Role of ultrasound in early pregnancy in differentiating normal and abnormal pregnancies

AS Tuladhar,[1] A Giri Tuladhar,[2] DB Karki,[1] A Shrestha[1] and S Pradhan[1]

1Department of Radiology and Imaging and 2Department of Gynaecology and Obstetrics, Nepal Medical College and Teaching Hospital, Attarkhel, Jorpati, Kathmandu, Nepal

Corresponding author: Dr. Abhushan Siddhi Tuladhar, MBBS, MD (Radio-diagnosis), Lecturer, Department of Radiology and Imaging, Nepal Medical College and Teaching Hospital, Attarkhel, Jorpati, Kathmandu, Nepal; e-mail: abhushan@nepalimail.com

ABSTRACT

A prospective study was carried out from November 2006 - December 2008 in which a total of 304 patients with early pregnancy were examined by ultrasound (US). Of these, 203 (66.8%) cases were normal pregnancies (including 8 cases of twin pregnancy), 32 (10.5%) missed abortions, 19 (6.3%) incomplete abortions, 14 (4.6%) complete abortions, 12 (4.0%) blighted ovums, 11 (3.6%) without sonographic evidence of pregnancy, 7 (2.3%) ectopic pregnancies and 6 (1.9%) molar pregnancies. US in early pregnancy gave a reliable and accurate differentiation between a viable normal pregnancy and an abnormal/ pathological pregnancy.

Keywords: Ultrasound, normal, abnormal, pregnancy.

INTRODUCTION

Since the introduction of ultrasound (US) in 1942 by the Austrian neurologist Dussik, it has revolutionized obstetric diagnosis and enriched gynaecology with a valuable diagnostic method.[1] During the first trimester of pregnancy, a unique and dramatic sequence of events occurs, defining the most critical and tenuous period of human development: the remarkable transformation of a single cell into a recognizable human being.[2] US has played a significant role in the establishment of early pregnancy, estimation of gestational age (GA), and in the evaluation of many problems of early pregnancy.[3] Because of the complex sequence of events that accompany first trimester development, it is not unusual for complications to occur. Approximately 15.0% of clinically recognized pregnancies are spontaneously miscarried; the loss rate is estimated at two to three times higher with very early and often clinically unrecognized pregnancy.[4,5] In women who present with threatened abortion, US is often the first and frequently the only study required to sort out the many differential clinical considerations. In approximately 50.0% of these patients, the results reveal a normal pregnancy, and the pregnancy progresses without difficulty. In the remaining patients whose outcomes are abnormal, US can usually diagnose the specific problem and expeditious and appropriate management can be undertaken.[6] US is currently the only available technique for the differentiation of normal from abnormal early pregnancy.[7] Several complications of early pregnancy such as molar pregnancy, blighted ovum, missed, incomplete and complete abortions and ectopic pregnancy can be detected accurately by US.[1]

MATERIALS AND METHODS

Three hundred and four cases of early pregnancy before 13 weeks of GA, attending Gynecology and Obstetrics Department of Nepal Medical College and Teaching Hospital, who were referred to the Department of Radio-diagnosis for different indications, during a period of 26 months, from November 2006 to December 2008, underwent transabdominal obstetric US. The scans were performed by commercially available real time ultrasound unit with a 3.5 MHz probe (Nemio 17 Toshiba Medical Systems). Confirmation of intrauterine pregnancy was made on the basis of presence of gestational sac (GS) and/ or product of conception within the uterine cavity. Estimation of GA was done by standardized measurements of Mean Sac Diameter (MSD) of the GS and/ or the Crown-rump Length (CRL) of the embryo. Presence of live embryo was confirmed by detection of cardiac activity in B Mode and was supported by M Mode study.

RESULTS

Altogether 304 patients in early pregnancy between the age of 17 to 32 years, irrespective of their parity and obstetric history were scanned. Out of these, 203 (66.8%) were normal pregnancies (including 8 cases of twin pregnancy), 32 (10.5%) missed abortions, 19 (6.3%) incomplete abortions, 14 (4.6%) complete abortions, 12 (4.0%) blighted ovums, 11 (3.6%) without sonographic evidence of pregnancy, 7 (2.3%) ectopic pregnancies and 6 (1.9%) molar pregnancies. Other pathological conditions of uterus and adnexa during pregnancy were also detected during the scan. These conditions included

Table-1: Ultrasonographic findings

US findings	No. of cases	%
Normal pregnancy	203	66.8
Missed abortion	32	10.5
Incomplete abortion	19	6.3
Complete abortion	14	4.6
Blighted ovum	12	4.0
No pregnancy	11	3.6
Ectopic pregnancy	7	2.3
H. Mole	6	1.9
Total	**304**	**100.0**

3 cases of bicornuate uterus with normal pregnancy in any one cornua in 2 patients and with missed abortion in 1 patient, 5 cases of fibroid uterus associated with normal pregnancy, different types of unilateral and bilateral ovarian cyst of different size in 7 patients.

