Original Research Article

Ultrasonographic evaluation of pelvic pain in first trimester of pregnancy: a prospective study

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ABSTRACT

Background: Early and accurate diagnosis of the cause of pelvic pain in first trimester of pregnancy is essential for appropriate clinical decision making thereby enabling correct and timely management. The aim of the study was to evaluate the role of ultrasonography in evaluation various causes of pelvic pain in the first trimester of pregnancy and correlate the imaging findings with clinical/per-operative findings.
Methods: This was a prospective observational study approved by the Institutional Review Board and conducted from November 2016 to March 2018. 67 patients with pelvic pain in their first trimester, attending the antenatal clinic or OBG emergency underwent pelvic ultrasonography and the findings were correlated with clinical/per-operative findings.
Results: Ectopic pregnancies formed the largest individual group comprising of 45 (67.2%) cases of the total study population followed by spontaneous abortion 5(7.5%). Other causes included subchorionic haemorrhage, ovarian torsion, uterine fibroid, simple/haemorrhagic/dermoid cyst of ovary and acute appendicitis. 4 (6%) patients had normal intrauterine pregnancy.
Conclusions: Ultrasonography has high diagnostic accuracy of 94% and 100% sensitivity for detecting the cause of first trimester pelvic pain.

Keywords: Ectopic pregnancy, First trimester of pregnancy, Pelvic pain, Spontaneous abortion, Ultrasonography

INTRODUCTION

Pelvic pain is a common clinical presentation in first trimester of pregnancy with causes ranging from simple pathologies requiring routine follow-up to complexities needing urgent surgical management. Making a correct diagnosis is challenging because of several confounding factors like non-specific symptoms and gravid uterus making abdominopelvic examinations difficult. The commoner causes of first trimester pelvic pain include ectopic pregnancy, spontaneous abortion (SA), ovarian torsion, ruptured/haemorrhagic ovarian cyst, subchorionic haemorrhage, while some rare causes are red degeneration of fibroid, appendicitis, urolithiasis and cystitis. Clinical history, laboratory investigations and ultrasonography play a pivotal role in diagnosis thereby enabling appropriate and timely management.

Ultrasonography (USG) is the primary imaging modality for diagnostic evaluation of pregnant patients.[1] Both transabdominal (TAS) and transvaginal (TVS) techniques are used (complement each other) in evaluating the pelvic structures.[2] USG should be the initial imaging test because of its easy availability, relatively low cost, rapidity and lack of radiation exposure; making its use preferable in emergency.[3,4] Colour Doppler imaging (CDI) has to be

used as per the ALARA principle as it causes heating of tissues because of which, the foetus may be potentially harmed.[5]

Magnetic resonance imaging (MRI) is mainly used when a correct diagnosis cannot be achieved by USG as MRI provides a good topographic display with better soft-tissue contrast and multiplanar imaging capabilities.[6,7] However, it is not ideal for use in emergency settings.

The aim of the study was to evaluate the role of ultrasonography in evaluation various causes of pelvic pain in the first trimester of pregnancy and correlate the imaging findings with clinical/per-operative findings.

METHODS

Study design and study population

The present study was a hospital based prospective observational study conducted between November 2016 to March 2018 in the Department of Radiodiagnosis in collaboration with the Department of Obstetrics and Gynaecology, Lady Hardinge Medical College and Smt. Sucheta Kriplani Hospital, New Delhi, India. The study was approved by the institutional ethics committee. 67 pregnant patients with first trimester pelvic pain presenting to the antenatal clinic or OBG emergency, with pregnancy confirmation by Urine Pregnancy Test (UPT) and USG were included in the study. Women who had history of vaginal bleeding without pelvic pain, abdomino-pelvic trauma, history of medical and surgical interventions for pregnancy termination and who were unstable requiring immediate treatment were excluded from the study.

Routine hematological investigations were obtained. Serum ß-hCG (Beta Human Chorionic Gonadotropin) levels were obtained in 51 out of 67 patients with serial ß-hCG levels monitoring before and after treatment. The discriminatory zone of ß-hCG (for confirmation of pregnancy) was taken as 1000-1100 mIU/ml with TVS.

