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Fetal biometry: National table is necessary

Kanu Bala

In 1960s, diagnostic ultrasound was evolving as a useful tool. Ultrasound specialists were looking for correct measurements of organs, fetal parts, etc. Usually there were nothing in the literature; specialists had to develop their own tables. Of course, in the ensuing years more data were collected and published regarding measurements in all areas of the body in which ultrasound could produce a satisfactory image.

In 1970s, ultrasound specialists presented a new question: 'Which table or graph should I use?' It was not surprising that as data were collected and published, discrepancies were found. The examiners have to be lucky to select an appropriate chart or have to ask colleagues what they were using. Many times we depend on charts inserted in the machines by the companies, but always they are not correct. Alternatively, we can conduct a scientific review of the literature, analyzing the data and choosing the most appropriate chart.

Good ultrasound measurements depend on an understanding both of anatomy of the structures under study and of the nature of their presentation in the ultrasound image. The physical principles on which the ultrasound instrument relies also have inherent limitations. All ultrasound measurements are the result of a chain of processes, beginning with the interaction of an acoustic pulse with tissue and ending with a quantitative interpretation made by an observer. We should consider the following points when we are taking any measurements in ultrasound examinations:

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1. No measurement can be more accurate than the axial or lateral resolution of the image at the point of measurement. This is at least 1 rom and 2 rom respectively. In general, the axial is superior to the lateral resolution. So, if possible, linear measurements should be made in an axial direction.

2. Measurements are best as near to the focal zone of the transducer system as possible.

3. For measurement between two single similar echos [such as BPD], the leading edge to leading edge approach is usually the most accurate as it does not depend on system gain settings.

4. Variations in the speed of sound in an image, due to changes in intervening tissue type, will cause errors in registration and axial distance measurement. A scanning approach which avoids such regions is preferable.

5. It should be born in mind when dealing with spherical structures such as cysts, that the slice thickness of an ultrasound beam is usually greater than the axial or lateral resolution.

6. Measurements should be made from the ultrasound imaging system's screen, rather than from hard copy.

7. The interpretation of a measurement is only as good as the reference data to which it is compared. It is worth taking time to ensure that these are reliable and appropriate for the individual diagnosis and the population under consideration.

8. Ultrasound measurements vary according to the machine and the operator, and between different scans by the same operator.

The single most useful piece of information that obstetrical ultrasound provides is an accurate determination of gestational age. Fetal biometry is a discipline devoted to measure the growth of fetal parameters. Fetal growth is the time dependent changes in body dimensions that occur throughout the whole gestation. Since fetal growth is so rapid, parameters such as bi-parietal diameter [BPD], femur length [FL], abdominal circumference [AC], or head circumference [HC] change significantly with gestational age and must be evaluated against normal tables or graphs.

Anatomic dimensions of fetus vary according to the race, nutrition status, build, and geographic location of the origin of the parents. For this reason it is essential to quote both the variation in an individual measurement and the variation within a population and to distinguish between the two when reporting a measurement. Only then will it be capable of reproduction or useful interpretation.

The obstetrical tables used in our country are produced from the data collected in the population of the developed countries, which may vary from our population. Many individual researchers of our country have collected obstetrical data and published their works in different journals. Most of them have agreed that, the measurements are not exactly similar to that of other countries and they felt the necessity of a large scale study at the national level. The members of the Bangladesh Society of Ultrasonography have discussed the issue in a number of meetings. They agreed that BSU is the appropriate organization to conduct such study in the national level. We have no time to lose but to start the work immediately.

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Estimation of Gestation Age by Fetal Femur Length in Bangladesh

Sabrina Quddus1, Kohinoor Begum2

This study was designed to determine the gestational age by fetal femur length measurement in our country. 976 consecutive, healthy gravid patients with optimal dates were included in a prospective study. The Femur Length of fetus along with other parameters were measured. The gestational age estimated from the femur length measurements from 15 to 41 weeks are presented here in a tabulated form. This is expected to give more accurate gestational age estimation than the western tables prepared on Caucasian population, that are still followed in our country.

Key words: Gestational age, Femur Length, Bangladesh.

Literature is fraught with studies and tables to determine gestational age from various fetal parameters. We still do not have tables for determination of gestational age of fetus of our own population. For this reason our gestational age assessment is not so accurate, especially in the third trimester when the growth trend of our fetus is slower than that of the western fetus. Therefore if we use their charts for age determination of fetus there is significant error in gestational age estimation and the fetus may appear small for date even when they are not. For this purpose this study was conducted so that we could determine the gestational age of our fetus more accurately by using our own data. This is of much importance here as gestational age assessment is the most common reason for fetal ultrasonography in our country since routine scanning is still not the practice here which is most likely due to socio-economic reasons.

The accuracy of femur length (FL) measurement in the prediction of gestational or menstrual age has been shown by various studies. That is why this parameter has been selected in this study to assess the fetal age accurately.

MATERIALS AND METHODS

This was a random cross sectional study in which 976 consecutive, healthy gravid women were studied form July 2002 to October 2003. Patients who met the following criteria, were included in the study:

Regular periods, well-defined last normal menstrual period, early onset of antenatal care, no history of maternal medical, surgical or obstetric complications or malnutrition, no uterine anomaly or fibroid and no congenital anomaly of the fetus.

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The ultrasonic scans were performed by a single Sonologist on one ultrasound machine, Aloka, SSD 900 of Japan. This excluded inter-observer variations. All measurements were made by electronic calipers in mm and the gestational age were expressed in weeks and days along with 2 standard deviations (2 SD) also expressed similarly.

RESULTS

Table No. 1: ESTIMATION OF GESTATIONAL AGE BY FETAL FEMUR LENGTH

FL (mm)	Ges. Age (wk +day)	2 SD (wk +day)	FL (mm)	Ges. Age (wk +day)	2SD (wk +day)
18	15	1	47	25+1	2
19	15+4	1	48	25+4	2
20	16	1	49	26	2
21	16+2	1	50	26+3	2
22	16+4	1	51	27	2
23	16+5	1	52	27+3	2
24	17	1	53	27+6	2
25	17+2	1	54	28+2	2
26	17+4	1	55	28+5	2
27	18	1	56	29+1	2
28	18+2	1	57	29+4	2
29	18+4	1+4	58	30	2
30	18+6	1+4	59	30+3	2
31	19+1	1+4	60	31	2
32	19+4	1+4	61	31+4	2
33	19+6	1+4	62	32	2
34	20+2	1+4	63	32+3	2
35	20+5	1+4	64	33	2
36	21+1	1+4	65	33+4	2
37	21+4	1+4	66	34+2	2
38	21+6	1+4	67	35	2
39	22+1	2	68	35+5	2
40	22+4	2	69	36+3	2
41	23	2	70	37+1	3
42	23+3	2	71	38	3
43	23+5	2	72	39	3
44	24+1	2	73	40	3
45	24+3	2	74	41	3
46	24+5	2			

The technique of measuring the femur length involves an initial determination of the lie of the fetus and locating of the femur. Once the femur has been located, an attempt is made to define both ends of the calcified portion. The image is then frozen and with multidirectional electronic calipers, the calcified portion is measured.

The aim is to measure a femur which is finely out lined and has clear-cut ends1. After 32 menstrual weeks, the distal femoral epiphysis is visible but not included in the measurement2.

DISCUSSION

Estimation of gestational age accurately is one of the most important functions of diagnostic ultrasound. Of all the parameters used to determine gestational age of the fetus, femur length has been proved to be one of the most accurate, by different studies. Determination of gestational age by ultrasound has now become an integral part of maternal antenatal care. Since upto 50 % of mothers who claim to know with certainty are in fact more than two weeks in error when gestational age is calculated with ultrasound. A discrepancy of 2 weeks can be critical for the survival of an infant who has to be delivered early because of some antenatal complication3.

In this study FL was measured from 15 to 41 weeks menstrual age. It was found to increase gradually with menstrual age. After regression analysis of the raw data, table 1 was prepared, to determine the gestational age from FL measurement.

Previous studies on our population had determined that our fetal measurements are smaller therefore we get inaccurate gestational age from the western tables that we use, especially in the later part of third trimester, that is, from 36 weeks onward4-9.

At 40 weeks the mean fetal femur length in Bangladesh was found to be 73 mm whereas it is 77 mm in Caucasian population.10 Which means that the mean fetal FL is 4 mm smaller here at term than the Caucasian fetal FL.

Measurement of the crown- rump length during the first trimester, at the time of least biologic variability, is a very precise method of determining gestational age.11,12. Accurate assessment in the second trimester is possible with the measurement of fetal biparietal diameter.13-15 Another biologic parameter, the fetal femur length, was measured by ultrasound and it was shown that the measurement of femur length was highly reproducible and accurate in the prediction of fetal age1. It was also found that FL can predict gestational age between 25 and 35 weeks with less than 5 days accuracy, and within 6 days at 40 weeks16. Other studies found FL to be roughly equivalent in accuracy to other parameters in estimating menstrual age, reaching a peak variability of approximately ± 3.5 weeks in the late third trimester of pregnancy10,17. The present study conforms to this finding. Here the peak variability of ± 3 weeks was found to be in the third trimester.

Femur length should be measured routinely and recorded after the 14th week of gestation. As with biparietal diameter considerable biological variation is present late in pregnancy18.

CONCLUSION

FL is an important and accurate parameter for gestational age estimation. But its accuracy decreases when we use the tables derived from studies on Caucasian population. The table presented in this study was prepared from data collected on our own population and will therefore give accurate assessment of fetal age, not only in Bangladesh but also in some other South Asian countries.

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Importance of Cephalic Index in Gestational Age Calculation : An Ultrasound Study of 265 Pregnancies

S. K. Dey1, S.Sobhan2 & M. H. Rahman2

Total 265 pregnant mothers were sonographically studied in the Centre for Nuclear Medicine and Ultrasound, Faridpur to evaluate the comparative role of foetal biparietal diameter (BPD) and femoral length (FL) in gestational age calculation and also verify the importance of cephalic index (CI) determination in test of acceptability of BPD. Patients of second or third trimester gestation period with known LMP (last menstrual period) were included in the study and BPD and FL were measured in all. In the patients of second trimester period, both BPD and FL or the only BPD correlate with the reported gestational age in maximum patients (46.25% and 41.25% respectively) while in patients of third trimester period, FL was the only determinant of gestational age in majority of cases(58.38%). Cephalic index (CI) fall out of the normal range (70 to 86) in only 4.15% patients among the total indicating its limited value in gestational age calculation specially if the FL is measured along with BPD simultaneously.

Key words: Gestational age by ultrasound, BPD, FL & cephalic index.

Uncertain gestational age is associated with higher perinatal mortality and an increased incidence of low birth weight and preterm delivery.1 Calculation of gestational age is one of the important aspects of prenatal ultrasound examination. Gestational age in second and third trimester pregnancy are usually calculated by measurement of biparietal diameter (BPD), femoral length (FL), head circumference (HC) and abdominal circumference (AC) although other measurements like orbital diameters,2 clavicle length,3 foot length4 etc. have also been considered. The accuracy of fetal age predictions using the BPD in the third trimester is somewhat limited.5 The variations of BPD increases while there is change of head shape like dolichocephaly or brachycephaly and can be associated with breech fetuses, multiple pregnancies or oligohydramnios.

These patients can be identified by measuring cephalic index (BPD/fronto-occipital diameter/ 100)6 If the index is beyond the range of 70-86 needs either correction of BPD by a recommended formula or replacement of BPD by head circumference (HC).7 The Centre for Nuclear Medicine and Ultrasound (CNM&U), Faridpur routinely uses BPD and FL for gestational age calculation in second and third trimester pregnancy. This study was aimed to see which one (between BPD and FL) is more useful in gestational age

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calculation and verify the role of cephalic index determination in test of acceptability of BPD.

SUBJECTS AND METHODS

The study population consists of 265 pregnant mothers of 19 to 41 years age range, 80 patients of second trimester and 185 patients of third trimester gestation period who attended the Centre for Nuclear Medicine and Ultrasound, Faridpur between the period June 2002 to November 2003. Entry to this study was limited to the patients with accurately known LMP (last menstrual period). Gestational age was calculated from biparietal diameter (BPD) and femoral length (FL). The BPD was obtained on a transaxial view of the fetal head at the level of the thalami, measured from outer table to inner table of the temporoparietal bone. The FL was obtained by measuring its ossified shaft taking the entire shaft perpendicular to the ultrasound beam8.

Gestational age was reported in weeks after correlating the menstrual history with the BPD and/or FL measurement and also considering the placental maturity and amount of liquor. Which one of the BPD and FL was more useful in calculating gestational age was noted.

Cephalic index(CI) was calculated in each patient by the formula:CI = BPD/FOD x 1007. Fronto-occipital diameter (FOD) was obtained from the same image used for BPD. Both the BPD and FOD was measured from outer edge to outer edge of the calvarium as recommended5. If the CI falls beyond the range of 70 to 86, the BPD was corrected using the formula: BPDa (area corrected BPD) = [BPD x FOD / 1.265)] ½.

RESULTS

Among the total, 80 patients was of second trimester gestation period with the gestational age ranging from 14 to 27.5 weeks. Gestational age among them as reported, correlates with both BPD and FL in 37 (46.25%) patients, while it was reported depending only on BPD in 33 (41.25%) patients and FL in 10 (12.5%) patients (Fig-1).

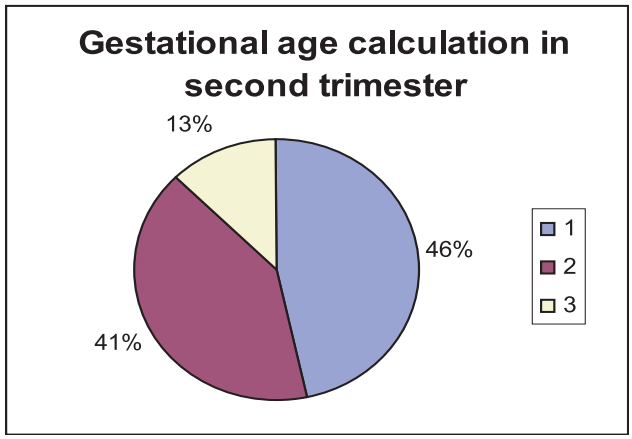

Fig-1: Correlation of BPD and FL with the gestational age in second trimester.

