HANDBOOK OF EMERGENCIES IN CLINICAL RADIOLOGY



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CHAPTER 5

GYNAECOLOGICAL EMERGENCIES: THE ROLE OF IMAGING IN CLINICAL PRACTICE

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INTRODUCTION

Emergencies in gynaecological and obstetric practice can be catastrophic and a high index of suspicion often following a detailed clinical history, physical examination, and relevant radiological investigation is crucial to arriving at a prompt and accurate diagnosis. Gynaecological and obstetric emergencies are important causes of morbidity and mortality in developing countries and often present as enormous challenges to an overstretched health system. The need for an efficient system to triage cases deploying radiological investigative tools cannot be overemphasized. These emergencies often present as acute abdomen or complications of pregnancy

Gynaecological emergencies of radiological importance include ectopic pregnancy, ovarian accidents, acute pelvic inflammatory disease, and complications of gynaecological malignancies.

Obstetric emergencies, as they connote, arise from pregnancy complications outside the first trimester.

This chapter seeks to highlight the salient features in the clinical presentations of gynaecological and obstetric emergencies with emphasis on important radiological findings. The role of multidisciplinary care in gynaecological and obstetric emergencies will be explored with the aim of espousing holistic care in clinical practice. Training and re-training cannot be overemphasized in a world of rapidly changing technologies and investigative tools. Keeping abreast with current investigative tools in the diagnosis and management of gynaecological and obstetric emergencies is particularly relevant in a developing country like Nigeria.

Gynaecological Emergencies

1. Ectopic pregnancy

This occurs when an embryo implants outside the endometrial lining of the uterus. It occurs in about 1% to 2% of live births. The most common site of implantation is the fallopian tube (in about 90% of cases). Other sites include the ovaries, cervix, and the peritoneal cavity. An ectopic pregnancy may also (rarely) coexist with a normal pregnancy referred to as a heterotopic pregnancy.

Risk factors for ectopic pregnancy

- ☆ pelvic inflammatory disease
- ☆ tubal surgery
- ☆ endometriosis
- ☆ tobacco smoking
- ☆ assisted conception

Clinical presentation

It is often characterized by lower abdominal pain, abnormal vaginal bleeding and occasionally, hypovolaemic shock.

Diagnosis

Diagnosis is made from a patient's sexual history, physical examination, serum hCG estimation and ultrasonography. In stable patients, laparoscopy may be offered for both diagnosis and treatment.

Radiological imaging

Transvaginal scan is the most appropriate radiological investigative tool for an ectopic gestation; although, the transabdominal route may suffice in certain instances.

Sonographic features

- ☆ an enlarged uterus

- ☆ presence of a pseudogestational sac (10 - 20%)
- ☆ hemoperitoneum in the pouch of Douglas
- ☆ free fluid in Morison's pouch
- ☆ live extrauterine pregnancy
- ☆ adnexal mass or cyst
- ☆ empty uterine cavity
- ☆ decidual cast
- ☆ hematosalpinx
- ☆ tubal ring

Differential diagnosis

- ☆ incidental adnexal masses
- ☆ ruptured corpus luteum
- ☆ acute appendicitis
- ☆ intrauterine pregnancy
- ☆ exophytic corpus luteum of pregnancy

Management

- ☆ ***Surgical:*** Salpingectomy and salpingostomy
- ☆ ***Medical:*** Indicated in stable patients with an ectopic size less than 3.5cm. Achieved with the use of methotrexate in conjunction with folinic rescue.

Fig 1: Transabdominal ultrasonography reveals a left adnexal mass.

Fig 2: Transvaginal ultrasonography shows a bulky but empty uterus with thickened endometrium and free fluid in the pouch of Douglas in a patient with ruptured ectopic pregnancy.

