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RESEARCH ARTICLE

ULTRASOUND APPEARANCES OF DIFFERENT TYPES OF ABORTION

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ABSTRACT

Purpose of the study: is to review the ultrasound appearances of different clinical types of abortion . Since its, introduction in late 1950 ultrasound become very useful diagnostic tool in obstetric practice. Each abortion type has its own ultrasound appearances.

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INTRODUCTION

The term abortion and miscarriage are synonymous to the expulsion of the conceptus of pregnancy before 28th week of pregnancy (1). The world health organization (WHO) definition is the expulsion or extraction of an embryo or fetus from its mother before weighing 500 gm or less. This weight corresponded to a gestational age of roughly 20 - 22 weeks and thought to provide some discrimination between pathologic causes (3). Depending on another criterion, abortion was defined as separation from the uterus of a product of conception in which the embryo or fetus was less than 16.5 cm crown rump length (4). Finally, abortion is now defined in British law as, termination of pregnancy before 24 week of gestation with no evidence of life (5).

Incidence: The true rate of spontaneous abortion in women is unknown exactly (6), the reported early loss rate among clinically recognized pregnancies is between 12 % and 15 % (3). Roberts and Lowe, 1975, suggested that, most conceptual losses occur before has been diagnosed and often before the first missed period (6).

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Edmond *et al*, 1982, concluded from their study that, the post implantation embryonic loss rate is probably four times the clinically recognized abortion rate (7). According to gestational age, Fantail and Shepard, 1987, said that the pregnancy loss rate as following: 52 % at or before 8 weeks,18 % at 9-18 weeks, and 15 % at or after 19 weeks of gestation (3). Little, 1988, suggested that, about 15 % of fertilized ova are lost before implantation (3).

Aetiology: Spontaneous abortion is the most common complication of pregnancy, in about 63 % of cases, a specific cause can be ascertained (9).

The possible causes are:

Abnormal Conceptus:

This include the following:

- Chromosomal abnormalities, half of all spontaneous abortion are associated with chromosomal abnormalities in the fetal tissue (11), the most common being, trisomy followed by monosomy –xo, and polyploidy (9).
- Structural abnormalities such as neural tube defect as anencephaly and spina bifida (5)(10).
- Genetic defect, autosomal dominant disorder or x-linked disorders can lead to spontaneous abortion (5).

Uterine abnormalities:- this can be congenital or acquired(10).

A-Congenital abnormalities of the uterus:

This result from failure of normal development of mullerian ducts (8) (10). These include the following:-

- Uterus Didelphys.
- Uterus Bicornis Bicollis .
- Uterus Bicornis Unicollis (bicornuate uterus).
- Septated Uterus, Arcuate uterus.
- Unicornoate uterus.
- Infantile Uterus (10)(12).

Acquired abnormalities of the uterus

- Retroversion-especially if the uterus trapped in the pelvis(5).
- Fibroid-especially sub mucus fibroid which distort the uterine cavity(10)(15).
- lntrauterine adhesion- this can follow vigorous uterine curettage(9).

Cervical incompetence

This is usually causing abortion in second trimester (8). The factors predispose to this Include

- Repeated dilatation of the cervix.
- Con biopsy.
- Repair operation of uterovaginal prolapse.
- Congenital incompetence is rare (9).

Endocrine factors

- Corpus lute in deficiency, may present as first trimester abortion (8) (9).
- Thyroid disorders (9).

Maternal diseases: Such as diabetes mellitus, Von Will brand's disease, systemic lupus erythematosus, Wilson disease all are associated with an increased risk of abortion (5). Maternal infection as pyelitis and appendicitis can stimulate the uterine contraction and lead to pregnancy loss (5). Other infections, have been implicated as possible causes of abortion and include, listerosis, brucellosis, toxoplasmosis, mycoplasmosis, psittacosis (5). Malaria is an important cause in the endemic areas (5). Viruses also can lead to abortion such as rubella, cytomegalo virus, measles, herpes, and influenza virus(9) (10).

Immunological factors: It has been suggested that, the failure of normal immune response in the mother could be an important factor in the aetiology of abortion(5).

Toxin and environmental pollution: Maternal smoking, alcohol consumption, heroin addiction and anesthetic gases all may adversely affect the fetal development (5) (8).

Drugs: Exposure to diethylstilbestrol in utero increase the incidence of sporadic abortion and cervical incompetence (13). Antineoplastic agents, oxytocic drugs, quinine, ergot derivative, prostaglandin, purgatives, and lead poisoning also may involve in the aetiology (1) (2).