DISCUSSION

Two-third of the patients (66.8%) were found to have normal pregnancies. The first definite sonographic finding to suggest early pregnancy is visualization of the GS which can be seen as early as 4 weeks of GA.[3,8,9] Pregnancies might be seen within the uterus before 5 weeks of amenorrhoea. Therefore, US at this early stage has critical value, particularly in patients suspected of having ectopic pregnancy.[3] Using a transabdominal approach, the yolk sac should be evident by 7 weeks, when the MSD is 20 mm.[10] Cardiac activity should be evident by 8 weeks, when the MSD is 25 mm.[10] The threshold for embryonic pole detection is between 5 and 6 weeks, when the MSD is between 5 and 12 mm.[11,12,13] Missed abortion, on the basis of work done by Pennell *et al*, the discriminating embryonic size for detecting cardiac motion has been determined as being 9 mm.[14] The patients with clinical diagnosis of threatened abortion but with sonographic absolute normal findings were also included in this group. About one fifth of patients (21.4%) had abortion in different stages which could be categorized as missed, complete and incomplete by single scan. Threatened abortion encompasses a broad range of conditions that are named based on the stage of development and the sonographic appearance of the product of conception, and is used when the patient is clinically considered to have a potentially living embryo.[15] The term missed abortion, still common in clinical practice, does not adequately describe the pathophysiological changes.[16] The diagnosis of about 32 cases (10.5%) of missed abortion was relatively easy and was performed in one scan. Absence of fetal heart beats confirmed the diagnosis. In 19 cases (6.3%) of incomplete abortion, the uterus was filled with blood clots and placental remnants. We diagnosed this by US by the presence of an irregular mass in the uterine cavity with or without a GS. Fetal structures were usually not seen. No intrauterine retained product of conception was seen in 14 cases (4.6%) of complete abortion. The diagnosis of embryonic demise should not be made by vaginal sonography in embryos measuring less than 5 mm CRL without a heartbeat, and an empty GS of less than 12 mm average diameter should not be diagnosed as blighted ovum. In these cases, follow up scan is suggested.[14]

The diagnosis of 12 cases (4.0%) of blighted ovum was made when there is absence of yolk sac or embryo in the GS when the MSD exceeded 20 mm.[17] Early diagnosis of blighted ovum was possible during single or in some cases, during a repeat scan done 2 weeks later. Specific size criteria can be used to differentiate a normal from an abnormal intrauterine GS using a transabdominal approach, discriminatory size criteria that suggest an abnormal sac include failure to detect a double decidual sac when the MSD is 10 mm or more, failure to detect a yolk sac when the MSD is 20 mm or more, and failure to detect an embryo with cardiac activity when the MSD is 25 mm or more.[18,19]

Hydatidform mole, the usual form of trophoblastic disease, is common in this part of the world. We diagnosed 6 cases (1.9%) of this disease by the presence of snowstorm like echogenic echoes with multiple cystic spaces inbetween. Trophoblastic diseases were diagnosed as early as 7 weeks of GA during a single scanning in this study. Trophoblastic disease is usually associated with a theca luteal cyst in 15.0-30.0% of cases due to excessive chorio-gonadotrophin secretion.[20]

Among 7 cases (2.3%) of ectopic pregnancy, 5 had adnexal mass with hemoperitoneum and 2 had unruptured tubal pregnancy without hemoperitoneum. In theory, an intrauterine sac can be distinguished from a pseudogestational sac because the former is located within the decidua, whereas, the latter is within the uterine cavity.[21] In practice, the distinction is often difficult to make with certainty.[22] There was no evidence of intrauterine or extrauterine pregnancy in 11 cases (3.6%), though they had history of amenorrhea and positive urine pregnancy test. This is because scan at very early stage of pregnancy before 4 weeks of GA might not show any evidence of intrauterine or extrauterine pregnancy. Also, patients give wrong dates of amenorrhoea and sometimes the urine pregnancy tests give false positive results.

US plays a vital role in the early stage of pregnancy. It provides an accurate diagnosis in a vast majority of patients in the first trimester and also gives a reliable differentiation between a viable normal pregnancy and

a pathological pregnancy. Being an easily available, safe, reliable, quick, cheap and easily reproducible investigation, US has a very important role in differentiating normal and abnormal / pathological pregnancies and therefore, in accurate management.