2. Ovarian torsion

Ovarian torsion is defined as the rotation of the adnexal supporting organ. It

may be complete or partial and often leads to ischaemia. It commonly affects both the ovary and the fallopian tube; however, in extremely rare circumstances, it may affect either of the two. Torsion occurs in the presence of a cyst or mass that is usually greater than 50mm, resulting in the rotation of both the infundibulo-pelvic ligament and the utero-ovarian ligaments. This can occur in both normal and diseased ovaries.

Epidemiology

Ovarian torsion occurs commonly in the reproductive age group when compared with the premenarchal and postmenopausal groups. Importantly, torsion can occur in early gestation especially between 10 to 17 weeks. Ovarian torsion affects 2% to 15% of patients who have had surgical treatment for adnexal masses when it affects women of any age group. The single most important risk factor is the presence of an ovarian mass.

Common symptoms

- ☆ acute lower abdominal pain
- ☆ nausea and vomiting

Diagnosis

Ovarian torsion is established from a patient's clinical history, physical examination, laboratory and radiological evaluation. Tumour markers such as CA125 and serum human chorionic gonadotropin are also helpful in identifying the risk factors for the torsion.

Radiological imaging

Ultrasonography is the imaging modality of choice and the initial diagnostic assessment tool in the evaluation of a pelvic mass. Pelvic ultrasonography provides information on the location of the adnexal mass and its size, density, and Doppler characteristics. The ultrasonographic features of ovarian torsion are oedematous ovarian enlargement (> 40mm), variable echogenicity, peripherally displaced follicles with hyperechoic central stroma, midline ovary, and free pelvic fluid.

Doppler findings show little or no ovarian venous flow, absent arterial flow, absent or reversed diastolic flow and a 'whirlpool' sign (twisted vascular pedicle).

Magnetic resonance imaging (MRI) is useful in diagnosing ovarian torsion when sonographic findings are equivocal; however, due to its expensive nature and relative non-availability, it is not deployed as a first-line screening tool. MRI, however, provides a more detailed evaluation of the soft tissue pelvic mass when compared to ultrasonography. Computed tomography scan is not recommended due to the use of ionising radiation.

Treatment

The management of ovarian torsion is either by laparoscopic approach or laparotomy. A salpingo-oophorectomy is frequently performed especially in the presence of necrosis and malignancy. More recently, detorsion and ovarian conservation are almost always recommended in order to preserve reproductive function. However, the earlier the surgical intervention, the higher the chances of ovarian conservation.

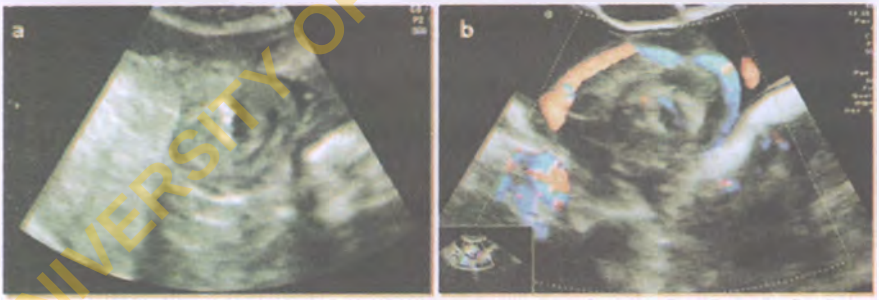

Fig 3: B-mode ultrasound image of the adnexal region (a), and colour Doppler ultrasound image of the same region (b) showing the characteristic appearance of the 'whirlpool' sign seen in ovarian torsion.

3. Ovarian hyperstimulation syndrome (OHSS)

Ovarian hyperstimulation syndrome (OHSS) is an uncommon iatrogenic

complication of superovulation that occurs during in-vitro fertilization. Most cases are mild; however, life-threatening severe cases may occur in a minority (0.1% to 3%). OHSS is characterized by cystic enlargement of the ovaries with a fluid shift from the intravascular to the third space. This is due to an increase in capillary permeability and ovarian neoangiogenesis. It usually results from the administration of human chorionic gonadotrophin (β-hCG).

