ORIGINAL ARTICLE

ROLE OF ULTRASONOGRAPHY IN THE DIAGNOSIS OF PREGNANCY

Sheela Kumari[1], Bharat Kumar[2], Vijay Kumar Singh[3], Rajesh Kumar Pandey[4], H. N. Jha[5], Kashif Shahnawaz[6]

ABSTRACT: INTRODUCTION: Ultrasonography is very much helpful to diagnose the pregnancy in very early weeks as well as to estimate the gestational age and to know the presence or absence of fetal life. It is a non-invasive technique without any known complications. It helps to diagnose pregnancy in early stage by demonstration of a gestation sac within the uterus. **MATERIALS AND METHODS:** 100 cases of amenorrhoea of 5 to 24 weeks were selected for the study. After proper examination, cases were ultrascanned to see the presence of gestational sac for the diagnosis of pregnancy. Ultrasound equipment used was the real time scanner with a 3.5 mHz linear array transducer. The parameters that can be measured in the first trimester include the dimension of the gestational sac, the fetal crown-rump length (CRL) and size of the yolk-sac. In the second trimester, the parameters that can be measured are biparietal diameter (BPD), foetal femur length (FL) and abdominal circumference (AC). **RESULTS:** It was shown in our study that, out of 100 cases, 53 cases were of normal pregnancy ranging from 6 weeks to 24 weeks. A gestational sac is confirmatory of an early pregnancy at 5 to 5.5 weeks of gestation. Accurate assessment of CRL is not possible until 6.5 to 7 weeks of gestation. A combination of BPD, AC and FL gives a three dimensional profile of the fetus, which may aid in the early diagnosis of intrauterine growth retardation. **CONCLUSION:** It is concluded from our study that this sophisticated diagnostic tool is useful in diagnosis of early pregnancy, pregnancy failure and dating of pregnancy. Ultrasonography has proved itself to be an extremely reliable and non-invasive aid in antenatal investigations.
KEYWORDS: Ultrasonography, Pregnancy, Diagnosis.

INTRODUCTION: Monitoring intrauterine fetal health is of paramount importance. The diagnosis of early pregnancy is an important step to ensure the proper growth and development of an individual right from the very beginning, for example- patients with recurrent abortions or preterm labour can be treated in the right direction, once the diagnosis and its etiology is established. On the other hand, those who have planned to terminate an unwanted pregnancy can also be helped by medical termination of pregnancy, which is much easier and safer during early months. Besides these there are many medical and eugenic grounds of early diagnosis of pregnancy. The early diagnosis of pregnancy in tubal gestation, hydatid form mole, will save the patients from serious and dangerous complications which follow the absence of timely diagnosis and treatment of these conditions.

In 1961, Donald[1] used ultrasonic waves in obstetrics practice. Later, Adam and Robinson[2] succeeded in diagnosing presence and absence of fetal life as well as gestational age. Therefore, by ultrascan we can diagnose the pregnancy in very early weeks as well as we can estimate the gestational age, we can also know the presence or absence of fetal life. Ultrascan is a non-invasive technique with no known complications. Thus, it helps to diagnose pregnancy in an early stage by demonstration of a gestation sac within the uterus, in contrast to clinical signs and hormonal assays

ORIGINAL ARTICLE

and other pregnancy tests which infer the presence of a pregnancy in the body of a woman. The demonstration of gestation sac by ultrasound within the uterus is thus superior and is a definite proof of pregnancy.[2] In view of the importance of early diagnosis of pregnancy, the present study shall be undertaken with the following objectives:

1. To find out the earliest time by which diagnosis of pregnancy is possible by this method.
2. To find out the percentage of confirmation.

It appears that ultrascan is a non-invasive technique, relatively more accurate in the confirmation of an early uterine pregnancy and appears to be safer and simpler procedure which can be repeated without much inconvenience to the patient. This study can be made having no untoward affect to the patient. This method can also diagnose a tubal pregnancy before rupture. Ian Donald (1961)[1] of Glasgow developed new diagnostic procedure by ultrasound for diagnostic purposes in obstetrics. According to Thompson,[3] a gestation sac was demonstrable in the B scope from the 8th week. Willocks and co-workers[4] first demonstrated that the product of conception could be visualized by ultrasound after 5.5 weeks of amenorrhoea. Uterus was elevated from the pelvis and the transmission of ultrasonic waves expedited by filling the bladder. Diagnosis of pregnancy is given after consideration of the following factors:

a. The presence or absence of a gestation sac ring.
b. The dimension of uterus.
c. The presence of organized echoes from within the uterine cavity.
d. Only organized echoes or no echoes from within the uterine cavity.

