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Transabdominal ultrasound features and limitations in diagnosis of intra- and extra-uterine pregnancy: A pictorial essay

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ABSTRACT

Transabdominal ultrasonographic examination is the imaging modality of choice in the diagnosis and confirmation of intra- and extra-uterine pregnancy. Still, it has its own limitations as the imaging appearances may vary. In this article, we present a pictorial review of ectopic pregnancy at different sites and intrauterine pregnancy associated with uterine malformations during which we experienced diagnostic dilemma regarding the origin of ectopic pregnancy and type of uterine malformations.

Key words: Ectopic pregnancy, transabdominal ultrasound, uterine malformation

INTRODUCTION

Ectopic pregnancy is a life-threatening gynecological emergency which occurs when a fertilized ovum implants at a site other than the endometrial lining of the uterus. Ectopic pregnancies occur in the fallopian tube in 97% of cases, with 55% in the ampulla, 25% in the isthmus, 17% in the fimbria, and 3% of cases within the abdomen, ovary, and cervix.[1] Advanced maternal age, previously diseased fallopian tubes, previous history of tubal reconstructive surgery, pelvic inflammatory disease, intrauterine contraceptive devices, and smoking contribute to majority of risk factors of ectopic pregnancy.

Clinically, the patient presents with classical clinical triad of pain, vaginal bleeding, and adnexal mass. However, this triad is highly non-specific and is present in only 45% of patients. Other presenting signs and symptom include any combination of the classic triad as well as amenorrhea, adnexal tenderness, and cervical excitation tenderness. Any suspected case of ectopic pregnancy should undergo a qualitative urine dipstick test for beta-human chorionic gonadotropin (HCG) (urinary pregnancy test) which is quick, easy, and sensitive test.[2,3] It has a sensitivity of 99% at a urine beta-HCG level >25 IU/L.[2] If a woman has a negative urinary pregnancy test, this almost invariably means that she does not have an ectopic pregnancy. However, if it is positive, the woman should have a pelvic ultrasonography done.[2,3] Assessment should begin with transabdominal scanning to evaluate the portion of the pelvis that cannot be visualized transvaginally. In addition to ultrasound and urine pregnancy test, serum beta-HCG level may be quantitatively analyzed. The normal threshold beta-HCG level on transvaginal scan (TVS) can diagnose all gestational sacs (when beta HCG >1000 mlU/ml) and on TAS can diagnose all gestational sacs (when beta HCG >1800 mlU/ml).[4]

Uterine anomalies are found in 9% of women with infertility and repeated abortions.

Ten percent of uterine anomalies are bicornuate. Incomplete fusion of the uterine horns results in a bicornuate uterus. The intervening myometrium extends for a variable length from the fundus to the cervix. A complete bicornuate uterus may have a single (bicornuate unicollis) or duplicated (bicornuate bicollis) cervix.[5] On three-dimensional ultrasound, a large fundal cleft may be visualized. The depth of the cleft is >1.0 cm in bicornuate uterus. Patients with a bicornuate uterus have a miscarriage rate of 28–35%.[6]

A rudimentary uterine horn pregnancy is very rare with the natural history of rupture of the pregnant horn during the second or third trimester, resulting in life-threatening heavy bleeding. A unicornuate uterus occurs when one Mullerian duct develops normally and the other does not - one-third are isolated, one-third have a non-cavitary rudimentary horn, and another one-third have a cavitary rudimentary horn that may or may not communicate with the unicornuate cavity. In one study, the reproductive outcome of women with a unicornuate uterus consisted of a miscarriage rate of 29% and an ectopic rate of 4%.[6,7]

Primary ectopic ovarian pregnancy is seen rarely. Ovarian pregnancy represents a diagnostic challenge. There is scant

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information on the ultrasonographic appearance of ovarian ectopic pregnancies. Usually, the diagnosis results from a surprising finding at surgery. The incidence of such pregnancies, as stated in Indian literature, varies from 0.001%[8,9] to 0.013%[10] of normal pregnancies and from 0.17%[9] to 1%[11] of ectopic pregnancies. In contrast to tubal pregnancy, patients with ovarian pregnancy do not generally have a history of impaired fertility. Several conditions can simulate ovarian pregnancy, including ruptured hemorrhagic corpus luteum and endometriotic "chocolate" cyst.

