Section A -Research paper

Types of Ovarian cyst: Review Article

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Abstract:

The adnexa is a set of structures adjacent to the uterus, consisting of the ovaries and fallopian tubes. Even though the fallopian tubes are one of the major adnexal structures, this article will focus on different types of cysts that can form within the ovary. The ovaries are suspended laterally to the uterus via the utero-ovarian ligament, covered by the mesovarium, which is one of the three components of the broad ligament, and connected to the pelvic sidewall via the infundibulopelvic ligament, which is also known as the suspensory ligament of the ovary. In premenopausal women, the ovaries produce numerous follicles a month, with one dominant follicle maturing and undergoing ovulation. As a result of ovulation, a fluid-filled sac known as an ovarian cyst can form on one or both ovaries. Adnexal masses or ovarian cysts are not uncommon, with 20% of women developing at least one pelvic mass in their lifetime. Various subcategories have characterized more than thirty types of ovarian masses, and management is determined by the characteristics of the lesion, the age of the patient, and the risk factors for malignancy. In women of reproductive age, most ovarian cysts are functional and benign and do not require surgical intervention. However, ovarian cysts can lead to complications such as pelvic pain, cyst rupture, blood loss, and ovarian torsion that require prompt management.

Keywords: Ovarian cyst, adnexal mass.

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Introduction:

An ovarian cyst is a fluid-filled sac in the ovary. It is a common gynecological problem that is divided into 2 main categories; physiological and pathological. Physiological cysts are mainly

follicular cysts and luteal cysts. Pathological cysts are considered as ovarian tumors, which might be benign, malignant, or borderline (Fig. 1) **(1).**

Many ovarian cysts are asymptomatic and found incidentally on routine pelvic examination or during imaging studies for another indication **(2).**

Sometimes ovarian cysts are associated with pelvic pain, discomfort and dispareunia. Cyst can even rupture leading to peritoneal irritation, peritonitis and hemoperitoneum. It can also present with torsion and pain, leading to acute abdomen **(3).**

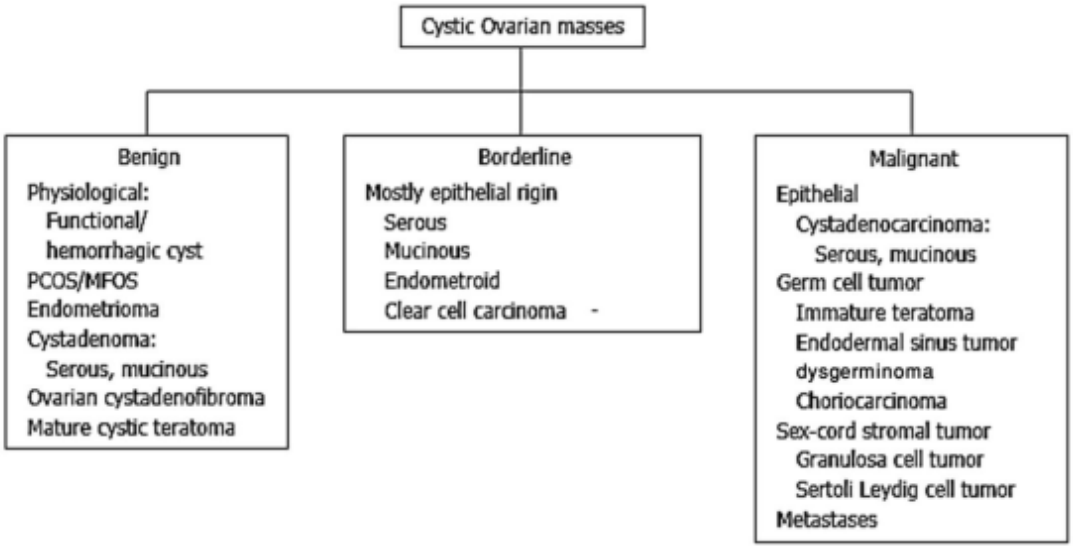

Fig. (1): Cystic ovarian masses (4)

Physiologic and functional ovarian cysts

These are the most common finding in reproductive age group, but can be found in any age group from infancy to postmenopausal period. These include follicular cysts, corpus luteal cysts, theca lutein cysts which are often asymptomatic, typically resolving in 8–12 weeks. If large, however, they can cause pressure effects or pain, and if significant hemorrhage, cyst leakage, rupture, or torsion occurs, acute symptoms develop **(5).**

Follicular cyst:

It is the most common functional cyst rarely larger than 8 cm. In healthy premenopausal women whose ovaries are not hormonally suppressed, monthly dynamic changes initially occur due to preovulatory development of a dominant follicle. During this phase of the cycle (variably referred to as the follicular, proliferative, or preovulatory phase), pelvic US depicts a developing follicle as a thin-walled, round to oval, a vascular simple-appearing cyst. At ovulation, its diameter ranges

from 1.7 to 2.8 cm, but a diameter of up to and including 3.0 cm is considered normal. A functional follicle develops when ovulation fails to occur, and the follicle continues to enlarge but remains simple in its US appearance (Fig. 2) **(6).**

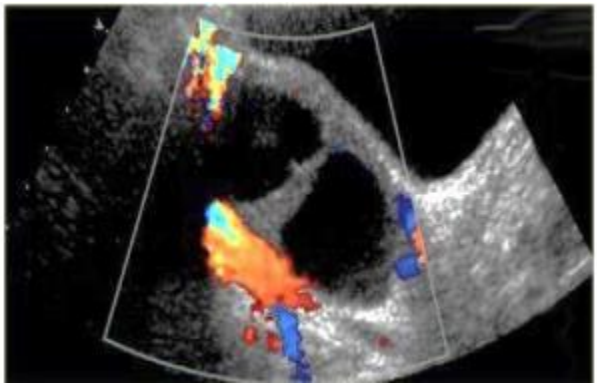

Fig. (2): The US-image shows two simple cysts in the right ovary with ovarian stroma in between. The surrounding vessels are normal and there are no vascularized septations. These were simple follicular cysts **(7).**

Corpus luteal cyst:

It is less common than follicular cysts. A functioning corpus luteum develops when the corpus luteum fails to resorb following ovulation. It measures up to 3.0 cm, but its gray-scale appearance is more varied and ranges from a thick-walled cyst with an irregular crenulated margin, to a cyst that appears more collapsed, giving it a relatively solid appearance (Fig. 3) **(8).**

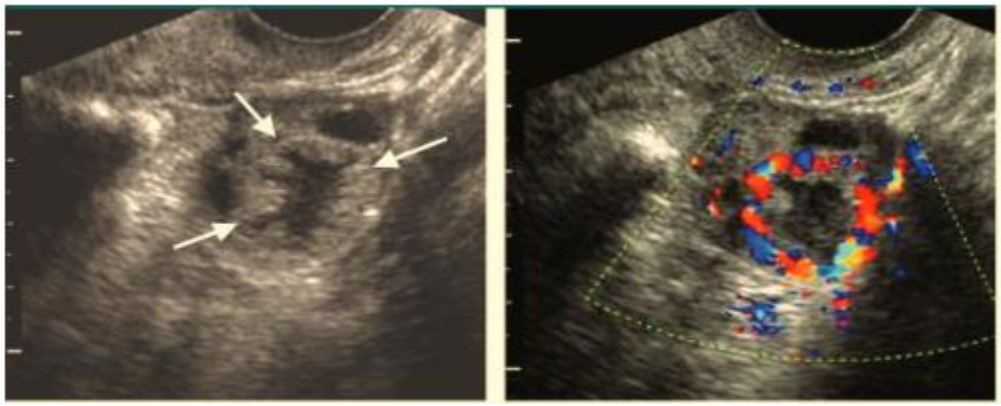

Fig. (3): Corpus luteum in a 35-year-old woman. (a)Transvaginal US scan demonstrates a typical appearance of a corpus luteum within the ovary. It has a slightly thick, crenulated wall (arrows) and a small cystic center. (b)Color Doppler US scan shows abundant flow in the wall of the corpus luteum **(9).**