Trauma: Amniocentesis carry about 1 % risk of abortion (5), chorionic villus sampling carry about 2% risk(14),abdominal surgery in early pregnancy and presence of intrauterine device also affect (5).

Blood incompatibility

- Rhesus is oimmunization-this can produce recurrent abortion due to fetal death from the hemolysis (10).
- ABO incompatibility – this is a less common cause(10).

Irradiation – it is a rare cause of abortion (1).

Male factor- High sperm count (>250 million /ml)can be a problem(10).

Some biologic correlates of abortion: According to a prospective study done by k. Awan, 1974, he found that, there are many biologic factors which affect pregnancy wastage as following (16)(17) :-

- Gravidity status, he suggested that, the second gravidity appears to be the safest for the purpose of fetal survival, and the pregnancy loss increase with increasing gravidity status.
- Mother's age, pregnancy loss is highest during less than 20 years mothers and over 35 years mothers. 20-29 years is the safest age for planning mother hood.
- Past pregnancy wastage, multigravida has higher incidence of pregnancy loss.
- Antenatal care, Abortion rate was higher in patients who either had no antenatal care or their care started after 20^{th} weeks of gestation.
- Blood relationship between spouses, in first cousin marriages women generally show higher pregnancy loss rate.
- Age differential between spouses, pregnancy loss is high when the husband is younger by one to nine years as compared to the wife, or when he is older by 15 year or more.
- Twin, twin conceptus are very likely to be lost in early fetal life.

EMBRYOLOGY

The first trimester of pregnancy is a dynamic period that spans ovulation, fertilization, implantation and organogenesis (19). After fertilization, the ovum and the sperm unite on day 14 to form the zygote. By day 20 the zygote has formed a blastocyst-fluid filled cyst lined with trophoblastic cell which forms the early placenta (19). Implantation of the blastocyst occurs within the endometrium of the uterus, this starts in day 20^{th} and completed by day 23th or 24^{th} menstrual age(18)(19).The maternal endometrial cells near to the blastocyst become modified to supply nourishment to the blastocyst and referred to as the decidual reaction (19). Several decidual layers may be identified by high resolution ultrasound, decidua capsularis can be seen bordering the gestational sac opposite tothe developing placenta, decidua basalis separates the chorion frondosum (the primitive placenta) from the uterine wall, decidua parietalis lies opposite the developing placenta, decidua basalis separate

the chorion frondosum (the primitive placenta) from uterine wall, decidua parietalis lies opposite to decidua basalis (fig.1) (18). During the 4th week of gestation the primitive uteroplacental circulation will form, also by the end of 4th week the primary yolk sac has regressed and secondary yolk sac forms, which is found between the amnion and chorionic membranes (19). Early in the 5thweek the extra embryonic vascular network forms (19). From 6-10 weeks of gestation, this called the embryonic period, in which all the adult internal and external structures form. The embryonic head is large and forming half of the crown-rump length (19). Early in fetal period, body growth is rapid and the head growth slower with the crown-rump length doubling between 11th and 14th week, the chorionic frundosum and decidua basalis form the placenta at about 9-10 weeks(19)(20).

Ultrasonic appearance of early normal pregnancy

Embryonic sonographic appearance:

Implantation: The embryo becomes completely embedded within the decidua of the uterine fundus at about 24 day or 3 *and half* weeks of gestational age. The gestational sac and the echogenic area of early implantation within thickened decidua on one side of uterine cavity, this appearance is called the intradecidual sign, which may represents the combination of echoes from the embedded blastocyst, the proliferative trophoblast and the lacuna between them. So the diagnosis of early intrauterine pregnancy can be made sonographically as early as 3 *and half* weeks of gestational age depending on this intradecidual sign (fig.2) (21). The other sign of the intrauterine pregnancy is the appearance of the gestational sac as awell-defined cystic area with characteristic echogenic border which represents the decidual reaction (20), this can be seen as early as the 4thweek of gestation (18). Double decidual sac sign is the other sign of normal early intrauterine pregnancy (22). It is seen as two concentric echogenic rims, this formed by the junction of the decidua parietalis and decidua capsularis, this sign can be identified from 2-9 weeks of fetal age, until the decidua capsularis abuts the decidua parietalis and close the space between, them (fig.2) (22)(23).

At 5thweeks, the gestational sac appears as echo free structure, as the embryonic parts at this stage are very small and impossible to see by sonographic imaging. The shape of the sac may vary depending on the fullness of the maternal bladder, so irregular shape sacs (dumbbell or crescent shaped) may represents normal variant (18). At 6th weeks of gestation, cardiac pulsation should be apparent. The bottom of the gestational sac should be inspected to search for the cardiac activity as the embryo usually occupies the inferior portion of the sac or lies near the chorionic frond sum(18) (19).

