Sudan University of Science and Technology College of Graduate Studies
Medical Diagnostic Ultrasound Program

Study of Pelvic Pain on Non Pregnant Women Using Ultrasonography

دراسة آلام الحوض لدي النساء غير الحوامل باستخدام الموجات فوق الصوتية

A Thesis Submitted for partial fulfillment for the requirement of (M.Sc.) degree in Medical Diagnostic Ultrasound

Prepared by:

Ferdous Yousif Rahmtallah Fadl Elkream

Supervisor

Dr. Ekhlas Abdelaziz Hassan

November 2018

الآية

قال تعالى:

﴿ تَبَارَكَ الَّذِي بِيَدِهِ الْمُلْكُ وَهُوَ عَلَى كُلِّ شَيْءٍ قَدِيرٌ ﴿ 1 ﴾ الَّذِي خَلَقَ الْمَوْتَ وَالْحَيَاةَ لِيَبْلُوَكُمْ أَيُّكُمْ أَحْسَنُ عَمَلًا وَهُوَ الْعَزِيزُ الْغَفُورُ ﴿ 2 ﴾ .

صدق الله العظيم

سورة الملك الآية 1 - 2

Dedication

Praise and love be to my family

Soul of my father

My respective mother

Lovely sisters and brothers

My son

My uncles

To my husband who have been my constant source of Encouragement

To all who care me

Acknowledgements

Alhamdulillah, all praises to Allah for granting competence to completing this work.

I acknowledge my family who supported me throughout my whole life, Dr. **IKhlas Abdelaziz** whose support encouragement and guidance paved my way for this long journey.

I am very grate full to the staff in Al managil teaching hospital and medical center in Almanagil for their cooperation and patience.

Thank you all for being the stem of my work and all person which guided me through this journey.

ABSTRACT

Pelvic pain may be the manifestations of various gynecologic and non gynecologic disorders in female. From less effecting rupture of the follicular cyst to life threatening conditions such as perforation of inflamed appendix.

This research aimed to know the role of ultrasound in diagnosis of different types female pelvic pain causes in gynecological and non gynecological etiology that may affect anatomy and function .

This data were collected from all female suffer from pelvic pain and come to al managil teaching hospital and some medical center in al managil area from twenty of July to twenty five of October.

This study included 60 female patients. The age of patients was ranged between 17- 70 years . 50 female patients were married and 10 were single patients ,and this study concluded that most cause of female pelvic pain is ovarian cyst.

The first chapter is an introduction about the key words of the title as well as the general and specific objectives to enumerate the step and variables of the study also the problem and significant of the study to conduct the research and why about the pelvic pain in the female although overview is added in this chapter.

The second chapter gives the previous literature also include anatomy , physiology , pathology , normal sonogrphic appearance of uterus and ovaries and the modalities used to diagnosed female pelvic and sonographic appearance of causes of female pelvic pain.

The third chapter include the technical methods and tools as well as the material and procedures important to collect data were mentioned ,also technique and the statistical methods used (SPSS).

The fourth chapter include the results and data analysis.

The fifth chapter described the discussion , conclusion and recommendations. In the discussion chapter we found that there is relationship between age and social status from one side and from other side cause of female pelvic pain but it not strong , most of female with pelvic pain in this study were married and in reproductive age.

المستخلص

آلام الحوض قد تكون اشاره للعديد من اضطرابات الأعضاء التناسلية وغير التناسلية لدي النساء ابتداء من أقلاها تمزق الكيس الوظيفي للمبيض إلي أكثرها خطورة مثل انفجار الزائدة الدودية الملتهبة

تهدف هذه الدراسة لمعرفه دور الموجات فوق الصوتية في تشخيص وتحديد أسباب الآم الحوض عند النساء في الأعضاء التناسلية وغير التناسلية التي تؤثر في التشريح والوظيفة .

جمعت بيانات هذه الدراسة من كل النساء اللاتي أتين بشكوى من الآم الحوض في مستشفي المناقل التعليمي وبعض المراكز الطبية في منطقه المناقل في الفترة من 20 يوليو إلي 25 اكتوبر.

احتوت هذه الدراسة علي 60 من النساء تتراوح أعمارهن بين17 إلي 70 سنه ' 50 متزوجات و 10 غير متزوجات . وخلصت هذه الدر اسه أن اغلب آلام الحوض سببها أكياس المبيض.

قسمت هذه الدراسة إلي خمسه فصول:

يحتوي الفصل الأول علي المقدمة والأهداف للدر اسه ومشكله البحث .

الفصل الثاني يشمل البحوث والدراسات السابقة ' التشريح ' وظائف الأعضاء ' علم أمراض الحوض والظهور الطبيعي لأعضاء الحوض باستخدام الموجات فوق الصوتية 'كذلك يشمل طرق التصوير الاخري لتصوير الحوض ' وظهور الأمراض التي تسبب الآم الحوض عند النساء باستخدام الموجات فوق الصوتية .

الفصل الثالث يحتوي علي الطرق والأدوات التقنية لجمع البيانات بالاضافه إلي حزمه التحليل الإحصائي .

الفصل الرابع يتضمن تحليل البيانات والنتائج .

الفصل الخامس يشمل المناقشة والخاتمة والتوصيات.

خلصت هذه الدر اسه إلي العلاقة بين آلام الحوض عند النساء و العمر و الحالة الاجتماعية ' في هذه الدراسة وجدنا معظم آلام الحوض عند النساء المتزوجات واللاتي في عمر الإنجاب.

List of contents

List of Tables

Table **Page**

List of Figures

Abbreviations

IVC : inferior vena cava.

FSH : follicular stimulating hormone.

PID : pelvic inflammatory disease.

STD : sexually transmitted disease.

IBD: inflammatory bowel disease.

IBS :irritable bowel syndrome.

RLQ :right lower quadrant.

IUCDs :intra uterine contraceptive devices.

HyCoSy : Hysterosalpingo- contrast- sonography.

SIS : saline infused sonography.

3D : three dimensional.

AIUM : American Institute for ultrasound in Medicine.

HSG : hystero salpingography .

TVS : transvaginal ultrasonography .

USG :ultra sonography .

RIF :right iliac fossa .

LIF: left iliac fossa.

SPSS : statistical package of social studies.

Chapter One

Introduction

1-1 Introduction

pelvic pain is a symptom that can affect both men and women. The pain that persists for a period of 6 months or more to be considered chronic while less than this duration is considered acute**(MarekJantos2007)**.

The pelvic ultrasound scan has become an essential extension of the clinical examination in gynecology. The investigation of abnormal uterine bleeding has been transformed by the use of transvaginal ultrasound to assess the endometrial cavity, which allows hysteroscopy to be reserved for those patients requiring resection of submucous fibroids or endometrial polyps. In many cases, adnexal masses can be fully characterized using ultrasound, and 3D ultrasound has become the method of choice in the assessment of congenital uterine anomalies. A successful ultrasound examination of the pelvis cannot be achieved without knowledge of a woman's full clinical history. Throughout the menstrual cycle, the uterus and ovaries are subject to a range of functional changes that are a reflection of the hormonal milieu. The use of contraceptives such as the progesterone-only pill causes an increased incidence of functional ovarian cysts and a thin endometrial echo, whereas tamoxifen increases the endometrial thickness and predisposes towards the development of endometrial polyps. As postmenopausal ovaries no longer undergo cyclical changes, the knowledge of the menopausal status of a woman can avoid an incorrect diagnosis of a functional cyst. Gynecological malignancy is more common in the menopause, the risk increases with age and a family or personal history of breast, ovarian, endometrial or bowel cancer**(Trish chudleigh et al 2004).**

A correct diagnosis at an earlier , less complicated stage could save the patient from a catastr ophic outcome

Thus the sonographer is personnel that are involved in the evaluation should have affirm understanding of the general symptomatology behind the various etiologies of pelvic pain. Initially, the most important aspect of the evaluation is taking the patients history. This guide the procedure that might be utilized in making the diagnosis. Supplying this information to the pelvic ultrasound will usually examine a number of anatomic structure **(Rochelle 1988) .**

1-2 Problem of study:

A lot of women attended in gynecological departments complaining of pelvic pain . The numbers of radiological investigation was done by using ionizing radiation which can affect pelvic organs. Thus the goal of imaging to make the most accurate diagnosis using the least amount of radiation. This study aims to determine pelvic pathology in patient with pelvic pain by ultrasound.

1-3 Objectives of the study:

1-3-1 General objective:

Study of pelvic pain on non pregnant women using ultrasonography.

1-3-2 Specific objectives:

-To evaluate the ability of ultrasound in the diagnosis of female patient that present with pelvic pain.

-To determine relation between cause an age.

-To identify the nature of ovarian cysts(simple , complex ,chocolate cyst).

-To assess the different inflammatory conditions(salpingitis ,uteritis , cervicitis and cystitis).

-To diagnose the appendicitis in female patients suffer from pelvic pain.

-To show the lower ureteric stone.

-To characterize the masses (fibroid , ovarian and pelvic mass).

- To identify the degree of ovarian torsion.

1-4 Hypothesis

Ultrasound is an effective modality in evaluation of pelvic diseases in female complain of pelvic pain.

1-5 Significance of the study:

Diagnosis of female pelvic pain is very important . we can select the best method in diagnose Thus Ultrasound play important role in diagnosis of female pelvic pain.

1-6 Over view of study

Chapter one: Introduction, problem of study, objectives, Hypothesis, Significant of study, over view of study .

Chapter two: Theoretical background and Literature reviews

Chapter three: Materials and methods.

Chapter four: Results.

Chapter five: Discussion, conclusion &Recommendation.

Finally References and Appendices .

Chapter Two

Theoretical background and Literature Reviews

CHAPTER TWO

Theoretical background and Literature Reviews

Firstly I will review the anatomy, physiology, imaging modalities used in the female pelvis and sonographic features of female pelvis and secondly the pathological features in these organs in females with pelvic pain and previous studies.

2-1 Anatomy

In human anatomy, the **pelvis** (plural **pelvis** or **pelvises**) is either the lower part of the trunk, between the abdomen and the thighs (sometimes also called **pelvic region** of the trunk), or the skeleton embedded in it (sometimes also called **bony pelvis**, or **pelvic skeleton**). The pelvic region of the trunk includes the bony pelvis, the pelvic cavity (the space enclosed by the bony pelvis), the pelvic floor, below the pelvic cavity, and the perineum, below the pelvic floor. The pelvic skeleton is formed in the area of the back, by the sacrum and the coccyx and anteriorly and to the left and right sides, by a pair of hip bones. The two hip bones connect the spine with the lower limbs. They are attached to the sacrum posteriorly, connected to each other anteriorly, and joined with the two femurs at the hip joints. the gap enclosed by the bony pelvis, called the pelvic cavity, is the section of the body underneath the abdomen and mainly consists of the reproductive organs (sex organs) and the rectum **(Marek Jantos 2007) .**

The skeleton of the pelvis is a basin-shaped ring of bones connecting the vertebral column to the femora. Its primary functions are to bear the weight of the upper body when sitting and standing; transfer that weight from the axial skeleton to the lower appendicular skeleton when standing and walking; and provide attachments for and withstand the forces of the

powerful muscles of locomotion and posture. Compared to the shoulder girdle, the pelvic girdle is thus strong and rigid. Its secondary functions are to contain and protect the pelvic and abdominopelvic viscera (inferior parts of the urinary tracts, internal reproductive organs); provide attachment for external reproductive organs and associated muscles and membranes. **(MarekJantos 2007).**

2-1-1 Vagina

The vagina is a collapsed muscular tube that extends from the external genitalia to the cervix of the uterus. It lies posterior to the urinary bladder and urethra, and anterior to the rectum and anus. It is normally directed upward and backward, forming a 90-degree angle with the uterine cervix. It measures approximately 9 cm in length and is longest along its posterior wall. The vaginal canal is a potential space in which the anterior and posterior walls usually touch. It is the passageway for the products of menstruation and is easily distended during sexual intercourse and childbirth. The vagina has a mucous membrane lining its muscular walls. This membrane receives secretions from the vaginal wall, the mucous glands of the cervix (around ovulation), and the vestibular glands of the vagina (during sexual excitement) **(Sandra L 2012).**

The uterine cervix protrudes into the upper portion of the vaginal canal, forming four arch like recesses called *fornices.* The posterior vaginal wall attaches higher on the cervix, and the fornices are blind pockets formed by the inner surface of the vaginal walls and the outer surface of the cervix. It is a continuous ring-shaped space with the posterior fornix running deeper than its anterior counterpart. This design eases the use of the transvaginal probe and concomitant visualization of the cervix and uterus **(Sandra L 2012).**

2-1-2Uterus

The uterus and vagina are derived from the embryonic müllerian (paramesonephric) ducts as they elongate, fuse, and form a lumen between the 7th and 12th weeks of embryonic development. The uterus is pear-shaped and is the largest organ in the normal female pelvis when the urinary bladder is empty . The average menarcheal uterus measures approximately 6 to 8 cm in length and 3 to 5 cm in anteroposterior and transverse dimensions. The size of the uterus varies with age and parity .

The uterus consists of a fundus, body, and cervix. The fundus is the widest and most the cervix. This is the point where the uterus bends anteriorly (anteversion) or posteriorly (retroversion) with an empty bladder. The uterine wall consists of three histologic layers: the serosa or **perimetrium,** the myometrium, and the endometrium. The external layer, the serosa, reflects on the anterior surface of the uterus at the isthmus. The muscular middle layer, the myometrium, is the thickest layer of the uterus and is primarily smooth muscle that is longitudinal and circular. The mucous membrane, glandular tissue lining the uterine cavity is the endometrium **(Sandra L 2012).**

The endometrium consists primarily of two layers: the superficial functional layer (zona functionalis) and the deep basal layer (zona basalis). The functional layer is a superficial layer of glands and stroma (supporting tissue) that sheds with **menses.** The basal layer is a thin layer of the blind ends of endometrial glands that regenerates new endometrium after menses. The endometrium changes dynamically in response to the cyclic hormonal flux of ovulation and varies in sonographic appearance and histologic structure, depending on the patient's menstrual status and the period of life in which it is studied **(Sandra L 2012).**

2-1-3 Fallopian Tubes:

The fallopian tubes, or oviducts, are coiled, muscular tubes that open into the peritoneal cavity at their lateral end. They are approximately 10 to 12 cm in length and 1 to 4 mm in diameter. The fallopian tubes lie superior to the utero-ovarian ligaments, round ligaments, and tubo ovarian blood vessels. They are contained in the upper margin of the broad ligament and extend from the cornua of the uterus laterally, where they curve over the ovary. The fallopian tubes are divided into four anatomic portions : infundibulum (lateral segment), ampulla (middle segment), isthmus (medial segment), and interstitial portion (segment that passes through the uterine cornua). The interstitial portion is the narrowest segment of the fallopian tube. The tube widens as it extends laterally, with the infundibulum being the wide,trumpet-shaped, lateral portion. The infundibulum is often referred to as the fimbriated end of the fallopian tube because it contains fringelike extensions, called *fimbriae*, which move over the ovary, directing the ovum into the fallopian tube after ovulation. The ampulla is the longest and most coiled portion of the fallopian tube and is the area in which fertilization of the ovum most often occurs because it is the most distensible region of the tube. The innermost region of the fallopian tube, with its mucosal layer, runs directly into the mucosal layer of the uterus (the endometrium). The continuous nature of the endometrium and the endocervical canal can act as a pathway for organisms, infection, and hemorrhage, because it is the most distensible **(Sandra L 2012).**

2-1-4 Ovaries:

The ovaries are almond-shaped structures, measuring approximately 3 cm long in a menarcheal female They usually lie posterior to the uterus at the level of the cornua. They are suspended from the posterior aspect of the broad ligament in a fold of peritoneum called the mesovarium. The

ovaries are usually located medial to the external iliac vessels and anterior to the internal iliac vessels and ureter . **(Sandra L 2012).**

2-1-5 Ureters:

The ureters are two muscular tubes whose peristaltic contractions convey urine from the kidney to the urinary bladder. each measures 25-30 cm in length , is thick walled and narrow. the diameter of ureter is normally 3mm, but is slightly less at its junction with the renal pelvis and where it runs within the wall of the urinary bladder which is its narrowest part. These are the commonest sites for renal stone impaction. The lower end of the ureters can be observed by scanning through a full bladder which provide a use full acoustic window. **(Palmer, P.E.S 1995**).