Theca lutein cyst:

It is the least common functional ovarian cyst. They are usually bilateral and occur with pregnancy. It is also seen in molar pregnancy, multiple gestation, choriocarcinoma, and diabetes mellitus. They can reach up to 30 cm and are generally multicystic and resolve spontaneously **(5).**

Hemorrhagic ovarian cyst:

It is an adnexal mass formed because of occurrence of bleeding into a follicular or corpus luteum cyst. Hemorrhagic ovarian cysts (HOC) are commonly seen in clinical practice because hemorrhage into a cyst is usually painful triggering the patient to consult her physician. They can present with variable clinical symptoms and signs ranging from no symptoms up to acute abdomen **(10).**

Sonographic features that are considered classic for a HOC and that allow a confident diagnosis are: a complex cystic mass with a reticular pattern of internal echoes (also known as fishnet, spider web, or lacy appearance, generally due to fibrin strands) and/or a solid-appearing area with concave margins, no internal flow at color Doppler US, and usually circumferential flow in the wall of the cyst. Wall thickness is variable in hemorrhagic cysts. They are often misdiagnosed due to their variable sonographic appearance; mimicking other adnexal masses (Fig. 4) **(11).**

Most of HOCs are functional, few of them can be neoplastic but they are universally benign. Surgical intervention should be deferred in the management of HOCs as most of them disappear spontaneously within 8 weeks, so confident clinical and sonographic diagnosis should be attempted to avoid exposing the patient to unnecessary surgery. In follow up, US is usually recommended after 2-3 consecutive cycle to confirm the diagnosis of HOCs. Surgical intervention may be indicated in cases of large cysts greater than 5 cm in diameter, severe persistent abdominal pain, failure of the cyst to resolve spontaneously, masses that cannot be confirmed to be benign by US criteria and finally occurrence of complications such as rupture and ovarian torsion **(10).**

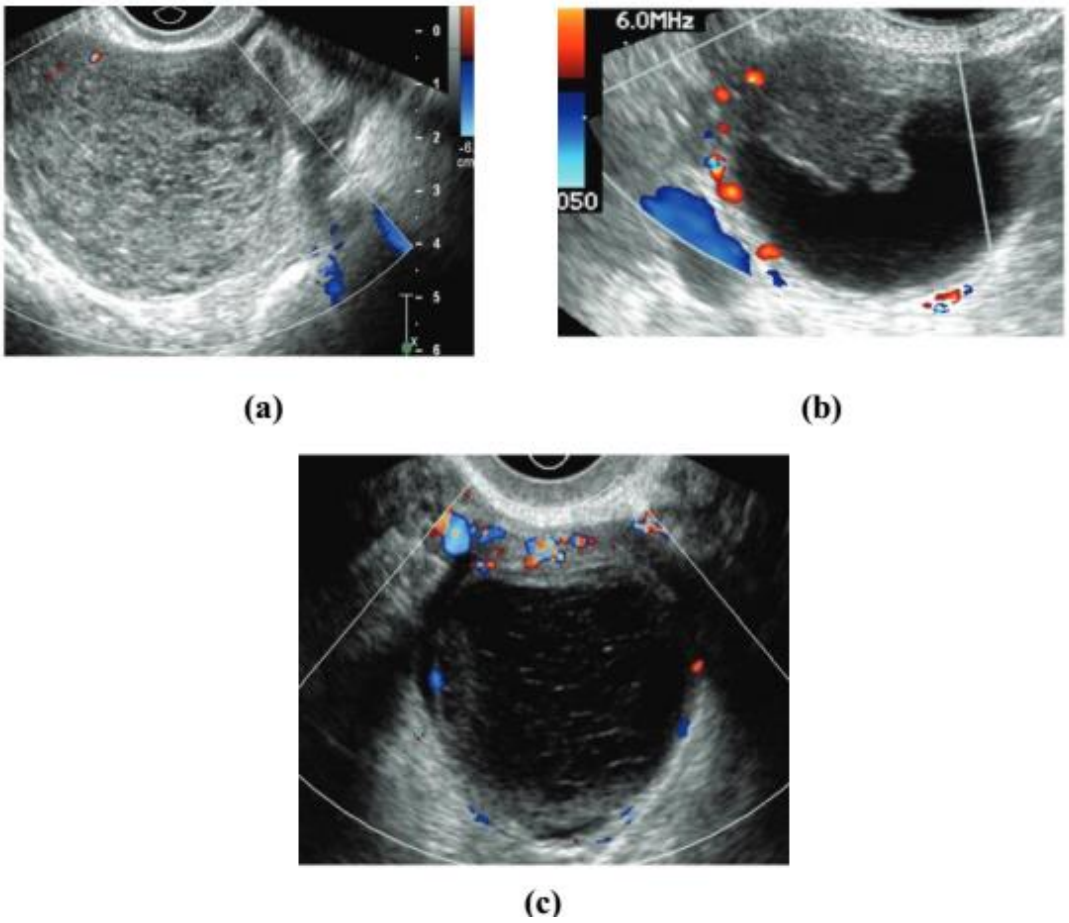

Fig. (4): HOC cysts: (a) Coronal transvaginal color Doppler US image of the ovary demonstrates echogenic, avascular, heterogeneous non shadowing material compatible with acute blood clot. (b) Coronal transvaginal color Doppler US image of the right ovary in a different patient demonstrates a cyst with a solid- appearing mural nodule. The nodule is avascular with concave edges, findings that are characteristic of a retracting clot. (c) Sagittal trans-vaginal color Doppler US image of the left ovary in a third patient demonstrates a cystic structure with avascular irregular fine linear echoes that represent fibrin strands in a resolving hemorrhagic cyst **(6).**

Polycystic Ovaries:

It is one of the most common human endocrinopathies, affecting 5%-10% of women of reproductive age. Patients with polycystic ovary syndrome are often anovulatory and will have multiple small (approximately 1 cm) follicles lining the periphery of both ovaries. often described as a "string of pearls appearance "Ovaries are enlarged to 2–5 times their normal size. The classic US feature is an enlarged ovary with 10 or more peripherally arranged cysts, each cyst of 2-8 mm in diameter, with an echogenic central stroma. Obesity, hirsuitism, and anovulation are the classical triad of this disorder also known as Stein Leventhal syndrome (Fig. 5) **(4).**

Fig. (5): Transvaginal US of a polycystic ovary. The ovary is more spherical in shape and has an increased number of follicles that are situated in the periphery of the ovary. Note also the presence of increased stromal echogenicity **(6).**

BENIGN NEOPLASMS

Benign neoplastic masses in the ovaries include dermoid cysts (mature cystic teratomas), endometriomas, epithelial ovarian cysts, usually serous, rarely mucinous, and ovarian cysadnofibroma **(12).**