Sac growth: A normal gestational sac grows about 1-1.5 mm /day (40). There is a rapid growth and increase in the volume of the developing gestational sac in the first trimester, from zero to 70 ml at 12th weeks (19). The gestational sac volume was approximated by using the following formula:

V (Sac volume) =4/3π (d /2)3
π= Constant ratio = 3.14
d = diameter of the gestational sac (24).

Fetal pole: This can be seen sonographically at 6-7 weeks, it is about 5 mm length and lies on the bottom of the gestational sac or near the placenta. By the 7th weeks the fetal pole has grown to about 1 cm. The cardiac activity can now be seen by real-time machine. The fetal head is nearly the same size as the fetal body and can be identified at 12th weeks. also biparietal diameter identify and measured at this time. Crown-rump length which is the long axis of the fetus can accurately assess the gestational age in the first trimester (19).

Yolk sac: This can be identified from 6th to 7th week as circular ring or as two parallel lines floating within the chorionic sac measuring about 1 cm in diameter (18) (19). After 11th weeks, it disappears (20).

The internal organs: Such as stomach and bladder are seen at the end of the first trimester at about 13th week (20). So the developmental milestones seen by ultrasound in first trimester of pregnancy are summarized as following:

Gestational sac 5-6 weeks.
Fetal pole 6-7 weeks
Cardiac pulsation 6-7 weeks
Somatic activity 8-9 weeks
Placenta 9-10 weeks
biparietal diameter12 week.
Yolk sac 5-7 weeks (20).

Types of Abortion and Their Ultrasonic Appearances Threatened Abortion: It is a clinical term that applies to women during the first 20th weeks of the pregnancy who have vaginal bleeding and a closed cervical os. It is a common complication that occurs in approximately 25% of the clinically apparent pregnancies. The management of this condition depends on whether the embryo is viable or not (25).

The Role of Ultrasound in Evaluation of Threatened Abortion: Ultrasound is an accurate method for evaluating threatened abortion since, It can readily demonstrate the presence or absence of embryonic heart motion. Difficult problem arises when the gestational sac lacks an embryo (25).

Ultrasonic features of threatened abortion

Abnormal gestational sac in early pregnancy: It is difficult to assess fetal viability in one examination between 5-7 weeks gestational age, as the gestational sac do not contain an embryo, so the appearance can be due to early normal pregnancy or due to nonviable pregnancy in which the embryo died or never developed. So one method to identify abnormal early pregnancy is to evaluate the appearance of gestational sac (25). Hellman and his colleagues, 1973, revealed on their study on ultrasonic diagnosis of early embryonic malformation, six types of abnormal gestational sacs as following:-

- Poorly defined gestational sac, These patients showed poorly defined gestational sacs which appear as fragmented, non-round structure with thin wall (Fig.3-b,c).
- Small gestational sac, here the gestational sacs appeared normal, but smaller than expected according the menstrual date.
- Abnormal intrauterine echoes, this group revealed some irregular echoes within the uterine cavity.
- Growth failure, the normal rate of growth is rapid and it is about 1-1.5mm per day. This group did not show this picture.

- Double sac, these women may had double ovum twin early pregnancy.
- low implanted gestational sac, low implantation is an unfavorable prognostic sign (fig. 3-d).

This study done on 140 patients, the number of patients represent each type and the percentage of abortion revealed in the following (table-1) (27). Smith *et al*. 1978, suggested that, "the implantation site does not reflect the aetiology or relate to the prognosis in threatened abortion". They consider the low site as stage rather than a cause of abortion (26). Nyberg and his colleagues, 1986, said that, the ultrasonic features suggest that the gestational sac is nonviable are including two major criteria and five minor criteria.

The two major criteria are

1-Large size gestational sac, ≥ 25 mm mean sac diameter which lacks an embryo. This considered as a major criterion because it had both 100% specificity and 100% predictive accuracy for identify abnormal gestational sac (Fig.3-a).
2-Grossly distorted sac shape, this also had 100% specificity and 100% positive predictive value for identifying abnormal sac.

The observed five minor criteria are the following

- Thin choriodecidual reaction, (≤2 mm in thickness).
- Weak choriodecidual amplitude reaching level of myometrial echoes.
- Irregular contour of chorio decidual reaction.
- Absence of double decidual sac for sac less than 10mm.
- Abnormal position with in the lower uterine segment.

They concluded from this study that, when one major and /or three or more minor criteria were seen the abnormal gestation could be correctly identified single examination with 100% predictive accuracy (25).