Ultrasound imaging

Transabdominal sonography (TAS) was performed first followed by transvaginal sonography (TVS) and colour Doppler imaging (CDI). Sonographic assessment was done on PHILIPS iU-22 (Intelligent U/S and High-End Color Doppler) ultrasound machine using high-frequency endocavitary (5-9MHz) and curvilinear (2-5MHz) probes supplemented with color doppler. The uterus was screened for the presence of intrauterine Gestational Sac (GS), yolk sac, foetal pole, cardiac activity, placenta/retroplacental/subchorionic region, lower uterine segment (LUS), internal OS and cervix. Assessment of the adnexa i.e. the fallopian tubes and ovaries was done for presence of any mass with/without GS; the echo pattern and vascularity of the mass. A search for fluid-free/loculated, anechoic/particulate in the Pouch of Douglas (POD)/pelvis was made. Thereafter, the abdomen

was scanned for evaluating the organs and free fluid. The sonographic findings were correlated with clinical/per-operative findings.

Statistical analysis

The data were analysed using the appropriate statistical SPSS software (version 25). Qualitative data were expressed as proportions and percentages and quantitative data as mean, range and standard deviation. P-value of <0.05 was considered statistically significant.

RESULTS

Most of the patients (80.6%) belonged to the age group of 20-30 years (age range: 20-41 years). The parity ranged from 0-4. Maximum number of patients i.e. 27/67 (40.2%) belonged to para 0 group, followed by 30% in para 1 group (Table 1).

Table 1: Etiological distribution (n=67).

Final diagnosis	No. of cases (%)
Unruptured tubal ectopic	17 (25.4)
Ruptured tubal ectopic - isolated	19 (28.4)
Heterotopic pregnancy	01 (1.5)
Ovarian ectopic	01 (1.5)
Cervical ectopic	03 (4.4)
Scar site pregnancy	02 (3)
Non communicating rudimentary horn pregnancy	01 (1.5)
Cornual pregnancy in a bicornuate uterus	01 (1.5)
Sub chorionic hematoma	03 (4.4)
Early pregnancy failure	05 (7.5)
Hemorrhagic cyst	04 (6)
Simple ovarian cyst	01 (1.5)
Dermoid	01 (1.5)
Fibroid	01 (1.5)
Ovarian torsion with ruptured tubal ectopic	01 (1.5)
Acute appendicitis	02 (3)
Normal intrauterine pregnancy (IUP)	04 (6)

Ectopic pregnancy (EP)

Ectopic pregnancy was the commonest cause of first trimester pelvic pain seen in 45/67 (67.2%) study subjects. The commonest per vaginal (PV) finding was forniceal mass followed by cervical motion tenderness-a sign highly specific for EP. 8.9% cases of EP had a past history of tubal pregnancy/disease/surgery and 6.7% had current/past history of IUCD use.

Fallopian tube was the most common site, involved in 38/45 (84.4%) patients. Extratubal sites included cervix (6.7%), cesarean scar (4.4%), ovary (2.2%) and non-

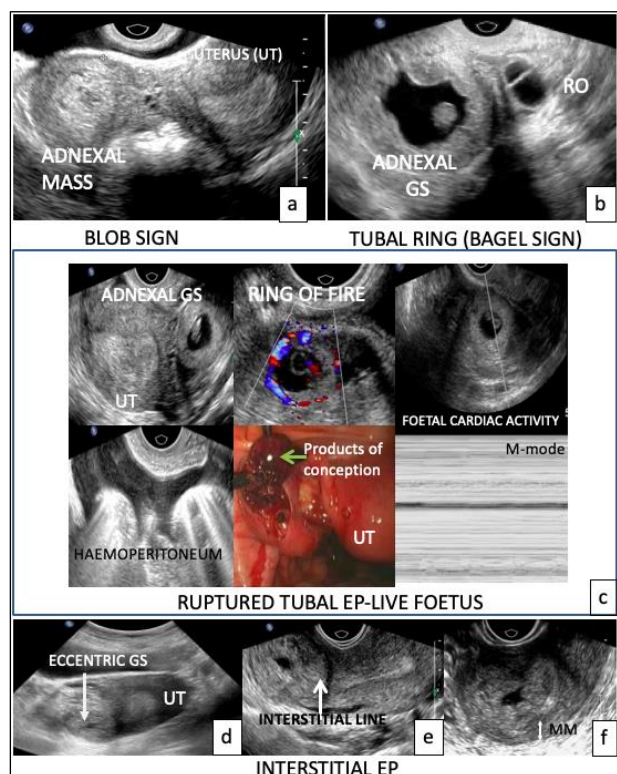communicating rudimentary horn of unicornuate uterus (2.2%).