Both BPD & FL correlate in 46%, only BPD in 41% & only FL in 13% patients.
Among the 185 patients of third trimester period, 108 (58.38%) patients gestational age was reported depending only on FL, both BPD and FL correlate in 60 (32.43%) patients while in 17(9.19%) patients only BPD was the determinant of gestational age (Fig-2).

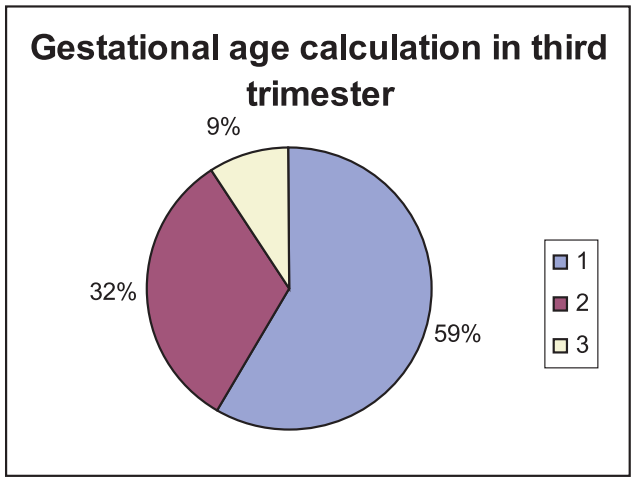

Fig-2 : Correlation of BPD and FL with the gestational age in third trimester.

Only FL correlate in 59%, BPD & FL correlate in 32% and only BPD in 9% patients.

Cephalic index (CI) was determined in all patients. The index falls beyond the normal range (70 to 86) only in 4 (5%) patients of second trimester and 7 (3.78%) patients of third trimester. Of the four patients of second trimester period, three were between 14 to 16 weeks of gestation period and the cephalic index was above the normal limit suggesting brachicephalic

head while in other the index falls below the range. Among the 7 patients of third trimester period, foetal head in 5 patients were apparently dolichocephalic and cephalic index fall below normal range while in 2 patients the index fall beyond the upper limit. There was also other 11 patients in this study where foetal head was apparently dolicocephalic and cephalic index among them was near the lower limit of normal range (70 to 73). In all these cases FL was the determinant of foetal gestational age as reported.

DISCUSSION

An accurate assessment of gestational age in all pregnancies is very important Errors in the assessment can lead to peri or neonatal morbidity or mortality. Ultrasound has been playing an important role in gestational age assessment specially as menstrual history is inadequate in many of the cases. Though the initial studies used BPD in this regard, now a days few other measurements are also being taken. With the view to more accurate measu-rement of gestational age several authors had advocated a composite age method of foetal dating based on multiple growth parameters10,11. The present study correlates BPD and FL in gestational age calculation in the second and third trimester pregnancies and shows that in the second trimester, both BPD and FL or the only BPD was useful in reporting gestational age in maximum cases (46.33% and 41.25% respectively). On the other hand in the third trimester, only FL was the determinant of gestational age in majority of cases (58.38%).

The accuracy of the BPD is based on the fetal head shape. If the fetal head is unusually rounded (brachicephalic) or elongated (dolichocephalic), can cause overestimation or underestimation of gestational age.

The acceptability of the BPD was tested by determining cephalic index in every cases in this study. The index falls out of the normal range in only 4.15% of the total pregnancies (Table-1). In case of apparent dolichocephalic head, the index was either near the lower limit of its normal range or below and in all these cases only FL was useful in reporting gestational age even after correction of BPD by the recommended formula. In 95.85% of cases the BPD was acceptable indicating no need of cephalic index determination in most of the patients unless there is apparently gross abnormality of fetal head shape. In the third trimester, as the FL correlates better than BPD with the gestational age, it should be measured always and thus the possible incorrect measurement of BPD will not be so significant.

Table -1: Patients with abnormal cephalic index out of the normal range.

SL No.	Gestational age	BPD/FOD in mm	Cephalic index (Normal=70 to 86)
1.	14 Weeks	28/32	87
2.	14.5 Weeks	29/33	87.88
3.	16 Weeks	34/38	89.47
4.	25 Weeks	62/90	68.89
5.	35 Weeks	86/125	68.80
6.	36.5 Weeks	88/127	69.25
7.	37 Weeks	89/133	66.91
8.	38 Weeks	89.5/129	66.38
9.	40 Weeks	90/133	67.67
10.	40-41 Weeks	96/106	90.57
11.	41 Weeks	98/110	89.09

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Ultrasound Evaluation of Intraventricular Haemorrhage in Low Birth Weight Baby

MSR Miah1, HA Rahman2, CH Rasul3, AK Paul4

A total of 81 low birth weight baby were evaluated by intracranial ultrasound for intraventricular haemorrhage in Centre for Nuclear Medicine & Ultrasound, Khulna during the period from January 2002 to December 2003. The aim of the study was to see the prevalence of intraventricular haemorrhage in low birth weight baby. 34 out of 81 cases were asphyxiated baby. Intraventricular haemorrhages were found in 19 (23.5%) baby of different birth weight. Among the asphyxiated baby, intraventricular haemorrhages were found in 11 (32.4%) cases and among non-asphyxiated baby, intraventricular haemorrhage were found in 8 (17%) cases. Grade III and IV haemorrhage in total very low birth weight baby was 18.5% and in total extreme low birth weight baby was 31.8%.

It was found from the study that prevalence and severity of intraventricular haemorrhage was inversely proportional to birth weight and intracranial ultrasound is an essential tool for its evaluation.

Key words: Intraventricluar haemorrhage, intracranial ultrasound, low birth weight.

Intracranial haemorrhage in newborn baby may result from birth asphyxia or trauma and rarely from primary haemorrhagic disturbance1,2. Haemorrhage due to trauma may be epidural, subdural or subarachnoid but that due to haemorrhagic disturbance is usually intracerebral. Haemorrhages in the ventricles i.e., intraventricular haemorrhage (IVH) usually occurs from prematurity or low birth weight baby or perinatal asphyxia without trauma3,4 and is the commonest form of pathology to be recognized by real-time ultrasound5.

The incidence of IVH increases with decreasing birth weight:- 60-70% in extreme low birth weight (ELBW) & 10-20% in very low birth weight (VLBW) baby6. IVH is rarely present at birth because 80-90% cases occur within 3rd day of life and 10-20% within 7 days of life. Delayed haemorrhage may occur in 5-10% cases between 7-28 days of life7,8 . IVH in the premature infant occurs in gelatinous subependymal germinal matrix which is highly vascular with poor tissue support. Predisposing factors for IVH include prematurity, hypoxic ischemic encephalopathy (HIE), respiratory distress syndrome and hypervolemia.7 IVH leads to infraction, which later develops periventricular leukomalacia (PVL) due to necrosis of preventricular whitematter6-8.

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Diagnosis of IVH can be done by clinical assessment and ultrasound evaluation. Possible clinical signs are tense anterior fontanelle, pallor and associated drop in haematocrit, limp unresponsive, tonic fits with decerebrate posturing etc. Ultrasound features are discrete echo-dense area adjacent to the head of caudate nucleus when small subependymal haemorrhage and if progresses ventricular dilatation and parenchymal involvement5. CT scan and MRI also can detect IVH. But in most of the cases ultrasound is more sensitive than CT scan and less sensitive than MRI. Sensitivity in detecting IVH by ultrasound and CT scan is 83% and 39% respectively10. So, before closure of fontanelle, ultrasonography is easier, cost-effective and acceptable method to diagnose IVH in infant.

The aim of this study was to find out the prevalence of IVH in the newborn with low birth weight baby.

PATIENTS & METHODS

This study was conducted for a period of 15 months from January 2002 to December 2003 in Centre for Nuclear Medicine & Ultrasound, Khulna. The newborn referred from the neonatal unit of Khulna Medical College Hospital and had low birth weight were included in this study. Birth weight below 2500 gm was recorded as low birth weight (LBW) and below 1500 gm as VLBW and below 1000 gm as ELBW10. Babies dying within three days and having congenital cranial anomaly were excluded from the study.

Physical examination of all patients was done by Paediatrician and basic information including gestational age, birth weight and perinatal factors such as maternal illness, mode of delivery etc were recorded in each case.

Intracranial ultrasound were done in all patients on the third day. Intracranial ultrasound scan were carried out through the anterior fontanelle in standard coronal and parasagittal views. IVH was classified as grades I to IV as proposed by Papille et al5. Grade I-Isolated subependymal haemorrhage, Grade II-rupture into ventricle, but no dilatation, Grade III-rupture into ventricle with dilatation, Grade IV- IVH with parenchymal extension. Ultrasound was performed by Siemmens Sonoline (SL-2) ultrasound machine with 3.5 MHz linear and sector probes.

Data were extrapolated in master sheet and then transferred into tables and figures using descriptive statistics.

RESULTS

A total of 81 cases were retaken for this study. Among them 34 were asphyxiated baby. Intra ventricular haemorrhage was found in 19 (23.5%) baby of different birth weight.

Thirty four babies with perinatal asphyxia were categorized into three groups according to birth weight (Table-I). Nine babies had extremely low birth weight (ELBW) and majority (55.6%) of them suffered from IVH. Table II shows forty seven babies having low birth weight without perinatal asphyxia. There were 8 (17%) cases of IVH among them and most of them were VLBW & ELBW babies.

Grades of haemorrhage in different level of birth weight and perinatal asphyxia (PNA) are shown in Table-III. Highest number (7) of grade III & IV haemorrhage were found in ELBW infants and it was more frequently associated with with PNA.

DISCUSSION

Intracranial haemorahge is diagnosed on the basis of the history, clinical manifestation, transfontanel cranial ultrasonography, computed tomography and knowledge of the birth weight specific risk of the type of haemorrhage2. Infants weighing under l000 gm are at high risk of IVH and should undergo ultrasound scan within first 3 days of life.11,12 The ultrasound scan can also detect cortical haemorrhagic infarction, cystic lesion of PVL, cortical atrophy and the progression of post haemorrhagic hydrocephalus.12,I3 CT scan can be done for those suspected infant in whom USG failed to reveal intracranial haemorrhage or infarction. We did ultrasound evaluation on the 3rd day as nearly all IVH occur within 72 hours of life5. The risk of IVH is highly correlated with the degree of prematurity5. We used birth weight as

Table 1 : IVH in asphyxiated babies (n = 34)

Birth weight	Number of baby	IVH cases	Percentage
LBW	14	02	14.3
VLBW	11	04	36.4
ELBW	09	05	55.6
Total	**34**	**11**	**32.4**

Table 2 : IVH in non-asphyxiated babies (n=47)

Birth weight	Number of baby	IVH cases	Percentage
LBW	18	02	11.1
VLBW	16	03	18.8
ELBW	13	03	23.1
Total	**47**	**08**	**17.0**

Table III: Grades of haemorrhage in newborn with risk factors (n=19)

Grade of IVH	Number of cases	LBW		VLBW		ELBW	
		-PNA	+PNA	-PNA	+PNA	-PNA	+PNA
I	02	1	0	1	0	0	0
II	04	1	1	1	0	1	0
III	07	0	1	1	2	1	2
IV	06	0	0	0	2	1	3
Total	19	02	02	03	04	03	05

an indicator for prematurity as most of the mother gave unreliable history of gestational age. In our study, we got 19 cases of IVH that represents 23.58% of the total low birth weight babies. In Bangladesh Institute of Child & Mother Health, Ahmed et al found 12.9% of IVH in a random sample of 253 newborn.6

Presently, improvements in perinatal and neonatal care have contributed a reduction in the overall incidence of IVH in VLBW infants from 40-50% in 1970 to 20-25% in 1990. However this decline has been compromised by the increased survival of ELBW infant. Murphy et al observed an overall incidence of 22% IVH in VLBW infants.3 In Bangladesh the prevalence of LBW is 45-48% and nearly one third of these are VLBW and ELBW baby which should make the figure of IVH quite high.14 There were some limitations in our study. Some potential cases had not been included in this study. Secondly, ultrasound was done by sonologist and not by a neonatologist. In developed countries like UK, cranial ultrasound has become a tool used by paediatricians who are familiar with ultrasound appearance of normal variation, developmental anomaly and different pathology15.

We have found that less the birth weight more severe was the haemorrhage and that Grade III & IV haemorrhage was mostly found in VLBW (18.5%) and ELBW (31.8%) infants which is consistent with other observation.16 The study report from Australia revealed 32% severe IVH (Grade III & IV) in VLBW children and mean gestational age of those infants were 26 ± l.9 weeks.3 We could not determine the gestational age for unreliable history of the mother.

From the study we have found that prevalence of IVH in low birth weight baby is 23.5%. We have also found that IVH inversely proportional to the birth weight and ultrasound is an essential tool for evaluation of IVH.

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Correlation Between Ultrasonography and Urinary Pregnancy Test in early Pregnancy : A Study of 381 Cases

Nargis Khanam, Sabina Banu, M.A.Awal, Selim M. Ansari

Correlation between ultrasonography and urinary pregnancy test (UPT) in 381 cases in very early pregnancy i.e., between 4-5 weeks of gestation is presented. All the patients had the history of conception and followed up upto 3 months after the last menstrual period. Among them, 364 women were finally found to be pregnant. Ultrasonography and urinary pregnancy test were done in all of them in consecutive days. The main research aim is to compare the USG sensitivity over UPT in the evaluation of suspected pregnancy in the very early stage. In case of ultrasonography, the sensitivity was 99%, specificity was 71 % and accuracy was 98% in contrast to urinary pregnancy test where sensitivity was 86%, specificity was 38% and accuracy was 81%. On USG, all of the false interpretations were during 4th week of gestation, whereas in urinary pregnancy test, false results were highest during 4th week (45%), followed by 5th week (31%) & 6th week (24%). The predictive value for `+' ve result on USG was measured insignificant higher than UPT whereas such value for `-' ve result on USG was found about four times higher than UPT.