DISCUSSION

Ectopic pregnancy is still the leading cause of first-trimester maternal deaths.

The possible adnexal findings on transabdominal ultrasonography in an ectopic pregnancy (unruptured sac) are as follows:[12-14]

1. Extrauterine gestational sac with or without visualization of live embryo and heartbeat.
2. An empty sac outside the uterus [Figure 1a and b].
3. Decidual cast or pseudogestational sac.
4. A thick hyperechoic band surrounding a small hypoechoic core giving the appearance of a donut sign [Figure 2].
5. A diffuse hyperechoic mass in the adnexa.

The findings associated with ruptured ectopic pregnancy are as follows:

1. Thick echogenic ring around a sonolucent center in adnexa.
2. Free fluid in cul-de-sac [Figure 3]. (TVS more efficient).
3. Heterogeneous adnexal mass. (Simple cyst or a mass with both fluid and solid components).
4. Fetus outside the uterus [Figure 4].
5. Intraperitoneal blood has a wide spectrum of appearances, but most often is seen as particulate material within fluid [Figure 5].
6. Frank clot can appear as a markedly echogenic solid mass.

Color and pulsed Doppler evaluation of adnexal masses are also greatly increase the specificity of ultrasonography for characterizing adnexal masses as trophoblastic tissue [Figure 6].

Doppler Findings

1. To distinguish a normal from an abnormal intrauterine gestational sac, as well as to differentiate it from a pseudogestational sac.
2. In a normally developing intrauterine pregnancy, there is focally increased color flow within the endometrium, at the site of developing trophoblastic tissue.
3. Low resistance, high-velocity flow is seen within trophoblastic ring in ectopic pregnancy.

Ovarian ectopic pregnancy may appear as a challenging diagnostic case. It is, especially, so because of its rare incidence, which reduces the examiner's awareness and increases the difficulty in acquiring enough experience in its sonographic imaging. Thus, it is reasonable to finalize the diagnosis of primary ovarian gestation according to the 4 classic Spiegelberg anatomic and histologic criteria, whichare as follows: (1) Fallopian tubes, including fimbria, must be intact and separate from the ovary,

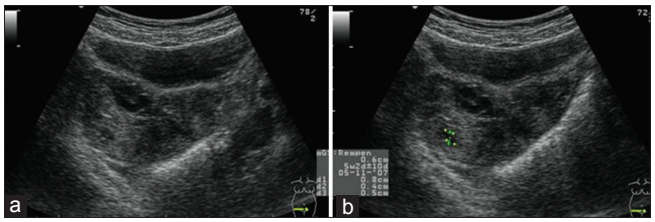

Figure 1: Transverse scan (Aloka SSD 4000, convex probe 5–2 MHz) of pelvis (a and b) shows an empty sac of mean gestational age 5w2d (b) outside the uterus in right adnexa with normal uterus and right ovary

Figure 2: Transverse scan (Aloka SSD 4000, convex probe 5–2 MHz) of pelvis shows a well-defined hypoechoic gestational sac with embryo of crown-rump length 7w0d surrounded by a thick hyperechoic rim in right adnexa adjacent to corpus luteal cyst giving the appearance of donut sign

Figure 3: Longitudinal scan of pelvis (Aloka SSD 4000, convex probe 5–2 MHz) in a case of right ruptured tubal ectopic pregnancy shows free fluid in cul-de-sac with fine internal echoes

(2) the pregnancy must occupy the normal position of the ovary, (3) the ovary must be attached to the uterus through the utero-ovarian ligament, and (4) there must be ovarian tissue (OT) attached to the pregnancy in the specimen. Unfortunately, these are surgical criteria - none of these criteria can be established by ultrasonography.[15,16]