2-1-6 Urinary bladder:

The urinary bladder is a reservoir , it is size, shape, position and relation all vary according to its content and the state of neighbouring viscera. When the bladder is empty ,it lies entirely in the lesser pelvis , but as it distends it expand anterosuperiorly in to the abdominal cavity . An empty bladder is somewhat tetrahedral and has base(fundus), neck, apex a superior and two inferolateral surfaces**. (Standring, S 2008).**

2-1-7 Urethra:

The female urethra is about 4cm long. Below the bladder neck it is embedded in the anterior vaginal wall, and the smooth muscle layers of the two structures intermingle **(Golden 1996).**

2-1-8 Pelvic Recesses And Bowel:

The peritoneal cavity contains two potential spaces formed by the caudal portion of the parietal peritoneum. These potential spaces are sonographically significant in that fluid may accumulate or pathology may be present in these locations. The **vesicouterine recess (pouch),** or anterior cul-de-sac, is located anterior to the fundus of the uterus between the urinary bladder and the uterus, whereas the **rectouterine recess**

(pouch), or posterior cul-de-sac, is located posterior to the uterus between the uterus and the rectum. The rectouterine pouch is often referred to as the *pouch of Douglas* and is normally the most inferior and most posterior region of the peritoneal cavity. One additional area that is sonographically significant is the retropubic space (also called the **space of Retzius**). It can be identified between the anterior bladder wall and the pubic symphysis. This space normally contains subcutaneous fat, but a hematoma or abscess in this location may displace the urinary bladder posteriorly. It is normal to observe a small accumulation of free fluid throughout the menstrual cycle in the posterior cul-de-sac. The greatest quantity of free fluid in the cul-de-sac normally occurs immediately following ovulation when the mature follicle ruptures. A small amount of fluid in the posterior cul-de-sac is considered normal; however, there is no sonographic means of confirming that the fluid is related to ovulation. Hemorrhage or infection within the fluid may be related to a ruptured cyst, ascites, a ruptured corpus luteum cyst, ectopic pregnancy, or pelvic inflammatory disease **(Sandra L 2012).**

The pelvic region also holds several digestive organs. these include the large intestine and small intestine. Both are vital to digesting food and expelling solid waste. The large intestine end in the rear of the pelvis at the anus, sphincter muscle that controls the disposal of solid waste. The intestines are supported by a series of muscles known as pelvic floor. These muscles also help the anus function as well as help push baby through the vaginal opening during childbirth **(Golden 1996).**

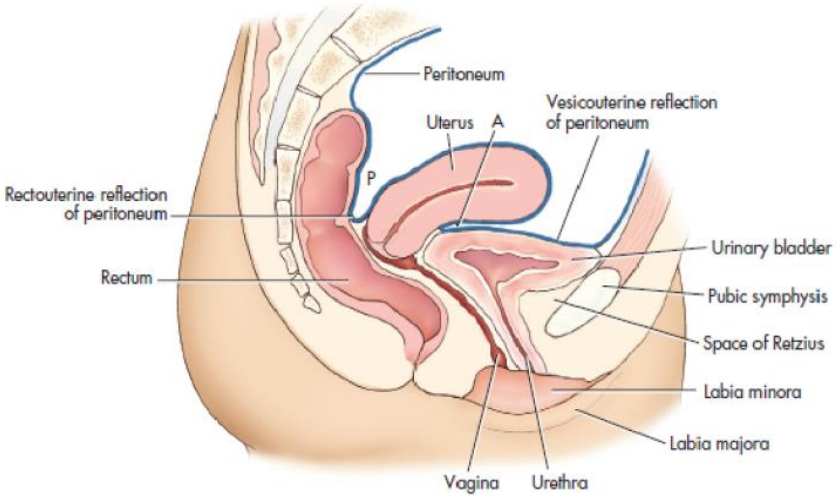


Figure 2-1 The peritoneum drapes over the uterine fundus and body to divide the pelvis into anterior *(A)* and posterior *(P)* sections. The peritoneum extends laterally from the uterus, forming the broad ligaments and creating the mesosalpinx as it folds over the fallopian tubes. The mesovarium is another fold of the peritoneum, which forms posterior to the broad ligament as it folds over the ovary**(Sandra L 2012)** .

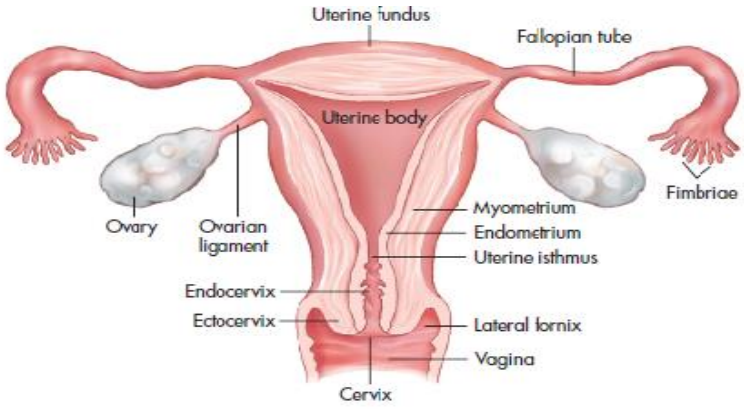


Figure 2-2 Normal female pelvic anatomy **(Sandra L 2012).**

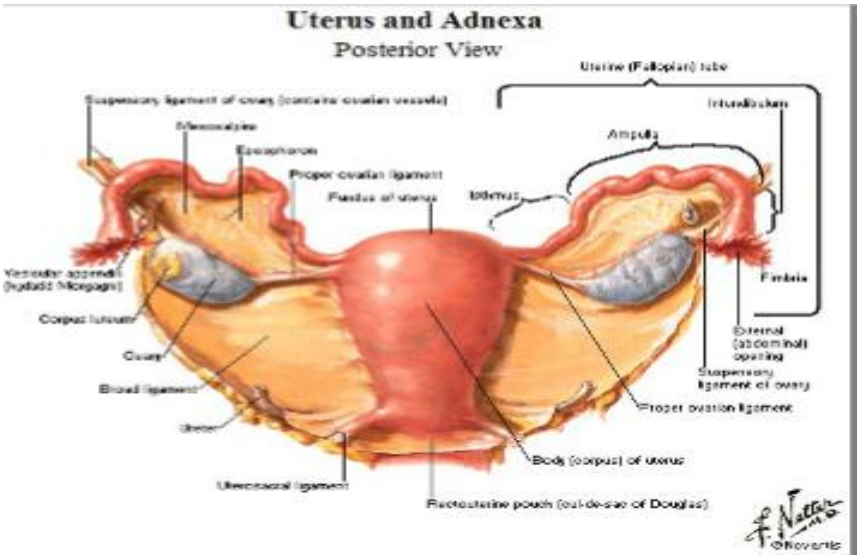


Figure 2-3 Show the posterior view of female reproductive system (Golden 1996).

2-2 Physiology:

2-2-1 *Pelvic vasculature*

The common iliac arteries course anterior and medial to the psoas muscles, providing blood to the pelvic cavity and lower extremities. The common iliac arteries normally bifurcate into the external and internal iliac (hypogastric) arteries at the level of the superior margin of the sacrum .The external iliac arteries course along the pelvic brim and continue inferiorly as the common femoral arteries, supplying blood to the lower extremities. The internal iliac arteries extend into the pelvic cavity, along the posterior wall, and provide multiple branches that perfuse the pelvic structures to include the urinary bladder, uterus, vagina, and rectum. The ovarian veins follow a slightly different course, as the left ovarian vein drains into the left renal vein, whereas the right ovarian vein drains directly into the inferior vena cava (IVC) **(Sandra L 2012).**

2-2-2 Blood supply to uterus:

Blood is supplied to the uterus by the uterine artery, which arises from the anterior branch of the internal iliac artery . From the internal iliac artery, the uterine artery crosses above and anterior to the ureter, extending

medially in the base of the broad ligament to the uterus at the level of the cervix. The uterine artery is tortuous and spirals up the sides of the uterus within the broad ligament to the cornua, where it courses laterally to anastomose with the ovarian artery. The uterine artery gives off many branches that perforate the serosa and carry blood to the myometrium . These branches anastomose extensively anteriorly and posteriorly within the myometrium, forming arcuate (arclike) vessels that encircle the uterus. The arcuate vessels can often be identified sonographically as anechoic tubular structures in the outer third of the myometrium.

Blood is supplied to the endometrium by the radial arteries, which "radiate" from the arcuate arteries within the myometrium. The radial arteries extend through the myometrium to the base of the endometrium, where straight and spiral arteries branch off the radial arteries to supply the zona basalis of the endometrium. The spiral arteries will lengthen during regeneration of the endometrium after menses to traverse the endometrium and supply the zona functionalis. Blood from the spiral arteries is shed during menses. The pelvic vessels supply blood to the functional layer of the endometrium **(Sandra L 2012).**

Lymph drainage is along the ovarian vessels to pre aortic lymph nodes at the level of the first and second lumber vertebra. Lymphatic vessels drain to internal and external iliac lymph nodes and Para-aortic nodes (Hudelist 2011).

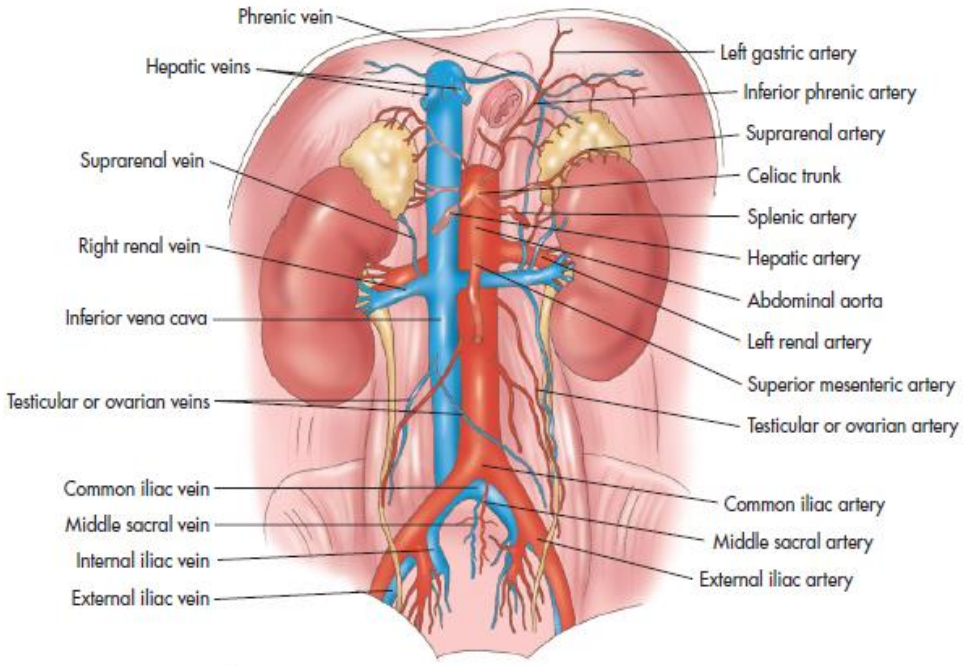


Figure 2-4 Blood is supplied to the pelvic cavity by the external and internal iliac arteries; the iliac veins drain the pelvis. The ureter enters the pelvis and courses anterior to the internal iliac artery to empty into the posterior base of the bladder **(Sandra L).**

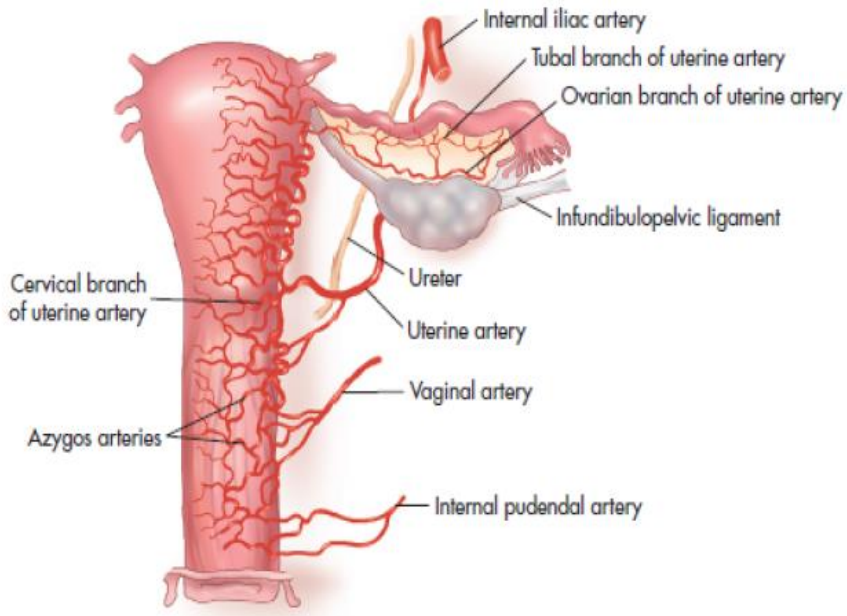


Figure 2-5 Blood is supplied to the uterus and vagina by the uterine artery (arising from the internal iliac artery) and the vaginal artery (arising from the uterine artery). The ovaries receive blood from branches of the uterine artery and from the ovarian arteries arising from the abdominal aorta **(Sandra L 2012).**

2-2-3 Muscles of the Pelvis

The filled urinary bladder displaces the bowel and acts as an acoustic window for evaluating three major groups of muscles . Pelvic muscles may be mistaken for ovaries, fluid collections, or masses. A symmetric bilateral arrangement indicates that they are muscles. The rectus abdominis muscles insert on the pubic rami and are paired parasagittal straps in the abdominal wall; they appear as hypoechoic structures with echogenic striations. The rectus sheath separates the sonographic appearance of the rectus abdominis muscle from surrounding fat and bowel as a bright linear echogenic reflector **(Sandra L 2012).**

2-2-3-1 Obturator Internus Muscles

In the lesser or true pelvis, the urinary bladder, reproductive organs, levator ani, and obturator internus muscles can be identified.

Sonographically, sections of the obturator internus muscle are seen at the posterior lateral corners of the bladder at the level of the vagina and cervix. This muscle is hypoechoic, ovoid, and surrounded by the obturator fascia, which serves as a tendinous attachment for the levator ani muscle **(Sandra L 2012).**

2-2-3-2 Pelvic Floor Muscles:

The levator ani muscle is best visualized sonographically in a transverse plane with caudal angulation at the most inferior aspect of the bladder. It is a hypoechoic, hammock-shaped area that is medial, caudal, and posterior to the obturator internus. The two other muscles of the lesser pelvis, the coccygeus and piriformis, are located deep, cranially, and posteriorly. They are not routinely visualized on ultrasound examination and are not distinguished from other surrounding muscles. The piriformis muscles are located on either side of the midline posterior to the upper half of the uterine body and fundus. This is the most common muscle to be mistaken for the ovary **(Sandra L 2012).** .