Endometriomas:

The ectopic implantation of endometrial tissue outside the uterus is termed as endometriosis. It is commonly seen in child bearing age. The ovary is the most common site for extra uterine endometrial tissue deposition, Endometriosis may be clinically silent or may present with pelvic pain, mdysmenorrhea and infertility **(13).**

Sonographically, it is a well-defined, smooth-walled uni- or multi loculated cyst that contains homogeneous low-level echoes, which impart a characteristic “ground-glass” appearance, no internal flow at color Doppler, no enhancing nodules or solid masses. In approximately 15% of cases, however, atypical findings may be visible, including mural irregularities, which are usually avascular and are likely due to adherent mural clot or fibrin (Fig. 6) **(14).**

Rarely, endometriomas may have flow due to the presence of endometrial tissue. It can overlap with other conditions, including hemorrhagic cyst, dermoid, and even ovarian carcinoma. Furthermore, malignant transformation to endometrioid or clear cell carcinoma has been reported in approximately 1% of endometriomas; this typically occurs with endometriomas larger than 9 cm and in women over 45 years of age **(4).**

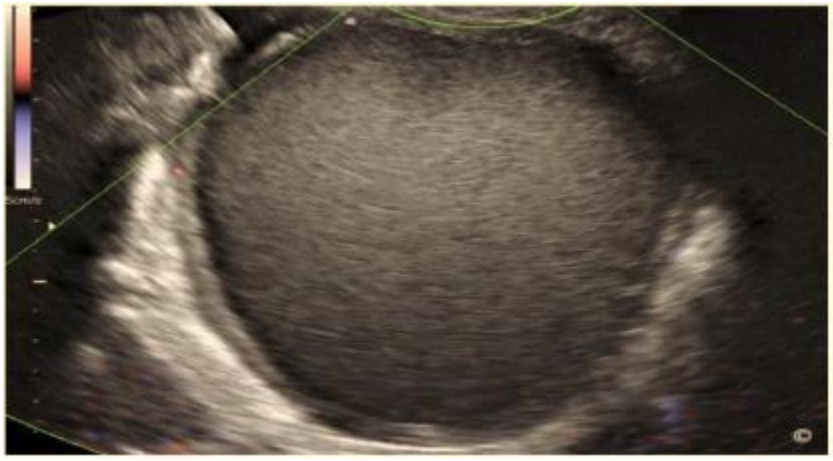

Fig. (6): Transvaginal US with color Doppler of an endometrioma showing a unilocular mass with ground glass appearance. Note the absence of vascularity within the content of the mass on color Doppler **(15).**

Dermoid cysts (mature cystic teratomas):

Dermoids, or mature cystic teratomas, are benign germ cell tumors of the ovary and are the most common neoplastic cysts found in adolescents. They arise from three embryogenic germ cell layers, constituting sebaceous material, hair follicle, skin glands and muscles. Dermoids can be present with dull abdominal pain but are frequently asymptomatic and often found by pelvic examination or incidental imaging **(16).**

They have a characteristic US appearance with focal or diffuse hyperechoic components (fat fluid levels), hyperechoic lines and dots (thought to be hair fibers within the cyst), and area of acoustic shadowing, with no internal flow at color Doppler US, and may contain a mural hyperechoic nodule called a Rokitansky nodule (Fig. 7) **(4).**

In adolescents, dermoid cysts are bilateral in 7-15% of patients. The main common complications of benign cystic teratoma are torsion (16%) and this may be caused by large size and the weight of their contents, malignant degeneration (2%), rupture (1-2%) and infection (1%) **(17).**

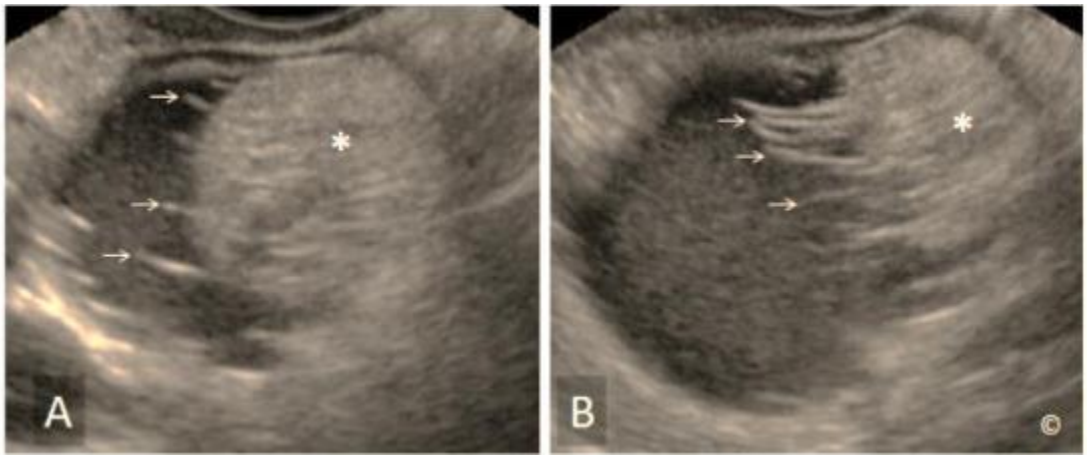

Fig. (7): Transvaginal US of dermoid cyst A and B. Note the white echogenic "ball" (Rokitansky nodule) in A and B. Note the long and short echogenic linear strands, which correspond to the hair content (arrows) **(18).**

Serous cystadenoma/mucinous cystadenoma:

They are benign epithelial ovarian tumors and are seen infrequently in adolescents. They should be considered in the differential of a persistent ovarian cyst, because of their ability to become extremely large with the possibility of borderline or low malignant potential **(19).**

Serous cystadenoma:

Is usually thin walled (less than 3 mm) cysts; unilocular or rarely multilocular (Fig. 8) **(4).**

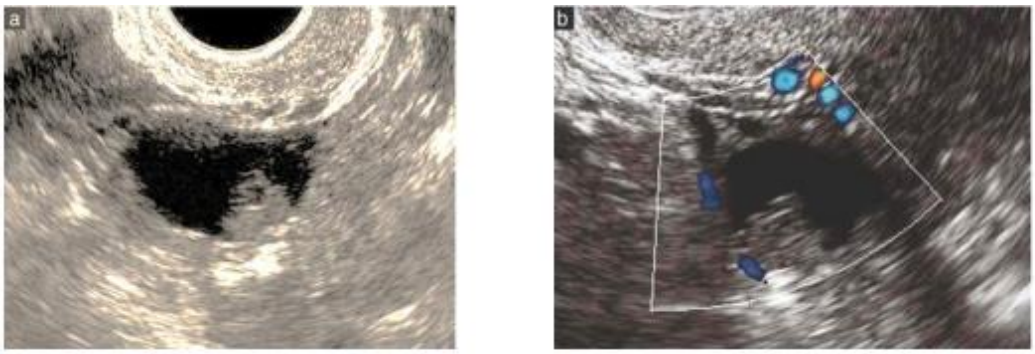

Fig. (8): US images showing benign serous cystadenoma: (a) gray-scale image showing small cyst with internal papilla; (b) power Doppler imaging did not show internal vascularization of the papilla **(20)**

Mucinous cystadenoma:

Is larger in size than serous cystadenoma. On US, it presents as multilocular (honeycomb like locules) with a thin regular wall and septa without any endo or exocytic vegetation (Fig. 9) **(5).**