Detection of fetal heart beats after the 7th weeks gestation
By using real-time scanner, there is no difficulty in showing the fetal heart beats from 7-8 weeks, and fetal movement also can be detected from the 9th week of the pregnancy (29). Jorgensen *et al*, 1980, in their study to evaluate the diagnostic ultrasound in threatened abortion, they found that, if signs of life can be demonstrated the chance of abortion is 10% (29). Simpson et at, 1987, found in their study on fetal loss rates after ultrasound proved viability in early pregnancy that, among (220) patients who had a viable pregnancy at 8th weeks, only seven (3.2%) had a fetal loss. They also suggested that, most recognized abortions manifested after 8th weeks actually represent pregnancies in which fetal demise occurred before 8th weeks (30). In study done by Rosati et al. 1989, revealed that, after detection of fetal life, the pregnancies ended in abortion in about 9.29%. They also said that, ultrasound examination in patient with early pregnancy bleeding, is able to differentiate between live or dead gestation, but cannot predict the future (31). Another study done by Quick and Berle,1992, showed that, patients with vaginal bleeding before 16th weeks gestation and positive fetal heart action, only 7.5% ended with abortion, especially if the bleeding stopped the pregnancy outcome will be normal (32). Dicky and his colleagues, 1994, demonstrated that, the overall pregnancy loss rate was 11.4% after the heart beats had been detected during 6thweeks gestation on endo - vaginal ultrasound (61). So the positive cardiac activity in the first trimester of the pregnancy is usually associated with successful outcome (33).

Intrauterine haematoma: Ultrasonic scanning in patients with symptoms of threatened abortion occasionally revealed an echo free area between the membranes and uterine wall. this is believed to be blood,(fig.4) (34). Mantoni and Pederson, 1981, believed that, the size of the haematoma had more prognostic importance than the rate of external bleeding. The size of haematoma depend on the ability of the blood to escape through the cervical canal. They revealed three different patterns of these haematoma's size: –

- Haematomas of more than 50ml occur after 16th weeks of gestation and result in a considerable risk of abortion.
- Haematomas smaller than 35ml, occurring at 12th-16thweeks gestation tend to diminish gradually in size with good prognosis.
- Small haematomas less than 5ml,just inside the internal os, probably represent continuous transcervical bleeding.

In study done by Sauerbrei and Pham, 1986, they showed that, the major prognostic factor of the pregnancy out come in patient with threatened abortion and intrauterine haematoma was the volume of the haematoma which approximated by the following formula:

$$V = D1\ D2\ D3 \times D.52$$

V = volume of the haematoma.

D1 D2 D3 = Perpendicular diameters of haematoma and to lesser extent, the relative volume of the heamatoma which represented by the volume of the haematoma divided by the volume of gestational sac. For haematoma volume less than 60 ml, the outcome tended to be favorable, for relative volume less than 0.4 the outcome also tended to be favorable (24). Nyberg *et al*, 1987, said that in patients with vaginal bleeding and intrauterine haematoma, the fetal mortality correlated with the following:

The location of the heamatoma:- They demonstrated three sites of the hematomas:-

- **Subchorionic:-** located between the myometrium and the placental
  membranes and or at the margin of the placenta, here the rick of fetal death 7 %(fig.4.b)(73)(74).
- **Retroplacental:-** located between the placenta and myometrium the risk of fetal death was 50% (fig.4.a)(73)(74).
- **Preplacental:-** located between the placenta and placental membranes,67% was the risk of fetal death.

The estimated percentage of the placental detachment- Placental detachment was strongly associated with fetal mortality as in (table-3) (35). Another study done by Mandruzzato *et al*. 1989, suggested that, the rate of spontaneous abortion in patients with intrauterine haematoma and a live fetus, similar to that observed in cases of threatened abortion without haematoma, and they correlated the fate of the pregnancy with the volume of the haematoma (62).

Table 1. Types of the abnormal gestational sac and the percentage of the associated abortion

The type of the malformation	No. of patient	% of total sample	% of abortion
1- Poorly defined gestational sac.	71	51	83
2- Small gestational sac.	63	45	94
3- Abnormal intrauterine echoes.	54	38.5	90.7
4- Growth failure.	38	27.1	92.2
5- Double gestational sac.	22	15.7	63.6
6- Low implanted gestational sac.	6	4.3	83.3

note:- Numbers are not additive because of multiple diagnosis.