2-2-3-3 Iliopsoas Muscles:

The iliopsoas muscles can be seen in the greater pelvis. The iliopsoas muscle is a combination of the iliacus muscle and the psoas major. The psoas major originates bilaterally at the paravertebral lumbar region and courses caudally. The iliacus muscle is contiguous with and arises posterior to the psoas major at the level of the superior two thirds of the iliac fossa. Together, they form the iliopsoas muscle, which continues in the caudal direction, coursing anterolaterally to its insertion on the lesser trochanter of the femur. The sonographic appearance of this muscle varies greatly depending on its development. On ultrasound examination, the iliopsoas muscle is discretely marginated and hypoechoic . The bright echogenic line representing the interposed fascial sheath can often determine the separation of the iliacus and psoas muscles. Both longitudinal and transverse images may be obtained through the urinary bladder midline with lateral angulation. Transvaginally, the positions of these muscles are deep and beyond the field of view **(Sandra L 2012).**

2-2-4 Uterine ligaments:

The levator ani muscle. The transverse cervical and uterosacral ligaments, the broad and round ligaments. The broad ligaments are formed by anterior and posterior reflection of peritoneum passing over the fallopian tubes. They enclose the parametrial connective tissue in addition to round ligaments uterine vessels ,and accompanying lymph channels and ovarian ligaments laterally. The uterus is supplied by sympathetic and parasympathetic nerves **(Hudelist 2012).**

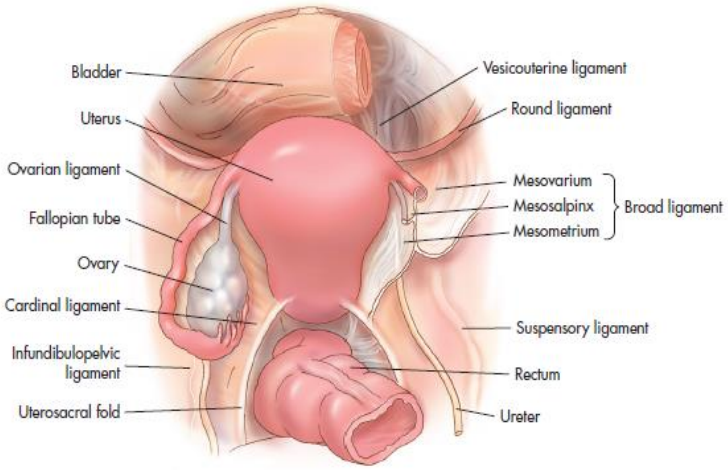


Figure 2-6 View of the pelvic cavity from above, looking inferiorly, showing the attachment of the round ligament and broad ligament to the uterus **(Sandra L 2012).**

2-2-5 Menstrual Cycle

A female's reproductive years begin around 11 to 13 years of age at the onset of menses (menstruation) and end around age 50, when menses ceases. The average menstrual cycle is approximately 28 days in length, beginning with the first day of menstrual bleeding. The length of the menstrual cycle can, however, vary considerably from one woman to another. Menstrual status is described using the terms *premenarche*, *menarche*, and *menopause*. **Premenarche** is the physiologic status of prepuberty, the time before the onset of menses. **Menarche** is the state after reaching puberty in which menses occurs normally every 28 days. **Menopause** refers to the cessation of menses. The menstrual cycle is regulated by the hypothalamus and is dependent upon the cyclic release of estrogen and progesterone from the ovaries **(Sandra L 2012).**

2-2-5-1 Ovarian cycle:

The ovarian cycle consist of two phases: the follicular phase and the luteal phase. The follicular phase of the ovarian cycle is considered to begin on day 1 and lasts until day 14 ,thus, in effect ending with ovulation. During the follicular phase the anterior pituitary gland secretes

FSH which initiate the follicular development of the ovary. Many follicle produced by the ovary only one follicle will be maintained and become graafian follicle. The luteal phase from day 15 to 28 after graafian follicle ruptures it is temporarily turned into an endocrine gland in the form of corpus luteum .The corpus luteum while producing estrogen in small amounts primarily produces progesterone to maintain the thickness of the endometrium and ovum **(Steven M. Penny 2011).**

2-2-5-2 Endometrial cycle:

The endometrial cycle has two phases: the proliferative phase and secretory phase. The proliferative phase occurs after menstruation and last until ovulation. The endometrium is influenced by estrogen and progesterone which produced by the ovary. Proliferation of the endometrium and occur as a result of estrogen stimulation. The secretory phase occurs after ovulation and stimulated by progesterone . progesterone maintains the thickness of endometrium in preparation of implantation. Should fertilization not take place , menses begin on day 1 of the cycle resulting from lack of estrogen and progesterone. Conversely if fertilization does occur the endometrial thickness is maintained by the continual production of progesterone by the corpus luteum of pregnancy **(Steven M. Penny 2011).**

2-3 Pathology:

2-3-1 Congenital abnormalities of the uterus:

Most of the female genital tract develop from the two paramesonephric (Müllerian) ducts, the caudal portions of which approximate in the midline and fuse to form the uterus, cervix, and upper part of the vagina .The upper divergent portions of the ducts form the uterine tubes .Congenital abnormality can result from failure of or incomplete fusion, failure of canalization, asymmetrical development **(Huderist 2011).**

2-3-2 Gynecologic causes of pelvic pain and its sonographic findings:

It include adenomyosis, degenerative fibroid, endometritis , endometriosis, pelvic inflammatory disease , rupture ovarian cyst, tubo-ovarian cyst , displaced IUCD **(Hudelist 2011).**

2-3-2-1 Leiomyoma:

Leiomyomas **(fibroids)** are the most common neoplasm of the uterus. They occur in 20% to 30% of females over age 30 years and are more common in black women. Fibroids are usually multiple and are the most common cause of enlargement of the non pregnant uterus. Although frequently asymptomatic, women with leiomyomas can experience pain and uterine bleeding. Leiomyomas may be classified as **intramural**, confined to the myometrium; **submucosal**, projecting into the uterine cavity and displacing or distorting the endometrium; or **subserosal**, projecting from the peritoneal surface of the uterus. Intramural fibroids are the most common. Submucosal fibroids, although less common, produce symptoms most frequently and may also be associated with infertility. Subserosal fibroids may be pedunculated and may present as an adnexal mass. They may also project between the leaves of the broad ligament, where they are referred to as "intraligamentous." Cervical fibroids account for approximately 8% of all fibroids**.(Carol M. Rumack et al 2011).**

Leiomyomas have variable sonographic appearances. The earliest sonographic finding of myomas is the demonstration of uterine enlargement or irregular uterine wall contour with a heterogeneous myometrial texture pattern. The sonographer should also look for contour distortion along the interface between the uterus and the bladder. The myoma alters the normal homogeneous myometrium. Discrete myomas usually are hypoechoic but can be hyperechoic if they contain dense

fibrous tissue. Bright clusters of echoes occur with calcific deposits and produce typical distal acoustic shadowing **(Sandra L 2012).**

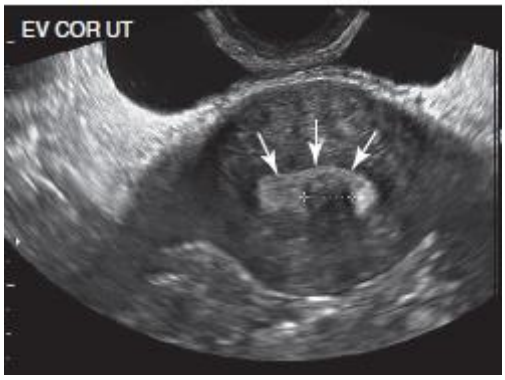


Figure 2-7 Transvaginal views of the uterus reveal subtle submucosal myomas *(arrows)* **(Sandra L 2012).**

. A

Figure 2-8 Transvaginal images of the uterine cavity with a moderate size intramural myoma *(arrows)* **(Sandra L 2012).**

2-3-2-2 Endometritis

Endometrial thickening or fluid may indicate endometritis. **Endometritis** is an infection within the endometrium of the uterus. It occurs most often in association with pelvic inflammatory disease (PID), in the postpartum state, or following instrumentation of the uterus. In patients with pelvic infection, the uterus is the conduit for infectious spread to the tubes and adnexa. Postpartum patients may develop endometritis after prolonged labor, vaginitis, premature rupture of the membranes, or retained products of conception. Clinically, the patient has intense pelvic pain **(Sandra L 2012) .**

Sonographically, the endometrium appears prominent, irregular, or both, with a small amount of endometrial fluid. Pus may be demonstrated in the cul-de-sac as echogenic particles or debris **(Sandra L 2012).**

Figure 2-9 The enlarged uterus with an edematous complex endometrium in a patient who presented 10 days postoperatively with intense pelvic pain. She was diagnosed with endometritis. **(Sandra L 2012).**

2-3-2-3 Endometrial Polyps

Patients with endometrial polyps can be asymptomatic, or they may present with uterine bleeding. Histologically, polyps are overgrowths of endometrial tissue covered by epithelium. They contain a variable number of glands, stroma, and blood vessels. Approximately 20% of endometrial polyps are multiple. They may be pedunculated, broad based, or have a thin stalk. They typically cause diffuse or focal endometrial thickening and are more frequently seen in perimenopausal and postmenopausal women. In menstruating women, they may be associated with menometrorrhagia or infertility. In postmenopausal women, especially those being investigated for bleeding, the major differential considerations are hyperplasia, submucosal myomas, or, less commonly, endometrial carcinoma **(Sandra L 2012).**

Sonographically, polyps appear toward the end of the luteal phase and are represented by a hypoechoic or isoechoic region within the hyperechoic endometrium. They initially may appear as nonspecific echogenic endometrial thickening. The polyp may be diffuse or focal and may also appear as a round echogenic mass within the endometrial cavity Cystic areas representing histologically dilated glands may be seen within a polyp **(Sandra L 2012).**

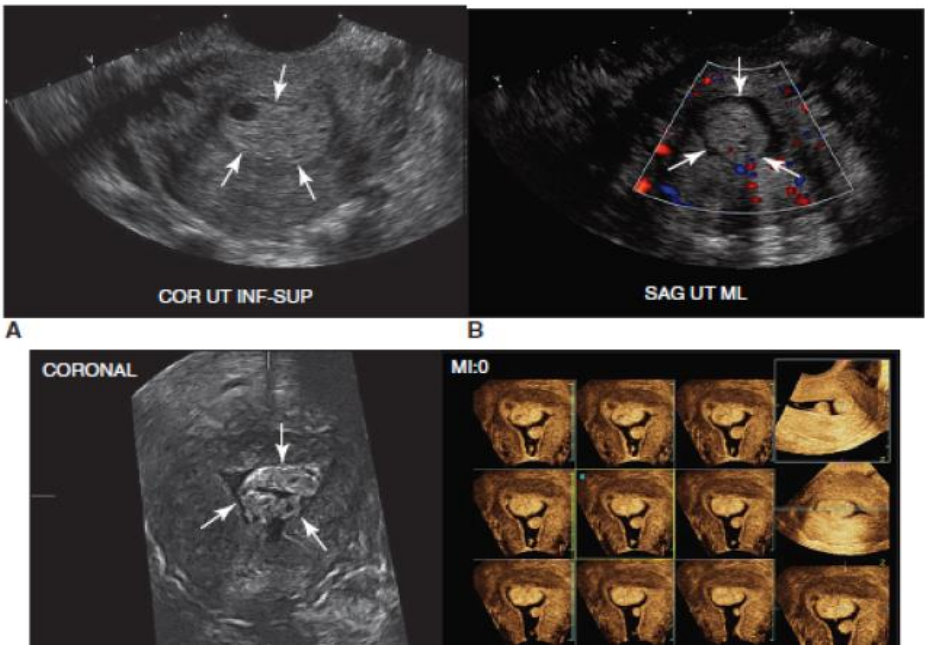


Figure 2-10 A and **B,** Transvaginal image of endometrial polyp shows a focal thickening within the endometrial cavity *(arrows).* **C,** 3D reconstruction of the polyp. **D,** Multiplane reconstruction of the endometrial polyp **(Sandra L 2012).**

2-3-2-4 Adenomyosis

Adenomyosis is a common condition characterized presence of endometrial glands and stroma within the myometrium, associated with adjacent smooth muscle hyperplasia. It is usually more extensive in the posterior wall. The endometrial glands arise from the basal layer and are typically resistant to hormonal stimulation. Adenomyosis can occur in both diffuse and nodular forms. The more common **diffuse** adenomyosis

is composed of widely scattered adenomyosis foci within the myometrium, whereas **nodular** adenomyosis consists of circumscribed nodules called **adenomyomas**. The uterine enlargement, pelvic pain, dysmenorrhea, and menorrhagia. Adenomyosis is more often seen in women who have had children and much less often in nulliparous or postmenopausal women **.(Carol M. Rumack et al 2011).**

The most common presentation of extensive adenomyosis is diffuse uterine enlargement, thickening of the posterior myometrium, indistinct border between the endometrium and myometrium (the involved area being slightly more anechoic than normal myometrium) , and myometrial cysts. Typically, adenomyosis involves the inner two thirds of the myometrium, where a slight decrease in echo content of the involved areas may be observed **(Sandra L 2012).**

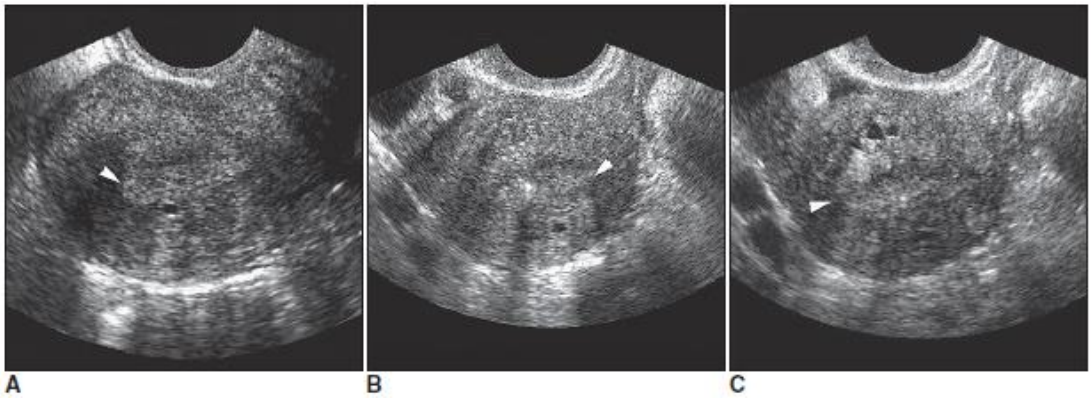


Figure 2-11 Adenomyosis on transvaginal scans—spectrum of appearances. **A,** Subendometrial cyst *(arrowhead)*. **B,** Cysts with heterogeneity in both anterior and posterior myometrium. **C,** Cysts with heterogeneity in anterior myometrium **(Sandra L 2012).**

2-3-2-5Endometriosis:

Endometriosis is a common condition in which functioning endometrial tissue is present outside the uterus. The ectopic tissue can be found almost anywhere in the pelvis, including the ovary, fallopian tube, broad ligament, the external surface of the uterus, and scattered over the peritoneum, cul-de-sac, and even the bladder. The endometrial tissue

cyclically bleeds and proliferates. In the diffuse form, this leads to disorganization of the pelvic anatomy with an appearance similar to pelvic inflammatory disease (PID) or chronic ectopic pregnancy. Two forms of endometriosis have been described: diffuse and localized (endometrioma). The diffuse form is more common and consists of endometrial plantings within the peritoneum and is rarely diagnosed by sonography. The localized form consists of a discrete mass called an *endometrioma,* or *chocolate cyst,* and can frequently be found in multiple sites **(Sandra L 2012).**

Endometriosis may appear as bilateral or unilateral ovarian cysts with patterns ranging from anechoic to solid, depending on the amount of blood and its organization . The ovaries are typically adherent to the posterior surface of the uterus or stuck in the cul-de-sac and may be intimately associated with the rectosigmoid colon and difficult to define. The endometrioma is a well-defined unilocular or multilocular, predominantly cystic mass containing diffuse homogeneous, low-level internal echoes . It is better characterized on transvaginal scanning **(Sandra L2012).**

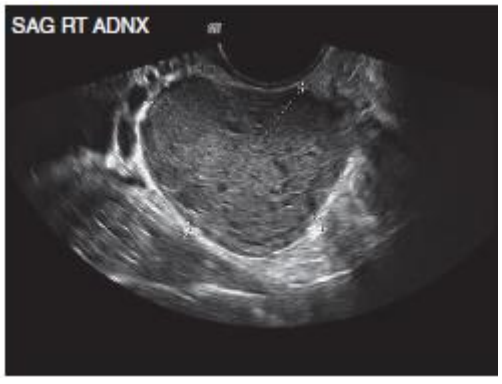


Figure 2-12 On ultrasound, endometriomas demonstrate a well-defined mass with homogeneous low-level echo **(Sandra L 2012).**

2-3-2-6 Ovarian Functional cysts

Ultrasound examination can reveal the presence of follicular cysts in women with a history of irregular vaginal bleeding. These cysts appear similar to a follicle but are larger in size, and can occasionally reach more than 100 mm in diameter. They are usually poorly vascularized, thus differentiating them from luteal cysts, which have thicker and more irregular walls and, typically, a good blood supply. The majority of functional ovarian cysts are detected incidentally in asymptomatic women. They are seen more often at the extremes of reproductive life when an ovulatory cycles are common place. The management of these cysts should be expectant as they usually regress spontaneously. A repeat examination after 6 weeks should be performed to confirm resolution. However, large functional cysts can cause pelvic pain, and occasionally ovarian torsion. In symptomatic women, intervention is sometimes necessary to alleviate symptoms **(Jane A. Bates 2004).**

2-3-2-7 Hemorrhagic Cysts

Internal hemorrhage may occur in follicular cysts or more commonly in corpus luteal cysts. The patient may present with an acute onset of pelvic pain **(Sandra L 2012).**

Most cysts measure less than 5 cm in diameter and regress during the subsequent menstrual cycle. A follow-up sonographic examination in 6 weeks usually documents change in size. **Corpus luteum cysts** result from failure of resorption or from excess bleeding into the corpus luteum. These cysts usually are less than 4 cm in diameter and are unilateral. They are prone to hemorrhage and rupture. The presenting feature is often pain. If the ovum is fertilized, the corpus luteum continues as the corpus luteal cyst of pregnancy during the first trimester of pregnancy, when maximum size is reached by 10 weeks, and resolution occurring by 12 to 16 weeks. Sonographic Findings Because of the hemorrhagic nature of

these cysts, they usually appear as complex masses with central blood clot and echogenic septations. This appearance is difficult to distinguish from ectopic pregnancy and endometriosis. They may exhibit posterior acoustic enhancement, depending on the content**. (Sandra L)**

Hemorrhagic Cysts sonographically depending on the amount of hemorrhage, clot formation, and time passed since hemorrhage. An acute hemorrhagic cyst is usually hyperechoic and may mimic a solid mass **(Sandra L 2012).**