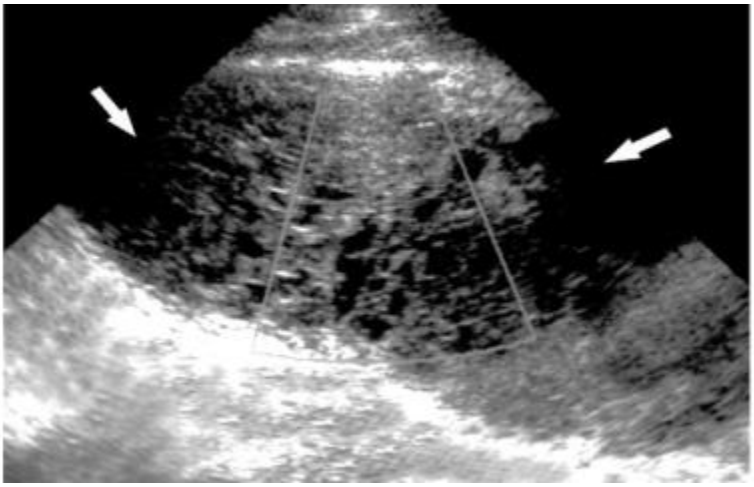

Fig. (9): Mucinous cystadenoma with an architecture similar to that of an HOC in a 32-year-old woman with abdominal and pelvic pain. The transabdominal US shows a large pelvic mass with enhanced through transmission and a reticular pattern. This was surgically removed and found to be a mucinous cystadenoma **(21).**

Ovarian cystadenofibroma:

It is an uncommon epithelial ovarian neoplasm in which fibrous stroma is the dominant component in addition to the epithelial lining. These are usually benign, occurring in the reproductive period and an accurate preoperative diagnosis may contribute to avoiding surgical intervention. Half of ovarian cystadenofibromas are purely cystic and the other half is complex cystic masses with a solid component and/or thick septa, there by mimicking a malignant lesion. Imaging findings of purely cystic cystadenofibroma are similar to cystadenomas **(4).**

Fibrotic Tumors:

Fibromas account for approximately 4% of all ovarian neoplasms. Women with these tumors are generally asymptomatic, and masses are typically detected in middle-aged women at palpation during routine gynecologic examination. Ovarian fibromas appear as solid hypoechoic masses with sound attenuation, thereby mimicking malignant neoplasms. They are associated with ascites in 40% of cases, particularly in larger lesions, and with pleural effusions (Meig syndrome) in a small percentage of cases **(9).**

Fibromas and cystadenofibromas are not related. Fibromas are of stromal derivation and have no epithelial component. In contrast, in cystadenofibromas, the fibrous component is part of the neoplasm, which is believed to be of epithelial and stromal origin similar to cystadenomas and cystadenocarcinomas (Fig. 10) **(22).**

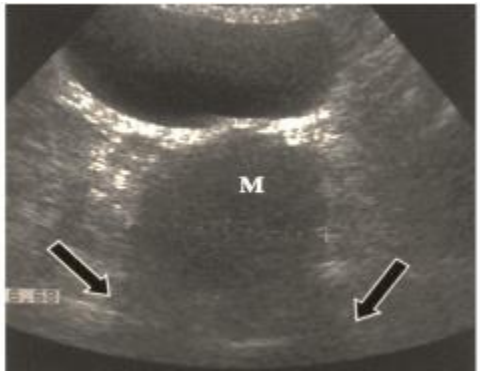

Fig. (10): Ovarian fibroma in a 68-year-old woman with prior hysterectomy. Transverse transabdominal US image shows a hypoechoic mass (M) with sound attenuation (arrows) **(23).**

Borderline cystic ovarian neoplasms

This group includes noninvasive ovarian neoplasms histologically characterized as epithelial tumors with a stratified growth pattern. These usually manifest in younger females with an excellent prognosis. Serous and mucinous neoplasms constitute the majority of borderline tumors **(2).**

On imaging, borderline serous cystic neoplasms manifest as complex cystic masses with mural nodules and septations. Serous borderline tumors may behave aggressively, presenting with lymphadenopathy and peritoneal implants. The serous borderline tumors still have a better prognosis in contrast to the high-grade serous cystadenocarcinoma. These are rarely diagnosed preoperative. The diagnosis may be considered based on a younger age group and mildly elevated CA-125 levels (Fig. 11) **(4).**

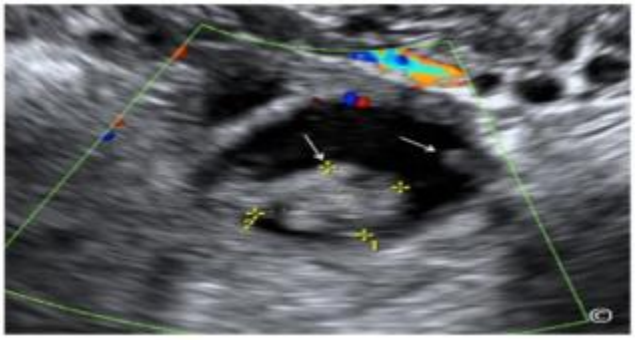

Fig. (11): Transvaginal US of a borderline serous cystadenocarcinoma. Note the presence of papillary projections (arrows) in a small cystic mass **(20).**

Borderline Mucinous ovarian tumors are less common than serous neoplasms, It is usually appear as large cystic multilocular masses containing sticky gelatinous fluid. Most of them are unilateral and well-differentiated (Fig. 12) **(24).**

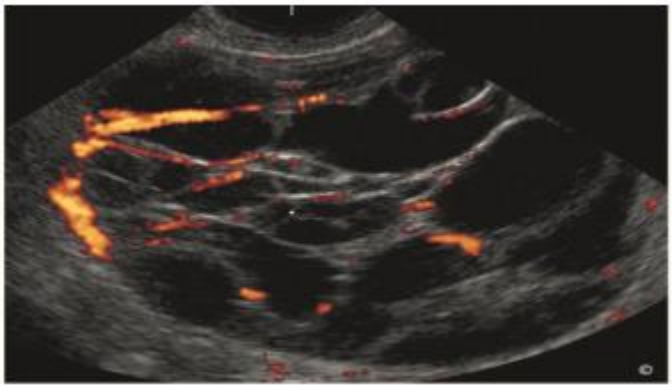

Fig. (12): Transvaginal US with high definition color of a borderline mucinous cystadenocarcinoma. Note the presence of multiple thick septations with vascularity noted on color Doppler **(20).**

Endometroid carcinomas:

They constitute 10%– 15% of all ovarian carcinomas. They are the most common malignant neoplasm arising within endometriosis. These tumors are bilateral in 30% - 50% of cases. Imaging findings include a large, complex cystic mass with enhancing solid component (Fig. 13) **(2).**