Table 2. The percentage of abortion after the detection of the fetal heart beats

Author	% of abortion after heart beat detection
Jorgensen *et al*, (1980).	10%
Simpson *et al*, (1987).	3.2%
Rosati *et al*, (1989).	9.29%
Quick & Berle (1992).	7.5%
Dicky & his colleagues (1994).	11.4%

Table 3. The percentage of the placental detachment and the associated fetal death. Percentage

% of the placental detachment	% of fetal death
≥ 50%	75%
20%- 50%	20%
< 20%	13%
no detachment	8%

Table 4. Features of haematoma that the different authors depend on in predicting the pregnancy outcome which associated with haematoma

Author	Features
Mantoni and Pedersen (1981).	- The volume of the haematoma, 50 ml and more had bad prognosis.
Sauerbrei and Pham (1986).	1- The volume of the haematoma, 60ml and more, unfavorable outcome. 2- The relative volume of the hematoma, 0.4 and more also had unfavorable outcome. 1- Location of the haematoma. 2-Percentage of placental detachment.
Nyberg et at., (1987).	- Volume of the haematoma.
Mandruzzato, *et al*, (1989).	- Reveal that there is no relation between the haematoma size and the fetal outcome.
Pedersen and Mantoni (1990).	(in contrast to their previous study).

Pedersen and Mantoni, 1990, they revealed in this recent study and in contrast to their previous study that, the large haematoma(> 50ml volume) do not seem to represent any danger to the pregnancy, since, the size of the haematoma are presents the difference between the concealed and revealed bleeding and the size does not indicate the severity of the bleeding (36)(37). Lastly, the retro -placental haematoma may appear as a retro- placental mass with anechoic or mixed echo pattern depending on the degree of the organization of these haematomas, this feature should not be confused with the normal retro placental myometrium, fibroid or the normal anechoic retro placental area which was seen in the beginning of the 12th weeks of gestation and it corresponds to the dilated vessels of the decidua basalis (38) (39) .

Missed abortion: This represents retention of the fetus within the uterus after death of the fetus (18). The cardinal ultrasonic sign of fetal death in the first trimester of pregnancy is the failure to detect fetal heart beats within the fetal pole. The primitive embryonic heart begins to beat in the 5thweek of gestation, at first it is feeble and irregular about 65/minute, by the 6th week it becomes rhythmic at about 145-170 beat/minute, by 7thweek any competent operator should be able to record the heart beats with certainty if it is present (43). The other feature of fetal death is when the crown - rump length is persistently small or if the sac /crown - rump length ratio is low or if the size appears to be sustained (43).

Poorly formed sac with an incomplete wall and transonic areas which are presumably blood is almost pathognomonic of pregnancy failure (43). Some abnormal sacs appear empty and may contain a very small fetal bud with a small placental component, some contain fetal debris which may give the appearance of layering probably due to debris lying in a fluid level between the material of different density (43). In later pregnancy a well-known sign of intrauterine death is the appearance of gas probably C02 in the fetal heart, great vessels and cord. Later on, the dead fetus becomes edematous and malformed, the cranium will be collapsed and there may be accumulation of fluid in the abdomen (18).

Blighted ovum

(Anembryonic pregnancy): It is a condition in which the gestational sac forms without the development of the embryo (18).The patient shows a positive pregnancy test and other clinical stigma of pregnancy, but these normal appearances are short lived (19). High incidence of chromosomal abnormalities had been found with this case with high percentage of trisomy (45) (46). If one sees a gestational sac smaller than 7thweek, he most not diagnose a blighted ovum without a repeated study after at least one week, but if the sac is larger than the sac after 8thweeks, with no evidence of fetal echoes and thin spotty trophoblast, one can diagnose a blighted ovum on one scan

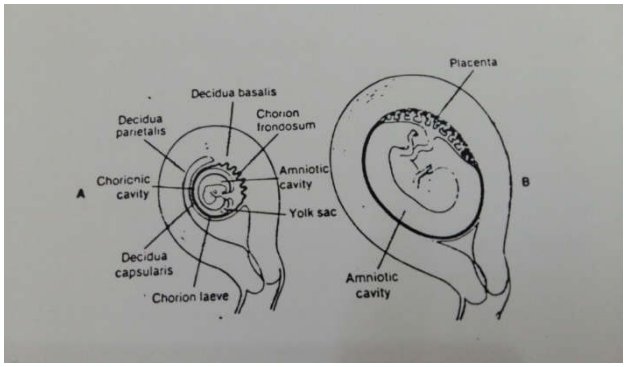

Fig. 1. The decidual layers of the uterus
A-End of the second month.
B-End of the third month.

