dorsal to the urinary bladder and ventral to the rectum ,it is designed for childbearing in which the early embryo implants and develop, it elaborates a supportive structure, the placenta, in conjunction with the embryo, to provide close connections between fetal and maternal circulation for the purpose of exchange nutrients, respiratory gases, wastes, and various regulatory substances; Atypical uterus is approximately 2.5 to 3.5 inches long and 1.5 inches at it's widest point. During pregnancy, its weight increases from about 3 ounces to 2.2 pounds and its capacity increases more than 4000 times. Under normal circumstances the uterus is both antiverted antiflexed *(David and Nayna, 2001)*.

Fig. (1): Anatomy of the uterus and the surrounding organs *(Quoted from Cunningham, 2001)*.
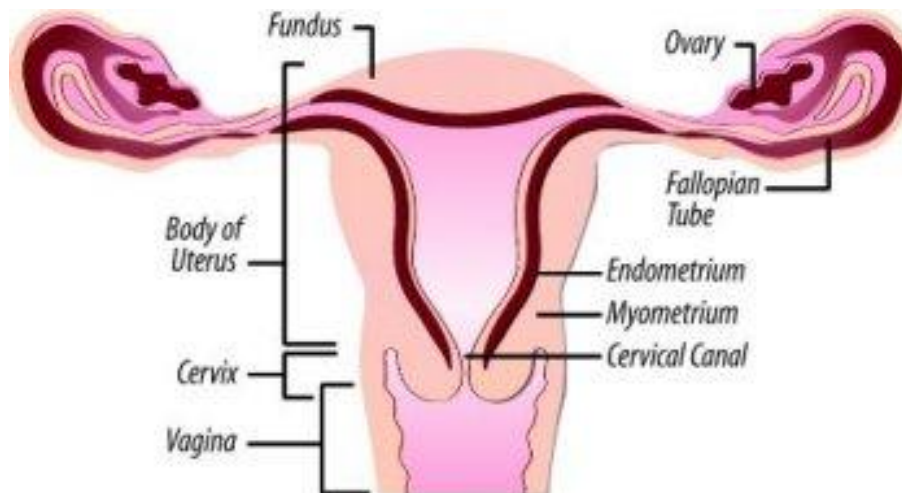

Fig. (2): The uterus is divided into a fundus, body, isthmus, and cervix *(Quoted from Netter, 1991)*.

The fundus is convex in all directions, and covered by peritoneum continuous with that on the vesical and intestinal surfaces. The lateral margins are slightly convex. The uterine tube pierces the

uterine wall at the upper end of each wall. The round ligament of the uterus is fixed below and in front of this point, while behind it is the attachment of the ligament of the ovary. These three structures lie within a fold of peritoneum, which is reflected from the margin of the uterus to the wall of the pelvis, and is named the broad ligament.

The cavity of the Body is a mere slit, flattened antero-posteriorly. It is triangular in shape, the base being formed by the internal surface of the fundus between the orifices of the uterine tubes, the apex by the internal orifice of the uterus.

The isthmus is the short narrowed portion of the uterus located inferior to the body and superior to the cervix.

The Cervix (neck of the uterus): The cervix is the lowest constricted segment of the uterus. It is somewhat conical in shape, with its truncated apex directed downward and backward,   but is slightly wider in the middle   than either above or below. Owing to its relationships, it is less freely movable than the body, so that the latter may bend on it. The long axis of the cervix is therefore seldom in the same straight line as the long axis of the body. The long axis of the uterus as a whole presents the form of a curved

line with its concavity forward, or in extreme cases may present an angular bend at the region of the isthmus *(Williams et al., 1995)*.

- The cervix projects through the anterior wall of the vagina, which divides it into an upper, supravaginal portion, and a lower, vaginal portion *(Clare, 1995)*.

- The supravaginal portion is separated in front from the bladder by fibrous tissue (parametrium), which extends also on to its sides and lateral ward between the layers of the broad ligaments, Posteriorly, the supravaginal cervix is covered by peritoneum, which is prolonged below on to the posterior vaginal wall, when it is reflected on to the rectum, forming the recto uterine excavation.