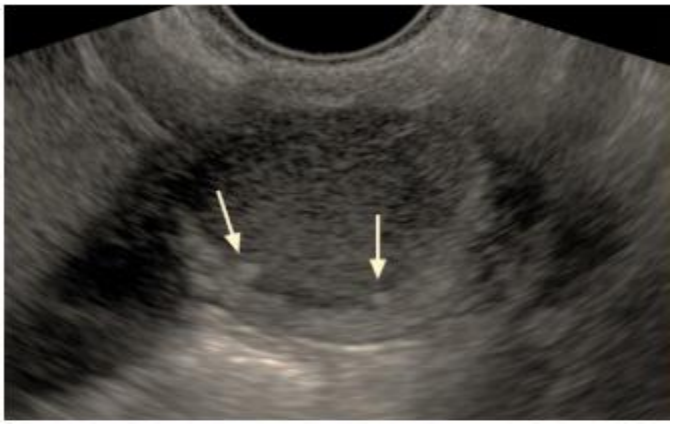

Fig. (13): Endometrioid carcinoma on background of endometriosis. Transvaginal US shows several small polypoid lesions that have diffuse internal low echoes (arrows) along the wall of the cystic mass **(7).**

Clear cell carcinoma:

It constitutes 5% of all ovarian carcinomas and is usually seen in patients with endometriosis. Imaging findings include a unilocular or large cyst with solid protrusions demonstrating mild post contrast enhancement and may overlap with cystadenofibroma. These findings are non-specific and add to the differentials of low malignant potential serous tumors (Fig. 14) **(4).**

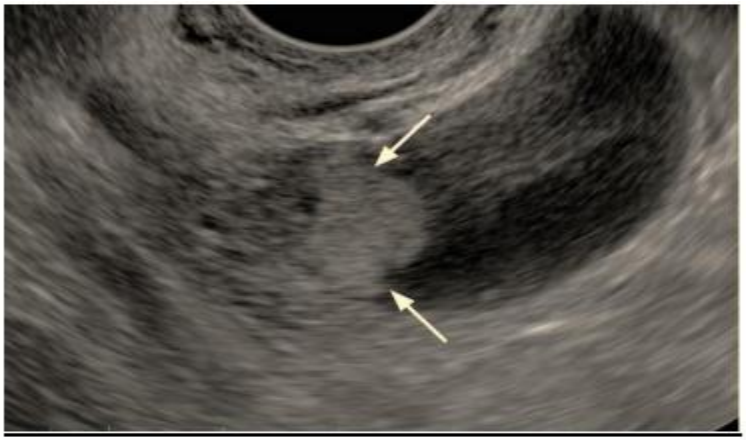

Fig. (14): Clear cell carcinoma. Transvaginal US shows a well-defined cystic mass with a solid nodule which has a smooth round margin and seems to be slightly different from typical papillary projections (arrows). Doppler US demonstrated blood flow in the solid nodule (not shown) **(7).**

Malignant cystic neoplasms

On imaging, malignant cystic neoplasms are complex masses with a solid and cystic component. The presence of a thick irregular wall (> 3 mm), septations (> 3 mm), papillary projections and

enhancing soft tissue with a necrotic component are highly suggestive of malignant neoplasms. They are usually associated with ascites, peritoneal and omental implants and lymphadenopathy, depending on the extent of the disease (Fig. 15) **(2).**

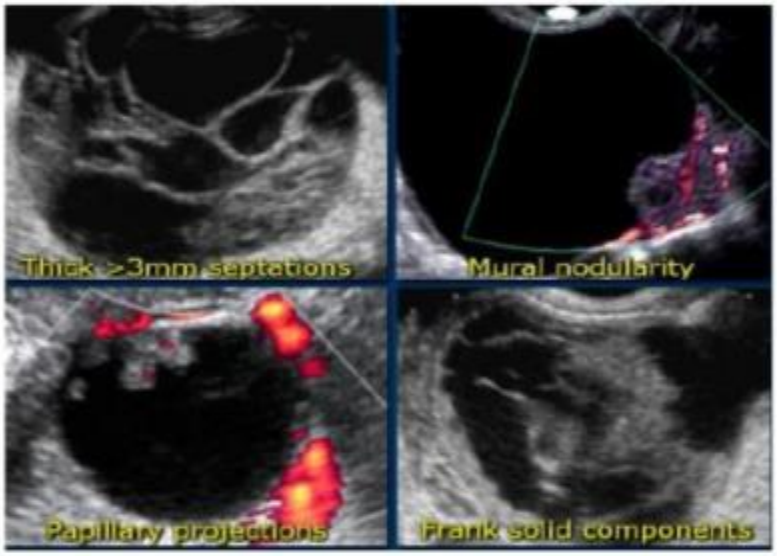

Fig. (15): Features of malignancy **(6).**

The three major types of ovarian tumors are epithelial, sex cord, and germ cell. Epithelial cell tumors represent the majority of all ovarian neoplasms (82%) (Fig. 16) **(25).**

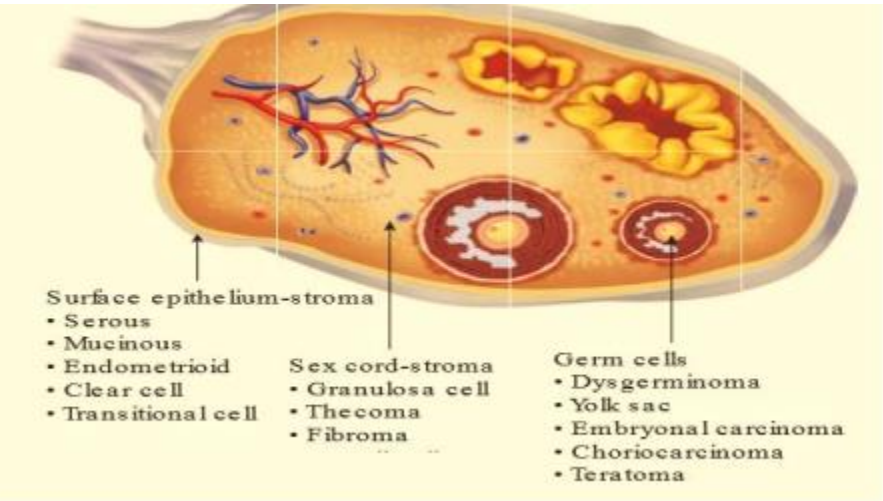

Fig. (16): Origin of the three main types of malignant ovarian tumors **(2).**

Serous cystadenocarcinoma:

It constitutes 25% of serous epithelial neoplasms, It is seen bilateraly and peritoneal carcinomatosis are frequently encountered with serous cystadenocarcinoma (Fig. 17) **(4).**

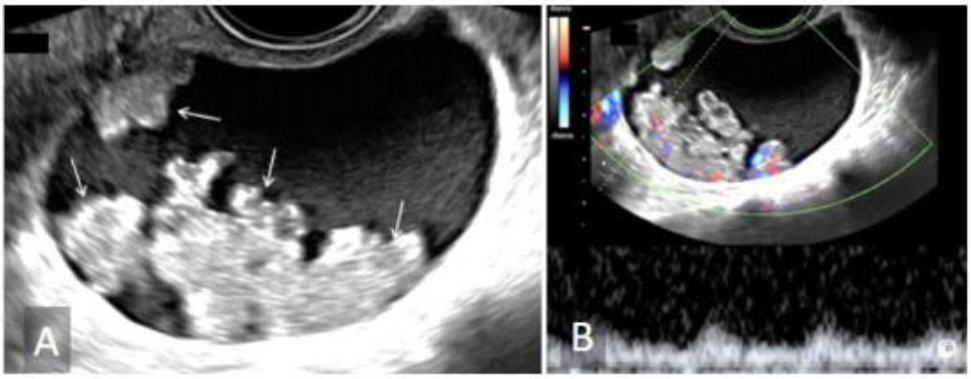

Fig. (17): Transvaginal US of serous cystadenocarcinoma of the ovary. Note the presence of multiple papillary projections in A (arrows) and in B, color and pulsed Doppler shows vascularity within the papillary projections **(20).**