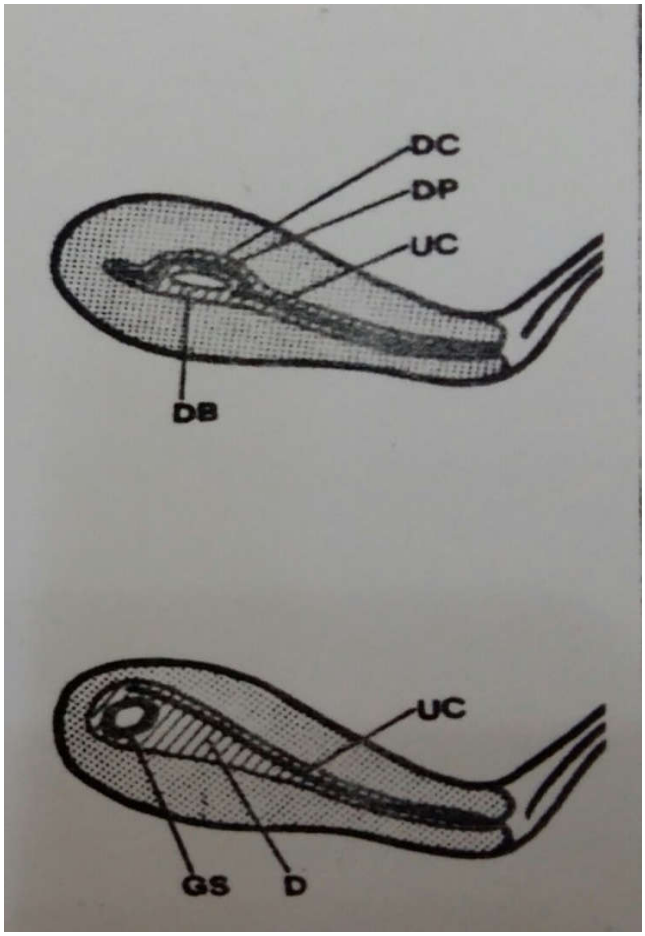

Fig. 2. *upper * Double decidual sac sign.
DC - decidua capsularis.
DP – decidua parietalis.
DB – decidua basalis .
UC – uterine cavity
*** lower * intradecidual sign.**
GS – gestational sac
D – thick decidua.
UC – uterine cavity.

alone (19). Robinson and Caines, 1977, suggested that the volume of the abnormal sac in case of blighted ovum never exceeds that of normal 7th week and it is about (2.5) ml, all cases of blighted ovum disappeared before the end of the first trimester (53). In research done by Bernard *et al* 1985, they showed that, a sac larger than 2cm in diameter and lacks of fetal echoes is highly suggestive of non-viability, but also they call for repeated study after one or two weeks to confirm the non-viability before the uterine evacuation is done (28).

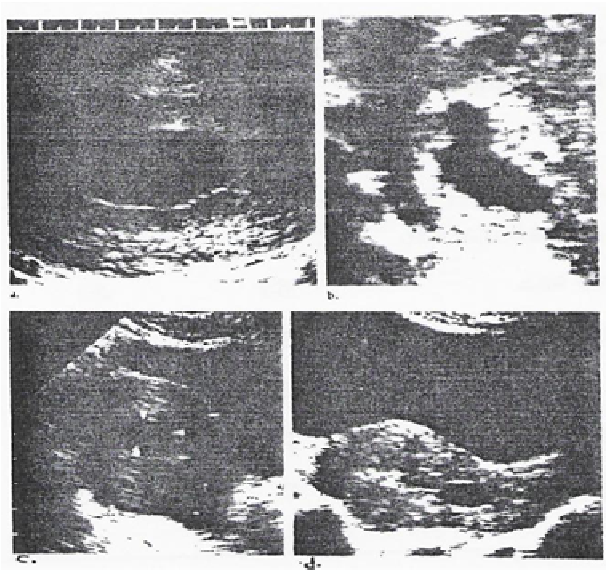

Fig. 3. The abnormal gestational sacs

a-abnormal large sac lacks an embryo(blighted ovum).
b-distorted sac shape.
c-irregular sac contour.
d-abnormal position of the sac in lower uterine segment.

Fig. (4) : intrauterine haematoma
a-Retro placental haematoma.
b-Sub chorionic haematoma.