Clinical presentation

This includes a distended abdomen with accompanying lower abdominal pain, ascites, nausea, vomiting and dehydration. Other features are hypotension, hypovolaemia, dyspnoea, acute abdomen (resulting from ovarian torsion, intraperitoneal haemorrhage, or rupture of cysts), electrolyte imbalance, hypercoagulable state and acute renal failure.

The evaluation of OHSS entails a history documenting the use of ovulation induction agents, physical examination for constitutional symptoms, signs of dehydration, abdominal swelling, and respiratory distress. Ultrasonography and laboratory investigations are deployed to confirm and classify symptom severity.

The ultrasonographic features of OHSS are bilateral symmetric ovarian enlargement, multiple cysts of varying sizes ('spoke-wheel' appearance) and evidence of third space fluid loss such as ascites, pleural effusion and/or pericardial effusion.

Management

The management of OHSS is largely supportive as the syndrome is often self-limiting. Supportive care includes rehydration with oral or intravenous fluids and the use of analgesics excluding NSAIDs.

Other treatment modalities include drainage of ascites in cases of respiratory compromise, intravenous albumin therapy and respiratory support/ ventilation.

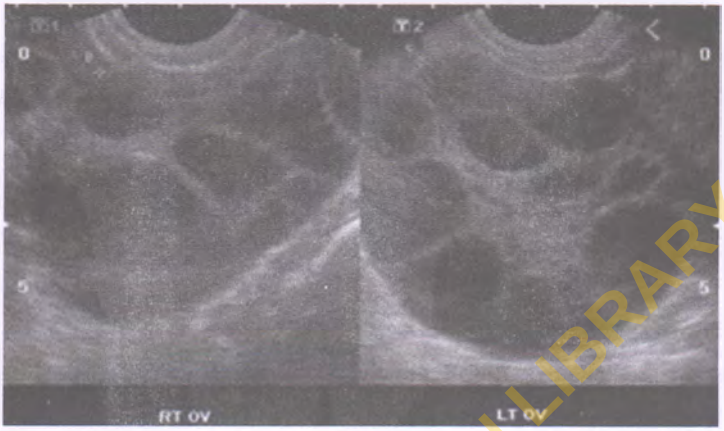

Fig 4: Transvaginal ultrasound images of both ovaries in a patient with OHSS shows enlarged ovaries with multiple huge cysts within them, giving the 'spoke-wheel' appearance.

4. Gestational trophoblastic disease (GTD)

Epidemiology

Gestational trophoblastic disease refers to tumours that are pregnancy related and arise from proliferation of the trophoblast. It is a broad term used to describe one benign and four malignant tumours namely hydatidiform mole (benign), invasive mole, choriocarcinoma, placental site trophoblastic tumour and epithelioid trophoblastic tumour. These tumours develop in the trophoblastic cells that form the placenta.

Risk factors for GTD include extremes of maternal reproductive age previous molar pregnancy and ethnicity (Asians are more predisposed).

Clinical presentation

Amenorrhoea, excessive pregnancy symptoms (nausea, vomiting), enlarged uterus, pelvic discomfort, hypertension, and abnormal vaginal bleeding are common with GTD. Some patients may present with features of hyperthyroidism due to the excessive serum β-hCG. Metastatic lesions may be found in the lungs (80%), vagina (30%), pelvis (20%) and liver/brain (10%).

Diagnosis

Diagnosis is made with the aid of quantitative serum β-hCG (which shows abnormal doubling) and imaging (ultrasonography). Tumour markers for GTD include serum β-hCG and human placental lactogen (placental site trophoblastic tumour). Histology of the evacuated tissue or uterus will clarify.