Figure 1: Sonographic findings in tubal EP. a) Heteroechoic right adnexal mass (Blob sign). UT-uterus. b) Echogenic ring surrounding right adnexal gestational sac (GS) adjacent to the right ovary (RO)-Tubal Ring (Bagel Sign). c) Ruptured EP showing right adnexal GS with live foetus, pelvic free fluid with echoes (haemoperitoneum). Intraoperative findings show ruptured tube with products of conception. d,e,f) Interstitial EP showing eccentrically located GS outside endometrial cavity with interstitial line sign and thin surrounding myometrial mantle (MM).

Tubal pregnancy

Ampulla was the commonest site.

Unruptured tubal EP

Unruptured tubal EP {17/45(37.8%) cases}. On USG, an adnexal mass (Blob sign) was seen in 53% cases while adnexal GS in 47% (Figure 1 a). The tubal ring sign (Bagel sign)-a hyperechoic ring surrounding an extrauterine GS was seen in 29.4% and ring of fire sign in 88% cases (Figure 1 b).m2/17(11.8%) cases had live foetus. 2/17(11.8%) cases were in the tubal interstitium-an uncommon site of EP. USG revealed an eccentric GS outside endometrial cavity with <5 mm of surrounding myometrium (Myometrial mantle-MM). Interstitial line sign-an echogenic line extending from the ectopic GS to

the endometrial echo; a feature highly specific for interstitial EP was seen in one patient (Figure 1 d, e, f).

Ruptured tubal EP {20/45(42.2%) cases} (Figure 1 c). On USG, 19 patients showed fluid in POD/pelvis suggesting tubal rupture. Tubal abnormalities included adnexal GS in 52.6% cases, adnexal mass in 47.4% cases and ring of fire in 21% of cases. 4/19(21%) cases had live foetus. 3 patients sonographically diagnosed as ruptured tubal EP actually had tubal abortions. Sonographic differentiation between them was not possible because of similar finding of echogenic pelvic fluid. One case, diagnosed as ovarian torsion on USG revealed ovarian torsion with ruptured tubal ectopic on laparotomy.

Uncommon sites of EP

Cervical pregnancy

PV examination revealed ballooned out cervix. USG showed intracervical GS with live foetus (Figure 2a).

Caesarean scar pregnancy

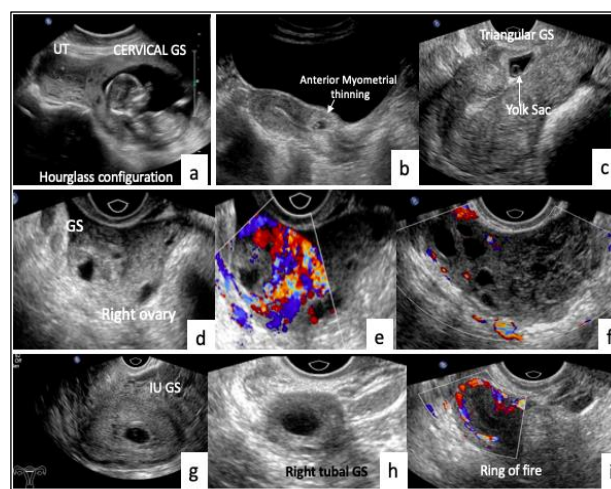USG revealed GS at scar site and anterior myometrial thinning (Figure 2b, c).