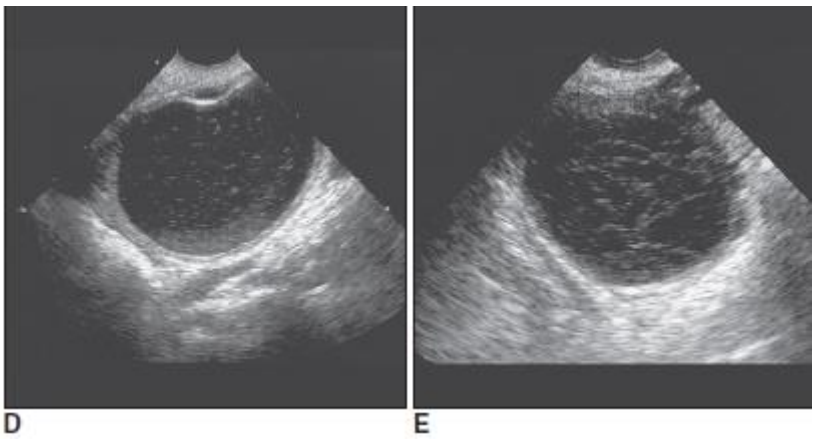


Figure 2-13 D, Large cyst containing multiple internal low-level echoes. **E,** Reticular pattern of internal echoes and septations within cyst. **(Sandra L 2012).**

2-3-2-8 Ovarian Torsion

Torsion of the ovary is caused by partial or complete rotation of the ovarian pedicle on its axis. Torsion usually occurs in childhood and adolescence and is common in association with adnexal masses. Ovarian torsion produces an enlarged edematous ovary, usually greater than 4 cm in diameter. Ovarian torsion is an unusual but serious problem because it accounts for 3% of gynecologic operative emergencies. Torsion typically involves not only the ovary but also frequently the fallopian tube. It may also be seen in women during the fertile years and even occurs during pregnancy in 20% of the cases. Torsion may present at any time in female

life, from childhood to the postmenopausal period. **(Sandra L 2012).** Torsed masses are often large (greater than 4 cm in diameter), vary in appearance from cystic to solid, and vary in echogenicity from relatively anechoic to markedly hyperechoic. A palpable mass may be present. Torsion occurs more frequently on the right side, and the pain may mimic acute appendicitis. Doppler examination usually reveals absent blood flow to the torsed ovary . Occasionally, however, blood flow can be detected to torsed ovaries. This is thought to be the result of the dual blood supply of the ovary or because of venous thrombosis, leading to symptoms before arterial thrombosis occurs **(Sandra L 2012).**

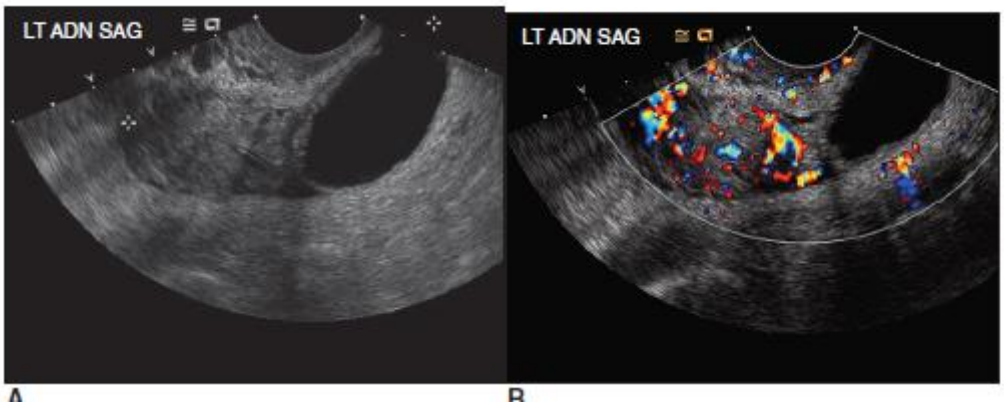


Figure 2-14 Ovarian torsion. **A,** Transvaginal images of the distended fallopian tube that is filled with hematoma. **B,** Color Doppler shows increased flow surrounding the inflamed tubal torsion**(Sandra L 2012).**

2-3-2-9 Pelvic inflammatory disease (PID):

Pelvic inflammatory disease (PID) and endometriosis are diffuse disease processes of the female pelvic cavity. Most commonly, PID is caused by sexually transmitted diseases (STD) , including gonorrhea and chlamydia. Although uncommon, PID can also be caused by a ruptured appendix and peritonitis. PID and endometriosis have very different clinical presentations and pathologies. However, early in the disease the clinical presentation of both endometriosis and PID is nonspecific and may mimic functional bowel disease. PID is an inclusive term that refers to all pelvic

infections(e.g., endometritis, salpingitis, hydrosalpinx, pyosalpinx, periovarian inflammation, tubo-ovarian abscess usually occurs bilaterally and may be found in the endometrium (endometritis), the uterine wall (myometritis), the uterine serosa and broad ligaments (parametritis), the ovary (oophoritis), and the most common location, the oviducts (salpingitis) **(Sandra L 2012).**

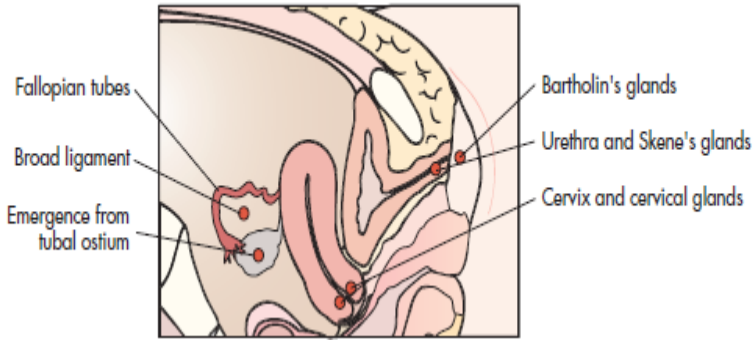


Figure 2-15 Pelvic inflammatory disease may be found in the endometrium, the uterine wall, the uterine serosa and broad ligaments, the ovary, and the fallopian tubes**.(Sandra L 2012).**

2-3-2-10 Salpingitis:

Is the most common disease of the fallopian tubes, almost always as a component of pelvic inflammatory disease. It is always microbial in origin. Salpingitis increase risk of tubal ectopic pregnancy. All form of salpingitis may produce fever, lower abdominal or pelvic pain and pelvic masses. They may result in tubo-ovarian abscess or tubo- ovarian complex and damage or obstruction of the tubal lumina may produce permanent sterility pyosalpinx, hydrosalpinx **(Salveson 1995).**

2-3-3 Non gynecologic causes of pelvic pain:

2-3-3-1 Infectious Cystitis

Women are at increased risk for cystitis because of colonization of the short female urethra by rectal flora. Mucosal edema and decreased bladder capacity are common. Findings may be more prominent at the trigone and bladder neck. Patients will present with bladder irritability

and hematuria. The most common finding at sonography is diffuse bladder wall thickening. If cystitis is focal, **pseudopolyps** may form which are impossible to differentiate from tumor **(Carol M. Rumack et al 2011).**

2-3-3-2 Bladder Calculi

Bladder calculi most often result from migration from the kidney or bladder stasis. Urinary stasis is usually related to a bladder outlet obstruction, cystocele, neurogenic bladder, or a foreign body in the bladder. Bladder calculi may be asymptomatic. If symptomatic, patients will complain of bladder pain or foul-smelling urine with or without hematuria. At sonography, a mobile, echogenic focus with distal acoustic shadowing will be seen. If the stone is large, edema of the ureteral orifices and thickening of the bladder wall may be shown. Occasionally, stones can adhere to the bladder wall because of adjacent inflammation; these calculi are known as "hanging" bladder stones. **.(Carol M. Rumack et al 2011).**

2-3-3-3Ureteral Calculi

The search for ureteral calculi may be particularly difficult at sonography because of overlying bowel gas and the deep retroperitoneal location of the ureter . However, **transvaginal** or **transperineal** scanning may be an optimal way to detect and demonstrate distal ureteral calculi that are not seen with a transabdominal suprapubic approach. When the ureter is dilated, the distal 3 cm will be seen as a tubular hypoechoic structure entering the bladder obliquely. A stone will be identified as an echogenic focus with sharp, distal acoustic shadowing within the ureteric lumen . There may be associated mucosal edema at the bladder trigone **(Carol M. Rumack et al 2011).**

Doppler ultrasound improves detection of ureteric jets. Color Doppler allows for simultaneous visualization of both ureteral orifices. Depending

on the state of hydration, jet frequency may vary from less than one per minute to continuous flow; however, jets should be symmetrical in a healthy individual. Patients with high-grade ureteral obstruction will have either a completely absent jet or a continuous, low-level jet on the symptomatic side **.(Carol M. Rumack et al 2011).**

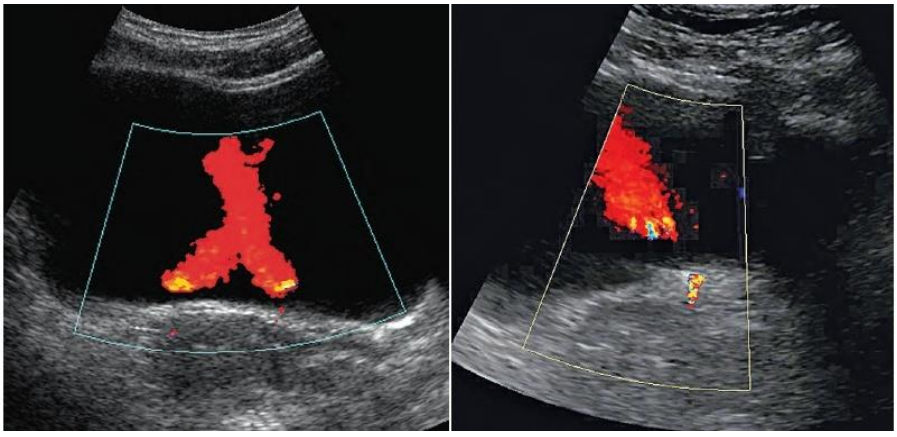


Figure 2-16 Color Doppler evaluation of ureteral colic. Transverse images of the bladder in two patients. **A**, Normal symmetrical bilateral ureteral jets. **B,** Persistent left ureteral jet distal to a partially obstructing left UVJ calculus. Note twinkle artifact posterior to ureteral calculus**.(Carol M. Rumack et al 2011).**

2-3-3-4 Inflammatory Bowel Disease: CROHN'S Disease

Inflammatory bowel disease (IBD) comprises Crohn's disease and ulcerative colitis. **Ulcerative colitis** is amucosal inflammation of the colon that shows minimal sonographic change, even with acute or long-standing disease. **Crohn's disease,** by comparison, is a chronic, transmural, granulomatous inflammatory process affecting all layers of the gut wall, also showing frequent changes in the perienteric soft tissue. Because of this unique gross pathology, Crohn's disease provides the major source of IBD patients referred for sonographic examination. Crohn's disease is a complex process of unknown etiology. It most often affects the terminal ileum and the colon, although any portion of the gut

may be involved. Grossly, the gut wall in Crohn's disease is typically very thick and rigid with secondary luminal narrowing. Discrete or continuous ulcers and deep fissures are characteristic, frequently leading to fistula formation. Mesenteric lymph node enlargement and matting of involved loops are common. The mesentery may be greatly thickened and fatty, creeping over the edges of the gut to the antimesenteric border. Recurrence after surgery and perianal disease are classic features **.(Carol M. Rumack et al 2011).**

2-3-3-5 Irritable Bowel Syndrome:

Irritable bowel syndrome (IBS), also known as "spastic colon," is a common disorder. While most people experience digestive troubles once in a while, what sets IBS apart is belly pain and diarrhea or constipation that comes back again and again. IBS affects 10% to 15% of people in North America **(MarekJantos 2007).**

2-3-3-6 Acute Appendicitis

Acute appendicitis is the most common explanation for the "acute abdomen presentation" to an emergency department. Patients typically have right lower quadrant (RLQ) pain, tenderness, and leukocytosis. A mass may also be palpable. This approach often becomes complicated when a normal appendix is removed in apatient with symptomatology caused by other factors. On the other hand, surgery may be delayed in some patients with acute appendicitis if the presentation is atypical. This approach may lead to perforation before the surgery, making it a complicated and difficult procedure, often followed by abscess formation. Symptoms of appendicitis overlap with a variety of other gastrointestinal conditions, including acute typhlitis, acute mesenteric adenitis, variations of Crohn's disease, right-sided diverticulitis, and in women, acute gynecologic conditions. It is important to recognize that not only can other conditions suggest acute appendicitis, but that acute appendicitis

may also suggest other diagnoses, particularly acute **pelvic inflammatory disease** (PID) **(Carol M. Rumack et al 2011).**

Sonographic feature of Appendicitis: Non compressible appendix > 7mm in diameter , blind ended aperistaltic tubular structure , MC Burney sign with focal pain , tenderness over inflamed appendix and increased periappendiceal echogenecity(hypoechoic areas with ill-defined margins with in inflamed fat **(Ahuja 2007).**

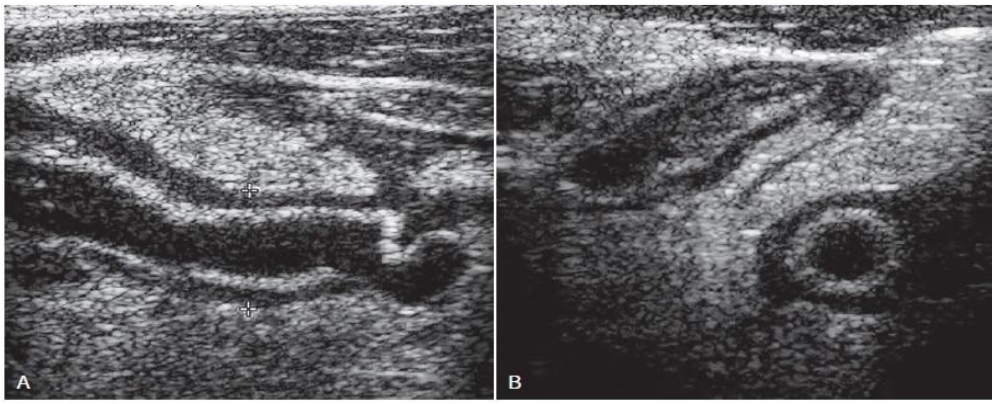


Figure 2-17 Acute appendicitis in two patients: spectrum of appearances. A, Long-axis views show the blind-ended tip of the appendix. **B,**Corresponding cross-sectional views. The appendix looks round in short axis on all cases, and the lumen is distended with fluid. The appendix is surrounded with inflamed fat**. (Carol M. Rumack et al 2011).**

2-3-3-7 Intrauterine contraceptive devices (IUCDs):

IUCDs are devices placed in the uterine cavity during menses for the purpose of birth control. Proper placement is verified by weekly digital palpation of the string in the cervix, performed by the patient. If the patient does not feel the string in the cervix, the IUCD may have been expelled or more likely the string has fallen off or retracted into the uterus. Patients with IUCDs are at increased risk for ectopic pregnancy and pelvic inflammatory disease **(Sandra L 2012).**

The most commonly used IUCDs are currently the Paraguard, a T-shaped flexible plastic wrapped in copper, and the Mirena, a T-shaped flexible plastic that releases low amounts of progestin to act as an

additional measure to prevent pregnancy. Traditionally, the metal-containing devices appear as highly echogenic linear structures in the endometrial cavity within the uterine body. Do not confuse them with the normal, central endometrial echoes. The newer plastic polymer hormone-releasing Mirena appears only mildly echogenic and may be difficult to appreciate when visualizing for the first time. For this reason it is important to ask the patient what type of IUCD she has. The displaced IUCD may not be suspected until an abscess or painful bowel involvement occurs. If the IUCD is displaced caudally in the lower uterine segment, approaching the cervix, this should be reported to the clinician. The IUCD may not be effective in this location and may be at risk for being expelled **(Sandra L 2012).**

Figure 2-18 The Paraguard IUCD should be easily identified by the echogenic linear stripe within the endometrial cavity**(Sandra L 2012)**

2-3-3-8 pelvic congestion syndrome:

Chronic pelvic pain that is associated with dilatation of pelvic vein (varices) and reduced venous return dull chronic pain exacerbated by prolonged standing and relieved by lying down and elevating the legs, pelvic congestion sonographic shows the presence of tortuous and dilated pelvic venous plexuses ,dilated arcuate veins crossing the uterine myometrium **(Salveson 1995).**

2-4 Imaging Modalities Used In Pelvis

2-4-1 Ultra sound:

Examination Technique

Transvaginal ultrasound scan is the method of choice for the examination of the non-pregnant pelvis . The examination follows the principles of bimanual vaginal examination. A combination of palpation and visual information greatly increases the accuracy of diagnosis. The position of pelvic organs can be modified to optimize the image quality. This also enables assessment of the mobility of pelvic organs and accurate localization of pelvic pain. The close proximity of pelvic organs to the ultrasound probe enables the use of high frequency transducers, which further contributes to the image resolution. Transabdominal ultrasound examination, however, remains the only method for examining virgins and those women who are unable to tolerate vaginal examination. The full bladder technique is necessary in these cases. The transabdominal technique should also be used as an adjunct to a vaginal scan in women with large pelvic masses that cannot be completely assessed transvaginally. However, a full bladder is not necessary in these cases. The pelvis should be examined systematically, with care taken to identify normal pelvic structures such as the uterus and healthy ovaries. Any abnormalities should then be examined in detail, after noting their origin and relation to the surrounding pelvic anatomy **(Trish chudleigh et al 2004)**

2-4-2 Doppler Examination

The Doppler assessment of the vascularity of a structure relies on the principle that a particle approaching the transducer reflects the ultrasound beam at a higher frequency then a particle that is stationary or moving away from the probe. Color Doppler enables visualization of blood vessels within the region of interest. The main role of color Doppler is to

direct the position of the pulsed Doppler gate. Blood-flow characteristics, such as blood velocity and impedance to flow, are then examined using flow velocity waveform analysis. The use of Doppler in examination of the uterus enables the identification of the base of a polyp and demonstration of a vascular connection between the uterus and a pedunculated fibroid. It has limited value in the preoperative diagnosis of malignancy of the uterus but is helpful in the characterization of adnexal masses. Ideally, Doppler interrogation of the ovary should be carried out in the first 5 days of the cycle in a premenopausal woman **(Trish chudleigh et al 2004)**

2-4-3 Sonohysterography

Sonohysterography (saline-infused sonography, SIS) has been shown to be of great value in further evaluating the abnormally thickened endometrium. By distending the endometrial cavity with saline, the examiner can distinguish endometrial growths and abnormalities. After performing routine transvaginal exam to orient the sonographer to the patient's anatomy and pathology, the doctor should explain the procedure to the patient and obtain consent. A sterile speculum is inserted into the vagina, and the cervix is cleansed with an antiseptic solution. A hysterosalpingography catheter is inserted into the uterine cavity beyond the cervical os. The catheter is prefilled with sterile saline before insertion to minimize air artifact. The speculum is removed and the transvaginal transducer is inserted into the vagina. The catheter is identified in the endometrial cavity by locating the saline filled balloon, and the saline is slowly injected through the catheter under sonographic visualization. The uterus is scanned systematically in sagittal and coronal planes to delineate the entire endometrial cavity. Appropriate images are obtained under the direction of the physician performing the procedure. A sweep of the fluid-filled endometrium in both planes can be captured on cine clips to further

document the presence of any pathology. In premenopausal women, the procedure is performed in the midmenstrual cycle, usually between days 6 to 10. This will prevent the possibility of disrupting an early pregnancy and prevent blood clots artifactually filling some of the endometrial cavity. For women with irregular cycles, the procedure is performed soon after the cessation of bleeding, if possible. In postmenopausal women, the procedure can be performed at any time or shortly after the monthly bleeding period if they are on sequential hormone replacement therapy. The procedure is not performed in women with acute pelvic inflammatory disease. In most cases there is no special patient preparation. Prophylactic antibiotics are given to women with chronic pelvic inflammatory disease and to women with a history of mitral valve prolapse or other cardiac disorders.

Sonographic Findings. Sonographically, after the saline is injected, the endometrial canal fills with saline and the borders are clearly identified . Any projections or filling defects can be delineated and confirmed in the sagittal and coronal planes. By using color Doppler, a vascular pedicle can be identified in polyps. The clinician carefully removes the catheter while injecting a small amount of the saline to help distinguish the cervical area **(SandraL2012).**

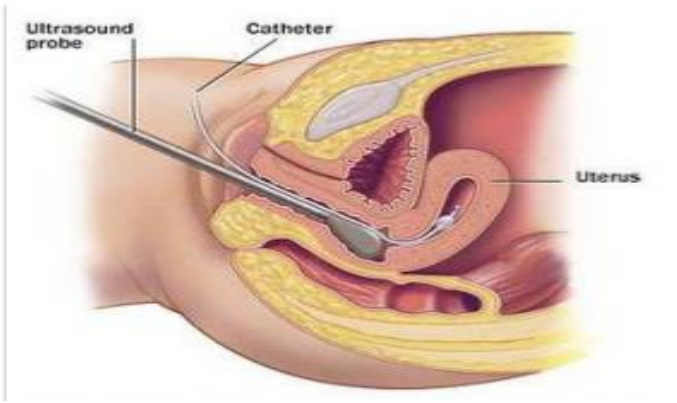


Figure 2-19 shows the HYCOSY is done such as laparoscopy (Kim SH ,2002).

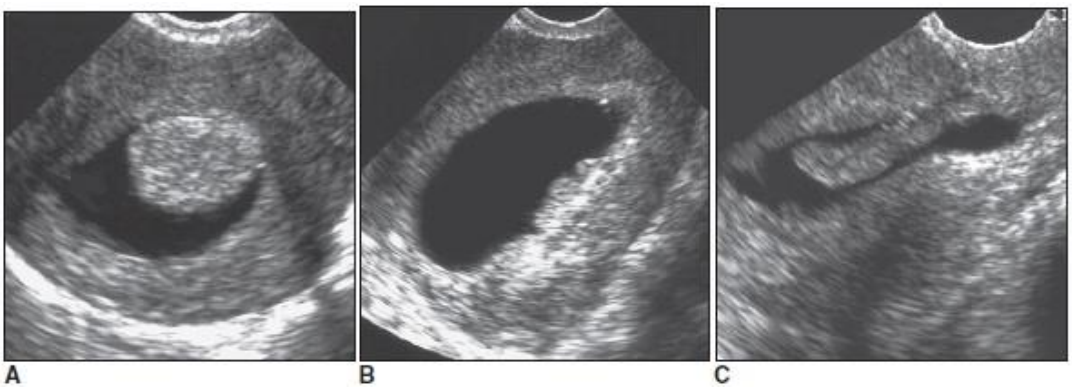


Figure 2-20 Sonohysterograms. **A,** Well-defined, round echogenic polyp. **B,** Carpet of small polyps. **C,** Polyp on a stalk**.(Sandra L 2012).**

2- 4- 4 Three-Dimensional Ultrasound

Three-dimensional ultrasound (3D ultrasound) is now an accepted additional technology in ultrasound that allows imaging from volume sonographic data rather than conventional planar data. Volume data are generally obtained by acquiring many slices of conventional ultrasound data, identifying the location of the slices in space, and reconstructing them into a volume. That data (voxels) can then be viewed as a 3D object and displayed using a variety of formats to rotate and view the images from different angles for optimal visualization of anatomy and pathology . An additional approach to acquiring volume data is to use multidimensional arrays. Display of 3D data has improved greatly. Currently the most common methods include multiplanar display of perpendicular slices through the volume and volume rendering. The display can be optimized to emphasize soft tissue or be changed to optimize vessels. Volume editing can be performed to eliminate or mask structures that obscure the areas of interest. Archived volume data may be further reviewed after the patient exam has been completed, permitting the reviewer to "rescan" the patient in the computer workstation**.** The current AIUM guidelines regarding 3D sonography state that because it is still a developing technology, its role is that of an adjunct to, not a

replacement for, two-dimensional ultrasound. Continued work will likely show that the most promise for 3D ultrasound in the pelvis is its ability to provide unique planes for improved evaluation of organs, tubal morphology, tumor invasion, accurate volume estimation, and guidance for invasive procedures. Sonohysterography also benefits from volume scanning. The exact location of a polyp, fibroid, or adhesion is readily identified. As the 3D technology becomes available in many more clinical sites, additional benefits will be identified. Four-dimensional ultrasound data are another new technology that allows 3D imaging in a real-time mode versus computerized imaging postcapture. These technologies are exciting areas in development along with efforts to improve resolution and application. **(Sandra L 2012).**

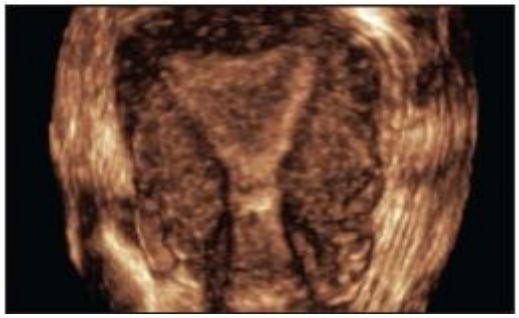


Figure 2-21 Three-dimensional reconstruction of the uterus showing a coronal image of the endometrium.**(Sandra L 2012).**

2- 5 Normal Ultrasound Appearances

2-5-1 Sonographic feature of normal uterus

The position and relationship of the female pelvic organs vary considerably with posture and as a result of interactions with the surrounding viscera. The central location and large size of the uterus in the pelvis allow it to be used as a landmark for orientation. However, the position and flexion of the uterus itself can vary. In transvaginal sonography, with the image oriented so that the probe is positioned at the

lowest point on the screen, an anteverted uterus projects from the anterior vaginal fornix to the right of the screen towards the bladder and anterior abdominal wall . Conversely, a retroverted uterus projects from the posterior vaginal fornix and extends to the left of the screen away from the bladder . The position of the body of the uterus in relation to the cervix, which is anchored in the midline, can also vary and a uterus might be anteflexed (angled forward) or retroflexed (angled backward) in relation to the cervix. A uterus that is axial lies in the same axis as the vagina and cervix; the ultrasound beam in this case is no longer perpendicular to the endometrium and consequently image quality might be less satisfactory. The size and shape of the uterus vary greatly in relation to parity and age. The bulk of the uterus consists of myometrium, which is the smooth muscle substance of the uterus and is continuous with the cervix. As the organ is predominantly made of one tissue type, its appearance is homogenous with a fine echodense texture. The thickness of the uterine walls is variable with age, parity and the presence of pathology. The area of myometrium closest to the endometrium is known as the junctional zone, and this might be less echogenic and is not always visible. The outer layers of the myometrium can be punctuated by small cystic spaces, which represent the arcuate vessels in cross-section, the flow within these vessels is classically slow and, with age, they might sclerose and calcify giving a hyperechoic appearance **(Trish chudleigh et al 2004)**

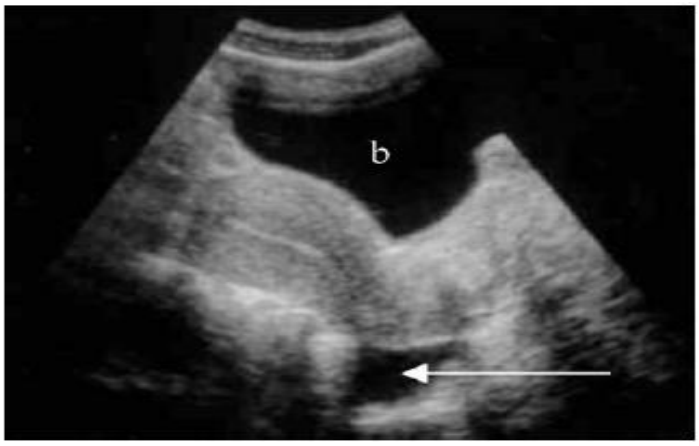


Figure 2-22 A transabdominal scan with a normal anteverted uterus. The full urinary bladder (b) is seen anteriorly and a small amount of fluid in pouch of Douglas posteriorly (arrow).
(Trish chudleigh et al 2004)

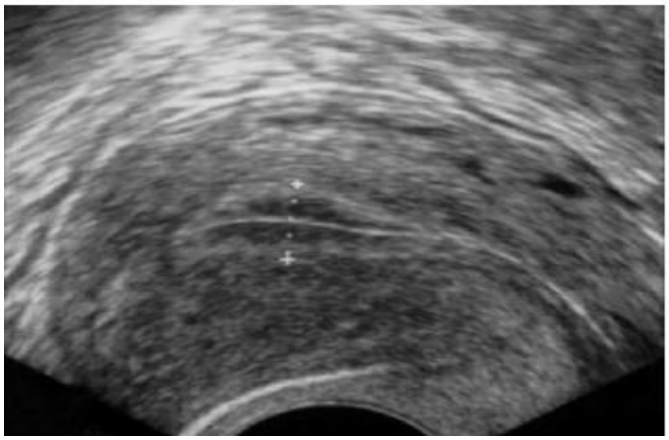


Figure 2-23 Measurement of the endometrium in a retroverted uterus in the late proliferative phase. The endometrium should be measured from the superior to the inferior endometrial/myometrial border encompassing both leaves of the endometrium, as indicated (+ − − − +). The midline echo should be at 90° to the sound beam to enable accurate measurement.
(Trish chudleigh et al 2004)

2-5-2 Sonographic feature of normal fallopian tubes

The fallopian tubes extend within the broad ligament from either cornu of the uterus to their fimbrial ends, which are usually located superior to the ovaries. The tube is made up of four parts: the interstitial portion, the isthmus, the ampulla and the infundibulum. The interstitial portion is located within the body of the uterus and can be clearly seen as a hyperechoic line extending from the lateral uterine angle to the origin of the broad ligament. the isthmus and ampulla are rarely seen without the use of contrast media. The infundibulum can be seen if it is floating in peritoneal fluid . Visualization of the tube is possible after distention either with contrast media or fluid in cases of hydro- or sactosalpinx. **. (Trish chudleigh et al 2004)**

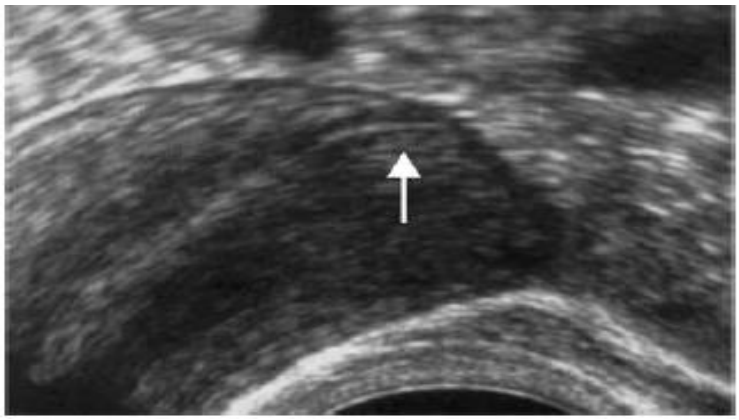


Figure 2-24 A view of the interstitial tube (arrow) appearing as a hyperechoic line extending from the cavity to the origin of the broad ligament **(Trish chudleigh et al 2004)**

2-5-3 Sonographic feature of normal ovaries

The ovaries are usually located in the ovarian fossa, inferior to the pelvic vessels on the lateral pelvic wall. However, they are mobile structures and can be found in the pouch of Douglas or above the uterine fundus; they can be located by following the broad ligament laterally. They appear as

ellipsoid structures, which are slightly hypoechoic in comparison with the myometrium . *Ovarian follicles* are simple, anechoic cysts with clear and well-defined walls. They grow at an average rate of 2 mm/day until they reach 20–25 mm in diameter, just before ovulation. Strictly speaking, the diagnosis of an ovarian follicle can only be made on a follow-up scan that demonstrates normal follicular growth or signs of ovulation. However, in practical terms every simple ovarian cyst measuring less than 25 mm in size in a premenopausal woman can be classified as a follicle. Doppler examination of the follicles reveals only limited vascularity **(Trish chudleigh et al 2004)**

Figure 2-25 A transabdominal view of the ovaries (arrows) and uterus (u) in a transverse section. Note the hyperechoic endometrium and hypoechoic follicles within the left ovary (L). **(Trish chudleigh et al 2004)**

2-6 Previous Studies:

Salveson KA 1995 our study has shown that the specificity of the ultrasound diagnosis of pelvic endometriosis lesions is high with low false positive rates. The negative diagnostic rate was less high specially in the diagnosis of bowel, rectovaginal, uterosacral ligament lesions. Therefore women with significant symptoms and negative diagnosis still require further investigation. The accuracy of ultrasound diagnosis is significantly affected by the location and number of endometriosis lesions.