Radiological features

Ultrasonographic features of GTD include the classic 'snow-storm' appearance of hydatidiform mole consisting of an enlarged uterus with a heterogeneous endometrial mass of variable echogenicity. A partial mole is often associated with a growth retarded or anomalous foetus with an enlarged and thick placenta consisting of several anechoic cystic lesions. Choriocarcinoma and placental site trophoblastic tumour are seen on grayscale ultrasound as non-specific focal masses with myometrial epicentre.

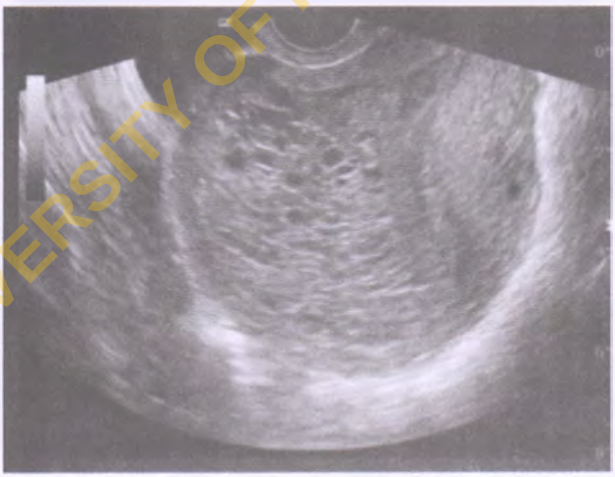

Fig 5: Transvaginal ultrasonography in a female with hydatidiform mole shows an enlarged uterus with heterogenous cystic and solid endometrial contents giving the 'snow-storm' appearance.

The MRI appearance of a molar pregnancy can be relatively nonspecific, especially in the first trimester. However, in the second trimester, hydatidiform mole is demonstrated as a heterogeneously hyperintense tumour distorting the normal zonal architecture. Screening for metastatic deposit in distant structures can be carried out with the aid of ultrasonography, chest X-ray, CT scan or MRI.

Treatment for GTD includes uterine evacuation for hydatidiform mole via suction curettage or hysterectomy for those patients who do not wish to have more children. Chemotherapy is employed in the treatment of both invasive mole and choriocarcinoma. Adjuvant radiation may also be considered for metastatic sites. All women with GTD are followed up due to the risk of persistent trophoblastic disease, and avoidance of conception via the use of suitable contraceptive is advised in the first year of completing treatment.

Obstetric Emergencies

1. Abortion

Abortion refers to the termination of pregnancy before independent survival. It may be induced or spontaneous. A miscarriage is often referred to as a spontaneous abortion, and it occurs in 30% to 50% of abortions. Induced abortions may be therapeutic or elective.

Clinical symptoms

- ☆ lower abdominal pain
- ☆ bleeding per vaginam
- ☆ passage of clots or fleshy tissue per vaginam

Classification

Abortions may be grouped as complete, incomplete, missed, and in certain instances, may occur as a blighted ovum. Risk factors for miscarriage include chromosomal abnormalities, older age at conception, obesity, diabetes, drug and alcohol abuse, trauma, thyroid disease, tobacco smoking, amongst others.

a. Complete abortion

This refers to the presence of an empty uterus in a woman who previously had ultrasound-confirmed intrauterine pregnancy. It is often associated with cessation of vaginal bleeding. Ultrasonography reveals a bulky but empty uterus with no evidence of retained product of conception.

Differential diagnosis

This includes a pregnancy that is too early to be detected on ultrasonography and a pregnancy of unknown location. An ectopic pregnancy may also be considered a differential.

b. Incomplete abortion

This occurs when there are still products of conception in the enlarged uterine cavity on ultrasonography. Ultrasonographic appearance is variable and ranges from the presence of foetal parts to a mass demonstrating mixed echogenicity. Complications would include endometritis, myometritis and disseminated intravascular coagulopathy (DIC).