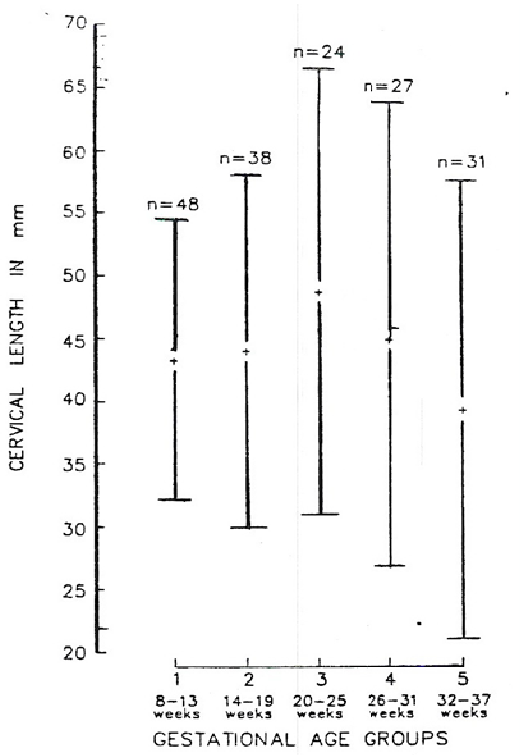

Figure 5. Diagram shows the change of cervical length in the pregnancy at measured by transvaginal ultrasound of 166 women subsequently delivered normally at term

Scatt and his colleagues, 1987, concluded that, empty sac with size greater than 26 mm was non-viable(47).

Inevitable abortion

This represents a pregnancy that will end in miscarriage dueto premature rupture of the membranes and dilatation of the cervix (18). The sonographic findings varied and may include the following:

- Incomplete or empty gestational sac (48).
- Dissection of the sac from the uterus which shows echo-free space representing blood between the sac and the myometrium (18).
- Atypical position of the sac in the lower uterine segment or near the cervix (18).
- Decreasing size of the gestational sac in serial examination (48).
- Fluid-fluid level indicating hemorrhage within the sac (18).
- No fetal cardiac activity (48).
- Evidence of cervical dilatation (18) .
- Visualization of the- fetus at the cervix or in the vagina (18).

Incomplete abortion: Here the patient aborted the pregnancy but some of the products of conception are left behind in the uterus, the patient present with sever vaginal bleeding due to retained tissue within the uterus which prevents its normal contraction (18). The sonographic appearances of this condition are as following:

- Enlargement of the uterus maybe demonstrated .
- The uterus may be empty or may contain poorly circumscribed gestational sac.
- A cluster of internal echoes representing fetal tissue.
- When acoustic shadowing is seen, a gas forming infection (septic abortion) occur, or remnant fetal bones may have been retained(18).

Complete abortion: When all the uterine contents have been expelled spontaneously. Ultrasound used to determine whether all of the products of the conception have been expelled from the uterus. The ultrasonic appearances of the complete miscarriage are:

- Enlarged uterus with no evidence of an intrauterine gestational sac, fetal tissue nor placenta.
- The endometrial cavity may contain prominent central echoes due to decidual reaction. The internal uterine echoes character should appear similar to non-gravid uterus.

The value of ultrasound here, is to help in obstetric management, as surgical intervention is usually unnecessary when the uterus is empty (18).

Cervical in competence: Most obstetrician on world accepted that the cervical incompetence can be a cause of abortion particularly in the second trimester of pregnancy (5). Diagnosis of this condition is based on history of repeated mid trimester abortion preceded by painless uterine contraction, rupture membranes and expulsion of normal fetus(49). Ultrasound can provide an additional method for diagnosis of cervical incompetence as it is noninvasive and safe during the pregnancy (49). Ultrasonographic documentation of cervical shortening and dilatation is crucial in the diagnosis of cervical incompetence (64). Sarti et at, 1979, described the method for ultrasonic examination of the cervix. They said that the full bladder is essential for initial visualization of the cervix, the patient is first examined in the transverse plane at slight cephalic angle in order to make the ultrasonic beam perpendicular to the cervical plane, the transducer is then aligned longitudinally or slightly oblique plane parallel to the long axis of the cervix, the endocervical canal appears as strong linear echo, usually in the center of myometrial echoes of the cervix, the endo cervical canal should be seen from the internal to the external os (48).