REFERENCES

1. Shrestha BL. Ultrasound in medicine. *J Nepal Med Assoc* 1985; 23: 239-46.
2. Laing FC, Frates MC. Ultrasound evaluation during the first trimester of pregnancy. In: Callen PW (ed.). Ultrasonography in Obstetrics and Gynecology. 4th Ed. W B Saunders 2000: 105-45.
3. Crespigny LC, Cooper D, McKenna M. Early detection of intrauterine pregnancy with ultrasound. *J Ultrasound Med* 1988; 7:7-10.
4. Scott JR.s Early pregnancy loss. In: Scott JR, Di saia PJ, Hammond CB, Spellacy WN (eds). Danforth's Obstetrics and Gynecology. 8th Ed. Philadelphia, Lippincott-Raven 1999: 143-53.
5. Wilcox AJ, Weinberg CR, O'Connor J *et al*. Incidence of early pregnancy loss. *New Engl J Med* 1988; 319: 189-94.
6. Sohey R, Woodward P, Zweibel WJ. First-trimester ultrasound: The essentials. *Semin Ultrasound CT MR* 1996; 17: 2-14.
7. Hansmann M, Hackrloer BJ, Staudach A, Wittonan BK, Telger TC. In: Ultrasound Diagnosis in Obstetrics and Gynecology. Springer Verlag, New York 1985:241-66.
8. Timor-Tritsch IE, Farine D, Rosen MG. A close look at early embryonic development with the high-frequency transvaginal transducer. *Amer J Obstet Gynecol* 1998; 159: 676-81.
9. Rossavik IK, Torjusen GO, Gibbons WE. Conceptual age and ultrasound measurements of gestational sac and crown-rump length in vitro fertilization pregnancies. *Fertil Steril* 1988; 49: 1012-7.
10. Nyberg DA, Mack LA, Laing FC, Patten RM. Distinguishing normal from abnormal gestational sac growth in early pregnancy. *J Ultrasound Med* 1987; 6: 23-7.
11. Robinson HP. "Gestational sac" volumes as determined by sonar in first trimester of pregnancy. *Brit J Obstet Gynecol* 1975; 82: 100-7.
12. Robinson HP, Hadlock FP, Shah YP, Lindsey JV. Combined data comparing menstrual age with average gestational sac size (mean diameter) and crown-rump length. In: Nyberg DA, Hill LM, Bohm-Velez M, Mendelson EB (eds). Transvaginal Ultrasound. St. Louis, Mosby-Year Book 1992: 335-52.
13. Hadlock FP, Shah YP, Kanon DJ, Lindsey JV. Fetal crown-rump length: Reevaluation of relation to menstrual age (5-18 weeks) with high-resolution real time US. *Radiology* 1992; 182:501-5.
14. Pennell RG, Needleman L, Pajak T *et al*. Prospective comparison of vaginal and abdominal sonography in normal early pregnancy. *J Ultrasound Med* 1991; 10: 63-7.
15. Nyberg DA, Laing FC. Threatened abortion and abnormal first trimester intrauterine pregnancy. In: Nyberg DA, Hill LM, Bohm-Velez M, Mendelson EB (eds). Transvaginal Ultrasound. ST. Louis, Mosby-Year Book 1992: 85-103.
16. Pridjian G, Moawad AH. Missed abortion: Still appropriate terminology? *Amer J Obstet Gynecol* 1989; 161: 261-2.
17. Nyber DA, Laurence AM, Laing FC, Harvey D. Value of the yolk sac in evaluation of early pregnancies. *J Ultrasound Med* 1988; 7: 129-35.
18. Nyberg Da, Laing FC, Filly RA. Threatened abortion: Sonographic distinction of normal and abnormal gestational sacs. *Radiology* 1986; 158: 397-400.
19. Nyberg DA, Laing FC, Filly RA, Uri-Simmons M, Jeffrey Jr RB. Ultrasonographic differentiation of the gestational sac of early intrauterine pregnancy from the pseudogestational sac of ectopic pregnancy. *Radiology* 1983; 146: 755-9.
20. Hertzberger BS, Kurtz A, Wapner RJ *et al*. Gestational trophoblastic disease with coexistent normal fetus. *J Ultrasound Med* 1988; 5: 467-9.
21. Yeh HC, Goodman JD, Carr L, Rabinowitz JG. Intradecidual sign: A US criterion of early intrauterine pregnancy. *Radiology* 1986; 161: 463-7.
22. Laing FC, Brown DL, Price JF, Teeger S, Wong ML. Intradecidual sign: Is it effective in diagnosis of an early intrauterine pregnancy? *Radiology* 1997; 204: 655-60.