In early pregnancy, there are many symptoms like amnorrhoea, nausea, morning sickness, fullness of breasts may present. It is not possible to make a certain diagnosis of pregnancy from any of the above mentioned symptoms, although a combination of them may be highly suggestive. The clinical diagnosis of pregnancy especially in very early stage depends on both symptoms and signs.

As accurate knowledge of gestational age is perhaps the most important piece of information in pregnancy management. Urinary pregnancy test (UPT) is now become very much popular among the patients for its easiness. Human chorionic gonadotrophin (HCG) is a glycoprotein found in the maternal circulation and is excreted in maternal urine after implantation1.

Ultrasonography (USG) is being used for diagnostic purposes in obstetrics since 1950's. In the early years, sonography was first used to determine the size, number and maturity of the embryo and fetus2-5. In the past 20 years, numerous other applications of sonography have been introduced that facilitate the diagnosis of a vast array of embryonic and fetal malformation in early pregnancy6,7. One of the main uses of USG is diagnosis and confirmation of early pregnancy. USG can also very importantly confirm the site and status of the pregnancy within the cavity of the uterus.

The main objective of this study is to assess the detection limit of very early pregnancy and to correlate the USG findings with the UPT as well as to emphasize the utility of USG in detection of viable pregnancy in early stage.

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MATERIALS AND METHOD

381 suspected pregnant women were selected from gynaecology out patient department of SZMC & Md. Ali Hospital, Bogra. Their age ranged from 19-38 years (26.6 + 9.2 years). All the patients were duly registered, detailed clinical history and all information regarding pregnancy evaluation in early stage were recorded. Ultrasonography was done carefully by Aloka SSD 1100 Flexus , Kontron Sigma 21 and HP ImagePoint USG machines with 3.5 MHz recti-linear probe.

USG and UPT were performed on all subjects in consecutive days.

Urinary pregnancy tests were done by using kit from STANBIO lab., Texas, USA following the standard laboratory procedure as directed by the manufacturer.

In every case, the USG findings were compared with the values of urinary test pregnancy. The sensitivity, specificity and accuracy were measured by the following formula :

RESULTS

Three hundred and eighty one suspected pregnant women were included in our study. Among them 367(96.33%) cases were found to have pregnancy in ultrasonographic study, whereas 319 (83.73%) cases were found to have positive pregnancy test in UPT. On USG, the sensitivity, specificity and accuracy were measured 99%, 71 % and 98% respectively, in contrast to UPT where the respective parameters were found to have 86%, 38% and 81%. In case of USG, all of the false interpretations were during 4th week of gestation , whereas in UPT, false results were highest during 4th week (45%), followed by 5th week (31%) & 6th week (24%).

On USG, the predictive value for `+' ve and `-' ve result was calculated 98% and 86% in contrast to UPT where `+' ve value was 86%, `-' ve value was 22%.

The results of USG finding and urinary pregnancy test are shown in the Table I & II.

Table I: Shows findings of USG

USG Findings	Pregnancy on follow up	No pregnancy on follow up	Total cases
Positive	362	5	367
Negative	2	12	14

Table II: Shows findings of UPT

UPT Findings	Pregnancy on follow up	No pregnancy on follow up	Total cases
Positive	297	22	319
Negative	48	14	62

DISCUSSION

It becomes almost a practice that almost all women with suspected pregnancy have either an ultrasound examination or urinary pregnancy test (UPT) in the very early stage of pregnancy.

Both of these examinations are now very much common for evaluation of early pregnancy. UPT, using latex agglutination slide test for the qualitative determination of human Choriogonadotrophin (hCG) hormone in urine is more commonly used for it's availability everywhere in the country, even in remote areas. It is commonly positive, if pregnant, on the day 35 onwards after period. Though it has an admitted failure rate of 1 %, it may be positive in non-gestational ovarian choriocarcinoma or in uncommon gastrointestinal tumors8. Tests for hCG may even give negative results after 16th weeks of gestation9. A positive result may not be found after 8 days following a missed menstrual period7. The main disadvantage of this is that it cannot detect the actual period of gestation.

Using ultrasonography, pregnancy can be diagnosed as early as the fourth weeks of gestation, including the accurate period of gestation. During this time, the accuracy of ultrasound for dating a pregnancy is within 1 week in 95 % of cases. This imaging modality is now common for evaluation of very early pregnancy & progression of pregnancy. Ultrasonography is a reliable diagnostic tool to

establish pregnancy diagnosis and to exclude any pregnancy related abnormalities during the first trimester10, 11.

hCG finding gives us significant idea about pregnancy, but not useful neither for the estimation of accurate gestational age nor for any pregnancy related anomaly like molar pregnancy , missed abortion, choriocarcinoma , ectopic pregnancy etc., which could be easily diagnosed bu USG. In our study the first USG evidence of pregnancy was found as early as 3 days after missed menstrual period in contrast to UPT evidence of 8 days after missed cycle.

However, combined USG and UPT studies allow us systemic evaluation of early pregnancy and to rule out any pregnancy related complications, if any.

CONCLUSION

Uncertain gestational age is associated with higher perinatal mortality and an increased incidence of low birth weight. So, a combination of both UPT and USG is of importance in the evaluation of very early pregnancy. But USG is more preferable and should be the first choice of investigation in this regard as for evaluation of both confirmation of pregnancy, estimation of accurate gestational age and exclusion of any pregnancy related abnormality.

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Utility fo Nephrosonogram Prior to Isotope Renography

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The purpose of the present study was to determine if nephrosonogram is useful prior to radionuclide renogram. Methods: 752 renograms (464 males. 288 females, age range 18 months to 77 years) were done. amongst these prior ultrasound scans were performed in 612 patients. Additional imaging tests e. g. IVU . renal angiogram etc. were done in 88 cases only. Results: Significant increases in the accuracy of renogram were observed with prior ultrasound scan. We performed nephrosonography almost routinely prior to radio nuclide renogram by probe renograph or gamma camera using 1-131 hippuran orthoiodohippurate (OIH) or Tc 99m diethylene triamine pentaacetate (DTPA).The 1st or arterial phase may be missed in probe renograph if the renal hilum is not marked by ultrasound Recently gamma cameras are available in our country and probe renograph is almost obsolete. Therefore nephrosonogram may not be so essential to study individual renal function.

However, in some gamma cameras, one or more photomultiplier tube (PMT) may be out of order and useful field size may be limited. In these situations prior nephrosonogram may be helpful in optimization of quality of gamma camera renogram also. All the Nuclear Medicine Centres in Bangladesh are equipped with ultrasonographs and no extra charge is made for nephrosonogram prior to radionuclide renogram. Conclusions-: We recommend USG prior to renogram. Renal hilum is easily marked by ultrasound scan and during nephrosonography (US G), some other important findings e. g. renal size. shape, position. number. calculus. cyst, neoplasm etc. also can be visualized. Intravenous Urography (IVU) and digital subtraction angiography (DSA) are rarely needed*.

Key Words: Isotope/radionuclide renogram, nephrosonogram, USG.

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Ultrasonography (USG) has a reported sensitivity of up to 98% for detecting renal obstruction1. However, the diagnostic yield of renal USG for excluding hydronephrosis in patients in intensive care units without predisposing factors for obstructive uropathy is very low2. Since 1981, we are performing nephrosonography almost routinely prior to radionuclide renogram (RR) by probe renograph or gamma camera using 1-131 hippuran / orthoiodo-hippruate (OIH) or Tc 99m diethylene

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triamine pentaacetate (DTPA). The 1st or arterial phase may be missed in probe renograph if the renal hilum is not marked by ultrasound. Recently gamma cameras are available in our country and probe renograph is almost obsolete. Therefore nephrosonogram may not be so essential to study individual renal function. However, in some gamma cameras, one or more photomultiplier tube (PMT) may be out of order and useful field size may be limited. Therefore prior nephrosonogram may be helpful in optimization of quality of gamma camera renogram also. All the Nuclear Medicine Centres in Bangladesh are equipped with Ultrasonographs. Individual kidney function is best assessed by radioisotope renogram (RR)3 which is divided into three phases: (a) arterial or vascular (b) secretory or glomerular and (c) excretory or clearance. Renal hilum is easily marked by ultrasound scan and during nephrosonography (USG), some other important findings e. g. renal size, shape, position, number, calculus, cyst, neoplasm etc. also can be visualized4-6. Intravenous Urography (IVU) and digital subtraction angiography (DSA) are rarely needed. Therefore, we like to perform nephrosonography prior to radionuclide renogram and in this study we compare the two situations, namely (a) sonogram + renogram (USa + RR) and (b) only renogram (RR) in various diseases.

MATERIALS AND METHODS

During December 1981 to December 2001, we performed 752 renograms (464 males, 288 females, age range 18 months to 77 years) in Institute of Nuclear Medicine at Dhaka, Nuclear Medicine Centres at Dinajpur and Rangpur, amongst these prior ultrasound scans were done in 612 patients. Additional imaging tests e. g. IVU (Intravenous arogram), renal angiogram etc. were done in 88 cases as per advice of the referring physician/ surgeon which was again influenced by socio-economic factors and available facilities. (Table-1). We have done 198 diuresis renograms. As the diuretic agent, we have USG, frusemide injections in 68 cases and oral water in 130 cases7,8. Results of renogram and usa are shown in Table-2. Water diuresis renography is useful for obstructive uropathy.

RESULTS

The patients who had both nephrosonogram (USG) and radionuclide renogram (RR) rarely needed additional imaging tests, e. g. IVU and angiogram. A young man of 19 years had normal DTPA renogram, but abnormal in hippuran study, later he needed hemodialysis and renal transplant for chronic renal failure.

DISCUSSION

The reasons of not doing ultrasound in all cases are (a) sometimes the ultrasound scanner was out of order (Institute of Nuclear Medicine, Nuclear Medicine Centre, Rangpur) or not available (Nuclear Medicine Centre, Dinajpur). (b) Rarely the workload was so high that we had to avoid sonography.

CONCLUSION

We recommend routine nephrosonogram prior to radionuclide renogram to diminish the need of invasive, risky and expensive investigations e.g. IVU and angiogram. Sometimes other congenital anomalies e.g. infantile uterus etc. may also be diagnosed9-11.

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Table- 1 : Number of patients in different places and periods

Place of study	Period	USG + RR	RR	Addl. Investigations
Inst of Nuc. Med.	Dec. 81- Dec. 88	375	24	49
NMC, Dinajpur.	Jan. 89- July 94	76	55	12
NMC, Rangpur.	Aug. 94- Dec. 01	161	61	27
		612	**140**	**88**

Table-2 : Results of sonogram and renogram

No. of Cases	**Diagnosis**	**Sonogram**	**Renogram**
145	Urolithiasis	Echogenic structure casting acoustic shadow	Delayed excretion only in advanced stages
137	Hydronephrosis	Pelvicaliectasis	Prolonged secretory & excretory phases
139	Medico-renal diseases e.g. diabetes, hypertension	(a) Swollen/small kidney (b) Renal corticomedullary indistinction (c) Normal echoes	(a) Small arterial phase (b) Prolonged secretory phase
61	Polycystic kidney	Echofree areas	Distorted secretory phase
29	Relative renal ischemia	Small kidney	Small arterial phase (ischemic)
15	Ectopic kidney	Abnormal site e.g. pelvis	(a) Normal renogram (b) Ischemic kidney
28	Renal neoplasm	Irregular echoes	All phases depressed
25	Congenital solitary kidney	Single kidney	Single kidney
33	Normal kidneys	Normal echoes	Normal renograms
612			

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Upper urinary tract infection in children: Evaluation with ultrasonography and Tc-99m DMSA scintigraphy

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Thirty-six children with urinary tract infection having positive urine culture were 'evaluated with ultrasound and renal cortical scintigraphy using Tc-99m dimercaptosuccinic acid (DMSA). Scintigraphy revealed upper urinary tract infection in 15 (41.6%) children, the involvement was bilateral in 9 cases and unilateral in 6 cases, Ultrasound findings were abnormal in 9 (25%) children, Of these 9 patients, 6 had parenchymal abnormalities, 2 had pelvicalyceal dilatation and 1 with diffuse renal enlargement. All cases with abnormal ultrasound findings also had abnormal DMSA scans. Renal ultrasound though has a low sensitivity for the detection of uper urinary tract infection but is a very useful modality for evaluating associated uropathies.

Urinary tract infection (UTI) is a common problem in the pediatric population. UTI may be limited to the renal parenchyma, upper collecting system, urinary bladder or urethra. If only renal parenchyma and pelvicalyceal system is involved, it can be classified as upper UTI. The clinical signs and symptoms of upper UTI are often non-specific. Lower UTI usually resolves without significant sequelae. Upper UTI is a major cause of morbidity in children. Incorrectly diagnosed and inappropriately treated upper tract infection may lead to renal scarring. Renal scarring can result in hypertension, proteinuria and chronic renal failure. Studies have shown that renal scarring can be prevented or diminished by early diagnosis and rigorous treatment of upper tract infection1.