Bernstein *et al*. 1981, accepted same method for ultrasonic examination of the cervix, they also suggested that, the over distention of the bladder should be avoided as it may press the cervix and give a closed appearance so the patient should be asked to partially empty her bladder and then repeat the examination, patients with a history suggesting cervical incompetence are examined at weekly intervals three to four weeks before and after the period of gestation when the abortion occurred (50).In study done by Brook *et al*, 1981, about the value of ultrasound examination in women already diagnosed as having cervical incompetence, they said that, the measurement of width of the cervical canal, should be made at angle between the uterine cervix and the body, at point of the greatest anteroposterior diameter, they found that, the width of (19) mm or more was suggestive of cervical incompetence, as all women whose measurement were below (19) mm proceeded with normal pregnancy until term (49). Cervical length was measured by vaginal ultrasound in normal patients in study done by kushnir *et al.* 1990, they measured the cervical length along the endo - cervical canal from the internal

os to the external os, they showed the following normal values of cervical length along the whole pregnancy as in the following diagram (fig.5) (64). Nzeh and Adetoro, 1992, studied the sonographic assessment of the incompetent cervix in pregnancy, they found that the mean diameter of the internal cervical os was 10 mm at 10thweeks gestation and 22.5 mm at 27thweeks gestation in patent who had cervical incompetence, this result comparted with 7.7 mm and 14.5 mm at 13thand 28thweeks gestation respectively for the control subjects (51). They noted other changes in this condition as widening of the internal os, herniation of the amniotic membranes and displacement of the mucus plug (51). Shortened cervix <3cm and open internal os with funneling of the membrane into the endocervical canal, also may be seen (52).

Transvaginal ultrasonography and pregnancy failure: In some situation, transabdominal ultrasound may become suboptimal due to the following causes, obesity, inability to fill the urinary bladder adequately, shadowing from the symphysis pubis, poor visualization of the gestational sac or its contents, unusual uterine position or uterine mass, the endo vaginal ultrasound technique overcomes many of this limitation since it performed with a high frequency technique, near field, focus transducer which is placed closer to the area of interest, a full bladder technique is not required (54).

Technique: This was performed after the patient fully voided, the patient supine on standard ultrasound examination table, the probe inserted in to the vagina after covered with sterile condom and lubricant (54). The frequency of the endo – vaginal transducer is of 5.0 MHz or 7.5 MHz (58). An evaluation of endo-vaginal ultrasound versus transabdominal technique in complicated first trimester pregnancies, done by Pennell *et al*, 1987, they revealed that, the correct diagnosis was made in all cases with endo-vaginal ultrasound which demonstrated the intrauterine embryo, heart motion and yolk sac more clearly and often these structures were not apparent on trans abdominal scans (54). Endo vaginal technique is likely to be diagnostic when transabdominal images fail to give definitive diagnosis in early pregnancies failure (54). Crespigny, 1988, concluded that vaginal ultrasound is superior to both static and transabdominal real-time ultrasound in the diagnosis of early pregnancy failure as it demonstrate the fetal heart movement of living fetus when mean sac diameter exceeded 12 mm which equal to about 5.3-6 weeks of gestation (55). The other two study done by Fadda *et al*, 1993, and Goldstein,1994, both accepted that the new endovaginal technique have better understanding of anatomic landmarks and expected growth rates and can improve the clinical management of the patient in early pregnancy failure(56) (57).

The value of color duplex Doppler ultra sound in predicting pregnancy failure: Doppler mode is used principally for fetal heart monitoring and now, used to identify the location of blood within the utero - placental circulation. Spectral Doppler imaging was used to analyze wave forms obtained from the decidual spiral arteries (59). In a study done by Jaffe and his colleagues, 1995, on the Doppler ultrasound and its value to predicting pregnancy failure they suggested that the abnormal color Doppler findings were associated with a significantly higher prevalence of complicated pregnancy, among women with abnormal Doppler findings43% ended in, abortion, whereas among women with normal findings 1.4% of them miscarried. This study indicates that abnormal blood flow patterns of early utero - placental circulation are associated with an increased prevalence of pregnancy complication and that color Doppler imaging may be used to predict pregnancy outcome (59). Funk and his colleagues, 1995, also accepted the use of Doppler sonogram to evaluate the uterofetoplacental perfusion during the course of the pregnancy and making it possible to recognize pregnancy at risk early (60).

Conclusion

The real time diagnostic ultrasound provides a moving dynamic images and it is to compound B-mode imaging as fluoroscopy to radiography (20). Although static scan imaging may complement ultrasonic studies in some institution, obstetrical examination should always be accomplished by real - time modalities (18). Obstetrical ultrasound enables the clinician to evaluate the presence of the pregnancy, development, growth and wellbeing of the fetus. The management is usually altered according to the ultrasonic appearance to provide optimal care for the mother and the fetus (18). It is unlikely that magnetic resonance imaging (MRI) will replace the ultrasound as a primary obstetric imaging modality in near future. Ultrasound has proven record of accuracy and safety in addition to its easy access and low cost, but MRI is helpful in evaluation of gross fetal anomalies, disturbance of fetal growth, and development when ultrasound is limited by oligohydramnios or maternal obesity (65).

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