Figure 4: Transverse scan of pelvis (Aloka SSD 4000, convex probe 5–2 MHz) shows fetus and placenta posterior to bladder with no hypoechoic rim of endometrial tissue surrounding it suggestive of the fetus outside the uterus

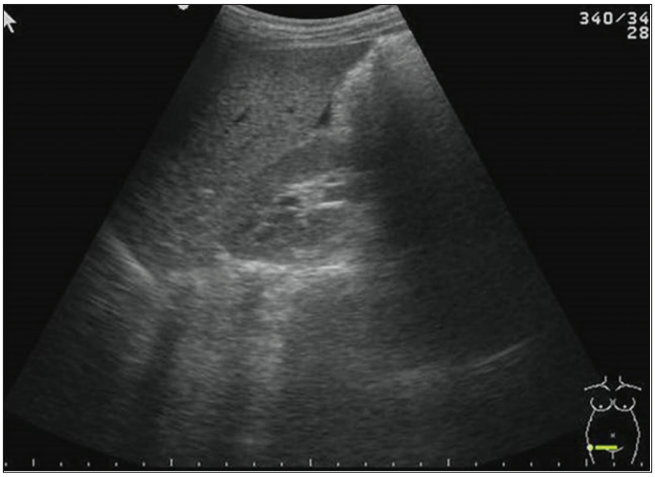

Figure 5: Transverse scan of abdomen (Aloka SSD 4000, convex probe 5–2 MHz) in a case of ruptured left adnexal ectopic pregnancy shows free fluid in Morrison's pouch

In cases of early gestational primary ovarian ectopic pregnancy, the indirect ultrasound signs such as the presence of hemoperitoneum associated with β-HCG >1000 IU/L, thick echogenic ring around the small echolucent area either on the surface or in the substance of ovary, and the absence of intrauterine pregnancy are highly suggestive.[17]

However, in gestational age of more than 10 weeks in primary ovarian ectopic pregnancy, it is difficult to differentiate from tubal ectopic pregnancy [Figure 7a and b]. The final diagnosis of ovarian pregnancy is based on the presence of OT over the pathological specimen [Figures 8a and b and 9].

The criteria for early sonographic diagnosis of rudimentary horn pregnancy (RHP) are as follows: (1) Pseudopattern of an asymmetrical bicornuate uterus, (2) absent visual continuity between the cervical canal and the lumen of the pregnant horn [Figure 10a and b], and (3) the presence of myometrial tissue surrounding the gestational sac [Figures 11-13].[18]

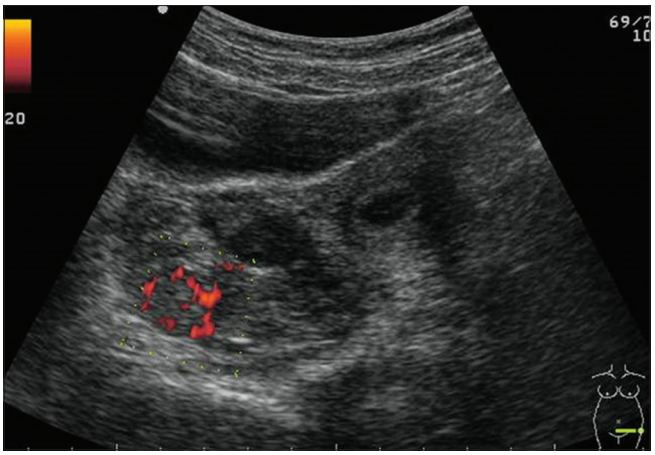

Figure 6: Color Doppler (Aloka SSD 4000, convex probe 5–2 MHz) evaluation of an empty sac of mean gestational age 5w2d outside the uterus in right adnexa with normal uterus and right ovary showing "ring of fire" appearance