Commonly used clinical and laboratory parameters are not reliable for diagnosis of upper UTI in children. Several imaging techniques have been evaluated as a means of differentiation of upper UTI from lower UTI. Intravenous urography (IVU) previously used for evaluating upper UTI in children. But this method is useful in identifying urinary tract anomalies that predispose infection and direct evidence of upper UTI is uncommon. Ultrasono- graphy has largely replaced IVU as the initial examination procedure of upper urinary tract in children with UTI to avoid exposure of ionizing radiation2. Studies have shown that renal cortical scintigraphy using Tc-99m DMSA is a highly sensitive and reliable technique for the detection of upper UTI3. Our centre has the facility to perform both ultrasonography and renal cortical

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scintigraphy that's why we have taken the opportunity to do this study. The aim of our study is to emphasize the value of renal ultrasound and renal cortical scintigraphy for early and proper management of upper UTI in children.

MATERIALS AND METHODS

Patients with clinical symptoms of UTI and positive urine culture who came to Centre for Nuclear Medicine & Ultrasound, Khulna for imaging studies were evaluated. All these patients were referred from Pediatric Unit, Khulna Medical College Hospital. Urine culture was regarded as a positive when there is a growth of single organism with a colony count of more than 10s/ml on a clean catch specimen. Ultrasonography and renal cortical scintigraphy were performed within 72 hours of receiving antibiotic. Sonographic examination was done in a Siemens Sonoline SL. 2 real time ultrasonogram equipped with a 3.5 MHz linear probe. Patients were asked to take water for full bladder before sonographic procedure. Ultrasound examinations are routinely performed with the patients in supine, laterals and prone positions at our centre. Single or multiple areas of increased or decreased cortical echogenicity and/or loss of cortico.medullary differentiation, with or without focal or diffuse renal enlargement were considered as the criteria of the sonographic diagnosis of upper UTI. Renal cortical scintigraphy was done 90 to 120 minutes after intravenous injection of Tc.99m.DMSA in a dose of 50 mCi/kg body weight using Gamma Camera equipped with a low energy parallel hole collimator.

Both posterior, posterior oblique and lateral views were obtained using 256x256 matrix acquiring 500 Kcounts per image. Single or multiple areas of varying degrees of diminished cortical uptake with or without bulging contour or diffusely decreased uptake in an enlarged kidney was considered as the criteria for the scintigraphic diagnosis of upper UTI. Sonographic findings were fmaily correlated with scintigraphic findings.

RESULTS

A total of 36 children were evaluated, of whom 25 were girls and 11 were boys and age ranged from 2 to 11 years. The organism isolated from the urine culture was Escherichia coli in all the cases. Ultrasound findings were abnormal in 9 (25%) children (Table-I).

Table : - 1 : Ultrasound results of childeren with UTI

Findings	No. of patients	Percentage
Normal	27	75
Positive		
Parencymal involvement	6	16.7
Pelvicalyceal dilatation	2	5.6
Diffuse renal enlargement	1	2.7

Of these 9 patients, 6 (16.7%) had parenchymal abnormalities (Figure-I), 2 (5.6%) had pelvicalyceal dilatation and 1 (2.7%) patient aged about 2 years with bilateral diffuse renal enlargement (Figure-II).

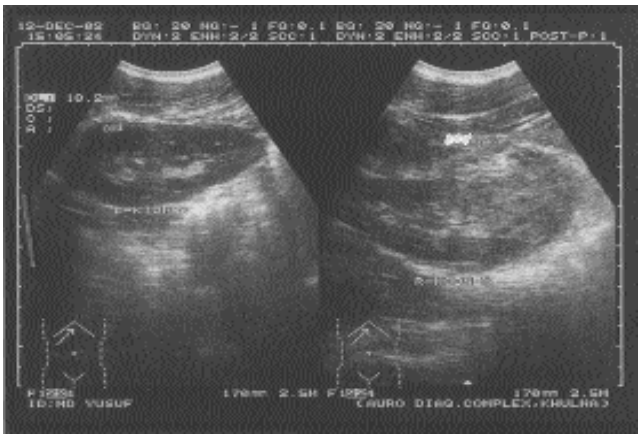

Fig.-1: Longitudinal sonogram of right kidney shows triangular area of increased echogenicity in upper pole.

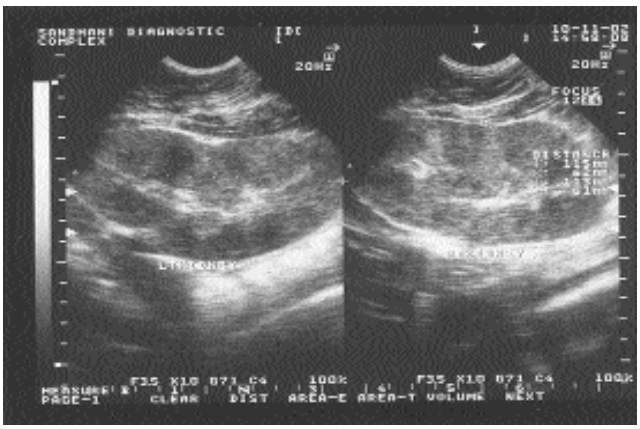

Fig.-2 : Longitudinal sonogram of kidneys shows diffuse renal enlargement.

Left kidney size was 11.5x 6.2 cm and right kidney size was 11.3x 6.1 cm. 27 children were found to be normal. Scintigraphy showed changes consistent with upper UTI in 15 (41.6%) children and the abnormality was bilateral in 9 (25%) cases and unilateral in 6 (16.6%) cases. Both ultrasound examination and renal cortical scintigraphy were done on the same day.
Table-II shows correlation of sonographic and scintigraphic findings. All children having abnormal ultrasound results also had abnormal DMSA scans.

Table : - 2 : Correlation of DMSA scans and ultrasound results

No. of patients	Scans	Ultrasound
15	Positive	Positive 9 Normal 6
21	Normal	Normal

DISCUSSION

The diagnosis of upper UTI in children is often difficult as patients present with different symptoms. Early and proper diagnosis is very important as delay of treatment and inadequate treatment may lead to renal scarring with progressive loss of functioning renal mass resulting chronic renal failure in course of time. So, accurate diagnosis of upper UTI is essential to prevent chronic renal damage. Various laboratory tests like leukocytosis. elevated erythrocyte sedimentation rate and serum C-reactive protein level have been reported for its diagnosis but these are unreliable to differentiate upper UTI & lower UTI4.

Among radiological modalities. IVU has a very low sensitivity for the diagnosis of upper UTI5. CT is probably a sensitive and effective technique for detecting upper UTI but its routine use in the evaluation of children with UTI is not practical due to radiation hazard6. This technique is also cumbersome and costly. Ultrasonography is a truly noninvasive imaging technique and is useful for evaluation and management of UTI in children. Ultrasound can measure renal size with millimeter accuracy without any radiation effect. It can identify structural or anatomical abnormality of the kidney. pelvis and urinary bladder that would help to take decision whether any patient has necessity for more extensive evaluation or not. Ultrasound has a sensitivity of 24 to 42% for the diagnosis of upper U11 in children7,8. We detected 25% abnormal results by ultrasonography in this study. The status of collecting system is best evaluated by : ultrasound and there are 2 patients with pelvicalyceal dilatation in the present study. Diffuse renal enlargement has been reported as a reliable sonographic sign of upper UTI, in children9. We have found one patient with diffuse renal enlargement.

Tc-99m-DMSA renal cortical scintigraphy is an excellent technique for early diagnosis of upper UTI. Approximately. 60% of the administered dose of DMSA is tightly bound to proximal tubular cells and only a small amount is slowly excreted in the urine. DMSA allows visualization of renal parenchyma without interference from retained tracer in the collecting system3. Due to accumulation. of a lesser amount of DMSA in the urinary bladder the gonadal radiation dose is significantly less. In our study group. 41.6% of the children had evidence of upper UTI in DMSA scans. This seems to be lower with that of 52% and 63% positive rate found in another two studies7,10. This may be cause that we have used parallel hole collimator instead of pin hole collimator.

These data show that Tc-99m-DMSA renal cortical scintigraphy has a high sensitivity in diagnosis of upper UTI in children and ultrasound is very useful in detecting obstructive uropathies that may be associated with UTI.

CONCLUSION

Upper UTI in children may be well demonstrated using combined technique of ultrasound and DMSA renal cortical scintigraphy. These are cost-effective, simple, safe and noninvasive modalities and may be taken as a routine procedure for the children with clinical suspicion of upper UTI wherever the facilities are available.

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Ultrasound of Fetal Brain

Kanu Bala

The human fetal brain represents millions of years of evolution such that it now consists of numerous complex structures, many of which are still not fully understood. Prenatal life can be divided into the embryonic period proper, i.e., the first 8 weeks following fertilization; and the fetal period, which extends to birth.1 The brain can initiate and co-ordinate movements, collate sensations, express varying behaviours but more importantly, can allow the person to be conscious of these events. Unfortunately, normal development and growth of the brain does not always occur so a range of abnormalities may develop, some of which may be detected by the use of ultrasound scanning. The vast majority of the congenital anomalies appear during the embryonic period.

EMBRYOLOGY

The fetal brain and other organs all develop from a single cell containing 23 pairs of chromosomes. The brain and spinal cord develop from an in-folding of tissue along what will become the future fetal back. This produces a closed tube made up of neural tissue with a central canal, hence the term neural tube. This begins during the third week of fetal life (fifth menstrual week) and takes another four weeks for the majority of the initial neural development to occur. At the cranial end of this neural tube, three swellings develop (primary vesicles), the prosencephalon (forebrain) most cranially, the mesencephalon (midbrain) and the rhombencephalon (hindbrain). There is further division such that the prosencephalon produces the telencephalon and diencephalon, and the rhombencephalon produces the metencephalon and myelencephalon (secondary vesicles). Within each vesicle the canal expands to form a primitive ventricle, while the tissue develops to form the solid structures. With further growth, there is axial folding so that the brain flexes ventrally. The telencephalon grows laterally to surround the adjacent tissue and so produce the cerebral hemispheres. As their growth continues, folds and clefts are produced which are the gyri and sulci. By the third trimester the cerebral hemispheres occupy a greater proportion of the fetal head compared to earlier gestations due to their degree of growth. Although the cerebral hemispheres undergo relatively rapid growth, the diameter of the lateral ventricles remains constant.2

FIRST AND EARLY SECOND TRIMESTER SCANNING

By 8-10 weeks (menstrually) the anatomy of the fetal head begins to become visible, initially only as a cystic area but then with more obvious structural integrity. The skull begins to ossify from around 10 weeks. By the end of the first trimester and into the second, visualisation mainly occurs while the head is being used for assessment of gestational age by means of the biparietal diameter. The approach is usually transabdominally with a 3.5 or 5 MHz probe. Transvaginal sonography can be used as early as 10 to 14 weeks. To obtain a clear image of the fetal brain, it may be necessary to maneuver the

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probe and/or the fetal head into the most convenient position. Usually, the operator must use both hands to point the probe to the anterior fontanelle and hold the fetal head in the desired position.

THE ROUTINE ANATOMY SCAN

At the 16th week of pregnancy, the intracranial structures become more identifiable transabdominally. The vast majority of intracranial scanning occurs during the fetal anatomy scan, which usually takes place at 18 to 21 weeks gestation. For the detection of abnormalities, standard ultrasound planes are used as it allows comparison with recognised norms both for appearance and for measurement. Three standard views are routinely obtained: the transventricular, the transthalamic and the transcerebellar. [Figure-1].

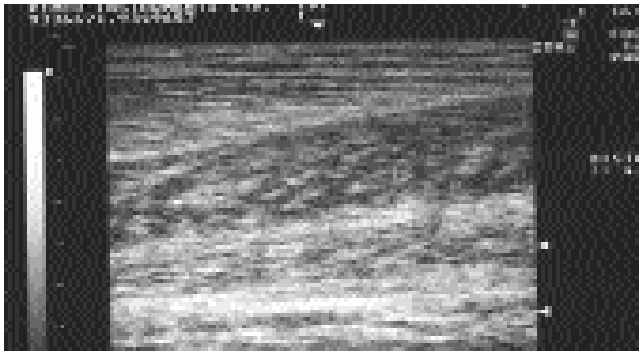

Figure-1: Standard ultrasound planes of scanning of fetal head. 1 -Transventricular plane, 2 - Transthalamic plane, 3 - Trnascerebellar plane.

THE TRANSVENTRICULAR VIEW

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This shows the lateral cerebral ventricles to be filled with echogenic choroid plexus. The lateral and medial walls of the ventricles run nearly parallel to the midline but as the temporal horns develop in the second half of pregnancy, the more posterior aspects are taken laterally. The cortical mantle is usually relatively sonolucent, which can lead to this being misinterpreted as an enlarged ventricle3. Another possible source of error occurs if the measurement is taken while the transducer is set obliquely to the fetal head so that the view is not completely axial as this will inadvertently increase the size4. Also the measurement should be taken perpendicular to the ventricular axis. The errors possible tend to increase the size and so may increase the false positive rate for ventriculomegaly. The generally accepted upper limit of normal at present is taken as 10 mm, which varies between 2.5 and 4.0 standard deviations from their respective means in the studies.

THE TRANSTHALAMLC VIEW

The biparietal diameter and head circumference are measured on this view, which also demonstrates the cavum septum pellucidum with its box-like appearance [Figure-2]. Absence of this may indicate an underlying pathology. Posterior to the cavum lies the thalami, separated from the other by the thin, midline third ventricle. They produce a relatively sonolucent diamond-shaped area in the centre of the head. The frontal and occipital horns are also present on this plane. Dilatation of the ventricular system may be indicated by prominent dilated horns and third ventricle. The biparietal diameter has been an accepted part of gestational dating since the initial use of ultrasound. The accuracy is greater between approximately 14 and 22 weeks. It is measured in the occipitotransverse position and can be potentially difficult if the fetus lies anterior-posterior or if the fetal head is deep in the maternal pelvis. The measurement is taken from outer to Inner skull vault. Similarly, head circumference measurements can be difficult to obtain. Head circumference offers the advantage of providing a better assessment of growth during the second half of pregnancy when the head is unusually shaped, such as dolicocephaly or brachycephaly. Although gestational age assessments become increasingly inaccurate during this time, serial measurements provide a method of examining growth.