Mucinous cystadenocarcinoma:

It constitutes 5% to 10% of mucinous epithelial neoplasms. They are mostly unilateral and have papillary projections and solid enhancing soft tissue components. They can rupture and cause pseudomyxoma peritonei (Fig. 18) **(2).**

Fig. (18): Transvaginal US images of a lesion eventually diagnosed as mucinous cancer following surgery: the lesion showing a thick papillary projection **(26).**

Germ cell tumor (GCT):

GCTs represent 15%-20% of all ovarian neoplasms and include the following subtypes: mature teratoma, immature teratoma, dysgerminoma, endodermal sinus tumor, embryonal carcinoma and choriocarcinoma **(4).**

Approximately 3-5% of ovarian GCTs are malignant. The most commonly occurring GCT is the dysgerminoma, which accounts for only 1-5% of all ovarian cancers **(25).**

Dysgerminoma:

Dysgerminoma is highly malignant and has its peak incidence in young women. Clinically the patients present with abdominal pain, abdominal distention, and presence of a palpable mass, reduced appetite, vomiting, and nausea as well as ovarian torsion. Dysgerminomas reveal in 28% of cases presence of lymph node metastasis (Fig. 19) **(27).**

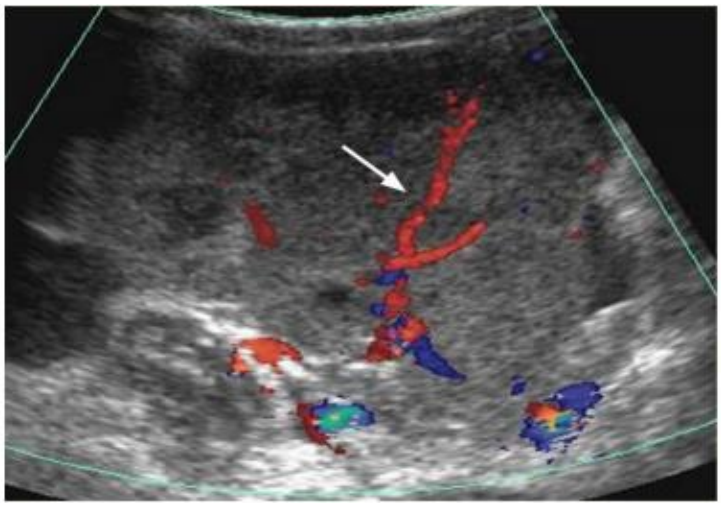

Fig. (19): Dysgerminoma: Transabdominal Doppler US shows a lobulated hypoechoic solid mass with prominent blood flow in the fibrovascular septa (arrow) **(7).**

Immature ovarian teratoma:

They are uncommon ovarian germ cell tumours. They differ from mature ovarian teratomas (dermoid cysts) histologically by the presence of immature tissue, and clinically by their more malignant behaviour. It is less common than mature ovarian teratomas, representing less than 1% of ovarian teratomas. They also affect a younger age group, occurring most often in the first two decades of life (accounting for 10-20% of malignant ovarian tumours in this age group). Presentation may be with a palpable pelvic mass or less commonly with abdominal pain **(28).**

An immature cystic teratoma is characterised by the presence of immature or embryonic tissue, as well as the mature tissue elements seen in a mature teratoma. It is associated with elevated serum AFP in 50% of cases. The imaging appearance is typical of a large, heterogeneous mass with a prominent solid component.Immature teratomas tend to be larger than mature cystic teratomas at initial presentation, also may metastasise to the peritoneum, liver or lung. Metastasis to the brain has also been reported (Fig. 20) **(29).**

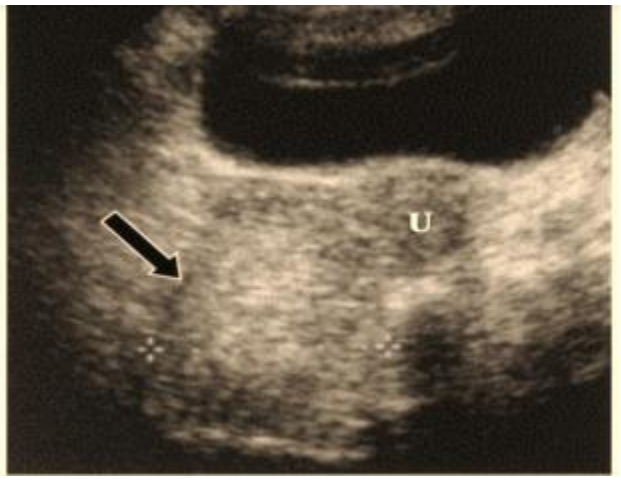

Fig. (20): Mature cystic teratoma in a 31-year-old woman with an elevated serum CA-125 level of 384. (a) Transabdominal US image shows hypoechoic mass with sound attenuation (arrow). U = uterus **(23).**

Endodermal sinus tumor (Yolk sac tumor):

Is a rare malignant tumor of germ cell group and seen during the second decade of life. It is associated with an elevated serum AFP level. US demonstrates a large heterogeneous complex mass with solid and cystic component **(2).**

Sex Cord Tumours

Granulosa cell tumor:

Accounts for less than 5% of all malignant ovarian tumors and is the commonest malignant sex cord tumor. Adult ovarian Granulosa cell tumors are the most common ovarian neoplasms associated with irregular menstruation cycles, menorrhagia and amenorrhea due to estrogen production by the tumor. On US, Granulosa cell tumor has been described as a complex cystic echogenic mass. sometimes showing a honey comb pattern. The multilocular cystic spaces are usually filled with hemorrhage or serous fluid. They are mostly confined to the ovary at the time of diagnosis (Fig. 21) **(4).**

Fig. (21): Granulosa cell tumor **(30)**

Ovarian metastases:

Constitute approximately 10% of all ovarian neoplasms. Metastases may occur via direct extension or peritoneal spread. The most common primary neoplasms are bowel, stomach and breast **(31).**

Krukenberg tumors are used as a synonym for ovarian metastasis from gastric cancer demonstrating mucin filled signet cells and are mostly bilateral and solid. Cystic ovarian metastases originate from colon cancer and frequently present as multi loculated cystic masses with a varying amount of solid component. Metastases from mucin producing tumors and also those with cystic and necrotic solid component closely resemble primary neoplasms (Fig. 22, 23) **(2).**