- The vaginal portion of the cervix projects free into the anterior wall of the vagina between the anterior and posterior fornices. The cavity of the cervix communicates with that of the vagina through a small, depressed, somewhat circular aperture, the external orifice of the uterus.

- The uterine tubes open into its upper part, one on either side, while below, its cavity communicates with that of the vagina.
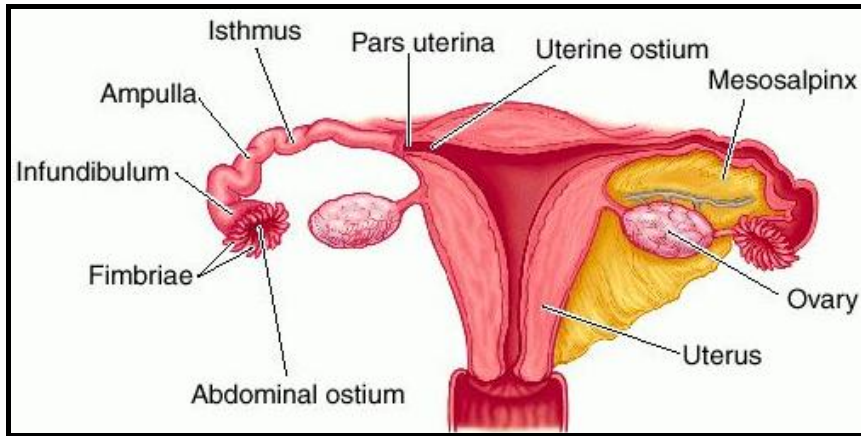
(Williams et al., 1995)

Fig. (3): Uterus and uterine tubes *(Quoted from Williams et al., 1995)*.

The (Uterine) fallopian tubes: The fallopian tubes are positioned between the ovaries and the uterus each is divided into parts: fimbrae, infundibulum, ampulla, tube or duct proper and isthmus which merge with uterus.

Fig. (4): Parts of fallopian tube *(Quoted from Berger, 2008)*.

- Infundibulum:the expanded funnel shaped distal end of the uterine tube.

- Fimbrae: the fringe of finger like projections of tissue at the distal ends of the uterine tubes.

- Ampulla: the goblet shaped dilatation near the distal end of the uterine tube which merges with the infundibulum to which the fimbriae are attached.

(Moore, 1998)

The vagina is the muscular canal lined with mucus membranes that extend from outside of the body to the cervix of the uterus. It also is known as the birth canal *(Moore, 1998)*.

The layers of the uterus are from inner most to outermost are as follows *(Gray et al., 1995)*:

- *Endometrium*: the inner glandular mucus membrane that lines the uterine cavity.

- *Myometrium*: it is the middle layer which consists of smooth muscles, its inner most layer is known as the juntional zone. The main branches of blood vessels and nerves of uterus are located in the myometrium.

- *Perimetrium*: is the outer serous lining of the uterus, a portion of the visceral peritoneum.
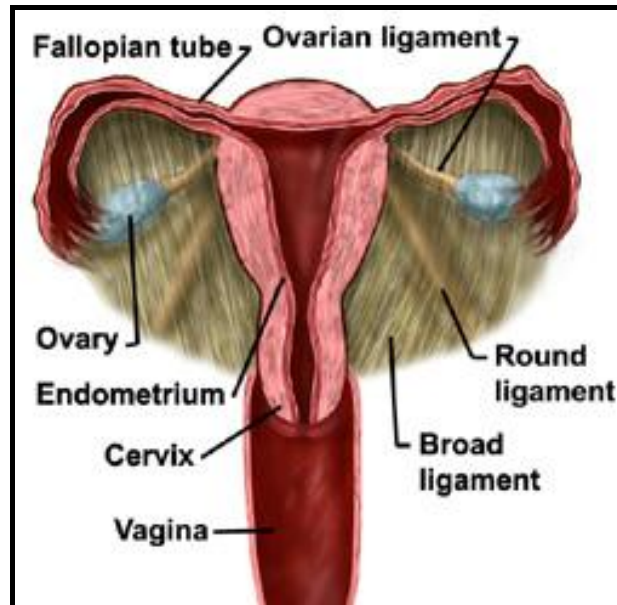
- *Peritonium*: which surrounds the uterus.