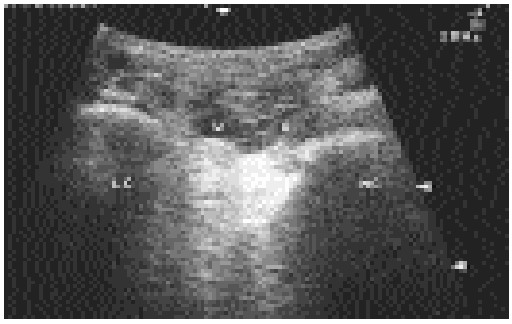

Figure-2: Ultrasound scanning of fetal head at the transthalamic level.

THE CEREBELLUM AND POSTERIOR FOSSA

The transcerebellar view illustrates the cerebellum and the cisterna magna, a fluid space between the cerebellum and inner calvarium filled with CSF [Figure-3]. The cerebellum is derived from the hindbrain and the primitive structures can normally be visualised as a cystic structure towards the end of the first trimester5. This should not be mistaken for an abnormal cystic structure. The cerebellum starts to produce its typical shape during the beginning of the second trimester, with the hemispheres meeting medially with the vermis. The standard view is taken axially with an inclination of 10-15 degrees from the canthomeatal line such that it shows the cavum septum pellucidum, inferior portion of the third ventricle and the cerebral aqueduct. This view also shows the cistema magna, which is the portion of subarachnoid space that fills the posterior fossa. The usual measurement is 2 to 10 mm, with a mean of 5 mm6.

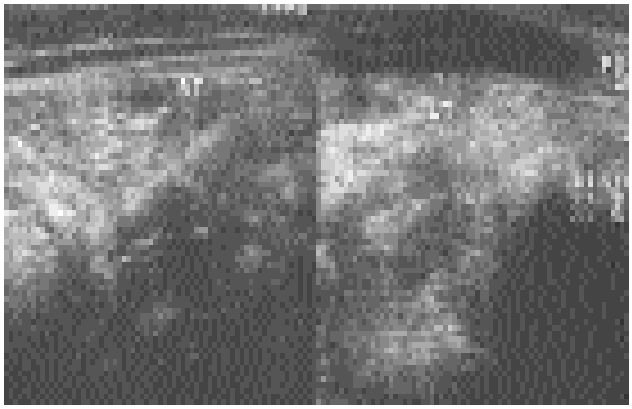

Figure-3 : Ultrasound scanning of fetal head at the transcerebellar level.

OTHER VIEWS

Coronal and sagittal views of the fetal head can be very useful for differentiating conditions, which have been identified on the standard views. The changes associated with agenesis of the corpus callosum are often seen better on these views. Transvaginal scanning has been used to study the fetal head in later gestations and the views obtained were similar to those of scanning the neonatal head7 [Figure-4].

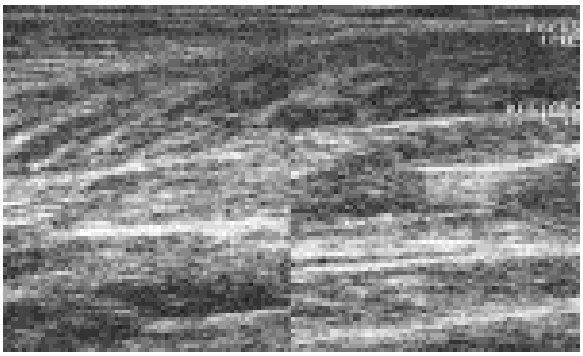

Figure-4 : Ultrasound scanning of fetal head at the sagittal view.

ABNORMAL FETAL BRAIN

The use of ultrasound scanning is partly to attempt to identify abnormal pathology, which may lead to in-utero complications or physical or mental problems during extra-uterine life. It may also signify underlying chromosomal abnormalities or genetic syndromes, which will influence the risk of recurrence in subsequent pregnancies [Figure-5].

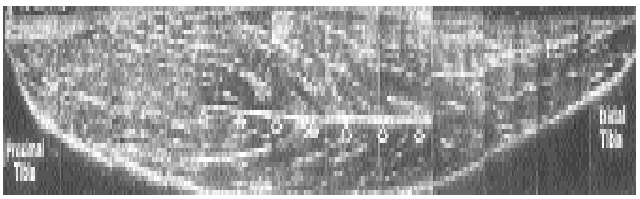

Figure-5 : A case of thanatophoric dwarfism.

The incidence of major congenital malformations is around 1-2%, whereas they account for about 20-30% of perinatal deaths. Of these approximately 15-20% is related to the central nervous system with the majority occurring in those with no known risk factors. There have been published studies on the detection rate of CNS abnormalities with the use of routine ultrasound scanning in the low risk population with sensitivities varying from 40 to 100%8-11. Although up to one fifth of cranial abnormalities may be missed, the vast majority of lethal abnormalities are picked up. The detection rate is influenced by a number of factors such as operator experience, equipment resolution, gestational timing of the scan, maternal build and fetal position.

NEURAL TUBE DEFECTS

This includes all abnormalities where there has been a disruption in the closure of the neural tube during early fetal life. They are classified as open or closed, differentiated by whether there is a skin (or modified skin) barrier between the amniotic fluid and the neural tissue. They are a common congenital abnormality second only to congenital heart disease. The underlying pathology seems to be failure of the neural tube to close although it has also been postulated that a closed neural tube could undergo secondary disruption and re-open12. It usually occurs at either end of the neural tube but can be at any of the segmental levels. Until recently most neural tube defects were screened by using maternal serum alpha-fetoprotein although this only screens for open defects. Now, in many centres it has been replaced by high resolution ultrasonography as the primary screening tool for the low risk population.

ANENCEPHALY

Anencephaly, the single most common open neural tube defect, is characterized by the absence of the cerebral hemispheres and the lack of bony calvarium above the orbits [Figure-6]. The fetus has a normal midbrain and posterior fossa, but lacks normal development of the cerebral hemisphere. It is incompatible with life. This was the first fetal abnormality detected by ultrasound13, being reported in 1964. Approximately one third of cases have a variable amount of angiomatous stroma that may mimic rudimentary brain. Anencephaly may be accompanied by polyhydramnios, which is thought to be secondary to severe brain dysfunction resulting in ineffective fetal swallowing. A similar diagnosis is one of exencephaly (acrania) where the brain tissue is present but disrupted, with the cranium still absent. Recent reports seem to point to exencephaly being a precursor of anencephaly 14,15 such that repeated chemical and mechanical traumas lead to progressive loss of neural tissue. Anencephaly is easily diagnosed during the second trimester and, with the increased use of transvaginal scanning, may be recognized earlier in gestation16,17. A portion of cases may be missed if scanned before 14 weeks, as the only feature at this point may be acrania18.

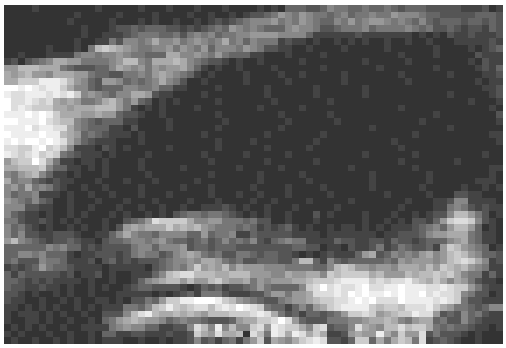

Figure-6: A case of anencephaly with absent cranium and cerebral hemispheres.

ENCEPHALOCELE

Encephalocele is a less severe form and it involves herniation of neural tissue through a cranial defect and was first described in the late seventies19. The sonographic appearance of cephaloceles is variable. It may involve the brain and meninges or just the meninges with cerebro-spinal fluid (CSF). The appearance can be of a solid, cystic or mixed mass depending on the nature of the involved tissue although, in the majority of cases, brain tissue protrudes through the defect [Figure-7]. Cranial distortion may occur with traction towards the cranial defect and there may be ventriculomegaly present. This may be the first clue to the underlying abnormality. Microcephaly may also be present due to brain tissue lying outside the cranium. The usual position of the defect is posteriorly, 75% being occipital, with the remaining 25% divided between frontal and parietal locations18. Abnormal karyotypes have been reported in up to 44% of encephalocele20. The differential diagnosis includes teratoma, cystic hygroma, haemangioma. branchial cleft cyst and cloverleaf skull and diagnosis is often based on visualisation of the skull defect. There are often associated anomalies, up to 65% in one study21. The general prognosis is poor but largely depends on the amount of brain tissue in the herniated sac. Other features, which may help to distinguish an encephalocele are a flattened

occiput and an acute angle (<90 degrees) between the mass and adjacent skin.

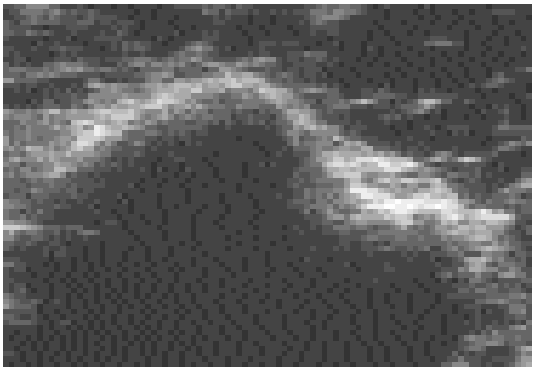

Figure-7 : A case of encephalocele with a bony defect in cranium, protrusion of meninges and a small amount of brain tissue through the defect.

HOLOPROSENCEPHALY

There is absent or incomplete formation of the telencephalon from the prosencephalon in early embryological life. If the forebrain begins to cleave then semilobar holoprosencephaly results rather than alobar, when no development has taken place. Lobar holoprosencephaly is the least severe form where there is normal separation of the thalami and ventricles but there is absence of the cavum septi pellucidi and olfactory tracts. Ultrasound in the more severe types show a mono-ventricular cavity surrounded by an incomplete brain mantle in association with abnormal midline structures [Figure-8]. The thalami are fused with alobar, whereas the fusion is only partial with the semilobar variety. Other midline structures may be absent. Alobar holoprosencephaly may have three separate configurations, namely, "pancake," "cup," or "ball" forms. The "pancake" type, which is the rarest, occurs when the residual brain is minimal and compressed over the skull base. A "ball" variation occurs when the cerebral cortex covers the monoventricular cavity. The "cup" form is intermediate between the two, with the residual brain having a cuplike configuration on the sagittal view. Approximately half the cases may have an underlying chromosomal disorder.

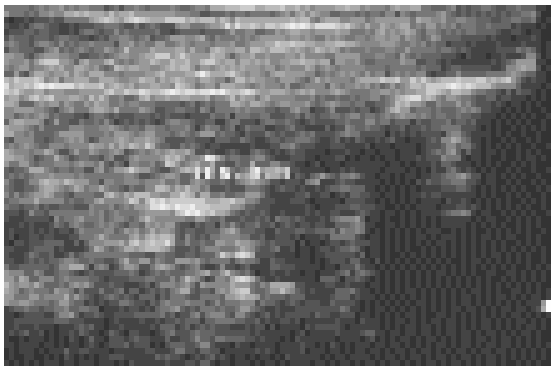

Figure-8 : Alobar holoprosencephaly showing a monoventricular cavity, almost no brain tissue mantle with abnormal mid-line structures.

HYDRANENCEPHALY

The term hydranencephaly is derived from the combination of the words hydrocephalus and anencephaly, although it differs from both these entities. In contrast to hydrocephalus, fetuses with hydranencephaly have a complete lack of cerebral tissue, and in contrast to anencephaly, there is covering by bone, skin, dura, and leptomeninges. Hydranencephaly is thought to result from bilateral in utero internal carotid artery infarction.

AGENESIS OF THE CORPUS CALLOSUM

The corpus callosum consists of a bundle of nerve tracts connecting the cerebral hemispheres to each other. Agenesis usually occurs during embryonic development but may occur secondary to a destructive process. In agenesis, the fibres do not cross the midline but instead form thick bundles separating the frontal horns from each other. There is dilatation and superior displacement of the third and fourth ventricles giving the appearance of an interhemispheric cyst, while the lateral ventricles are displaced laterally and superiorly. Diagnosis is made easier if the interhemispheric cyst is visible which can be helped by coronal and sagittal views. The cyst needs to be distinguished from other causes of a cystic mass. All types of holoprosencephaly have agenesis of the corpus callosum as a feature.

MICROCEPHALY

This is associated with many causes and usually results in severe mental retardation. Diagnosis does not usually become apparent until towards the end of the second trimester when there is a reduction in brain growth, which leads to the head size growth velocity tailing off. It is suggested when the head measurement is more than 3 standard deviations below the mean. Diagnosis at the time of routine anatomy scan is unlikely21 and this can be upsetting for parents who are at an increased risk, usually because they already have one child suffering with it.

VENTRICULOMEGALY

This describes the condition of increased ventricular dilatation [Figure-9]. Some use the term hydrocephalus as a general term whereas others use it specifically for conditions where the CSF pressure is known to be elevated. Overall, the amount of CSF present can be increased by i) obstruction to outflow at the ventricular level (non-communicating obstructive); ii) obstruction to outflow by obliteration of the subarachnoid space e.g. previous haemorrhage, infection or congenitally small occiput (communicating obstructive); iii) increased production e.g. choroid plexus tumour; or iv) reduced brain tissue from destruction, atrophy or reduced development.

The accepted upper limit of normal for lateral ventricular size is 10 mm. The incidence of ventriculomegaly is approximately 1 in 1000 and is the most common cranial abnormality detected on ultrasonography. It is generally associated with a poor outcome, especially if there are added anomalies, which occur in up to 80% of cases. Also, it can be difficult to be certain that the ventriculomegaly is isolated, such that one may need to consider a detailed fetal cardiac scan. Massive ventriculomegaly can be mistaken for hydranencephaly where there is absence of the cerebral hemispheres but with hydranencephaly there is no thin rim of cortex and, more importantly, there is no increased risk of aneuploidy or recurrence.