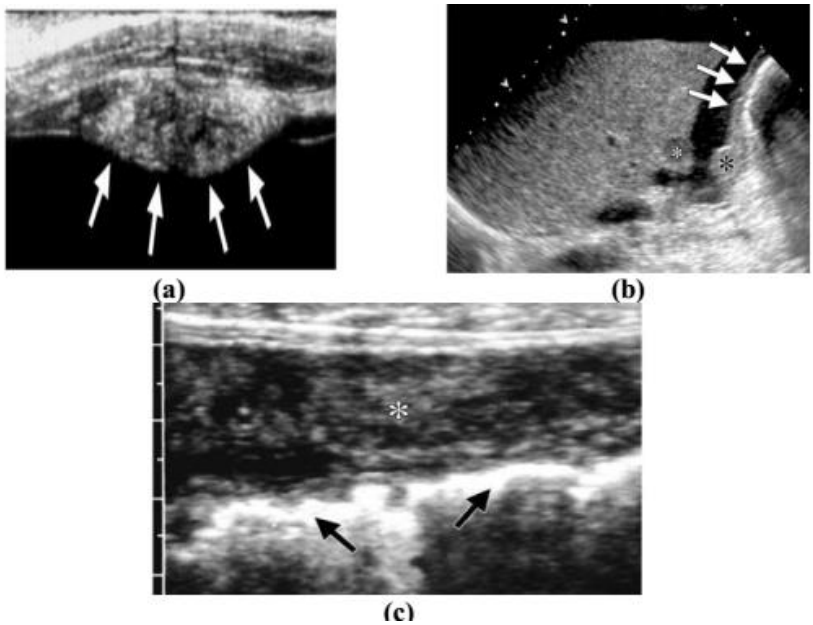

Fig. (22): Ovarian metastases: (a) Superficial US image obtained by linear transducer demonstrates a soft-tissue nodule (arrows) on the peritoneal surface outlined by ascites, findings that are compatible with a peritoneal implant. (b) Sagittal transabdominal US image of the right upper quadrant obtained in a different patient shows ascites with peritoneal thickening (arrows) and nodularity (black asterisk), as well as a surface implant on the liver (white asterisk). (c)Superficial US image obtained by linear transducer in a third patient demonstrates superficial soft-tissue thickening (asterisk) due to omental metastases. Note the posterior bowel displacement (arrows) **(6).**

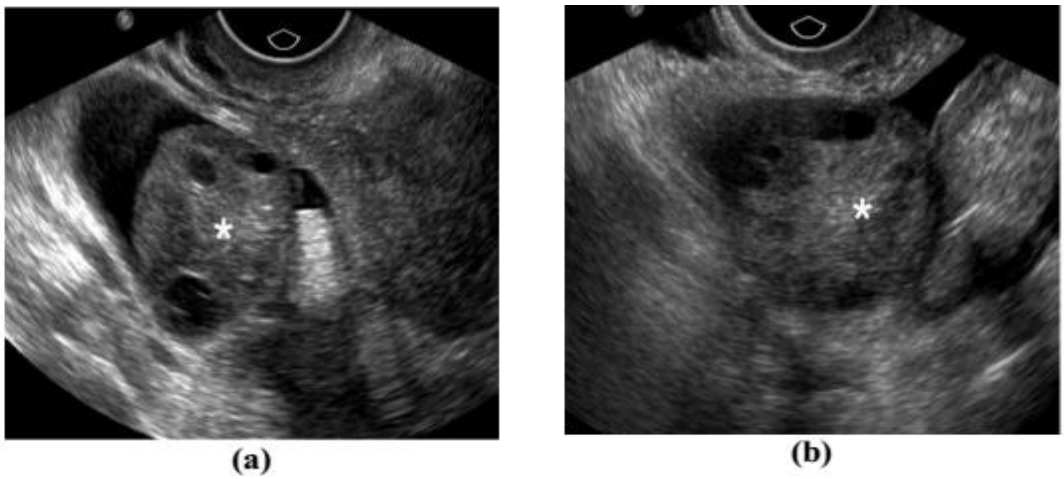

Fig. (23): Krukenberg tumor: Transvaginal US shows a round hypoechoic solid mass (asterisks) with a peripheral small cyst in the right ovary (A) and left ovary (B) **(7).**

Benign extraovarian masses that mimic ovarian cysts

Most adnexal masses arise from the ovary. Most extraovarian masses are benign. Some extraovarian lesions may mimic ovarian cysts. The following benign extraovarian masses can usually be diagnosed on the basis of their US appearance **(9).**

Paraovarian Cysts:

Paraovarian cysts usually occur in the broad ligament and they are usually appear as simple cysts and are easily recognized if a separate ipsilateral ovary is identified. They may be mistaken for a simple ovarian cyst if one does not recognize they are separate from the ovary (Fig. 24) **(11).**

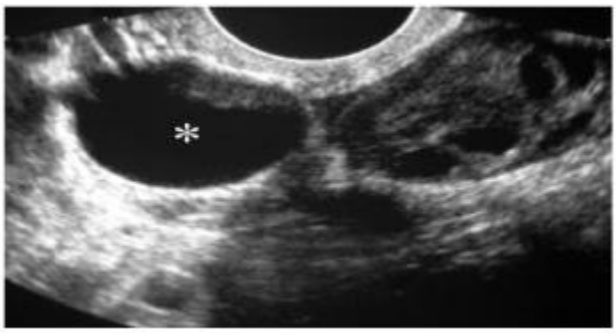

Fig. (24): Incidentally discovered paraovarian cyst in a 23-year-old woman with irregular menses. Sagittal transvaginal US image of the left adnexa demonstrates a simple cyst (asterisk) contiguous with, but clearly separate from, the ovary **(6).**

Hydrosalpinx:

The normal fallopian tube is rarely seen on US . When the tube is filled with fluid, it is easily seen. Sonographic features that are considered classic for a hydrosalpinx, and that allow a confident diagnosis, are a tubular shaped cystic mass with either short round projections (ie, small nodules generally, 3 mm, also known as “beads on a string” appearance representing the endosalpingeal folds) or a waist sign (ie, indentations on opposite sides). The hydrosalpinx should be seen separate from the ipsilateral ovary. The presence of a tubular structure filled with clear fluid in the adnexal region should raise suspicion for a hydrosalpinx, especially when a separate ovary is seen. Hydrosalpinges are typically asymptomatic and are commonly seen in postmenopausal women (Fig. 25) **(11).**

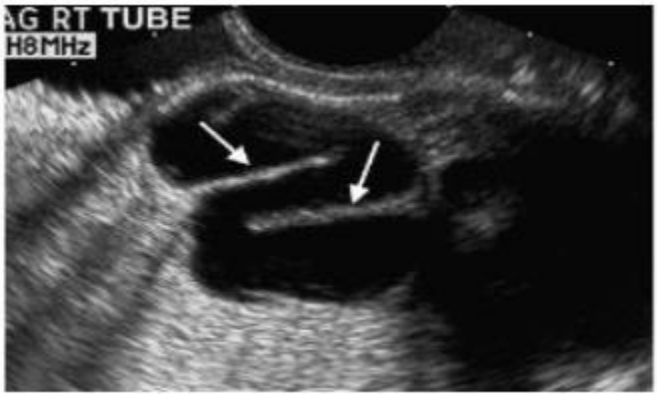

Fig. (25): Hydrosalpinx in a 46-year-old woman. Sagittal transvaginal US scan demonstrates a tubular-shaped cystic mass with several incomplete septa (arrows) **(9).**

Pedunculated Uterine Leiomyoma:

These are typically solid masses that may be mistaken for an ovarian fibroma if one does not identify a separate ipsilateral ovary. Color or power Doppler US demonstration of a vascular pedicle connecting the mass to the uterus is good evidence of a pedunculated fibroid. Rarely, cystic degeneration can occur, leading to confusion with malignancy, particularly if the extraovarian location is not recognized **(9).**

Peritoneal Inclusion Cyst:

A peritoneal inclusion cyst is believed to occur in the presence of a functioning ovary and adhesions, with the latter usually due to prior pelvic surgery, endometriosis, or pelvic inflammatory disease. Peritoneal inclusion cysts are typically asymptomatic. It is typically appear as cystic masses with septa .The septa may be thick attach to pelvic organs such as the uterus, bowel and ovaries, and contain detectable flow at color Doppler US. Peritoneal inclusion cysts may be mistaken for ovarian neoplasms, but the key to their recognition is the demonstration of a normal ovary within or along the periphery of the cystic mass (Fig. 26) **(11).**

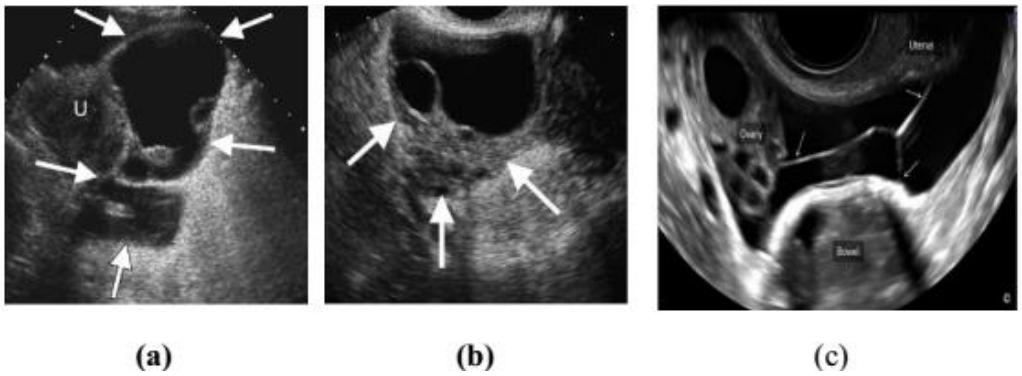

Fig. (26): Peritoneal inclusion cyst in a 29 year old woman. (a)Transverse transabdominal US scan shows a complex left adnexal cyst (arrows) with septa. A portion of the cyst conforms to the contour of the uterus (U). (b) Transvaginal US scan reveals a normal ovary (arrows) at the periphery of the cysts (c)Transvaginal US reveals the presence of multiple thin septations (arrows) that entrap fluid and attach to pelvic organs such as the uterus, bowel and ovary (labeled) **(9).**

Tubo-ovarian abscess:

A tubo-ovarian abscess (TOA) results from a severe pelvic inflammatory disease and represents a breakdown of the adnexal structures (ie., ovary and fallopian tube) by the infection and inflammation process. Women are typically symptomatic with fever and pelvic pain and tenderness, but on occasions TOA may be silent. US characteristics include a multilocular mass with thick walls and thick incomplete septae that are filled with an echogenic fluid of ground glass appearance. The fluid content derives from the inflammatory process. The sonographic appearance may be similar to endometriomas, but endometriomas are more commonly unilocular in asymptomatic women and do not have incomplete septations (Fig. 27) **(15).**

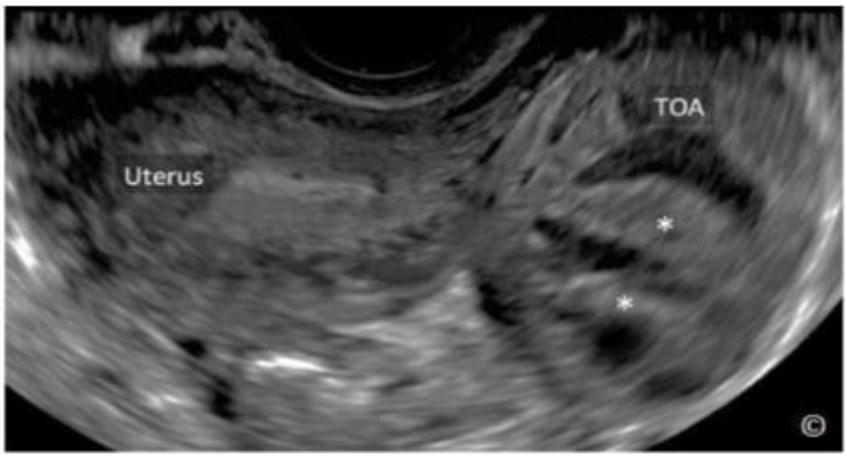

Fig. (27): Transvaginal US of a TOA. Note the ovoid shape of the TOA, with thickened walls and septations (asterisks). The uterus (labeled) is noted adjacent to the TOA **(7).**

Ovarian Torsion:

Ovarian torsion is defined as partial or complete rotation of the ovarian vascular pedicle resulting in obstruction to venous outflow and arterial inflow. Ovarian torsion requires quick diagnosis and immediate surgical intervention in order to preserve the ovary. Adnexal torsion occurs in 2.7% of all children who present with acute abdominal pain. Adnexal torsion in children is most commonly caused by a benign ovarian cyst or teratoma. In fact, 97% of torsions are the result of benign pathology. The size of an ovarian cyst has not been shown to correlate with an increased risk of ovarian torsion. Ovarian torsions are more likely to result on the right side due to the protective effect of the sigmoid colon. Laparoscopic detorsion of the torsed adnexa is the procedure of choice (Fig. 28) **(32).**

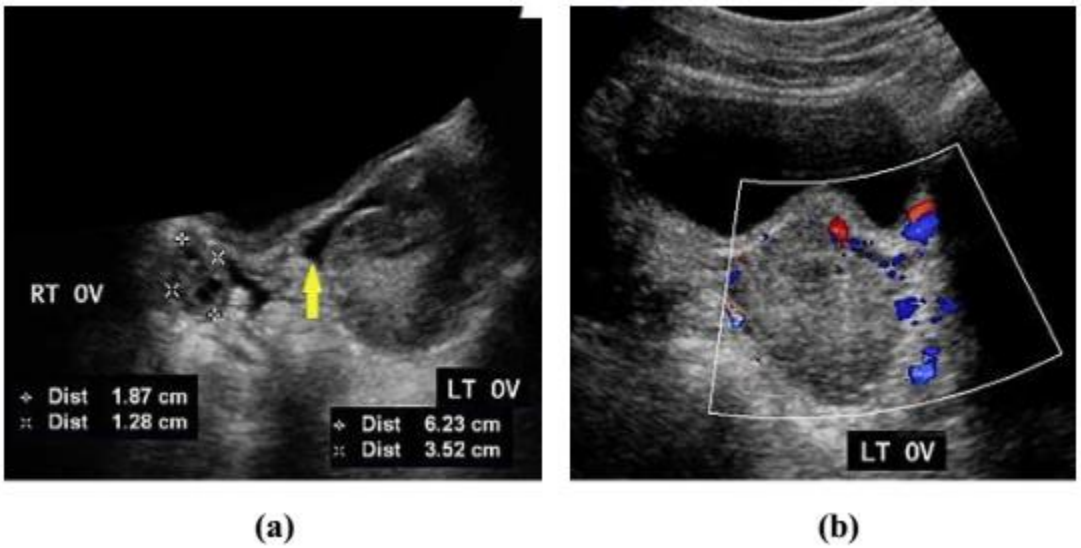

Fig. (28): Transabdominal US images from a 9 yr old girl with torsed Lt ovary. (a) Note the enlarged Lt ovary in the absence of masses, its maximum dimension was 6.2 cm, as well as the free pelvic collection (yellow arrow), the tiny peripherally arranged follicles and the central afollicular stroma. (b) Absent intraovarian vascularity by Color Doppler US **(33).**

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