Fig 6: Transvaginal ultrasonography in a patient with incomplete abortion shows a bulky uterus with irregular heterogenous endometrial contents consistent with retained products of conception.

c. Missed abortion

This occurs when the uterus contains a non-viable foetus without any symptom of a miscarriage. The ultrasound gestational age and symphysio-fundal height are both less than the actual age of the pregnancy using the last menstrual period. The diagnosis of miscarriage should only be considered when a foetal pole with a crown rump length of ≥ 7mm exists without evidence of foetal cardiac activity.

Fig 7: Transvaginal colour Doppler ultrasonography of an intrauterine foetus in the first trimester shows no evidence of cardiac activity in a patient with a missed abortion.

d. Blighted ovum

This is also referred to as anembryonic gestation. It occurs when the embryo never developed or developed and is subsequently reabsorbed. This diagnosis is made on transvaginal sonography when a sac with mean gestational diameter (MGD) greater than 25 mm is seen with no demonstrable yolk sac.

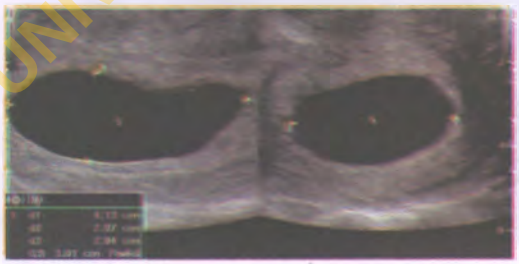

Fig 8: Transvaginal ultrasonography of the uterus containing a gestational sac shows a mean sac diameter of 30mm (approximately 8 weeks gestational age) with no yolk sac or fetal pole seen within it, consistent with a blighted ovum. (S = gestational sac)

e. Threatened abortion

This occurs when there is vaginal bleeding in early pregnancy without evidence of cervical dilatation or change in consistency. It may be associated with mild cramps; however, it is usually painless. It occurs more commonly in the first trimester.

Management of abortions

The management of abortions can be conservative, medical, or surgical. Conservative care largely entails bed and pelvic rest, pain relief and treatment of underlying factors such as infection. Medical management is often enlisted in the first trimester and involves the use of Prostaglandin E1 analogues such as misoprostol alone or in combination with mifepristone (RU-486). Medical management has been linked to access to safe, effective, and acceptable abortion care. Surgical management, on the other hand, entails the evacuation of the uterine cavity under aseptic conditions. This is often done with the Karman's syringe and cannula, resulting in the generation of negative pressure used in evacuating the products of conception. Sedation or general anaesthesia may be provided. For pregnancies in the second trimester, a dilatation and evacuation is often performed under general anaesthesia. Administration of analgesics and prophylactic antibiotics is advisable and rhesus immunoglobulin is given to rhesus negative mothers to prevent sensitization. Complications of surgical management include uterine perforation, pelvic infections, and uterine synechiae.

2. Red degeneration

Large fibroids ($\geq$ 50mm) may undergo red degeneration in pregnancy especially in the second and third trimesters. Uterine fibroids are estimated to occur in about 12.5% of all pregnancies. Red degeneration results in lower abdominal pain due to ischaemia and haemorrhagic necrosis when the fibroid outgrows its blood supply. This pain is further potentiated by the prostaglandins released by the damaged cells.

Clinical presentation

- ☆ lower abdominal pain
- ☆ nausea
- ☆ vomiting
- ☆ occasional fever in a pregnant woman with pre-existing fibroids

Sonographic features are cystic and inhomogenous appearances along with reduced vascularity and poor Doppler flow. Treatment is conservative and includes bed rest, liberal fluid intake and analgesia. NSAIDs should be used with care in the third trimester to prevent pulmonary hypertension following premature closure of the ductus arteriosus.