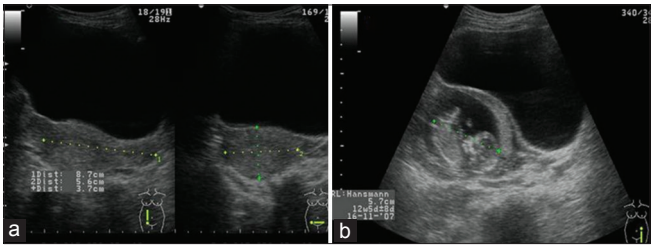

Figure 7: Ultrasound pelvis (Aloka SSD 4000, convex probe 5–2 MHz) shows normal uterus (a) measuring 8.7 × 5.6 × 3.7 cm and fetus with placenta of crown-rump length 5.7 cm corresponding to 12w5d seen in left adnexa posterior to the bladder. (b) There is no obvious myometrial rim surrounding the sac, hence difficult to comment regarding the origin of ectopic pregnancy

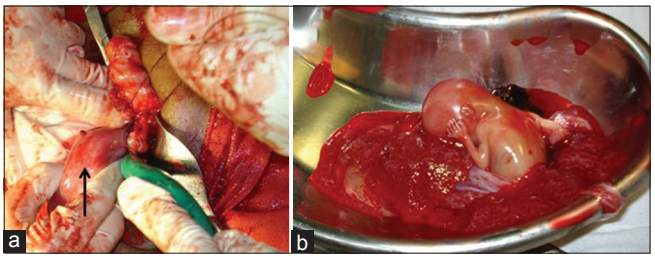

Figure 8: Intraoperative photograph of the same patient described in Figure 7 showing normal intact uterus (arrow in a) and enmass removal of trophoblastic tissue along with the fetus. (b) In addition to it, intraoperatively the right ovary and both fallopian tube were intact and the left ovary was not identified separately from the trophoblastic tissue suggestive of possibly ruptured ectopic ovarian pregnancy of 12w5d

In addition, hypervascularization typical to placenta accreta may support the diagnosis of RHP.[18]

The differential diagnosis of sonographically suspected RHP is a tubal pregnancy, cornual pregnancy, and an intrauterine pregnancy in a bicornuate uterus. A tubal pregnancy will not show a ring of myometrium surrounding the gestational sac, but the differentiation between the latter two conditions and RHP

may be difficult. Variation in thickness of the myometrium in two horns and a marked distance between them favor the diagnosis of a RHP.[19] In contrast to RHP, continuity between the endometrium lining the gestational sac and the other uterine horn is typical for a pregnancy in a bicornuate uterus [Figure 14a and b].

55% of uterine anomalies are septated. A septated uterus is derived from incomplete resorption of the uterovaginal septum. Since the paramesonephric ducts have previously fused, the serosa of the uterine fundus is intact. A serosal indentation up to 1.0 cm may be present with a septated uterus; a serosal indentation

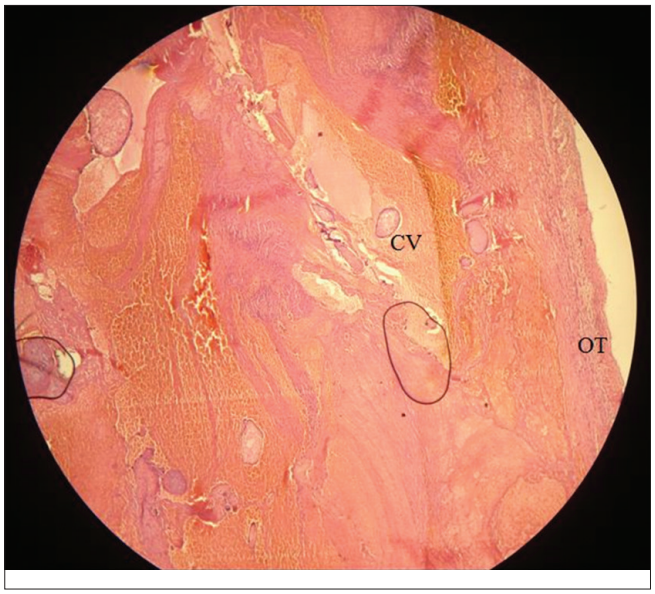

Figure 9: Histologic section taken from the intraoperative specimen described in Figure 8 shows the ovarian tissue and the chorionic villi