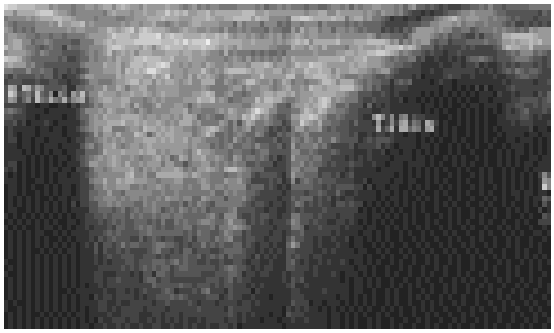

Figure-9: Gross ventriculomegaly showing grossly dilated lateral ventricles.

AQUADUCTAL STENOSIS

Aqueductal stenosis is one of the more common causes of in utero hydrocephalus. The origin of stenosis of the aqueduct is often unknown, although specific causes of aqueductal stenosis do exist. For instance, in utero infection such as viral infections with cytomegalovirus may cause adhesive arachnoiditis and may obstruct the flow of CSF at different sites including the aqueduct of Sylvius. Moderate-to-massive dilatation of the lateral ventricles is easily identified. The fetus may have mild dilatation of the third ventricle with a normal fourth ventricle. Usually, the diagnosis of aqueductal stenosis is made by exclusion, by noting no other specific cause of the hydrocephalus. The ventriculomegaly in aqueductal stenosis often progresses throughout pregnancy, and other CNS anomalies or chromosomal abnormalities occur infrequently.

CHOROID PLEXUS CYST

These were first highlighted in 1984 and are thought to represent neuro-epithelial folds in the lateral ventricles filled with CSF and cellular debris22. They are found in approximately 1% of fetuses although the incidence in routine post-modems across all age groups is much higher. The cysts are best visualised at the ventricular level and tend to lie in the posterior aspects of the plexus [Fogure-10]. There has been a lot of interest in the last few years after their association with chromosomal abnormalities was noted. The cysts themselves are not pathological and have usually resolved by the end of the

second trimester. Instead, they seem to act as a marker for the underlying abnormality.

It is obvious that the importance lies on performing a detailed scan to exclude additional anomalies once choroid plexus cysts have been identified23.

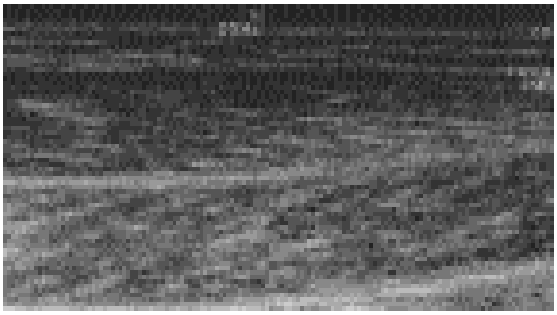

Figure-10: A case of choroids plexus cyst showing a small cyst in choroids plexus.

DANDY-WALKER MALFORMATION

One of the more common midline cystic abnormalities is the Dandy-Walker malformation, which is characterized by a midline cyst located within the posterior fossa [Figure-11] that communicates with the fourth ventricle. This cyst is situated posterior to the ventricle and is associated with near or complete absence of the cerebellar vermis and with an enlarged posterior fossa. Associated hydrocephalus is seen in 80%, concurrent CNS malformations occur in more than 50%, and systemic or chromosomal abnormalities are common.

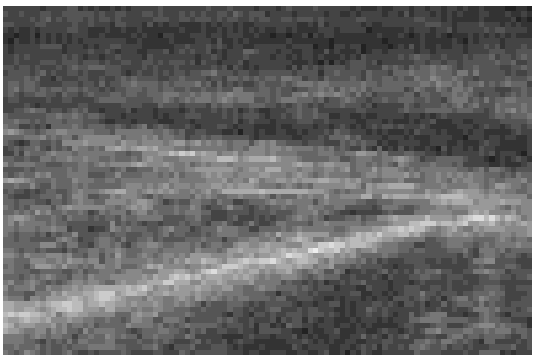

Figure-11: Dandy Walker Cyst at the posterior fossa with thin cerebellum.

ARACHNOID CYST

Arachnoid cysts are membrane-lined fluid-filled cavities that may occur anywhere within the brain [Figure-12]. Intrabrain cystic collections are with a random shape and size. Cysts located in the mid-brain [50-65%], suprasellar, and quadrigeminal regions may expand and cause secondary ventriculomegaly. A cyst has been reported to rupture and disappear spontaneously in utero. Arachnoid cysts can be confused with bilateral processes such as holoprosencephaly.

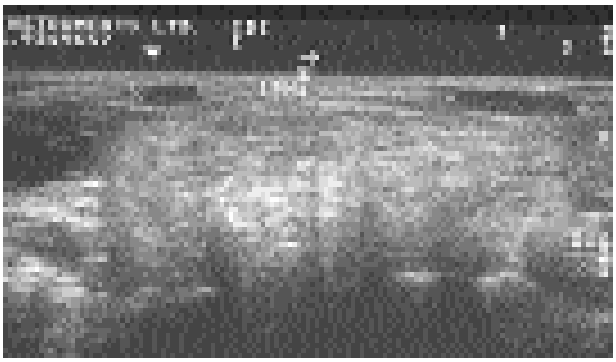

Figure-12 : A case of arachnoid

SECONDARY CHANGES OF INFECTIONS

Disseminated fetal infections can occur with cytomegalovirus, rubella, herpes, varicella and toxoplasmosis (TORCH). The majority of fetuses do not become affected from maternal infections and in those that do, the commonest abnormality is microcephaly. The route of infection seems to be transplacental. They have also been shown to be associated with fetal intracranial calcifications, particularly CMV and toxoplasmosis24. The calcifications tend to show in the ventricular walls, often without acoustic shadowing, and can therefore be very subtle25. They may go unnoticed especially if there had been a subclinical maternal infection. The finding of intracranial calcifications should lead the clinician to maternal serology testing.

CONCLUSION

Visualisation of the internal cranial anatomy may appear relatively easy but interpretation of this information is the area which needs much thought if it to be useful for both the clinician and parents.

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Evaluation of Liver Transplantation : Important Role of Ultrasound & Colour Doppler

H. Rahman1, S. K. Dey2

Diagnostic ultrasound is recognized worldwide as the premier cross-sectional imaging modality. Although other imaging modalities have advantages over sonography in certain anatomical regions, no cross-sectional imaging modality is more readily available or more widely used throughout the world than sonography. Therefore, there is a growing need in every country to learn ultrasound.

That ultrasound has biological effects was first noticed three-quarters of a century ago by scientists experimenting with techniques for the underwater detection of obstacles at sea1. Ultrasound was widely used in physical therapy, and this application has a long-established niche in clinical practice2. During the second World War, the ultrasonic pulse-echo method was developed for the detection of cracks in metal. With the cessation of hostilities, interest grew in the possibility that the technique could be used for medical diagnosis.3,4 By the 1960s, two-dimensional imaging had becoming practicable, albeit with slow, manually operated scanners.5 With the inventions of real-time scanning and gray-scale display,6,7 ultrasonic imaging began widely to be accepted; steady improvements, resulting from developments in transducer materials, signal processing, and display. Most recently, colour flow imaging, three-dimensional display, and the use of contrast agents, along with the development of specialized scanning.

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systems for intracavitary, intraluminal, and intraoperative examinations, have further strengthened the importance of diagnostic ultrasound in clinical medicine.

Over 20,000 liver transplants have been performed in the world since 1988. The current one-year graft survival rate in the United States is approximately 79% with one year patient survival rate of approximately 87%. Improved surgical techniques, development of effective immuno-suppressive medications, human leucocyte antigen typing for recipient matching, and establishment of co-ordinated transplant sharing systems have greatly improved the success rate in liver transplantation8. Graft survival statistics are further enhanced by prompt identification of liver transplant dysfunction and rapid intervention when appropriate.

Important role of ultrasound and Colour Doppler in liver transplant evaluation specially in assessment of common complications is reviewed.

PRE-OPERATIVE ASSESSMENT

Pre-operative assessment consists of vascular patency, mapping native vascular anatomy, quantification of diseased liver volume, identification of vascular collaterals secondary to portal hypertension and a search for intra- or extra-hepatic malignancy. There are many ways to accomplish this including angiography and ultrasound, but currently CT with CT angiography in the arterial phase and portal phase is the favoured method.

POST-OPERATIVE ASSESSMENT

Evaluation of the newly transplanted liver requires a precise understanding of the surgical anatomy. Many variations are possible including segmental or reduced-size transplantation, especially in the paediatric population. Variations of the arterial anastomoses are necessary when the donor hepatic arterial anatomy is anomalous. Variations of venous anastomoses are necessary when the recipient portal vein is thrombosed. The sonologist must be aware of any variations so that a thrombosed accessory hepatic artery or a stenotic jump graft is not missed9,10.

The liver transplant ultrasound examination should include a general survey of the abdomen and pelvis in order to identify and qualify any haematomas or fluid collections. The liver parenchyma is then examined to rule out any focal abnormality, specifically any fluid collection, area of infraction, or possible neoplasm. The biliary system should be evaluated to rule out obstruction or sludge accumulation, especially in a patient with hepatic artery thrombosis. The intra and extra-hepatic arteries are checked to confirm patency and the waveforms are analyzed to rule out stenosis. Patency of the portal vein is confirmed and the Doppler waveform analyzed, particularly across the anastomosis. Patency of the three hepatic veins is confirmed and their waveforms are evaluated. Finally, the inferior vena cava is checked with special attention to the upper anastomosis.

EARLY COMPLICATIONS

The major complications of liver transplantation are rejection, vascular stenosis or thrombosis, biliary leak of obstruction, and malignant disease. Acute rejection is best monitored by serum liver enzymes, bilirubin, and ammonia levels and diagnosis is established by biopsy. Ultrasound and Doppler have little to offer in the diagnosis of acute rejection. Doppler ultrasound, however, plays a key role in monitoring for potential vascular complications.

a) Hepatic artery thrombosis :

The hepatic artery anastomosis is technically the most difficult to create and problems such as stenosis, thrombosis, and fistula formation have the most significant impact on liver transplant success as they predispose to infraction, intra-heoatic abscess, biliary structure, and biloma. Doppler findings indicating hepatic artery stenosis include an intra-hepatic tardus-parvus waveform with low resistance flow and a high-velocity jet with turbulence at the point of stenosis. A focal high-velocity jet just beyond the hepatic artery anastomosis in excess of 200 cm/sec or greater than 3 times the velocity in the pre-stenotic hepatic artery is highly indicative of a clinically significant stenosis. The identification of an intra-hepatic tardus-parvus waveform with low resistance (<50% RI) flow, and a prolonged upstroke in systole (>.08 sec) with rounding of the systolic peak should force a careful survey in the anticipated region of the anastomosis for the high-velocity jet. Although an intra-hepatic arterial tracing may be demonstrated it should be remembered that a severe stenosis may still lead to biliary ischaemia, or may progress to complete thrombosis.

Absence of an arterial signal along the main portal vein and its branches on spectral and colour Doppler ultrasound indicates hepatic artery thrombosis. Since this is a diagnosis based on an absence of flow, great care must be taken to ensure proper Doppler settings. Scanning by a second experienced sonologist is encouraged, since this ultrasound diagnosis routinely leads to arteriography. Use of ultrasound echo-enhancing agents is recommended to improve perception of a week arterial signal and decrease the rate of false positive diagnosis of therapy artery thrombosis.

In case of hepatic artery thrombosis which are treated conversely, collaterals will develop and an intrahepatic arterial signal can be detected by Doppler ultrasound as early as two weeks after the thrombosis. This typically manifests as a thready tracing with a tardus parvus appearance and can be seen in as many as 40% of patients with documented hepatic artery thrombosis, especially children.

In the early postoperative period, the hepatic

artery tracing can be quite variable but often shows a relatively high resistance flow. This is a relatively common manifestation of the anoxia and traumatic insult sustained by the liver during harvesting, handling, preservation, and surgery. The high resistance flow typically resolves within a few days of transplantation. A delayed finding of high resistance is a poor prognostic indicator and some of these patients go on to develop thrombosis. The exact cause of thrombosis is not always apparent and in numerous cases is presumed to be secondary to immunological causes and rejection11-15.

b) Acute rejection :

Several authors have studied the possibility of predicting acute liver transplantation rejection by identifying changes in the hepatic vein waveform. During rejection, hepatocellular oedema and inflammatory infiltration increase the pressure within the confining capsule of the liver. This reduces the compliance of the liver and results in a dampened hepatic vein waveform. The theory is appropriate but other causes of hepatocellular oedema, such as cholangitis, hepatitis, and upper IVC anastomotic stenosis produce similar damping, thereby limiting the specificity of this finding. The diagnosis of rejection is best made by needle biopsy. Ultrasound and Doppler guidance can be used to guide the biopsy needle into the liver but away from the large central vessels16.