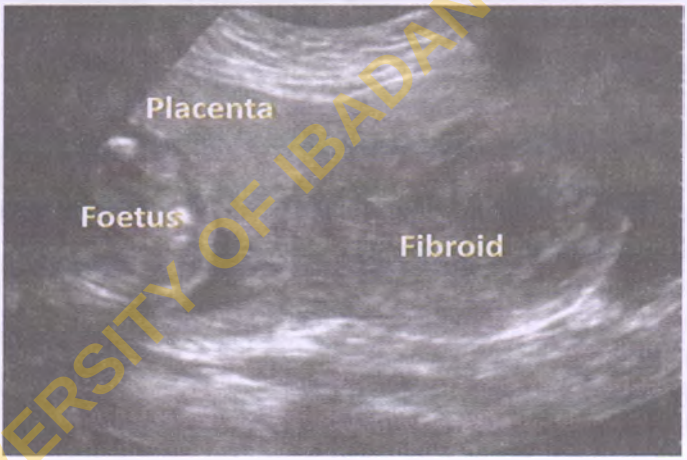

Fig 9: Transabdominal obstetric ultrasound image showing a foetus co-existing with a huge uterine fibroid. Multiple irregular hypoechoic areas are seen within the fibroid consistent with features of degeneration.

3. Intra-uterine growth restriction (IUGR)

Intra-uterine growth restriction refers to foetal growth rate that is below normal with respect to the growth potential of the foetus which is influenced by race and gender. The term IUGR and SGA (small for gestational age)

have been used interchangeably; however, SGA in strict terms refers to a birth weight that is less than the 10th percentile for that particular gestational age or two standard deviations below the population norms on the growth charts. The incidence of IUGR is about six times higher in developing countries compared to developed countries, and it differs amongst populations and races.

IUGR may be symmetrical or asymmetrical with the former developing in early gestation and the latter in late gestation. Aetiological factors can broadly be grouped into genetic disorders, infections, and utero-placental insufficiency.

Ultrasonography and Doppler studies

These are important investigative and monitoring tools that are deployed in the management of IUGR. They provide an accurate estimate of the foetal age and weight through the measurements of parameters such as head circumference (HC), femur length (FL) and abdominal circumference (AC). The HC/AC ratio is used in the evaluation of asymmetric IUGR. Doppler velocities such as uterine artery Doppler, umbilical artery Doppler, middle cerebral artery Doppler, cerebro-placental ratio (CPR), ductus venosus Doppler, and aortic isthmus Doppler are used for assessing foetal wellbeing. Select parameters in assessing IUGR using the umbilical artery Doppler include pulsatility index, resistance index, and end-diastolic velocities, which are measurements of the foetal circulation. The biophysical profile is also used to assess risk and monitor IUGR foetuses. An important component of this study is the use of ultrasonography to evaluate foetal movement, breathing, tone, and amniotic fluid volume.

Early detection of IUGR is key, and its management involves monitoring and early delivery. Administration of corticosteroids prior to 34 weeks gestation has been found to be useful in lung maturity. Multidisciplinary management involving the obstetrician, neonatologist, radiologist, and anaesthetist is essential for optimal care.

4. Ante-partum hemorrhage (APH)

Ante-partum hemorrhage refers to bleeding from the genital tract after foetal viability, but prior to the birth of the infant. APH complicates 3% to 5% of pregnancies, and it is majorly caused by placenta previa and abruptio placentae. About 20% of preterm deliveries are associated with APH, which is a leading cause of maternal and perinatal mortality.

Obstetric hemorrhage contributes about half of the estimated 500,000 maternal deaths that occur globally each year and remains an important cause of maternal mortality in developing countries.

5. Placenta previa

Placenta previa occurs when the placenta is partly or wholly implanted in the lower segment of the uterus. It occurs in 0.3% to 0.5% of all pregnancies. Abnormal invasion of the placenta (AIP) into the uterine wall is a potentially life-threatening obstetric complication, and it has a spectrum of disorders which include placenta accreta, increta and percreta. AIP may require large-volume blood transfusions and, occasionally, hysterectomy.