Zafar N 2011 ultrasound has been proven to be useful in detecting any underlying pelvic pathology. Lee et al concluded that identification of the twisted vascular pedicle through ultrasonography is suggestive of ovarian torsion and color Doppler sonographic could be helpful in pre-dicting the viability of adnexal structures by depicting blood flow within the twisted vascular pedicle. Gray-scale findings typically include asymmetric enlargement a solid heterogeneous appearance, and peripheral cystic areas detected by Doppler sonographic is highly predictive of adnexal torsion and is therefore useful in the diagnosis of ovarian torsion, thus our result is similar to those of international studies. USG is a valued tool for clinically suspected appendicitis and it enhances the diagnostic accuracy in of cases with pain in RIF and reduces the number of negative appendicectomies. Of 58 cases of appendicitis pain in abdomen and vomiting were the predominant clinical symptoms, but they are not specific for acute appendicitis, tenderness in RIF was present in almost all cases. these findings tallied with the findings of the study by acute appendicitis is the most common acute abdominal condition , necessitating emergency surgery. When the clinical signs and symptoms are combined with USG helps in diagnosing, the diagnostic accuracy is significantly high. USG helps in diagnosing other causes of RIF pain

which help in excluding appendicular pathology. We recommend USG as a valuable tool in diagnosing acute appendicitis in spite of sophisticated investigations like CT abdomen and laproscopy, thus reducing the cost of treatment and preventing negative laparotomies.

Tarjan Z , et al 1994 Their study conclude that ultrasound advantage over CT is that it allows precise correlation of the ultrasound findings with the area of maximum tenderness or with a palpable mass. with another advantage of ultrasound is its mobility and flexibility. It can be done in the emergency ward, high care units and the operating room, handheld units, in the fact anywhere. Furthermore, in case of intra peritoneal fluid, ultrasound guided puncture is a safe and rapid way to determine if the fluid is blood , pus ,bile, amylase, gastric contents, etc. ultrasound examination allow a natural and direct form of communication with the patient .information provided by the patient may lead to a specific search for ultrasound finding, while vice versa, certain findings may lead to a specific question to the patient. In24% 12 cases of our patient with finding of appendicitis, pain in the pelvic and lower abdomen, vomiting and tenderness in RIF were the predominant clinical symptoms, was present in almost all cases in our study, USG helps in diagnosing other causes of the RIF pain which helps in excluding appendicular pathology.

Seong 2003 their study conclude the sonographic findings of pelvic congestion syndrome were dilated left ovarian vein with reversal caudal flow, presence of varicocele, dilated arcuate veins crossing the uterine myometrium, polycystic changes of the ovary, and variable duplex wave form during the valsalva maneuver. Combined transabdominal and transvaginal sonography are potentially useful as a noninvasive screening tool for determining which patients with chronic pelvic pain may benefit from selective ovarian venography and transcatheter emobilization.

Farquhar C et al evaluate three methods (transvaginal ultrasonography, sonohysterography and hysteroscopy) for investigating abnormal uterine bleeding in women who had not yet reached the menopause. All three methods were found moderately accurate for detecting cancer, hyperplasia and fibroid, with transvaginal ultrasound perfortming the worst of the three for fibroid. This study was concluded that all three diagnostic tests were moderately accurate in detecting intrauterine , but there was considerable variation between the studies. Sonohysterography and hysteroscopy performed better than TVUS in detecting submucous fibroid.

Maartha 2013 describe the role of TVS to assess ovarian cyst in reproductive age the scope of this review to focus the management of benign ovarian cyst in reproductive age are common occurrence in this patients population.

Zimmermann et al 2012 The study results are consistent with available data and underline that uterine fibroids are a common in fertile age. Uterine fibroids can cause multiple bleeding and pain symptoms which might have a negative impact on women's life , influencing their sexual , social and work life.

Chapter Three

Materials and Methods

3-1 Materials

3-1-1 Population of the Study

This descriptive study of sixty female patients (n=60) were selected to be the sample unit in this study.

3- 1-2 Area and duration of the Study

The study was conducted in Al managil teaching hospital and some medical center from the twenty of July to the twenty five of October 2018.

3 -1-3 Machines :

An ultrasound machine (Mindary , Zoncare with two probes – convex 3.5 MHz , Ultrasound imaging system) with a B mode capabilities is used. The transducer is a phased – array 3.5 MHZ, TVS 5-7 MHZ, and (Sonoscape machine with three probes –convex, TVS and Linear) and ultrasound gel is applied to the transducer to prevent any attenuation or artifact. And thermal Paper Printer was used. A data collection sheet is used to collect the data and to number the patients.

3-1-4The inclusion criterion:

Any female patient attending the hospital in that period mentioned complaining of pelvic pain.

3 -1-5 The exclusion criteria:

-Pediateric

- pregnant women

- traumatic women

To collect the suitable data for the study; personal information from any patient is written in the data collection sheet as well as the results .This includes the following:

General information, Clinical information and Ultrasound findings. See the appendix**.**

3-2 Methods:

3-2-1 Ultrasound technique of the female pelvis:

The examination begins with the patient in the supine position. Scans are performed in the sagittal and transverse planes from the anterior approach using the bladder as acoustic window (transabdominal) as well as transvaginal scan. The highest frequency transducer with empty bladder permitting adequate penetration is used. This is usually in the 3.5MHz. A convex probe is used and an acoustic gel is applied.

3-2-2 statistics:

Finally the data is analyzed by using Statistical Package for Social Sciences (SPSS).

3-2-3 Ethical consideration

- There was official permission to hospitals to take the data.
- No patients names were recognized.
- No patient data were published.

Chapter Four

Results

Table 4-1 Age distribution

	N	Minimum	Maximum	Mean	Std. Deviation
Age	60	17	70	31.27	11.564
Valid N (listwise)	60				

Table 4-2 Frequency distribution of Age group

Age	Frequency	Percent	Valid Percent	Cumulative Percent
15-25	27	45	45	45
26-35	20	33.3	33.3	78.3
36-45	7	11.7	11.7	90
Valid 46-55	2	3.3	3.3	93.3
56-65	3	5	5	98.3
66-	1	1.7	1.7	100
Total	60	100	100	

Table 4-3 Frequency distribution of social status

Social status	Frequency	Percent	Valid Percent	Cumulative Percent
Single	10	16.7	16.7	`16.7
Married	50	83.3	83.3	100
Total	60	100	100	

Table 4-4 distribution of area of pelvic pain

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Suprapubic pain	38	63.3	63.3	63.3
	RIF pain	15	25.0	25.0	88.3
	LIFpain	7	11.7	11.7	100.0
	Total	60	100.0	100.0	

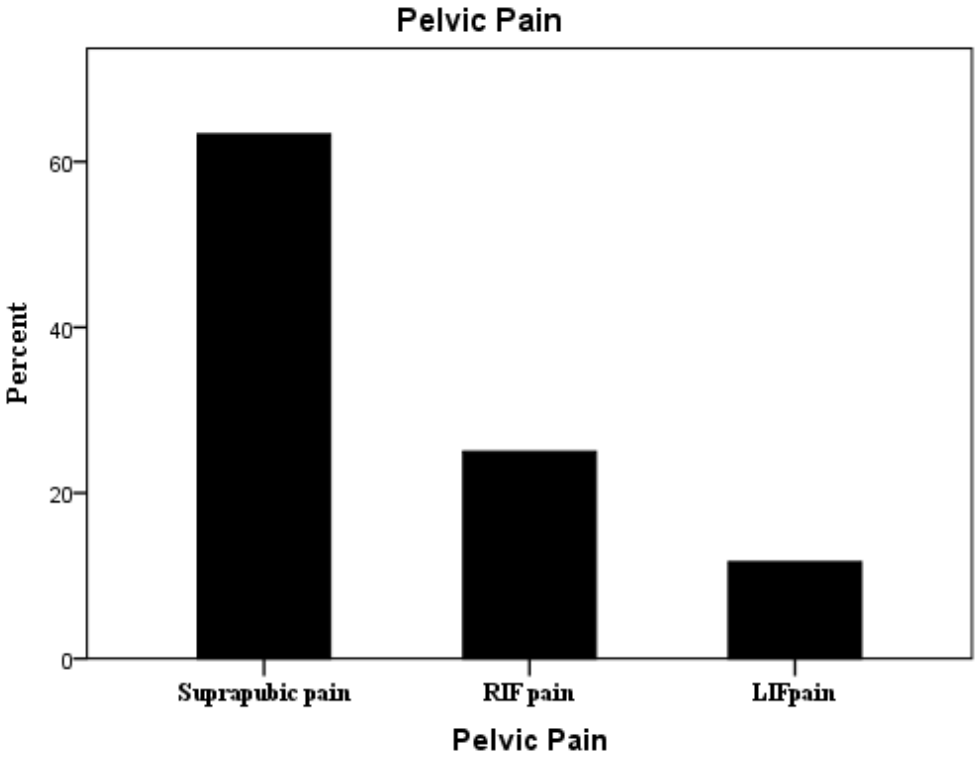


Figure 4-1 distribution area of pelvic pain

Table 4-5 distribution of Vaginal Bleeding

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	7	11.7	11.7	11.7
	NO	53	88.3	88.3	100.0
	Total	60	100.0	100.0	

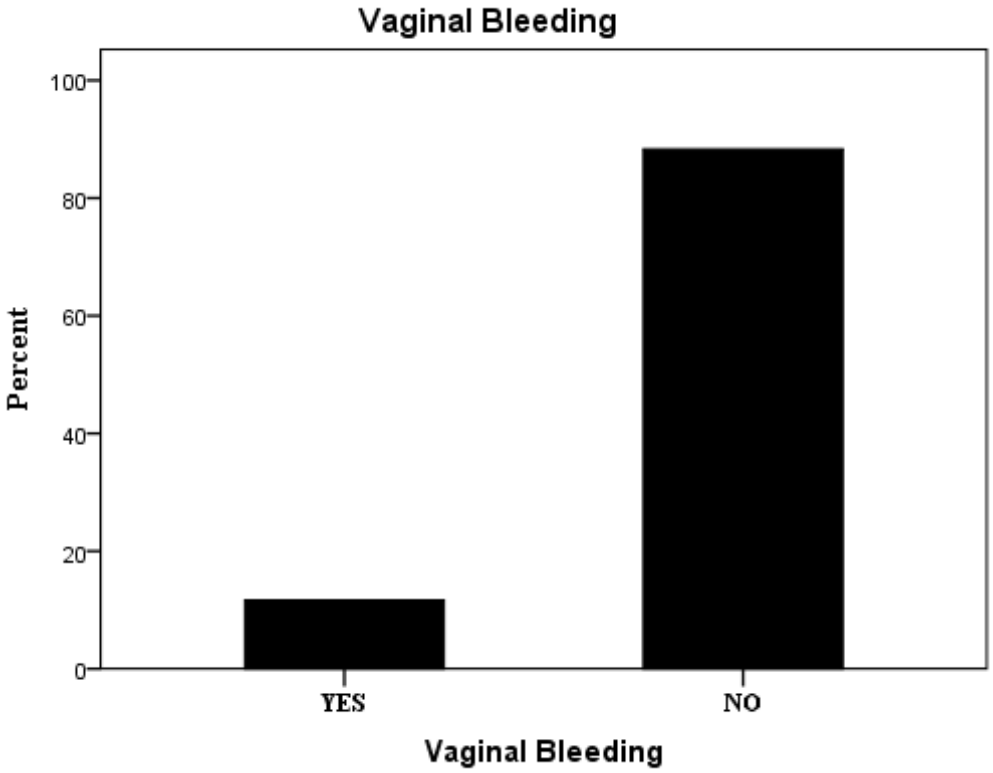


Figure 4-2 distribution of vaginal bleeding

Table 4-6 distribution of vaginal Discharge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	16	26.7	26.7	26.7
	NO	44	73.3	73.3	100.0
	Total	60	100.0	100.0	

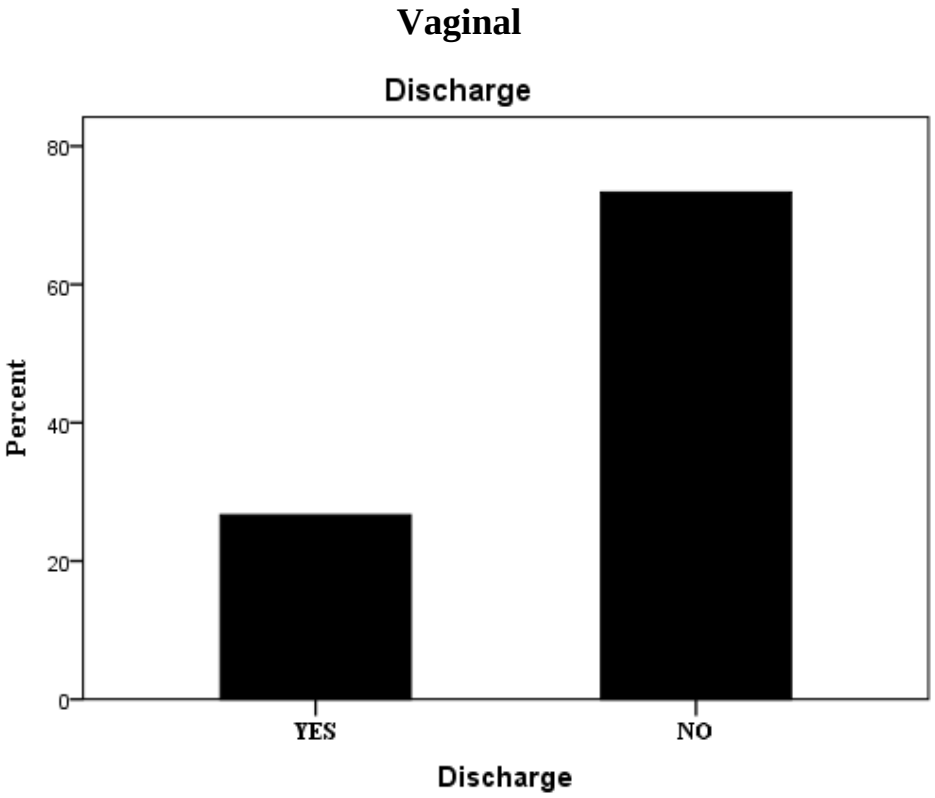


Figure 4-3 distribution of vaginal discharge

Table4-7 distribution of Dysuria

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	6	10.0	10.0	10.0
	NO	54	90.0	90.0	100.0
	Total	60	100.0	100.0	

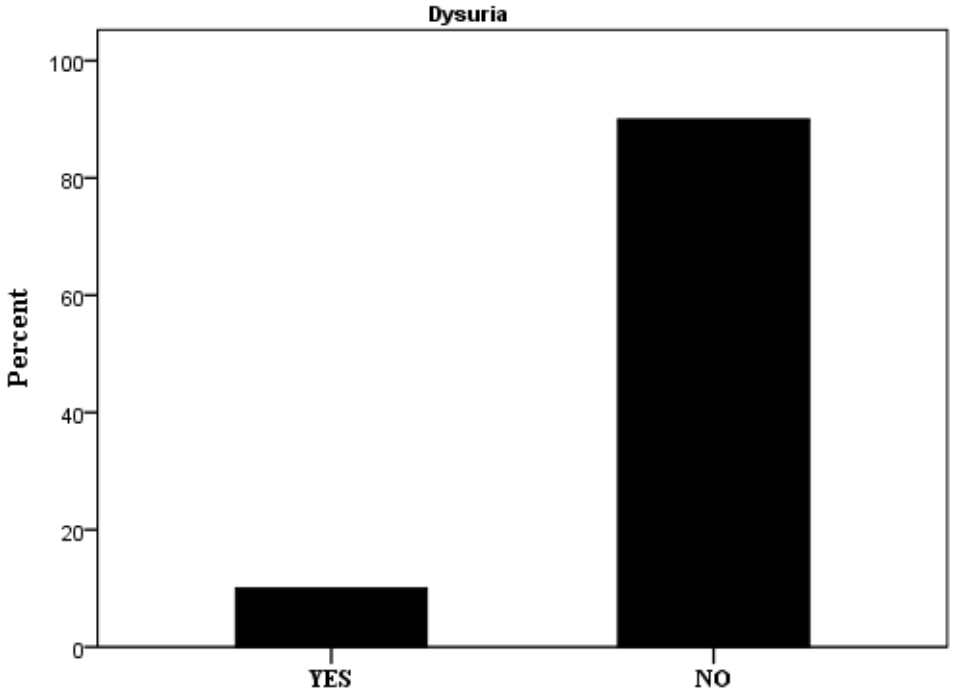


Figure 4-4 distribution of dysuria

Table 4-8 distribution of Uterus Size

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal	42	70.0	70.0	70.0
	Enlarged	18	30.0	30.0	100.0
	Total	60	100.0	100.0	