Figure 2: Uncommon sites of EP. a) Cervical pregnancy-"hourglass/figure of 8" configuration of the uterus, empty endometrial cavity, closed internal os and a GS with live foetus below internal os in the cervical canal. b, c) Cesarean scar site pregnancy-empty uterine cavity and cervical canal, "triangular GS" implanted at scar site and thinning of the anterior myometrium. d,e) Ovarian pregnancy at presentation. (f) Follow up USG after expectant management. g,h,i) Heterotopic pregnancy-simultaneous visualization of intrauterine GS (IU GS) and right tubal GS, the latter showing ring of fire on CDI.

Ovarian pregnancy

Sonographic features included bulky right ovary with a thick-walled cystic lesion on its surface and periovarian fluid. CDI showed markedly increased perilesional vascularity. Patient was given expectant management followed by fall in serial ß-hCG levels. Follow up USG revealed gradual resolution of the lesion and normalization of ß-hCG levels (Figure 2 d-f).

Heterotopic pregnancy

There was one case of heterotopic pregnancy with history of IUCD insertion. She presented with pelvic pain and bleeding. Sonography confirmed simultaneous visualization of an intrauterine and a right adnexal GS (Figure 2 g-i).

There were 2 cases (one cervical and one cesarean scar EP) where MRI was done and it supported USG findings.

Pregnancy in müllerian anomalies (2 cases)

One patient had unicornuate uterus with non-communicating rudimentary horn pregnancy, managed successfully by rudimentary horn resection. The other patient, with OHVIRA syndrome, had right cornual pregnancy and underwent medical termination of pregnancy.
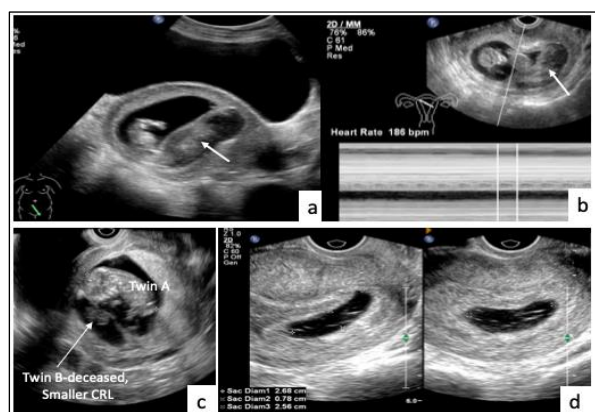

Figure 3: USG findings in other obstetric causes of pelvic pain. a, b) SCH (arrows)-hypoechoic subchorionic collection and live IUP. c) Twin pregnancy with early demise of one foetus. d) SA-heteroechoic endometrial collection; no foetus.

Subchorionic hematoma

All 3 patients had live IUPs with heterogeneously hypoechoic subchorionic collection on USG. The patients were managed conservatively with resolution of SCH on follow up imaging (Figure 3 a, b).

Spontaneous abortion (SA) (5 patients)

Two patients had twin IUP with early demise of one foetus (absent cardiac activity and smaller CRL) (Figure 3 c). Two patients had incomplete abortion with retained products of conception (Figure 3d). One patient had open internal os, GS in cervical canal and absent colour flow in the GS suggesting inevitable abortion.

Haemorrhagic corpus luteal cyst

Haemorrhagic corpus luteal cyst appeared as cystic lesion with internal reticulations. CDI showed ring of fire (Figure 4 a).

Uterine fibroid

Uterine fibroid appeared as well-defined round hypoechoic lesion without degenerative changes.

Ovarian masses with live IUP (2 cases)