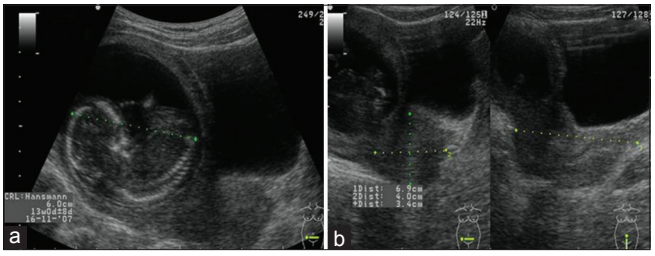

Figure 10: Transverse and longitudinal scan of pelvis (Aloka SSD 4000, convex probe 5–2 MHz) shows gestational sac and fetus (a) of crown-rump length 6 cm corresponding to 13w0d surrounded by thin rim of myometrium (b)which is not seen in continuity with the uterine cavity and cervical canal suggestive of non-communicating left rudimentary horn pregnancy

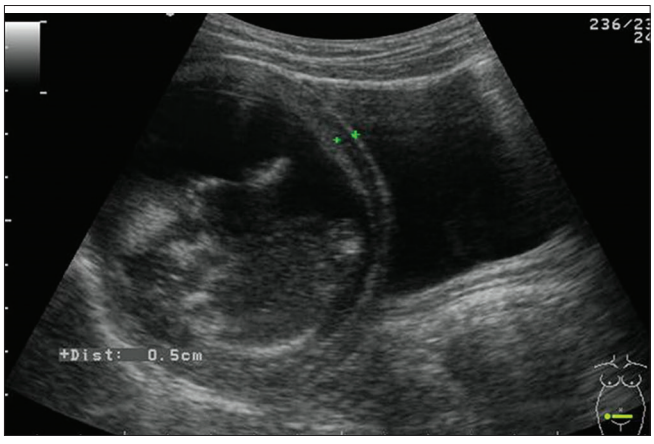

Figure 11: Transverse scan of pelvis (Aloka SSD 4000, convex probe 5–2 MHz) shows well-defined hypoechoic thin rim of myometrial tissue of average thickness 5 mm surrounding the gestational sac in a diagnosed rudimentary horn pregnancy

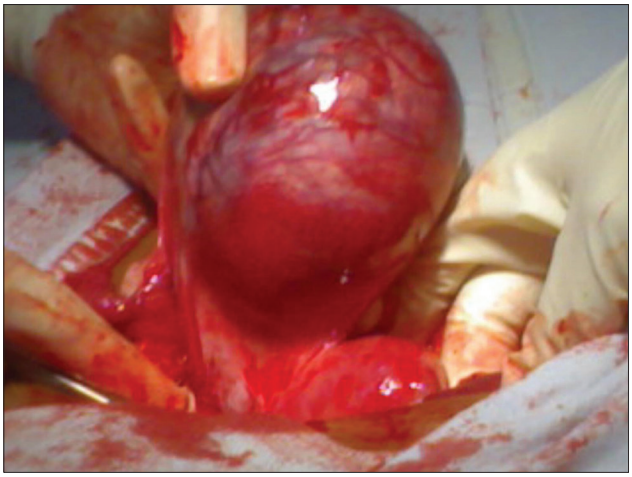

Figure 12: Intraoperative photograph of patient described in Figure 10 showing unruptured non-communicating rudimentary horn pregnancy with the uterus (arrow)