Diagnosis of early pregnancy was achieved by detection of fetal heart movement (Robinson, 1966),[5] measurement of foetal crown-rump length (Robinson, 1973,[6] Robinson and Fleming, 1975[7]) and estimation of gestation sac volume (Robinson, 1975).[7]

MATERIALS & METHODS: One hundred cases of amenorrhoea 5 to 24 weeks were selected for the present study from those attending Obstetrics and Gynaecological outpatient department of Darbhanga Medical College & Hospital, from the period of Nov-2014 to January 2015 (three months). After proper examination, cases were ultrascanned to see the presence of gestational sac for the diagnosis of pregnancy. Then urine was also collected for immunological test of pregnancy. Immunological test for pregnancy was one by Latex agglutination inhibition test (Gravindex test), because this test is the easiest to perform and equally sensitive to other immunological tests. For this test, a fresh random sample of urine was used.

The urine was used ordinarily without filtration, concentration, adjustment of pH or any previous preparation. Only in negative cases morning sample of urine was used. Interpretation of results was done by simple naked eye examination. In positive test, no agglutination was seen within two minutes and in negative tests, agglutination occurred within two minutes. For ultrascan examination, equipment used was the real time scanner (real time 'B' mode Toilu) which was diagnostic sonar system with a 3.5 mHz linear-array transducer. A full urinary bladder is necessary for the adequate examination of the female pelvis. After identifying the uterus, uterine cavity was searched for the presence of gestation sac, fetal echo and foetal throughouts. If scanning revealed the presence of foetus within the gestation sac, measurement was made of either crown-rump length and the measurements were compared with the duration of amenorrhoea. Viability of foetus was determined by noting the foetal movement or preferably by visualizing the beating of foetal heart.

ORIGINAL ARTICLE

After identification of gestational sac, a fetal pole with heart motion can be identified by the 7th week of gestation and fetal trunk and limb movements by the 9th weeks. The parameters that can be measured in the first trimester include the dimension of the gestational sac, the fetal crown rump length (CRL) and size of the yolk sac. CRL measurement is the most accurate means of dating the pregnancy in first trimester. CRL measurement is the longest demonstrable length of the fetus excluding the fetal limbs and it is the most accurate sonographic technique in establishing gestational age. The calipers are made in outer portion of the cephalic pole and the rump. It is prudent to take three measurements in each fetus during the same examination and average the results. CRL is calculated by the following formula:

$$\text{Gestational age in days} = \sqrt{8.052\ CRL + 23.73}$$

A rapid rule of the thumb for a quick calculation of the gestational age is to add 6.5 to the CRL measurement in cm. The result will be the menstrual age in weeks.

Biometry in the 2nd trimester can be done by measuring Biparietal Diameter (BPD), Fetal Femur Length (FL) and Abdominal Circumference (AC). Femur length has been established as an accurate predictor of gestational age because of the normal biologic variation. This measurement is more accurate in the 14 to 20 week gestational age group. Fetal age can be calculated by the formula-

Gestational age = 2.22 x femur length (in mm) + 62.5 (in days).

RESULTS:

Ultrasonic Diagnosis	No. of cases
Normal pregnancy	53
Marginal placenta previa	4
Hydramnios	1
Twin pregnancy	5
Incomplete abortion	16
Quadruplets	1
Anencephaly	1
Hydatidiform mole	2
Missed abortion	2
Ruptured ectopic gestation	2
Threatened abortion	3
Breech presentation	3
Intrauterine foetal death	3
Abdominal ectopic gestation	1
Right ovarian cyst	1
Oligohydramnios	1
Retroverted uterus	1
Total	**100**
50% of the cases were of normal pregnancy. 16% of cases were of incomplete abortion.	
Table 1: Distribution of cases according to ultrasonographic diagnosis	