Placenta previa is classified into major and minor types based on ultrasonographic features. When the placenta overlies the cervical os, it is classified as major previa. When the leading edge of the placenta is in the lower uterine segment but is not covering the cervical os, it is regarded as minor or partial previa. Risk factors for abnormal placentation include advanced maternal age, previous retained placenta, and previous uterine surgery such as myomectomy, Caesarean section, and uterine curettage.

Fig 10: Transabdominal obstetric ultrasonography shows the placenta completely covering the internal os of the cervix, consistent with major placenta previa.

6. Abruptio placentae

This refers to the sudden separation of a normally sited placenta. It is an important cause of maternal morbidity and perinatal mortality. Risk factors include advanced maternal age, previous abruptio placentae, hypertension, preeclampsia, smoking, multiple gestation, polyhydramnios, short umbilical cord and blunt abdominal trauma. It can be classified into either partial or complete, or sometimes, as marginal or central. It may also be described as either revealed or concealed abruptio placentae.

Diagnosis

The diagnosis of abruptio placentae is aided by an ultrasound study which is useful in determining the placental location and eliminating placenta previa as being responsible for bleeding. It is important to note that the sensitivity of ultrasonography in visualizing placental abruption is low. A multidisciplinary and pragmatic approach to care is essential. Prompt delivery either via Caesarean section or vaginally (in mild abruption) is critical as placental abruption is life-threatening to both foetus and mother. Complications of abruptio placentae include prematurity, coagulopathy, severe haemorrhage, risk of hysterectomy, and foetal demise.

Fig 11: Colour Doppler obstetric ultrasonography in a patient with antepartum haemorrhage secondary to abruptio placentae, showing a heterogenous hypoechoic lesion (H) between the placenta and the uterine wall which shows no colour flow within it, in keeping with a retroplacental haematoma.

7. Vasa previa

Vasa previa occurs when fetal vessels run through the amniotic membranes in proximity to, or overlying the internal cervical os. These unsupported vessels are at risk of shearing at the time of membrane rupture causing rapid foetal exsanguination. Vasa previa is known to have three major risk factors namely: velamentous insertion of the cord, succenturiate lobe, and a low-lying placenta.

Diagnosis

It can be diagnosed with real-time ultrasonography with Doppler intervention. This shows when a foetal vessel is either covering or located within 20mm of the internal cervical os. It is important that the location of the placental cord insertion be identified at the mid-trimester ultrasound scan deploying 2D imaging and colour Doppler. The pulse wave Doppler is the most accurate technique to determine if a vessel is of foetal origin. Antenatal diagnosis of vasa previa has been associated with improved perinatal outcomes.

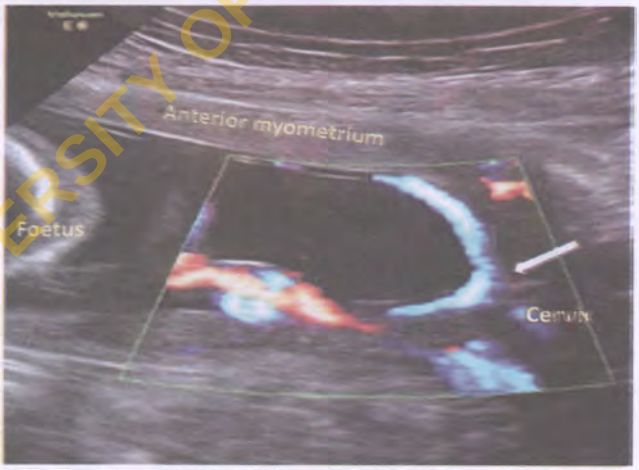

Fig 12: Colour Doppler ultrasound image in a patient with vasa previa shows velamentous cord insertion and with cord vessels coursing over the internal os of the cervix (arrow).