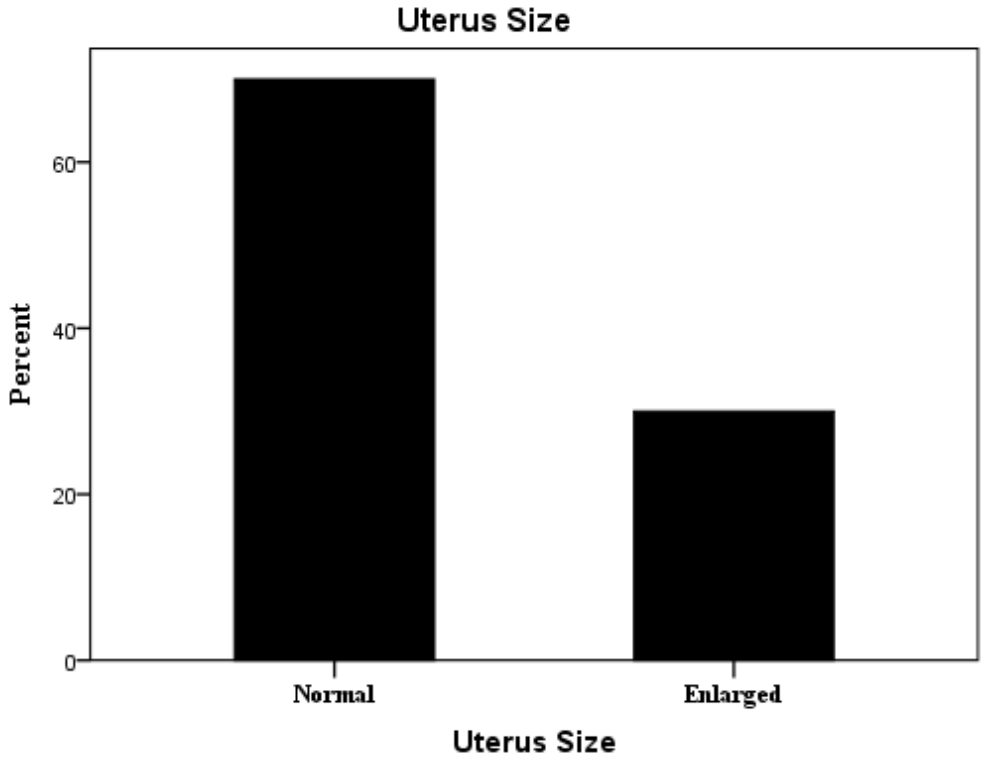


Figure 4-5 distribution of uterus size

Table 4-9 distribution of Uterine Mass

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	9	15.0	15.0	15.0
	NO	51	85.0	85.0	100.0
	Total	60	100.0	100.0	

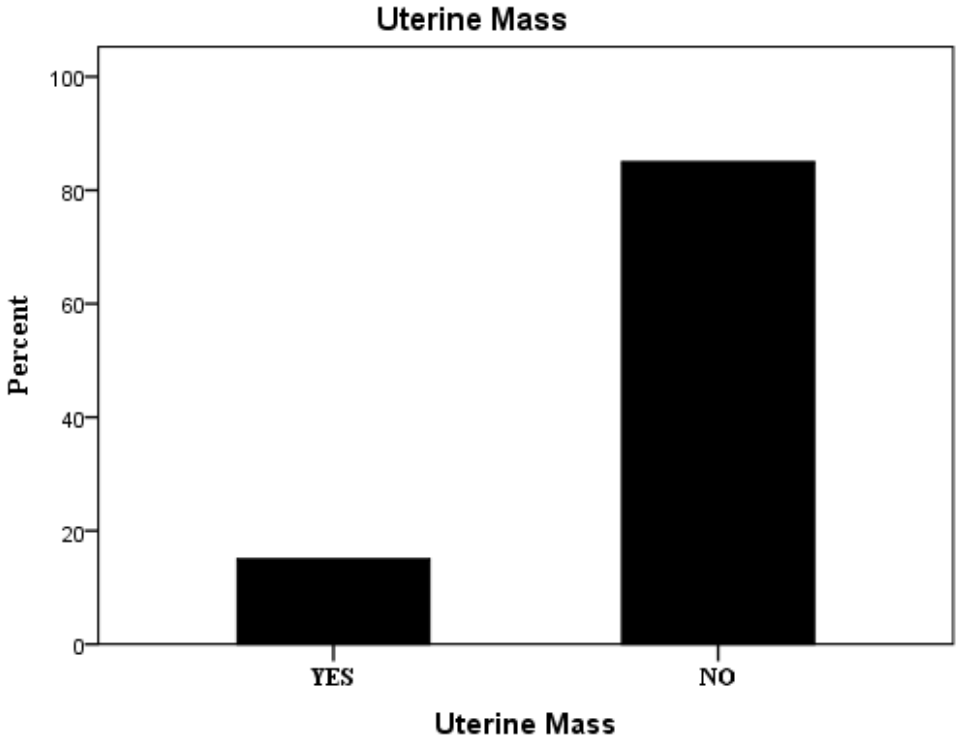


Figure 4-6 distribution of uterine mass

Table 4-10 distribution of Ovarian Mass

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	1	1.7	1.7	1.7
	NO	59	98.3	98.3	100.0
	Total	60	100.0	100.0	

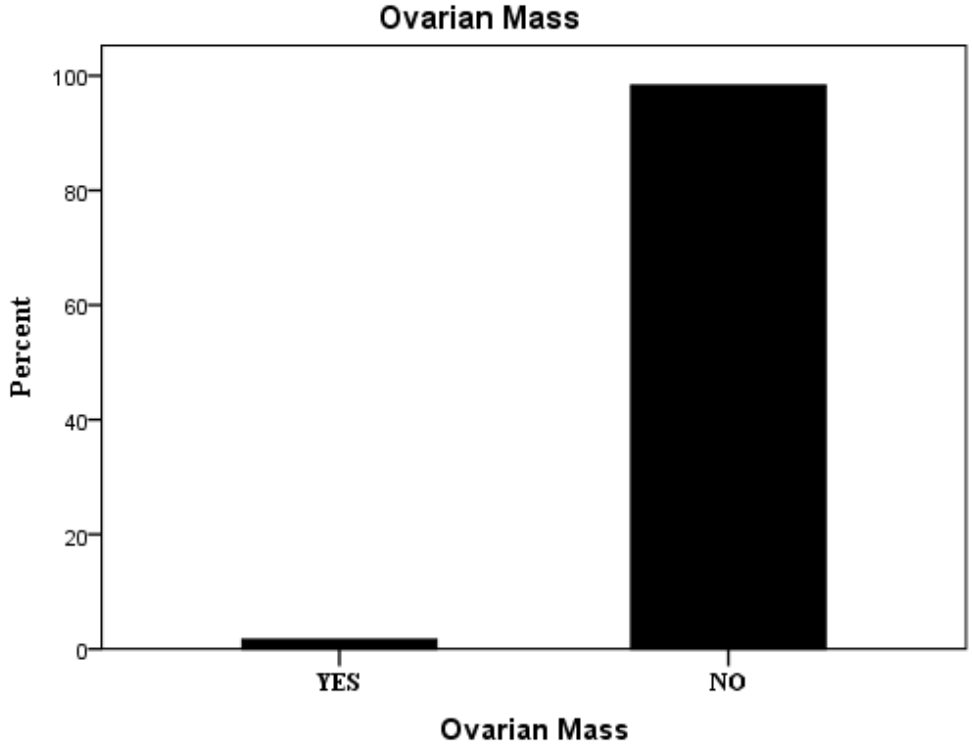


Figure 4-7 distribution of ovarian mass

Table 4-11 distribution of Ovarian Cyst

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	27	45.0	45.0	45.0
	NO	33	55.0	55.0	100.0
	Total	60	100.0	100.0	

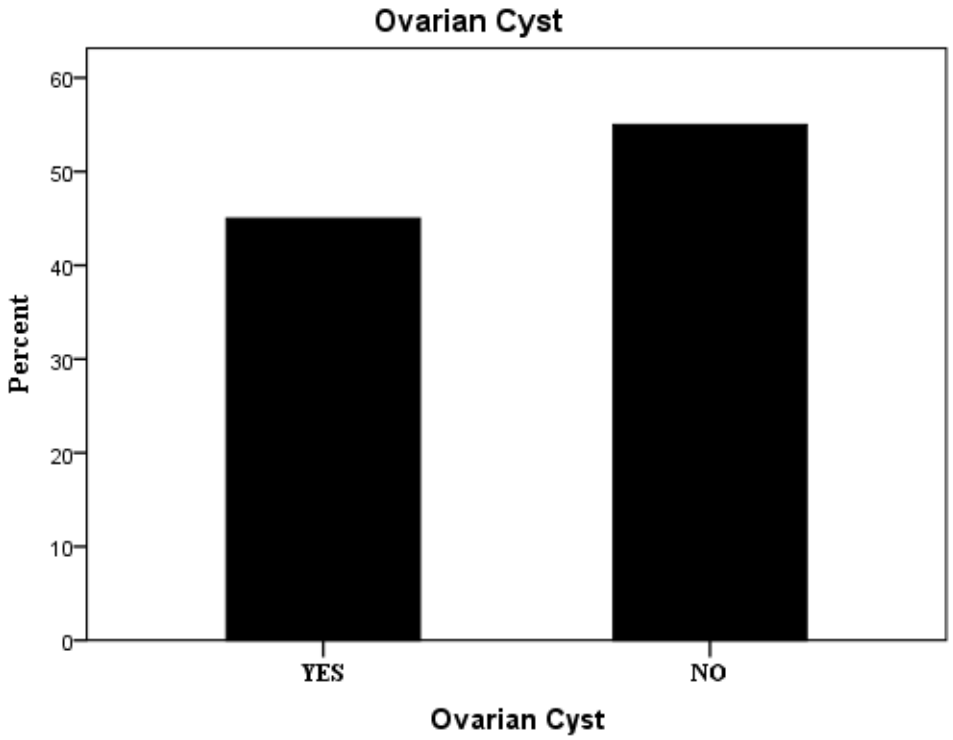


Figure 4-8 distribution of ovarian cyst

Table 4-12 distribution of Fluid collection in pouch of douglas

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	6	10.0	10.0	10.0
	NO	54	90.0	90.0	100.0
	Total	60	100.0	100.0	

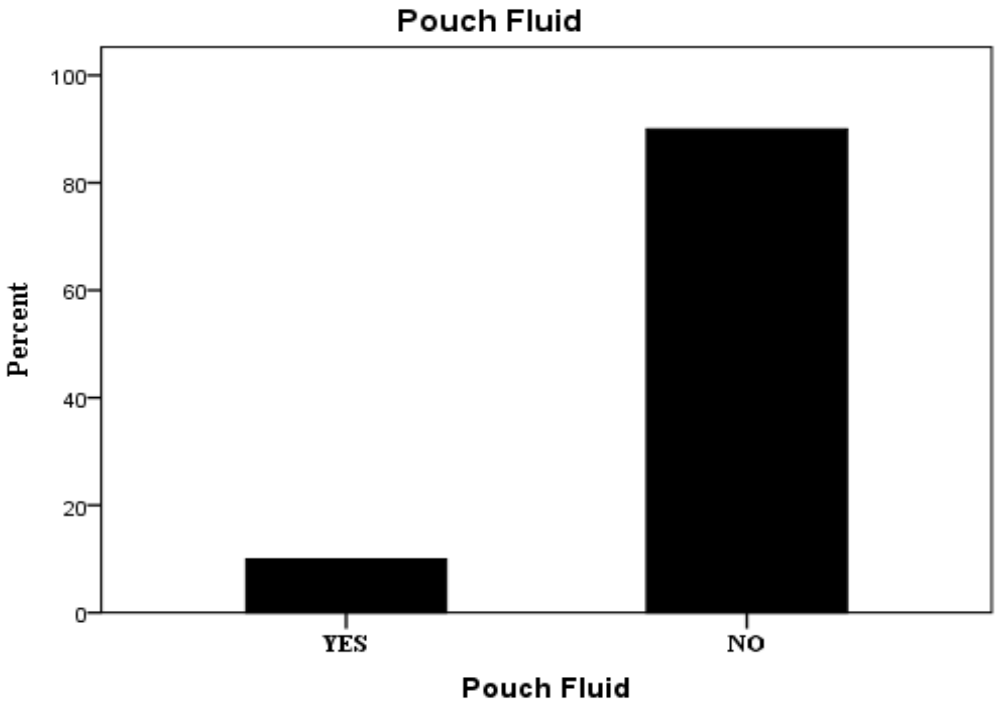


Figure 4-9 distribution of fluid collection in pouch of douglas

Table 4- 13 distribution of Sonographic Findings

	Frequency	Percent	Valid Percent	Cumulative Percent
Ovarian cyst	27	45	45	45
Fibroid	5	8.3	8.3	53.3
Endometritis	3	5.0	5.0	41.7
Fluid collection	7	11.7	11.7	69.9
PCO	9	15.0	15.0	84.9
Appendicitis	1	1.7	1.7	86.6
Ureteric stone Valid	1	1.7	1.7	88.3
Hydrosalpinx	1	1.7	1.7	90
Cervical polyp	1	1.7	1.7	91.7
IUCD	1	1.7	1.7	93.4
Cervical fibroid	2	3.3	3.3	96.6
Ovarian mass	1	1.7	1.7	98.3
Ectopic kidney	1	1.7	1.7	100.0
Total	60	100.0	100.0	

Chapter Five

Discussion, Conclusion and Recommendations

5-1 Discussion:

From the collective findings of this study that the more affected ages between 15-25 year in 27 patients (45 %), with distribution of 50 married (83.3%) and 10 single (16.7%) .

All patients selected should have pelvic pain but table (4-4) shows the distribution of pelvic pain among the surveyed patients in the study and it indicate that majority of them suffer from supra pubic pain of 38 patients (63.3%) ,RIF pain in15 patients (25%) and LIF pain in 7 patients (11.7%) , in the study 7 patients (11.7%) have vaginal bleeding and 53 patients (88.3%) have no vaginal bleeding Table(4-5) show this distribution. Also most of patients have no vaginal discharge 44 patients (73.7%) and 16 patients (26.7%) have vaginal discharge in table(4-6) this distribution. While most of patients have no dysuria 54 (90%) and 6 patients (10%) have dysuria as in table (4-7).

Most of surveyed patients have normal uterus size 42 patients (70%) and 18 patients (30%) have enlarge uterus in table (4-8) this distribution. In table (4-9) uterine mass in surveyed patients , it indicate that most of the patients do not have uterine mass 51 patients (85%) and 9 patients (15%) have uterine mass.

Table(4-10) shows the distribution of ovarian mass 1 patient (1.7%) has ovarian mass and 59 patients do not have ovarian mass. While 33 patients (35%) have no ovarian cyst but 27 patients (45%) have ovarian cyst this distribution in table (4-11).

Most of patients in this study have no fluid collection in posterior cul-de-sac (pouch of douglas) 54 patients (90%) and 6 patients (10%) have no fluid in pouch of douglas this distribution in table (4-12).

In this study the sonographic findings that cause female pelvic pain in table (4-13) this distribution as follow: ovarian cyst 27 patients (45%) , PCO 9 patients (15%) , fluid collection in posterior cul-de-sac 7 patients

(11.7%), uterine fibroid 5 patients (8.3%) , endometritis 3 patients (5%), cervical fibroid 2 patients (3.3%) , cervical calcification 1 patient (1.7 %), appendicitis 1 patient (1.7 %) , lower ureteric stone 1 patient (1.7 %) , hydrosalpinx 1 patient (1.7 %) , cervical polyp 1 patient (1.7 %) , IUCD 1 patient (1.7 %), ovarian mass 1 patient (1.7 %) , ectopic pelvic kidney 1 patient (1.7 %). In this study we conclude that most cause of female pelvic pain is ovarian cyst and most of pelvic pain was occur in reproductive age this same as a result of (Maartha 2013) , and fibroid are common in women in fertile age. This as same results of (Zimmermann 2012).

5-2 Conclusion

Ultrasound has low cost and absence of ionizing radiation or need to contrast material , US has important role in diagnosis of female pelvic pain. Knowledge of normal and pathological sonographic appearance of pelvic and attention to technique will enable the sonologist to make optimal used of this optimal modality.

pelvic pain may vary multiple organ systems can contribute to pelvic pain and the gastrointestinal , genitor urinary and peritoneum all must be considered in patients who come with this symptoms.

In this study we conclude that most cause of female pelvic pain is ovarian cyst.

In this study showed Most of pelvic pain was occur in reproductive age and less common in menopause women.

The accuracy of TVS was highest in diagnosis of type of ovarian cysts , small lesion in uterus and fluid collection in pouch of douglas

The accuracy of linear TAS was high in diagnosis of Appendicitis.

Both clinical and sonographical evaluation of pelvic pain should be considered for the diagnosis of female pelvic pain. From the collective findings of this study and considering its limitations in sample size. the diagnosis cannot be based on ultrasound only , on the presence or absence of color flow doppler or on the morphological findings give information help in accurate diagnose in pelvic masses .