Figure 13: Post-operative specimen showing intact fetus with rudimentary horn

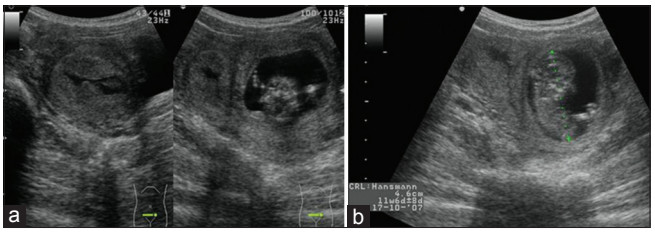

Figure 14: Transverse and longitudinal scan of pelvis (Aloka SSD 4000, convex probe 5–2 MHz) shows two endometrial cavities in continuity with the cervical canal with pregnancy in left endometrial cavity (a) of crown-rump length 4.6 cm corresponding to 11w6d (b) suggestive of bicornuate uterus with pregnancy in one horn and minimal endometrial collection in other horn

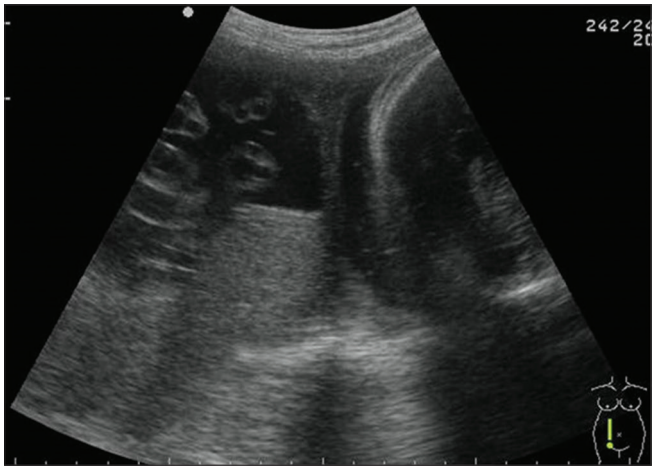

Figure 15: Longitudinal scan of pelvis (Aloka SSD 4000, convex probe 5–2 MHz) shows uterine septum separating the endometrial cavity with umbilical cord lying on right side and fetal head on left side of the cavity

>1.0 cm is indicative of a bicornuate uterus.[5] While this cutoff was arbitrarily selected, it accurately distinguishes between a septated and a bicornuate uterus.[20] The septa may vary in thickness depending on the amount of fibrous and muscular tissue within it. There are several studies carried out regarding the correlation between the length of the septum and pregnancy outcome. In general, the septated uterus has unfavorable pregnancy outcome as compared with other uterine anomalies[6,21-23] [Figure 15]. The septated uterus should be differentiated from bicornuate uterus for treatment and management point of view, as for septated uterus, non-invasive hysteroscopic removal of septa is the treatment of choice, whereas if surgery is possible and/or indicated for the bicornuate uterus, an abdominal approach is required to perform metroplasty.[24]

Complications of ectopic pregnancy can be secondary to misdiagnosis, late diagnosis, or treatment approach. Failure to make the prompt and correct diagnosis of ectopic pregnancy could result in tubal or uterine rupture, depending on the location of the pregnancy, which could lead to massive hemorrhage, shock, disseminated intravascular coagulopathy, and death.

CONCLUSION

Transabdominal ultrasonography is still widely accepted and easily available imaging modality in the diagnosis of ectopic and intrauterine pregnancy associated with uterine malformations. However, it has limitations in predicting the exact origin of ectopic pregnancy and pregnancies associated with the type of uterine anomaly. Hence, the ultrasonologist should be aware of various ultrasound imaging features along with clinical and biochemical criteria and correlate with histological findings for confirmation.