One patient had a large (5.2 x 3.1 cm) anechoic, thin walled left ovarian simple cyst with enhanced through transmission (Figure 4 b). The other patient had right adnexal dermoid cyst (3.9x3.6 cm)-well-defined hypoechoic mass with hyperechoic areas within and multiple thin, echogenic bands giving the characteristic "dot-dash pattern". CDI demonstrated mild peripheral vascularity (Figure 4 c, d).
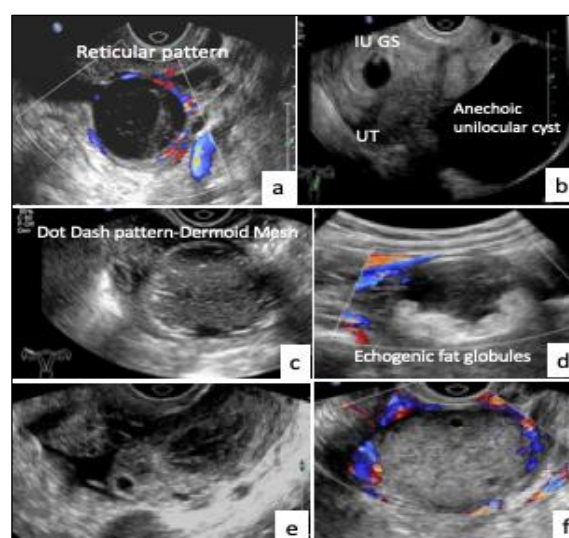

Figure 4: Non-obstetric causes of pelvic pain. a) Hemorrhagic CL cyst- fishnet weave/reticular pattern and -peripheral vascularity. b) Simple left ovarian cyst. c,d) Dermoid cyst showing 'Dot-dash pattern' and echogenic fat globules. e,f) Ovarian torsion- bulky ovary-peripherally arranged follicles and absent internal vascularity.

Ovarian torsion

This patient had bleeding PV and a tender left forniceal mass. USG revealed absent intrauterine GS, minimal

endometrial collection and massively enlarged (5.8 x 3.4 cm) heteroechoic left ovary with peripherally arranged follicles and surrounding fluid. Peripheral vascularity was present but no internal vascularity suggesting SA with ovarian torsion. Laparotomy revealed left ampullo-fimbrial mass and hemoperitoneum suggesting ruptured tubal EP with torsed left ovary (Figure 4 e, f).

Acute appendicitis (2 patients)

These patients presented with acute pain in right iliac fossa. On USG, inflamed appendix was visualized as blind ending, aperistaltic, incompressible, tubular structure with wall to wall diameter of 13 and 14 mm respectively with increased vascularity of the wall on CDI. The patients had live IUP and underwent appendicectomy.

In 4 of our study subjects, no cause for pelvic pain could be found at presentation as well as on follow up.

Surgery was done in 31/67 (46.2%) patients (4 unruptured and 19 ruptured tubal EP, 1 rudimentary horn pregnancy, 3 cervical pregnancies, 1 ovarian torsion with ruptured tubal ectopic, 2 IUPs with acute appendicitis and 1 case of incomplete abortion). Histopathology reports were obtained for 3 patients (2 cases of appendicectomy, 1 case of ruptured tubal EP with gangrenous, torsed ovary). 24 (35.8%) subjects had expectant management while 12 (18%) had medical management (including Inj. Methotrexate/Medical termination of pregnancy). The imaging findings were correlated with per-operative findings/clinical follow up. Table 2 enumerates the etiologies in which the USG diagnosis given was different from the final diagnosis.

Table 2: Etiology with discordant USG and final diagnosis.

Final diagnosis	USG diagnosis	
	Same	**Different**
Unruptured tubal ectopic (n=17)	14	03[a]
Ruptured tubal ectopic - isolated (n=19)	18	01[b]
Ovarian torsion with ruptured tubal ectopic (n=1)	00	01[c]

[a]These cases had tubal abortions - sonographically diagnosed as ruptured EP because of hemoperitoneum.
[b]This case was sonographically diagnosed as unruptured tubal EP. Emergency laparotomy done following clinical deterioration revealed a rent in fallopian tube and hemoperitoneum suggesting ruptured tubal EP.
[c]Sonographic identification of tubal EP was not possible in this case due to diminished visibility of left adnexa owing to massively enlarged ovary, extreme probe tenderness.