5-3 Recommendations:

-Ultrasound must be first modality to detect the cause of female pelvic pain ,thus could be used as routine checkup.

-Transvaginal ultrasound is best in gynecological pain .

-In all emergency hospital there must be qualified ultrasound machine with new accessories and Doppler facilities.

-Further study with more sample.

References

-Anil T. Ahuja et al 2007 diagnostic imaging ultrasound first edition .

-Carole M. Rumack et al 2011 Diagnostic ultrasound 4th edition , volume one.

-Cronin P ,Mc Pherson SJ ,Meaney JF , Mavor A , (2002) venouscovered stent successful occlusion of asymptomatic internal iliac arteriovenous fistula cardiovasc intervent radiol; 25:323-5.

-Farquhar C et al ,2015 national institute for health research ,centre for reviews and dissemination ,university of York.

-Goldstein SR, (1996) Report for cleaning and preparation of endocavitary ultrasound transducers between patients. Ultrasound obstet Gynecol; AIUM, 7:92-94 old version.

-Herald T. Lutz & Hassen A. Gharbi(2006). Chapter2: Manual of diagnostic ultrasound in infectious tropical diseases. springer-verlag; Berlin Heidelberg: Germany: 2006. P8.

-Hudelist G , Ballard K , English J, wright J , Banerjee S , Mastoroudes H , Thomas A , Singer CF , keckstein J Hudelist G , English J , Thomas AE , Tinelli A , Singer CF ,1997 Dec ; 12(12): 2649-53. Journal of clinical and diagnostic research. 2009 oct;(3): 1731-1736.

-Jane A. Bates 2004 , abdominal Ultrasound How , why and when second edition.

-Kim SH , yang DM ,et al 2002 , diagnosis of pelvic adhesions in patients with endometrioma : the role of transvaginal ultrasonography .

-Maartha et al 2013 Journal of obstetric and gynecological ultrasound

- MarekJantos 2007."understanding chronic pelvic pain" pelviperineology 26(2) : 60-69.

-Palmer .P.E.S.1995 "Manual of diagnostic ultrasound" first edition, WHO , Geneva . (PP 154- 178).

- Rochelle F .Andreotti M. D. FACR, FSRU , FAIUM (1988) Department of Radiology and Radiological Sciences Vanderbilt University Medical Center www. aium. Org. American Institute for Ultrasound in Medicine (AIUM) Bioeffects considerations for the safety of diagnostic ultrasound. J Ultrasound Med.

-Salveson KA , Eik-Ness SH 1995 Areview of epidemiological studies of human exposure to ultrasound. Ultrasound obstet Gynecol, 6:293-298.

-Sandra L 2012, text book of diagnostic sonongraphy, 7th edition volume one.

-Standring ,Susan et al. 2008 " Grays anatomy" , 40Th edition ,churechill livingstone elseiver , USA (PP 2248-2309).

-Steven M. Penny 2011 Examination review for ultrasound abdomen and obstetrics Gynecology.

-Tarjan Z , Mako E, Winterniz T, et al (2002) The value of ultrasonic diagnosis in acute ultrasound obstet Gynecol 2004 Aug; 24 (2): 180-5 ultrasound obstet gynecol. 2011 Apr, 37(4) :480-7.

-Trish chudleigh et al 2004 , Basky Thilaganathan, obstetric ultrasound , How, Why and when . 3rd edition

-Zafar N , Kupesic Plavsic S. (2012) Role of Ultrasound in the Evaluation of Acute Pelvic Pain in Non pregnant Reproductive Age Patients . Donald School J Ultrasound Obstet Gynecol ; 6 (2) : 207-2017.

-Zimmermann et al 2012 BMC womens health 12:6 http: // doi. Org/ 10.1186/ 1472 – 6874. 12.6 .

Appendices

APPENDIX A

Data collection sheet

General information:

- Patient age ☐ year. ☐
- Social status: Married ☐ Single . ☐

Clinical informations:

- pelvic pain:

Supra pubic ☐ R.I.F ☐ L.I.F ☐

- Vaginal bleeding: Yes ☐ No ☐
- Vaginal discharge: Yes ☐ No ☐
- Disuria: Yes ☐ No ☐

Ultrasound findings:

- Uterine size…….

Normal
enlarged

- Uterine mass: Yes No

Size……. Echo
Texture……..

- Ovaries: Normal ☐ Abnormal ☐

Mass: size…….. Cyst: ☐
size …….. ☐

- Pouch of Douglas collection: Yes ☐

No ☐

- R.I.F and L.I.F mass: Yes ☐ No ☐

Size…… ☐
Echo Texture…….…… ☐

- Urinary Bladder wall thickening: yes ☐ No ☐
- Vesical stone: Yes ☐ No ☐
- Ureteric stone: Yes ☐ No ☐
- Endometrium cavity wall thickening: Yes ☐ No ☐

APPENDIX B

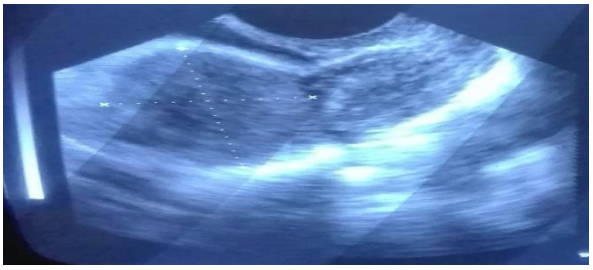
Data Sheet Collection

Number	Patient Age	Social Status	Sonographic Findings
1	22	Married	Ovarian cyst
2	65	Married	Ovarian cyst
3	22	Married	ovarian cyst
4	47	Married	ovarian cyst
5	29	Married	Fundal Fibroid
6	25	Married	ovarian cyst
7	35	Married	Endometritis
8	39	Single	ovarian cyst
9	60	Married	Fundal Fibroid
10	25	Married	Fluid collection in post cul-de-sac
11	30	Married	Fluid collection in post cul-de-sac
12	25	Married	Endometritis
13	30	Married	Ovarian cyst
14	34	Married	Ovarian cyst
15	25	Married	PCO
16	35	Married	Ovarian cyst
17	40	Married	Cervical calcification
18	17	Single	Appendicitis
19	30	Married	Ovarian cyst
20	30	Married	Endometritis
21	25	Single	PCO
22	25	Married	Fundal Fibroid
23	20	Married	Ovarian cyst
24	26	Married	Ovarian cyst
25	30	Married	Ovarian cyst
26	30	Single	Multiple fibroids
27	32	Married	Ovarian cyst
28	45	Married	Ureteric stone
29	45	Married	Fundal fibroid
30	38	Married	Ovarian cyst
31	18	Single	Cervical polyp

32	23	Married	PCO
33	35	Married	IUCD
34	25	Married	Ovarian cyst
35	30	Married	Ovarian cyst
36	20	Married	PCO
37	24	Single	Fluid collection in post cul-de-sac
38	25	Married	PCO
39	25	Married	Ovarian cyst
40	32	Married	Cervical fibroid
41	21	Married	PCO
42	60	Married	Ovarian mass
43	25	Married	Fluid collection in post cul-de-sac
44	32	Married	Fluid collection in post cul-de-sac
45	20	Single	PCO
46	35	Married	Ovarian cyst
47	35	Married	Fluid collection in post cul-de-sac
48	30	Married	Fluid collection in post cul-de-sac
49	47	Married	PCO
50	38	Married	Cervical fibroid
51	22	Married	Ovarian cyst
52	21	Married	Ovarian cyst
53	40	Married	Ovarian cyst
54	19	Single	Huge Ovarian cyst
55	70	Married	Ectopic right pelvic kidney
56	17	Married	PCO
57	35	Married	Ovarian cyst
58	22	Single	Ovarian cyst
59	27	Married	Ovarian cyst
60	22	Married	Ovarian cyst

Appendix C

Images

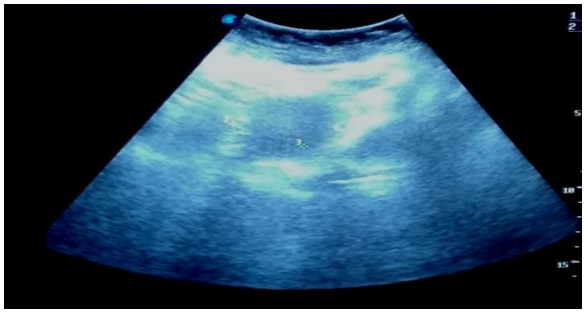


29 Years female with subserous fibroid measured about (4.6 x4.2)cm.

40 years female with right ovarian cyst (5.2x3.1) cm.

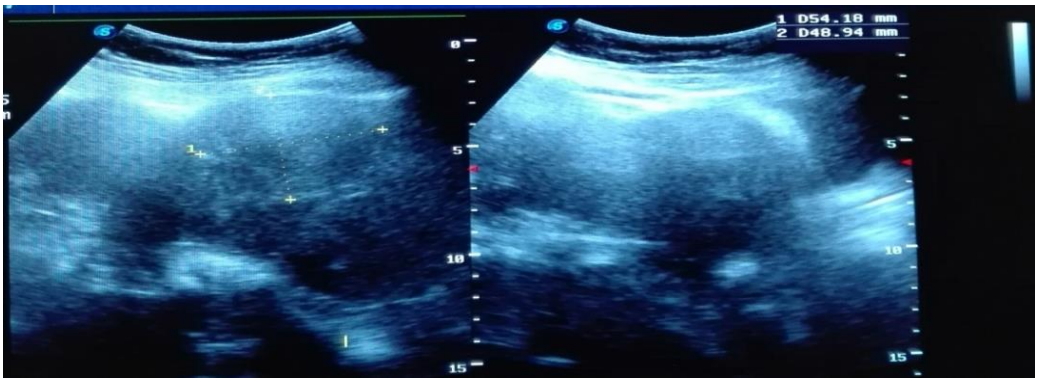
22 Years female with Rt ovarian (hemorrhagic) cyst measured about (4.2x2.5) cm.

47 Years female with left ovarian cyst measured about (5.9 x5.5)cm.

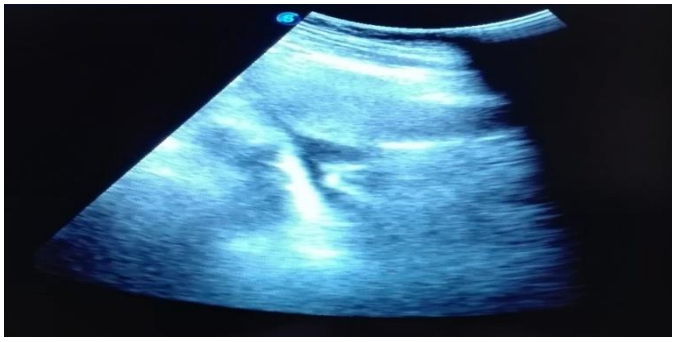


65 Years female with left ovarian cyst measured about (4.6x 4.4)cm.

39 Years female cyst with follicular cyst in Rt ovary measured about (2.6x2.4) cm



60 Years female bulky uterus with multiple subserous fibroid the largest one measure about 5.4x4.8) cm



25 Years female with enlarge uterus with fluid collection in posterior cul-de-sac-------PID.

30 Years female with enlarge uterus with fluid collection in posterior cul-de-sac-----PID

30 years female come with chronic pelvic pain diagnosed by ultrasound it is right ovarian cyst (Hemorrhagic cyst) measure about (15.5x 12) cm.

25 years female with poly cystic ovaries (PCO)

30 years female with fluid collection in endometrium ------endometritis

45 years female with left tubular cystic structure(19) mm. -------Hydrosalpinx

38years female with left ovarian complex mass most systic component (8.3x5.4)cm

--- Suggestion of Ca ovary

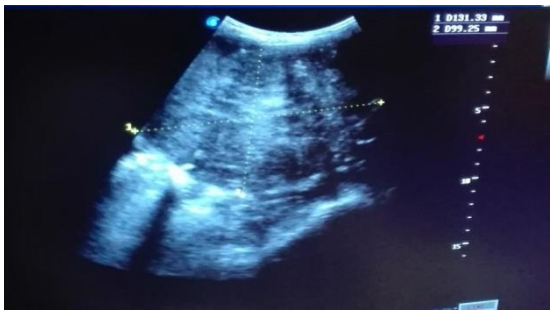
18 years female with hyperechoic components in cervix (2.6 x2.3) cm ---cervical polyp

35 years female with IUCD

25 years female with left ovarian cyst (3.5 x3.3)cm .

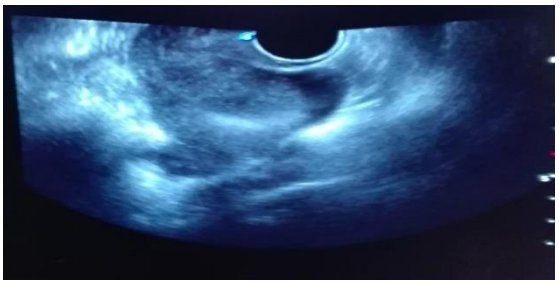
23 years female with PCO

30 years female with right ovarian cyst (cyst with septum) ---(4x3.9)cm.

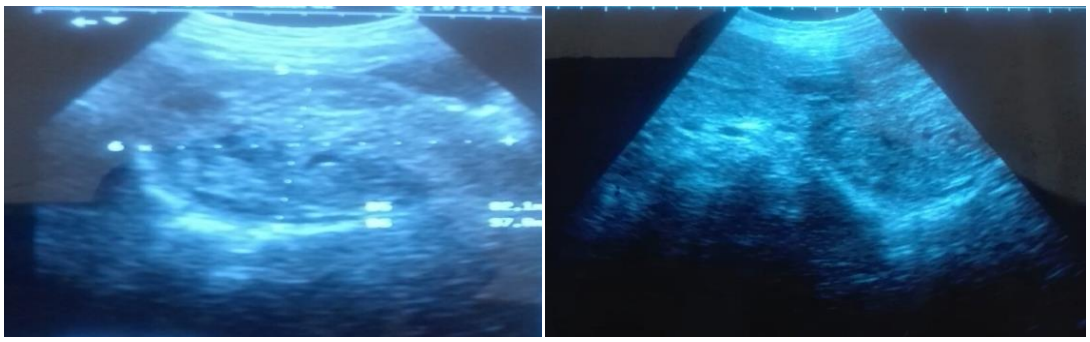


30 years female with fibroid with heterogeneous texture and micro calcification (13.1 x 9.9) cm

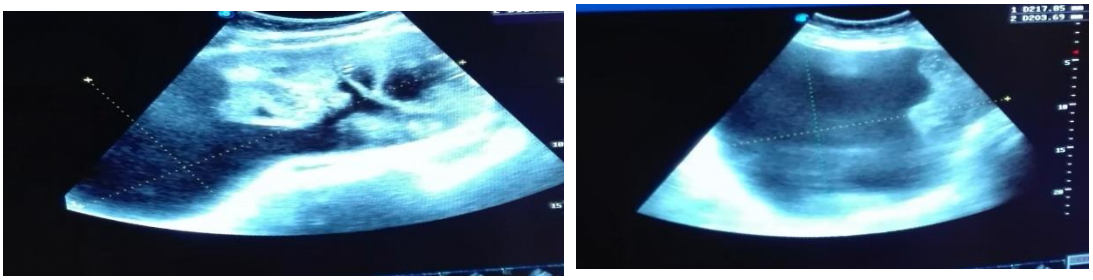
45 years female with multiple subserous fibroids it push UB wall the largest one measure abouts (4.4 x4) cm



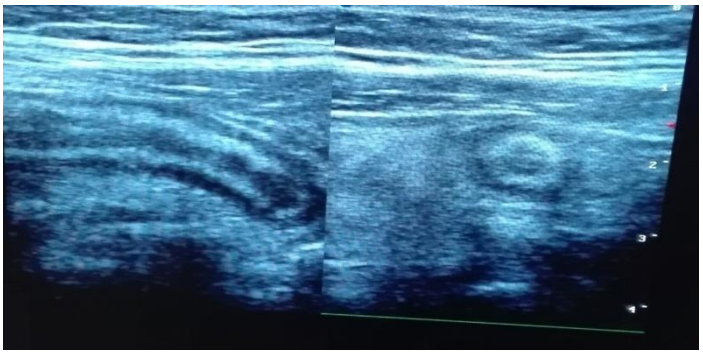
25years female with retroflex uterus and she has fluid collection in posterior cul-de sac + right ovary with follicle measured about (22x 15) cm.



32 years female with cervical fibroid (8.2 x9.7)cm



60 years female with Huge cystic mass with multiple septa and internal solid mass in right ovary (21.7 x20.3) cm ------suggestion Ca ovary.



17 years female with Appendicitis

19 years female with huge left ovarian cyst measure abouts (6.6 x6.2) cm.

70 years female with right ectopic pelvic kidney