ORIGINAL ARTICLE

Gestational age (Sonographic value)		Crown-rump length (mm)
Weeks	Days	
8	2	18
9	3	30
11	-	50
12	4	62
7	4	14
8	2	18
10	2	30
8	5	15
10	-	20
10	-	20
9	4	35
11	4	50
9	4	35
10	6	45
11	2	48
12	2	56
10	2	44
8	3	30
8	-	17.3
6	-	6.6
6	-	8
7	-	11
9	-	24
Mean = 29.04 +S.D. = 16.52 +S.E. = 03.44		
Table 2: Gestational age and crown-rump length of fetus in utero		

Gestational age		Bi-parietal diameter (mm)	Abdominal Circumference (cm)	Femur Length (cm)
Weeks	Days			
12	-	20	5	1
12	2	20	5.6	1
12	4	20	5	1
12	5	21	5.6	1
13	-	23	7	1

ORIGINAL ARTICLE

13	2	24	7	1
13	4	24	7	1
14	2	27	8	1.5
14	3	27	8	1.5
14	4	28	8	2
14	6	28	8	1.5
15	-	29	9	2
15	-	29	9.3	1.8
15	2	30	9	2
15	4	29	9	2
16	-	33	10.5	2.1
16	2	34	11	2
16	3	34	10.5	2.1
17	-	36	11.7	2.5
18	-	40	13	2.7
18	2	41	13	2.7
18	4	41	13	2.7
19	-	43	14.1	3
20	-	46	15.2	3.3
20	3	23	15.2	3.3
21	-	50	16.4	3.6
21	6	55	16.4	3.7
22	-	52	17	3.9
22	-	53	14.1	3.0
22	-	53	17.5	4
24	-	60	19	4.5
24	-	62	19.7	4.4

Table 3: Gestational age and bi-parietal diameter, abdominal Circumference and femur length of foetus in utero.

Sonographic Parameters	No. of cases	Range	Mean	+S.D	+S.E
Crown-rump length (mm)	23	6.6-62	29.04	16.52	3.44
Bi-parietal diameter (mm)	51	20-60	35.29	11.75	1.68
Abdominal Circumference (cm)	51	5.6-19.7	11.35	4.02	0.57
Femur length (cm)	51	1.0-4.5	2.43	1.12	0.16

Table 4: Mean level of sonographic parameters in total no. of cases.

DISCUSSION: In our present study, the ultrasonic examination was carried out in 100 patients from 6-24 weeks of amenorrhoea.

Table 1 shows that, out of 100 cases, 53 cases were of normal pregnancy ranging from 6 weeks to 24 weeks. Sonar diagnosed 16 cases as incomplete abortion, 3 cases as threatened abortion.

ORIGINAL ARTICLE

The diagnosis of missed abortion was made in 2 cases, hydatidiform mole in 2 cases, ectopic pregnancy in 3 cases, marginal placenta previa in 4 cases. There was one case of anencephaly, and one case of quadruplets. There were 5 cases of twins and 3 cases of breech presentation. There was one case of hydramnios, 3 cases of intrauterine foetal death, one case of right ovarian cyst, one case of oligohydramnios and one case of retroverted uterus. Drum (1976)[8] scanned 1152 patients with clinical diagnosis of threatened abortion. All these patients had positive pregnancy at the time of examination. On scanning, he found threatened abortion in 375 patients (32.5%) only, missed abortion in 124 (10.8%) patients, blighted ovum in 128 patients (11.1%), molar pregnancy in one patient, incomplete abortion in 324 (28.1%) and complete abortion in 200 (17.4%). McVicar and Donald (1958)[9] described a technique to differentiate molar pregnancy from an early uterine pregnancy. The echoes from clusters of vesicles which can be suppressed by reducing the gain power of the apparatus ,whereas fetal echoes appear strong and clear from 10th week onwards and cannot be suppressed by reduction in gain setting. Platt (1981)[10] identified the ultrasonographic echoes pattern in the diagnosis of hydatid form mole, closely resembling the classic 'snow flake' pattern seen in true moles. Kratochwill (1978)[11] stated that a definite diagnosis of ectopic pregnancy was only possible, if a gestation sac could be demonstrated beside the uterus.

Table 2 shows the crown rump length (CRL) in different gestational age. Accurate assessment of CRL is not possible until 6.5 to 7 weeks gestation. A gestational sac is confirmatory of an early pregnancy at 5 to 5.5 weeks of gestation.