LATE COMPLICATIONS

a) Arteriovenous fistula :

Arterio-venous fistulas are a late complication of transplantation and are most often the result of a biopsy. Imaging rarely reveals an abnormality but Colour Doppler often shows a localized flash artefact. When Doppler settings are adjusted for high velocities, the feeding artery and draining vein are better visualized. Spectral Doppler reveals a low resistance arterial waveform with high diastolic velocity17,18.

b) Stenosis of portal vein :

The donor *portal vein* is usually anastomosed end-to-end with the recipient portal vein. Variations may be required if the recipient portal vein is thrombosed, hypoplastic or insufficient length. Because the vessel is relatively large, colour Doppler findings can be rather striking. Not all flow disturbances perceived by colour Doppler are haemody-namically significant and compromise of portal vein flow is relatively rare. When it occurs, it may be due to a mismatch between the sizes of the recipient and donor portal veins, or to an excessive length of vessel causing a kink, or to a stenosis. If portal vein stenosis is suspected, the velocity gradient across the anastomosis should be measured by spectral Doppler; a velocity gradient of less than four-fold is unlikely to be significant. Post transplantation portal vein thrombosis is quite rare and most often attributable to technical factors. If slow velocity is identified in the portal vein (<1 m/sec) it may be due to increased intra-hepatic resistance from rejection, or to reduced inflow as can be seen with the collateral steel phenomenon which can occur when large varices remain unligated, shunting blood from the portal system to the systemic circulation, bypassing the liver19-21.

c) Stenosis of inferior vena cava :

The donor inferior vena cava (IVC) has a long intra-hepatic course and is therefore transplanted along with the liver. The IVC may be inserted in-line with both supra- and infra- hepatic anastomoses; the native intra-hepatic IVC is excised with the diseased liver. The surgical technique which is currently favoured retains the native IVC of the recipient in place and the upper end of the donor IVC is anastomosed end-to-side to the native IVC. The lower end of the donor IVC is oversewn, which functionally converts it into an hepatic vein. This type of anastomosis is commonly referred to as a "piggy back". Any compromise of the upper caval anastomosis, from either stenosis or kinking may cause hepatic venous outflow obstruction. Ultrasound findings include marked damping, or complete flattering of the hepatic vein velocity profile with complete loss of periodicity, distension of the hepatic veins and a high velocity jet with turbulance just above the caval anastomosis. Loss of periodicity may also be due to compression of the hepatic veins by the surrounding liver tissue by oedema in the early

post-operative period, typically due to preservation injury, or by oedema in the later post-operative period related to injection. Due to the relatively large size of the IVC and the potential for a size mismatch between the donor and recipient cavae, a greater than four-fold velocity gradient at the anastomosis is required to confidently diagnose a haemodynamically significant stenosis.

In those patients with an in-line IVC, compromise of the lower anastomosis may present as lower extremity oedema and renal failure. Ultrasound and colour Doppler imaging of the anastomosis may reveal a kink or focal stenosis with a relatively high velocity jet. As with a piggy-back procedure a size mismatch between the donor and recipient vessels may produce a relatively high velocity jet and a less than three-fold velocity increase at the anastomosis is seldom clinically significant. A three- to four-fold gradient is likely to be significant and should be correlated with the clinical findings. A greater than four-fold gradient must be considered haemodynamically significant.22,23

CONCLUSION

Ultrasound imaging and Colour Doppler is the best modality to be familiar with the surgical alternatives in liver transplantation and understand the common complications of liver transplantation and how to best study them by ultrasound. Finally it has allowed transplant patients greater opportunity to return to a more normal life-style after surgery.

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History of Ultrasound in Obstetrics and Gynecology

Rukhsana Shaheen

In history, the arrival of the real-time scanners have added impetus to ultrasound techniques and had established ultrasonography as the most important imaging modality in obstetrics and gynecology. Since it's early conception, the advent of ultrasonography has created the new specialty called prenatal diagnosis, developed very quickly to become the single most important diagnostic investigation in the field of obstetrics and gynecology, including the healthcare for women.

A technology push situation further evolved when enhancement in diagnostic capabilities of scanners was propelled by the almost explosive advancements in electronic and microprocessor technology, occurring most significantly in the 1980s and 90s. 3-D ultrasound made the scene in the late 1980's and further revolution happened in sonography in obstetrics and gynecology.

The A-scan, which had evolved from the early metal-flaw detectors, would not have a lasting impact in clinical medicine without evolving in to the B-scan, which had its origin in the military radar. The bistable B-scan also would not have become an advanced and a respectable diagnostic tool without the development of the scan-converter and gray scaling. The gray scale compound static scanner, with the incorporation of progressive electronic and computer technology available in the late 1970s had establish itself as a genuine stand-alone clinical diagnostic tool..

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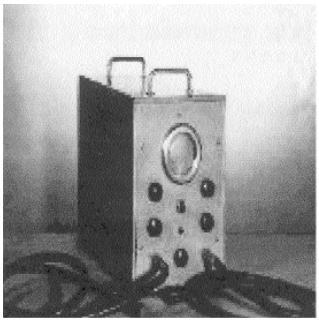
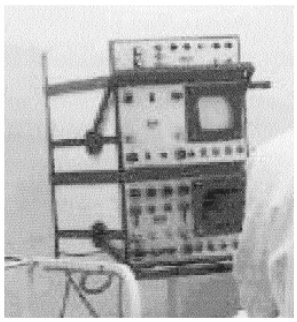
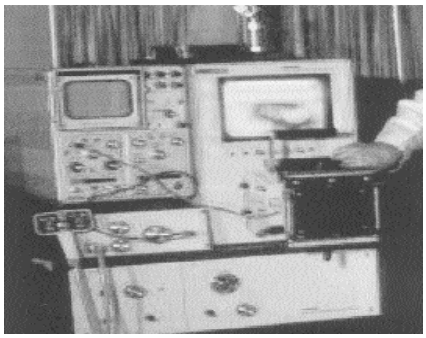


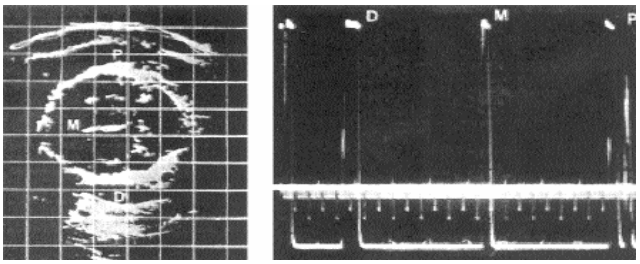
Flaw delection A-mode Scanner, early 50s'



The early B-scan with the bistable oscilloscope**



Scan converter incoporated in early American model, Image is being displayed on the TV monitor on the right. Note: The Black-on-white display format.

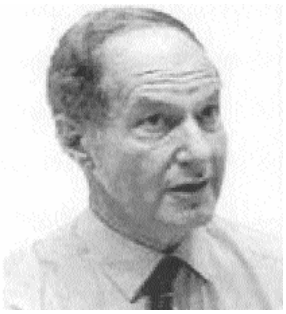


The early bistable oscilloscopic B-scan image at the level of the BPD and the A- scan tracing showing cephalic (P and D) and midline echoes (M). The distance between the 2 cephalic echoes is the BPD. Without scan converters on-screen (oscilloscope) measurements on the B-mode image are not possible. Very accurate measurements can however be made using the A-scan calipers.

The A-mode scan had been used for early pregnancy assessment (detection of fetal heart beats), cephalometry and placental localization in Europe, Britain, United States, Japan, China, USSR, Poland and Australia in the early 1960s, many early papers in cephalometry followed in the late 1960s.

The measurement of the biparietal diameter (BPD) having been invented by Ian Donald in 1961 and further expanded in his department by James Willocks.

Professor Ian Donald
1910 - 1987



Stuart Campbell

Stuart Campbell's landmark publication in 1968 'An improved method of fetal cephalometry by ultrasound,' described the use of both the A- and B-mode scan to measure the fetal biparietal diameter. In 1971, with improvements in the caliper system, Campbell and Newman published normograms for the biparietal diameter from the 13th weeks of gestation and had made cephalometry a standard tool for the assessment of fetal growth and maturity.

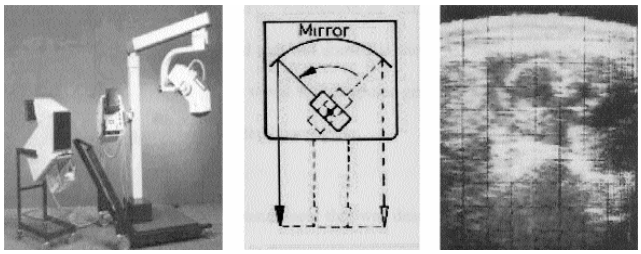
Two years later in 1973, measurement of the fetal crown-rump length was described by Hugh Robinson in Glasgow, who was then a research registrar, life size magnification of the images had become possible with the newer machines which enabled accurate measurements to be made on early embryos.

Fetal biometry developed and 'flourished' inI980's, as accurate fetal measurements, do not require the prerequisite of very high-resolution equipment. At least two dozen measurements were invented to assess gestational age and fetal size, each claiming their unique usefulness. Nevertheless by the middle 1980s only a few parameters were considered as standard measurements and ones that had 'stood the test of time'. These include the crown-rump length (CRL), the biparietal diameter (BPD), the head circumference (HC), the femur length (FL) and the abdominal circumference (AC).

In 1972, the Scottish group, basing on the ultrasonic findings, expounded the concept of 'blighted ovum' in Obstetrics, first described by Ian Donald in 1967, which had changed considerably the concept and management of pregnancies with vaginal bleeding in the fIrst trimester. Visualize the gestational sac by B-mode ultrasound was first described by Donald and MacVicar team in 1963. In 1965, The gestational sac diameters in the assessment of fetal maturity was described by Lou M Hellman and M Kobayashi in 1969 and by Pentti Joupilla (Finland), Salvator Levi (Brussels) and E Reinold (Vienna) in 1971. Kobayashi also described the ultrasonic appearance of extra-uterine pregnancy using bi-stable B-mode ultrasound in 1969. Kenneth Gottesfeld in Denver reported in 1970 a large series of patients where fetal death in utero was diagnosed solely on bistable ultrasound scan.

The innovation had soon completely changed the practice of ultrasound scanning with the advent of the real-time scanners. The first real-time scanner, better known as fast B- scanners at that time, was developed by Walter Krause and Richard Soldner (with J Paetzold and and Otto Kresse) and manufactured as the Vidoson@ by Siemens Medical Systems of Germany in 1965.

D Hofmann, H Hollander and P Weiser published its first use in obstetrics and gynecology in 1966 in the German language. Hofmann and Hollander's paper in 1968 on 'Intrauterine diagnosis of hydrops fetus universalis using ultrasound' also in German is probably the first paper in the medical literature describing formally the diagnosis of a fetal malformation using ultrasound.

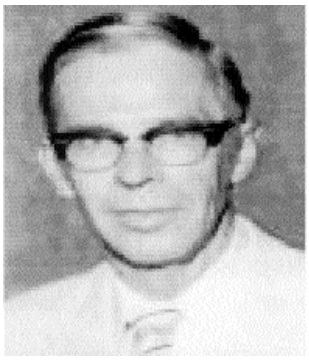


The Vidoson*, its working mechanism and the resultant image of a fetal face and hand. The transducer housing is mounted on a mobile gantry and rigidly connected to the main console. The scanning frequency was 2.25 MHz. Scaling and caliper functions were not present.

Estimation of intrauterine fetal weight basing on combination of the biparietal diameter and thoracic circumference first reported in 1965, by the Thompson group in Denver, Colorado. He reported an accuracy of within 300 grams in 66% of the weight estimates. This was followed by work from Garrett in Australia, Hansmann in Germany and Campbell in England. In 1977, Hobin's group at Yale published one of the most important papers in fetal biometry, 'Estimation of fetal weight by computer-assisted analysis of fetal dimensions.' And that had started in the next 10 to 15 years an almost non-stopping search all over the world for computer-generated models of fetal weight determination basing on multiple fetal parameters.

The abdominal circumference measurement that was described by Campbell and Wilkin in 1975, remained the mainstay measurement in the evaluation of fetal growth and nutrition. The assessment of gestational age and intrauterine growth retardation using ultrasonic parameters was the subject of a huge number of research papers.

Detection of fetal heartbeat by the A-scan and audio doppler ultrasound (the first 'Doptone,' was invented in 1965) had been variously reported by early groups; such as Wang (1964, M-mode ftom 10 weeks), Kratochwil (1967, vaginal A-scan from 7 weeks), Bang and Holm (1968, A- and M-mode from 10 weeks). But it was not until 1972, that Hugh Robinson in Glasgow, basing on improved instrumentation reported a practically useful 100% detection of fetal cardiac action from 7 weeks onwards. The fetus was first located with B- scan ultrasound and the heartbeat observed with a directed beam in A- and M-mode. This breakthrough has profound implication in the management of early pregnancy bleeding and threatened miscarriages.



Horace Thomoson

Richard Soldner

The detection of fetal pulsation using doppler ultrasound was first reported in 1964 by D A Callagan who was working with ultrasonic devices at the United States Naval Medical Research Institute at Bethesda, Maryland. In the following year (1965), Gynecologist Wayne Johnson working with the Rushmer team at the University of Washington reported 100% accuracy in the detection of fetal life in 25 patients at 12 weeks (from LMP).

Visualization of the the fetal yolk sac with the real-time scan was first described by Eric Sauerbrei and Peter Cooperberg in Vancouver, Canada in 1980. It is interesting to note that perhaps because of its size (and hence the difficulty to visualize with existing equipment at that time) its significance and usefulness in early pregnancy failures was not discussed until much later in the second half of the 1980s.

B-mode placentography was successfully reported in 1966 by the Denver group in the United States and the Donald group in 1967 (Usama Abdulla). Ultrasonic diagnosis of molar pregnancies described as early as 1963 by the same group.

The diagnosis of fetal malformations obviously received the enormous attention that was deserved and findings of many abnormalities diagnosable by ultrasound have been described. Ian Donald included a case of hydrocephaly in one of his early introduction ultrasound papers in 1961, which demonstrated 'tissue interface

within the body by ultrasonic echo sounding'. In Bertil Sunden's thesis in 1964 there was description of the diagnosis of anencephaly in the third trimester using on the bi-stable Diasonograph. In 1968, D Hofmann and Hans Hollander in Germany reported on 9 cases of 'hydrops fetus universalis' and William Garrett in Sydney reported the diagnosis by ultrasound of a fetus with polycystic kidneys in 1970. These two papers were probably the two earliest papers describing formally the diagnosis of a congenital anomaly using ultrasound. Both reports were about cases in the third trimester and resulted in fetal death.