REFERENCES

1. Valley VT, Fly CA. Ectopic Pregnancy. eMedicine; 2005. Available from: http://www.emedicine.com/EMERG/topic478.htm.
2. Condous G. Ectopic pregnancy-risk factors and diagnosis. Aust Fam Physician 2006;35:854-7.
3. Murray H, Baakdah H, Bardell T, Tulandi T. Diagnosis and treatment of ectopic pregnancy. CMAJ 2005;173:905-12.
4. Nyberg DA, Mack LA, Jeffery RB, Laing FC. Endovaginal sonographic evaluation of ectopic pregnancy: A prospective study. Am J Roentgenol 1987;149:1181-6.
5. Troiano RN, McCarthy SM. Müllerian duct anomalies: Imaging and clinical issues. Radiology 2004;233:19-34.
6. Hill LM. The Sonographic Detection of Uterine Anomalies. Spain: Institute for advance medical education (IAME); 2006.
7. Akar ME, Bayar D, Yildiz Set *et al.* Reproductive outcome of women with unicornuate uterus. Aust NZJ Obstet Gynaecol 2005;45:148-150.
8. Mehmood SA, Thomas JA. Primary ectopic ovarian pregnancy (report of three cases). J Postgrad Med 1985;31:219-22.
9. Mitra J, Das PC. Primary ovarian pregnancy (with a case report). J Obstet Gynaecol India 1973;23:509-13.
10. Sakunthaladevi I, Reddy RS, Reddy DB. Ovarian pregnancy. J Obstet Gynaecol India 1967;17:314-21.
11. Dass RK. Primary ovarian pregnancy. J Obstet Gynaecol India 1974;24:76-80.
12. Drife J, Magowan B. Clinical Obstetrics and Gynaecology. London, United Kingdom: Saunders; 2004. p. 169-71.
13. Brown DL, Doubilet PM. Transvaginal sonography for diagnosing ectopic pregnancy: Positivity criteria and performance characteristics. J Ultrasound Med 1994;13:259-66.
14. Madani Y. The use of ultrasonography in the diagnosis of ectopic pregnancy: A case report and review of the literatur. Medscape J Med 2008;10:35.
15. Comstock C, Huston K, Lee W. The ultrasonographic appearance of ovarian ectopic pregnancies. Obstet Gynecol 2005;105:42-5.
16. Spiegelberg O. Zur Cosuistik der Ovarialschwanger schalt. Arch Gynaekol 1973;13:73-6.
17. Carugno J, Patel D, Mercado R. Case report: Laparoscopic management of ovarian ectopic pregnancy. Female Patient Prim Care Ed 2006;31:16.
18. Tsafrir A, Rojansky N, Sela HY, Gomori JM, Nadjari M. Rudimentary horn pregnancy: First-trimester prerupture sonographic diagnosis and confirmation by magnetic resonance imaging. J Ultrasound Med 2005;24:219-23.
19. Kriplani A, Relan S, Mittal S, Buckshee K. Pre-rupture diagnosis and management of rudimentary horn pregnancy in the first trimester. Eur J Obstet Gynecol Reprod Biol 1995;58:203-5.
20. Fedele L, Ferrazzi E, Dorta M, Vercellini P, Candiani GB. Ultrasonography in the differential diagnosis of "double" uteri. Fertil Steril 1988;50:361-4.
21. Salim R, Regan L, Woelfer B, Backos M, Jurkovic D. A comparative study of the morphology of congenital uterine anomalies in women with and without a history of recurrent first trimester miscarriage. Hum Reprod 2003;18:162-6.
22. Kupesic S, Kurjak A. Septate uterus: Detection and prediction of obstetrical complications by different forms of ultrasonography. J Ultrasound Med 1998;17:631-6.
23. Propst AM, Hill JA 3rd. Anatomic factors associated with recurrent pregnancy loss. Semin Reprod Med 2000;18:341-50.
24. Syed I, Hussain HK, Weadock W, Ellis J. Uterus, Mullerian Duct Abnormalities. Available from: http://www.canberra.edu.au/researchrepository/file/b2609812-bad7-defa-6281-1d86851e4c7f/1/full_text.pdf. [Last accessed on 2017 Nov 17].

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