Ligments:

Fig. (5): Uterus and uterine ligments as seen from infront *(Quoted from www.surgery.Com)*.

The uterus is held in place by the following ligaments:

The ligaments of the uterus are eight in number: one anterior; one posterior; two lateral or broad; two uterosacral; and two round ligaments *(Holt et al., 1994)*.

1. The anterior ligament consists of the vesicouterine fold of peritoneum, which is reflected on to the bladder from the front of the uterus, at the junction of the cervix and body.

2. The posterior ligament consists of the recto-vaginal fold of peritoneum, which is reflected from the back

of the posterior fornix of the vagina on to the front of the rectum. These folds are named the sacrogenital or recto uterine folds. They contain a considerable amount of fibrous tissue and non-striped muscular fibers which are attached to the front of the sacrum and constitute the uterosacral ligaments.

3. The two lateral or broad ligaments pass from the sides of the uterus to the lateral walls of the pelvis. Together with the uterus they form a septum across the female pelvis, dividing that cavity into: anterior part containing the bladder, posterior part containing the rectum, and in certain conditions some coils of the small intestine and a part of the sigmoid colon. Between the two layers of each broad ligament are contained: (1) the uterine tube superiorly; (2) the round ligament of the uterus; (3) the ovary and its ligament; (4) the epoophoron and paroophoron; (5) connective tissue; (6) unstriped muscular fibers; (7) blood vessels and nerves.

4. The round ligaments are two flattened bands between 10 and 12 cm in length, situated between the layers of the broad ligament in front of and below the uterine tubes. The round ligaments consist principally of muscular tissue, some fibrous and areolar tissue, besides blood vessels, lymphatics; and nerves, enclosed in a duplicature of peritoneum.

In addition to the ligaments just described, there is a band named the ligamentum transversalis colli (Mackenrodt) on either side of the cervix uteri. It is attached to the sides of the cervix and to the vault and lateral fornix of the vagina, and is continuous externally with the fibrous tissue, which surrounds the pelvic blood vessels *(Moore, 1998)*.
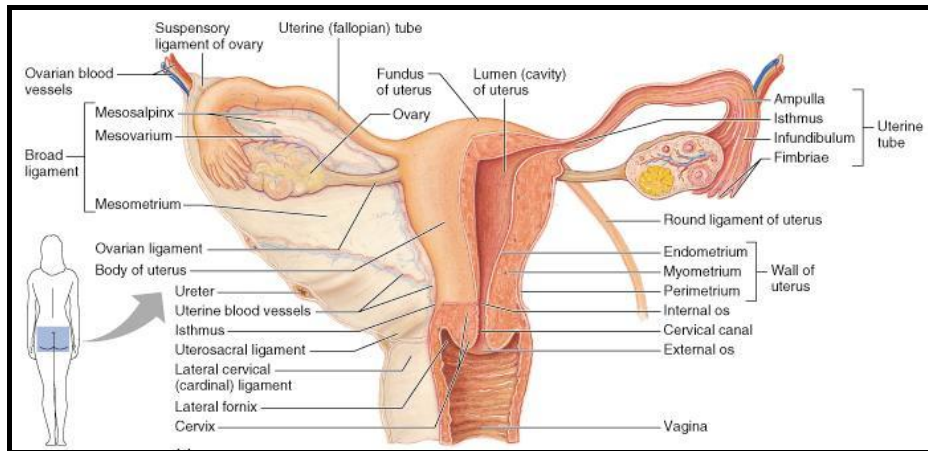

Fig. (6): Normal uterine anatomy-cut section *(Quoted from Cunningham, 2001)*.