Table 3 shows the measurement of Biparietal diameter (BPD), abdominal circumference (AC) and Femur length (FL) in different gestation age. G D O'Brien et al (1981) [12] showed that 95 percent confidence limits of a femur measurement at 14 to 20 weeks were ± 6 days, from 20 to 30 weeks were ± 12 days and from 30 to 41 weeks were ± 18 days. A combination of BPD, AC and FL gives a three dimensional profile of the fetus, which may aid in the early diagnosis of intrauterine growth retardation.

CONCLUSION: From the findings of our present study, it is concluded that this sophisticated diagnostic tool is useful in diagnosis of early pregnancy, pregnancy failure and dating of pregnancy. Ultrasound does not causes any adverse effect on the mother and the fetus, also there was no case of false negative report by this technique. Thus, the ultrasonic examination of the uterus in general presents no major difficulty and has proved itself to be an extremely reliable and non-invasive aid in antenatal investigations.

REFERENCES:
1. Donald I, Brown T G: Demonstration of tissue interfaces within the body by ultrasonic echo sounding: Br J Radiol. 1961, Sept.; 34: 539-46.
2. Adam A H, Robinson H P, Dunlop C: A comparison of crown-rump length measurements using a real time scanner in an antenatal clinic and a conventional B-scanner. Br J Obstet Gynaecol. 1979; 86: 521-4.
3. Thompson R S, Trudinger B J, Cook C M, Giles W B, Connelly A. Low dose aspirin therapy improves foetal weight in umbilical placental insufficiency. Am J Obstet Gynaecol. 1988; 159: 681-5.

ORIGINAL ARTICLE

4. Willocks J, Donald I, Duggan T C, Day N. Foetal cephalometry by ultrasound. J Obstet Gynaecol Br Commonw. 1964, Feb; 71: 11-20.
5. Robinson D E, Garrett W J, Kossoff G. Ultrasonic echoscopic examination in late pregnancy. Obstet Gynaecol. 1966. Aug; 28(2): 164-169.
6. Robinson H.P. Sonar measurement of foetal crown-rump length as means of assessing maturity in first trimester of pregnancy. Br Med J. 1973; 6: 28-31.
7. Robinson H.P, Fleming J E. A critical evaluation of sonar "crown-rump lengh" measurements. Br J Obstet Gynaecol, 1975; 82:702-10.
8. Drumm J.E, Clinch J, Mac Kenzie G. The ultrasonic measurement of foetal crown-rump length as a method of assessing gestational age. Br J Obstet Gynaecol. 1976; 83: 417-21.
9. Macvicar J, Donald I, Brown T G. Investigation of abdominal masses by pulsed ultrasound. Lancet. 1958. Jun 7; 1(7032): 1188-1195.
10. Platt L D, Manning F A, Hill L M. Qualitative amniotic fluid volume determination by ultrasound: antepartum detection of intrauterine growth retardation. Amer Jour of Obstet & Gynaecol. 1981, 139(3): 254-258.
11. 11.Kratochwill A, Holmes J H, de viliger M, Kuzner E, Kraus R, Kossof G, Poujol J, Strandness D E. Handbook of clinical ultrasound, 1978; John Wiley & Sons New York, pp: 223.
12. G D O' Brien & J T Queenan. Growth of the ultrasound foetal femur length during normal pregnancy, part 1. Amer Jour of Obstet & Gynaecol; 141(7), 1981: 833-837.

AUTHORS:
1. Sheela Kumari
2. Bharat Kumar
3. Vijay Kumar Singh
4. Rajesh Kumar Pandey
5. H. N. Jha
6. Kashif Shahnawaz

PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Department of Physiology, DMCH, Laheriasarai, Darbhanga.
2. Tutor, Department of Physiology, DMCH, Laheriasarai, Darbhanga.
3. Assistant Professor, Department of Physiology, DMCH, Laheriasarai, Darbhanga.
4. Tutor, Department of Pharmacology, DMCH, Laheriasarai, Darbhanga.
5. Professor & HOD, Department of Physiology, DMCH, Laheriasarai, Darbhanga.
6. Assistant Professor, Department of Community Medicine, MGM Medical College, Kishanganj, Bihar.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Kashif Shahnawaz,
Manhar Road, Chhoti Quazipura,
Darbhanga, Bihar-846004.
E-mail: kashif.shahnawaz98@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None