DISCUSSION

Our study emphasised on the spectrum of ultrasonographic findings in patients presenting with pelvic pain in first trimester of pregnancy which is a common symptom in this group and often associated with morbidity and even mortality. USG is used as the initial imaging modality and is most often able to diagnose specific pathologies without the requirement of any additional imaging. Familiarity with different etiologies of pelvic pain and knowledge of their sonographic findings helps in earlier detection of abnormalities and complications to prevent diagnostic and therapeutic delay, thus improving foetomaternal well-being.[2]

In our study EP accounted for majority of the cases followed by SA. The rate of EP has been reported to be 2% of all pregnancies.[8] The prevalence of EP in our study was much higher (67.2%) compared to estimate by Lee et al of 6-16% in patients presenting with abdominopelvic pain and/or vaginal bleeding.[8] This could be due to referral bias as ours is a tertiary care hospital. SA accounts for 12-15% of clinically recognized pregnancies while its prevalence in our study was very low (7%) possibly due to exclusion of patients presenting with vaginal bleeding in absence of pelvic pain from the study and a sizeable proportion of these patients may not be referred for sonography from the OBG emergency. In addition, a certain proportion of these patients may not require medical intervention or hospitalization owing to its occurrence in early stages of pregnancy.[9]

Past history of tubal pregnancy/disease/surgery was present in 8.9% of patients of EP in our study compared to 14.9% in a study by Jacob et al in 110197 patients.[10] 6.7% patients had history of current/past use of IUCD similar to findings of study by Cheng et al.[11] Tubal ectopics accounted for majority (84.4%) of the cases of EP which was in agreement with a study by Bahouth et al.[12]

Non-tubal EPs (NTE) include implantation sites other than fallopian tube. Their overall incidence is rising because of increased use of ARTs and cesarean sections. Moreover, their contribution to maternal morbidity and mortality is disproportionate compared with tubal pregnancies due to their atypical presentations resulting in diagnostic delay.[13] So, it is essential to be aware of their imaging findings.

In a pregnant woman with pelvic pain, sonographic absence of IUP when the ß-hCG level is above discriminatory zone is highly suspicious for EP or recent abortion.[8] Early diagnosis, by a combination of clinical history, TVS and serial ß-hCG levels can drastically reduce morbidity as well as mortality. A ruptured EP can result in compromised future fertility and accounts for 6% of all first trimester maternal deaths.[2]

The incidence of müllerian anomalies is 3-5% in general population. Adverse pregnancy outcomes are often encountered in such patients. A high index of suspicion in patients with recurrent pregnancy loss leads to early diagnosis of these cases.[14]

The non-obstetric causes of pelvic pain in our study

included simple/haemorrhagic/dermoid cyst of ovary, uterine fibroid, ovarian torsion and acute appendicitis. Diagnosing these conditions during pregnancy can be challenging due to several confounding factors seen in normal pregnancy such as displacement of pelvic structures by gravid uterus, difficult clinical examination and non-specific symptoms like nausea, vomiting etc.[15] Hence, one should have a high index of suspicion while evaluating a patient with pelvic pain and normal obstetric ultrasound findings.

In our study, USG had 94.7% sensitivity and 84.2% specificity in detecting tubal rupture (at the time of presentation) amongst all tubal EPs. A correct diagnosis on USG was possible in all cases of extratubal EPs as well as other etiologies for pelvic pain. Patients with no obvious cause of pelvic pain at presentation and follow up, were given a USG diagnosis of normal IUP.

Total 5 cases in our study population had discordance in sonographic and final diagnosis. 3 of them, diagnosed as ruptured tubal EP on USG were actually tubal abortions. It is difficult to differentiate them sonographically because of similar findings of hemoperitoneum and lack of clear cut difference in clinical presentation. The other case was initially diagnosed as unruptured tubal EP but eventually developed rupture during expectant management. Another case was that of ovarian torsion with ruptured EP diagnosed sonographically as torsion only because of massively enlarged ovary resulting in poor visibility of adnexa and a poor index of suspicion of EP.

Ultrasonography was found to have a high diagnostic accuracy of 94% for evaluation and diagnosis of the cause of first trimester pelvic pain and 100% sensitivity in detecting a cause for pelvic pain.

CONCLUSION

In conclusion, USG can be labelled as an excellent first-line imaging modality for diagnosing the cause of pelvic pain in first trimester of pregnancy, due to relatively high diagnostic accuracy and sensitivity, ease of performance and suitability for use in emergency thereby enabling the clinician for a prompt and appropriate management.

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