Vessels and nerves of the uterus:

A- Arterial supply

The arteries of the uterus are the uterine, from the internal iliac artery, and the ovarian, from the abdominal aorta (Fig. 6). They are remarkable for their tortuous course in the substance of the organ, and for their frequent anastomoses. The uterine arteries pass medially from the pelvic sidewalls and run to the lateral borders of the cervix. Here, each

divides into a descending vaginal branch and a larger uterine branch that ascend along the lateral margin of the uterus supplying it by curving branches known as arcuate artery. The terminal portion of the main trunks continues along the fallopian tubes each ending in small ovarian branches. The termination of the ovarian artery meets that of the uterine artery *(David and Nayna, 2001)*.
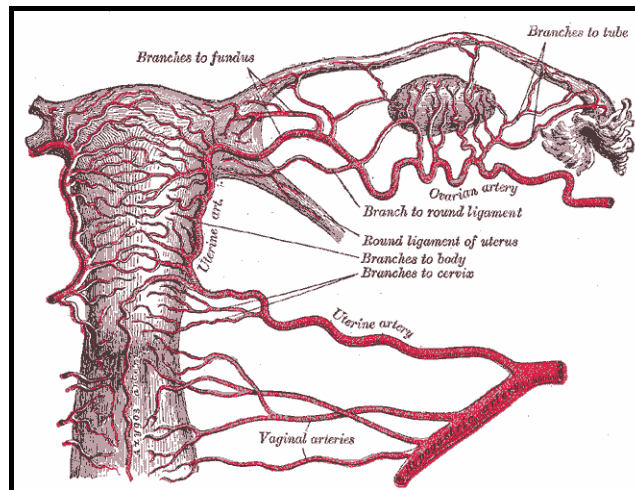

Fig. (7): The arteries of the internal genital organs of the female, seen from behind *(Quoted from Williams et al., 1995)*.

Arterial supply of the female pelvis:

Internal Iliac Artery (Hypogastric Artery)

The internal iliac artery (the Hypogastric artery) supplies the pelvic walls and the pelvic viscera.The internal iliac artery terminates in two main stems (bifurcation), one anterior and one posterior. The anterior branches (visceral and parietal) of the internal iliac artery include the inferior gluteal,

obturator, internal pudendal, vesical, middle hemorrhoidal, and genital (uterine and vaginal) arteries. The posterior branches (parietal only) include the superior gluteal, iliolumbar, and lateral sacral arteries. Absence of the internal iliac artery is rarely observed *(Pelage et al., 2005)*.

Uterine Artery

The uterine artery is the second branch of the anterior division of the internal iliac artery (after the inferior gluteal artery) in 51% of cases. In 6% of cases, the uterine artery is the first branch of the internal iliac artery above the level of the inferior gluteal and superior gluteal arteries. The uterine artery has a characteristic *U* shape, with a descending segment that parallels the lateral pelvic wall, a transverse segment that crosses the distal ureter at the level of the cervix, and an ascending segment that courses along the uterine margin at the medial edge of the broad ligament. The uterine artery may have a common trunk with the vesical or vaginal artery. The uterine artery has several branches: the cervico-vaginal artery, which arises from the transverse segment and which should be spared during embolization, and the intramural (arcuate) arteries, which course through the outer third of the myometrium. The uterine artery may be replaced

by small arterial branches or may be absent; it is often replaced by the ipsilateral ovarian artery. The congenital absence of both uterine arteries is encountered in less than 1% of cases. The presence of aberrant uterine vessels that originate in the abdominal aorta also has been reported *(Pelage et al., 2005)*.

The ovarian artery arises anteromedially from the abdominal aorta a few centimeters below the renal arteries in 80%-90% of cases and has a characteristic corkscrew appearance. Rarely, the ovarian artery arises from the renal, lumbar, adrenal, or iliac artery. Identification of the normal ovarian artery is not usually possible with angiography because of the small diameter of the artery (usually, less than 1mm). The ovaries are supplied by ovarian arteries in 40% of cases, by both uterine and ovarian arteries in 56% of cases, and by uterine arteries alone in 4% of cases.

Arterial Anastomoses

There are two different types of arterial anasto-moses between the uterine arteries and the ovarian arteries: left-to-right anastomoses (between the left and the right uterine arteries) and utero-ovarian anastomo-ses (between the uterine artery and the ovarian artery). Left-to-right anastomoses are visible in about 10% of cases, and utero-ovarian anastomoses are identified in

15