8. Twin-to-twin transfusion syndrome (TTTS)

Twin-to-twin transfusion syndrome (TTTS) is a rare but serious condition that can occur in pregnancies when identical twins share a placenta. Abnormal blood vessel connections form in the placenta and allow blood to flow unevenly between the babies. TTTS is a disease of the placenta, and it affects each twin differently. Ultrasonography, foetal MRI and foetal echocardiography are used in evaluating the severity of the condition and in taking a decision on delivery. The Quintero staging system is used in clinical practice to classify the severity of TTTS.

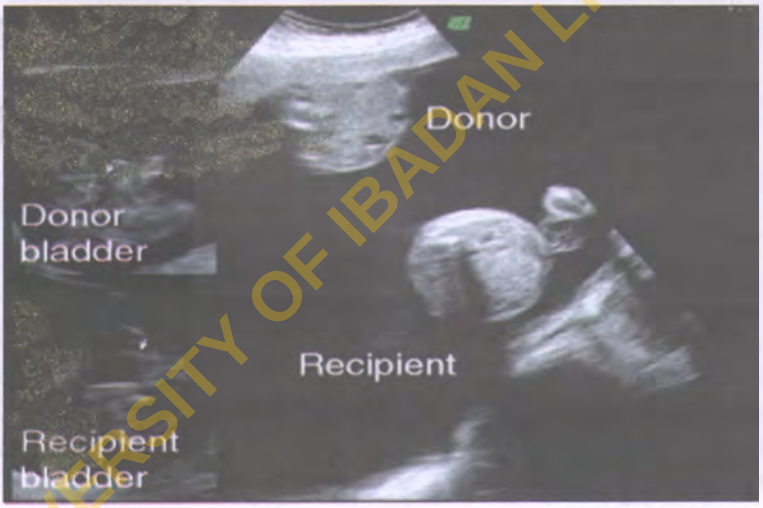

Fig 13: Transabdominal obstetric ultrasonography shows donor and recipient foetuses in twin-twin transfusion syndrome. The recipient twin is much smaller, has a small bladder and is plastered to one side of the gestational sac, with associated oligohydramnios of its amniotic sac. The recipient twin has associated polyhydramnios, and in severe cases, features of foetal hydrops (not shown) may also be seen.

Miscellaneous

Other rare causes of obstetric and gynaecological emergencies exist, which

are beyond the scope of this chapter but would be listed here. They include the following:

a. Appendicitis in pregnancy

This is an important cause of acute abdomen in pregnancy. Its diagnosis represents a challenge as the classic symptoms are often masked in pregnancy. Ultrasonography is used to evaluate foetal well-being as well as the inflamed appendix (enlarged appendix greater than 6 mm, immobile, and noncompressible). The curative treatment for acute appendicitis is appendectomy, however, laparotomy and pelvic irrigation may be offered in cases of perforation.

b. Intestinal obstruction in pregnancy

Intestinal obstruction in pregnancy is rare and often results from adhesions from previous abdominal surgery. Small bowel obstruction, however, may be due to volvulus. Plain abdominal X-ray and MRI have been found to be useful. Management is often conservative; however, surgery is required for volvulus.

c. Obstructed hernia in pregnancy

Hernia in pregnancy is usually not an immediate concern except it becomes painful or obstructed. It is usually congenital, but it may arise due to the stretching and weakening of the abdominal muscles in pregnancy. An obstructed hernia is an emergency, and it would require immediate surgical intervention.

Conclusion

Radiological imaging plays a pivotal role in gynaecological and obstetric emergencies. It provides a safe and reliable means of evaluating common emergencies which can be life-threatening to both the mother and the unborn baby. The need for multidisciplinary care in obstetric and gynaecological emergencies has been emphasized, and this chapter highlighted some of the salient findings on radiological imaging. Proper

image interpretation based on clinical history and physical examination is important as multiple differential diagnoses may influence treatment. Training on basic imaging studies is particularly important in a world of rapidly changing technologies especially in low-income countries with scarce manpower and resources. Collaboration with key stakeholders in the healthcare sector is imperative and needed to improve healthcare delivery and patient satisfaction through prompt treatment of emergencies.

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