The diagnosis and management of a 17 weeks anencephaly was reported as early as 1972 by Stuart Campbell using static B-mode equipment. This was followed by the diagnosis of spina bifida in 1975, both reports appeared as landmark papers in the Lancet. Manfred Hansmann in Bonn, Germany and John Hobbins at Yale were among others, early pioneers in the ultrasonographic diagnosis of fetal malformations.

With the advent of better real-time scanners, many more malformations were diagnosed in the late second trimester when fetal organs become more discernible on the scans. A review published in 1981 (Stephenson and weaver) reported that around 90 different fetal malformations had been diagnosed by ultrasound.

Common anomalies that were considered straight forward to diagnose at that time included anencephaly, hydrocephaly, exomphalos, duodenal atresia, polycystic kidneys, hydrops fetalis and limb dysplasias. More difficult areas for diagnosis of malformations were the fetal face, the fetal extremities and the fetal heart. The diagnostic accuracy progressively improved with more experience and better resolution machines. With the advent of the newer high-resolution scanners, and by the transvaginal transducer the diagnosis of these and other more subtle conditions were achieved. Particularly at an earlier gestation, moving from the third trimester of pregnancy to the second and later on to the first trimester in the latter half of the 1990's. Fetal trisomies, spina bifida and the more subtle cardiac? From the detection of life, to the measuring of fetal sizes, determination of morphological normality to the evaluation of circulatory and growth dynamics, all have been making profound changes to the entire concept of routine antenatal care and obstetric practice in everyday life. Ultrasound has markedly enhanced and pushed forward the study of congenital abnormalities among obstetricians, pediatricians, geneticist, pathologist and other allied specialties. All of a sudden, obstetricians started to learn about so many congenital malformations that they have not even heard of.

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Gallbladder perforation diagnosed by High Resolution Ultrasound: Report of 2 cases and Review

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Perforation of gall bladder means breach of continuity of gallbladder wall which is a rare and serious complication of acute cholecystitis. It is a potentially lethal problem due to delayed diagnosis. Two cases of perforation of gall bladder were diagnosed by High Resolution Ultrasonogram (HRUS) in our center which were confirmed after laparotomy. Sonographic findings in one case were thick irregular gallbladder wall with breach of continuity in anterior wall and localized peri-cholecystic abscess formation in the adjoining liver. Dense bile and multiple stones were seen inside the gallbladder and one large stone (~2.1 cm) was lodged in the cystic duct region. In another case gallbladder was partially contracted with thick edematous wall and sign of perforation in the fundus, shows no stone inside. Small collection was seen in the parietal wall adjoining the fundus of gallbladder. No intra-abdominal free fluid was seen in both cases. Both the cases were managed surgically with good post operative recovery. Review of published literatures revealed that definitive preoperative diagnosis of gallbladder perforation is uncommon and usually accounts for high morbidity and mortality. These are possibly the first reported cases of sonographically diagnosed gallbladder perforation in our country.

Indexing word : Gallbladder perforation, Acute cholecystitis, Gall stone, HRUS in gallbladder perforation.

Gall bladder perforation is a rare complication of cholecystitis. It is rarely diagnosed preoperatively and the delay in making the definitive diagnosis usually accounts for the increased incidence of morbidity and mortality associated with this condition1,2. Patient's symptoms of gallbladder perforation are similar to those of uncomplicated acute cholecystitis, so it is difficult to diagnose by clinical means. The inherent resolution of sonography offers an excellent display of the gallbladder and surrounding tissues allowing detection of peri-cholecystic collection secondary to gallbladder perforation.3 The sonographic findings in patients with gallbladder perforation are peri-cholecystic fluid collections, free peritoneal fluid, disappearance of the gallbladder wall echoes, focal highly echogenic areas with

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acoustic shadows in the gallbladder, and an inhomogeneous, generally echo-poor gallbladder wall4. Peri-cholecystic collections have a varied sonographic appearance ranging from anechoic to complex collections, and their internal characteristics seem to depend on the duration of the peri-cholecystic process. The residual gallbladder lumen or calculi can be identified within or peripheral to the peri-cholecystic process. The most acceptable mechanism for perforation of the gallbladder is: (1) impaction of a calculus in the cystic duct; (2) gallbladder distension due to secretion into its lumen by mucous glands located in the walls of the gallbladder; (3) vascular impairment of the gallbladder due to distension of the viscus; and (4) ischemia, necrosis, and perforation of the gallbladder wall3. A history suggestive of chronic gallstone disease is common in patients with chronic perforation. Multiple stones in the biliary tree and the gallbladder are very common and may mask the presentation of gallbladder perforation in patients with either biliary colic or biliary tract infection5. Acute acalculous cholecystitis is an uncommon condition and a very serious illness which may lead to gallbladder perforation and death if remain undiagnosed. The condition has numerous causes that result in bile stasis and ischemia leading to inflammation and infection in the gallbladder wall. The bedside diagnosis is extremely difficult, especially in critically ill patients. Current imaging techniques including ultrasonography, computer tomography, and radionuclide cholescintigraphy are very helpful67. Pericholecystic abscess formation is a serious complication of cholecystitis that develops after gallbladder perforation and is usually associated with acute inflammatory signs and symptoms. The sonographic findings ranged from a well defined band of low-level echoes around the gallbladder to multiple, poorly defined hypoechoic masses surrounding an irregular, indistinct gallbladder outline8. There are very few reports of intra-hepatic perforation of the gallbladder resulting in formation of hepatic abscess9. In the presence of ascites ultrasound is not appropriate to distinguish between gallbladder perforation and acute acalculous cholecystitis. In a study, markedly elevated serum alkaline phosphatase was the only discriminating finding indicating gallbladder perforation. The correct and early diagnosis of gallbladder perforation is important for the treatment and prognosis10. Perforation of gallbladder wall is the most dangerous complication of cholelithiasis. Suspicion of perforation should be considered particularly in elderly patients with cholelithiasis and suddenly evolving pain in the right upper quadrant. Ultrasound examination of patients with this disease is an easy technique for diagnosis.11 Here we are reporting two cases of perforation of gallbladder with history of cholelithiasis in one patient and acalculus cholecystitis in another patient which were diagnosed by HRUS in our center and various aspect of gallbladder perforation are discussed.

CASE REPORTS

Case one:

A 35 years old lady was admitted to surgery ward, Mymensingh Medical College Hospital (MMCH), Mymensingh with upper abdominal pain. She was a known case of cholelithiasis and managed conservatively after admission. Later on she was referred to CNMU, Mymensingh for ultrasound evaluation of hepatobiliary system. Ultrasound examination was done with Toshiba Core vision real time, Color Doppler Ultrasonogram equipped with both curvilinear, linear & sector probes with wide range of frequency from 2 mHz to 8.5 mHz. Scanning was done by multiple sonologists (authors) in supine and lateral position. Findings on HRUS were thick irregular gallbladder wall with area of

perforation in the anterior wall and localized peri-cholecystic abscess formation (~3.1 X 2.4 cm) in the adjoining liver. Dense bile with multiple stones were seen inside the gallbladder and one large stone (~2.1 cm) was lodged in the cystic duct region. No other definite sonographic abnormality or free fluid is seen in the abdomen. Surgery was done and sonographic diagnosis was confirmed as perforation of gallbladder. (Fig: 1)

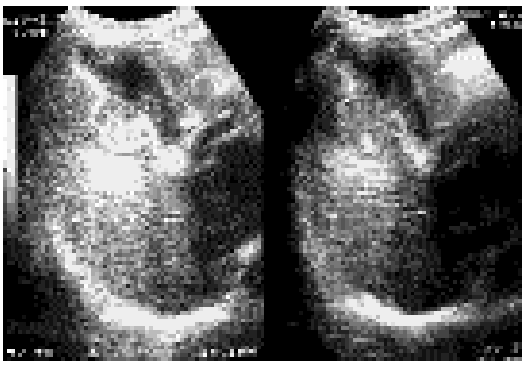
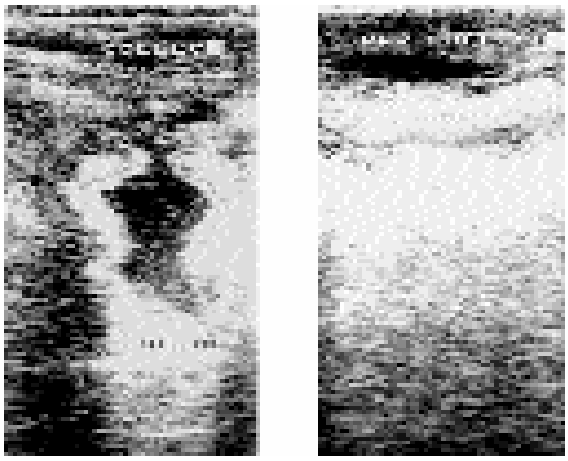


Figure 1 : Perforation of gallbladder showing peri-cholecystic abscess formation in the adjoining liver.

Case two:

A 65 years old man was admitted to surgery ward, MMCH with sudden upper abdominal pain. Clinical diagnosis was acute cholecystitis and managed by conservative treatment. After 3 days of admission the patient was referred to CNMU, Mymensingh for ultrasound examination of hepatobiliary system. Ultrasonogram was done with the same machine following same procedure as the previous case. HRUS findings were partially contracted gallbladder with thick edematous wall and sign of perforation in the fundal region. No stone was seen inside the gallbladder. Small fluid collection was seen in the parietal wall adjoining the fundus of gallbladder. No other abnormality or free fluid was seen in the abdomen. He was managed surgically and sonographic diagnosis was confirmed as perforation of gallbladder. (Fig: II)



a b

Figure 2 (a, b) : Perforation of gallbladder in the fundus with adjoining parietal collection (by HRUS)

DISCUSSION

Gallbladder perforation is a dreaded complication of acute cholecystitis and associated with a high mortality rate if diagnosis is delayed. Early detection of gallbladder perforation reduces the mortality and morbidity rates. Sonography is useful for diagnosis of gallbladder perforation and detecting the defect in the gallbladder wall. It should be the first-line imaging modality for evaluating the patients with gallbladder perforation12. About 70% of patients with acute cholecystitis usually meet the following sonographic criteria: (1) gallbladder wall thickening of 5 mm or greater, (2) gallbladder wall anechoicity, (3) gallbladder distension, as determined by an external anteroposterior width of 4 cm or greater, and (4) cholelithiasis13. The patients with perforated gallbladder usually shows slightly thicker gallbladder wall (range 3-20 mm, average 7 mm) compared with the uncomplicated cases of acute cholecystitis (range 2-13 mm, average 5.3 mm). It is not possible to find a common sign characteristic for imminent perforation. Localized fluid collection in the wall of gallbladder may be seen just prior to the perforation14. The finding of a sonolucent halo around the gallbladder is often an indicator of acute cholecystitis complicated by gangrene with or without perforation of the gallbladder. The pathologic basis of the finding of a sonolucent zone around the gallbladder is thought to represent massive thickening of the gallbladder wall, with a possible contribution from adherent

edematous omentum in the region of the fundus of the gallbladder15. The composition and location of gallstones differ in Western and Eastern people. Clinical manifestations of biliary calculous disease has been postulated to differ based on ethnic or environmental factors. A combined hospital study in a Chinese population over the period of 11 years was conducted to study the clinical profiles at risk for gallbladder perforations. Total seventy-one patients were studied and the perforations were categorized as either acute (type I) in 14 (19.7%), sub-acute (type II) in 25 (35.2%), or chronic (type III) in 32 (45.1%). The incidence of severe underlying disease was significantly greater ($p = 0.02$) in patients with acute and sub-acute perforation as compared with chronic perforation. A history suggestive of chronic gallstone disease was common in patients with chronic perforation5. In another study, history suggestive of chronic gallstone disease was found in 0% of patients with type I(acute), in 35% of patients with type II(sub-acute), and 60% of patients with type III(chronic) perforations. The incidence of severe systemic disease was significantly greater (p less than 0.01) in patients with type I as compared to type III perforation16. Perforation of the gallbladder is a rare cause of pyogenic liver abscess. This condition may be more common when the gallbladder is partially or totally intrahepatic17. Iatrogenic perforation of the gallbladder (PGB) during laparoscopic cholecystectomy leads to spillage of bile and gallstones into the peritoneal cavity, which can result in serious postoperative infection18. When patients are given appropriate antibiotics perioperatively with proper aspiration of spilt bile and if the peritoneum is irrigated, the operative and postoperative courses are similar to patients with unperforated gallbladder19. Perforation of the gallbladder occurred in 3.8% of patients with acute cholecystitis treated at one hospital in an 8-year period. The average age of the patients was 69 years and the female : male ratio was 3:2. Most had a history suggestive of gallbladder disease and most had coexisting cardiac, pulmonary, renal, nutritional or metabolic disease. Perforation occurred within 72 hours of the onset of symptoms in half the patients; the diagnosis was not suspected preoperatively in any20. In another study, perforation of the gallbladder occurred in 35 patients in 6 years review, with a 2.3:1 male predominance. Thirty-three percent of patients had a history of symptomatic cholelithiasis which emphasizes that if elective cholecystectomy had been performed, this complication could have been avoided. A large number of cases (40 percent) were found to be acalculous variety which suggests a possible changing trend in the pathogenesis of gallbladder perforation. Cholecystectomy with intra-operative cholangiography and adequate drainage appears to be the procedure of choice, and aggressive operative intervention without delay is thought to contribute to the relatively low mortality of 8.6 percent in that series21. In another report, the average age of gallbladder perforation was 67 years. There was no difference in the sex-distribution. Nearly always gallstones and inflammation were present, so widened indication of cholecystectomy for gallstone-illness was recommended22. We also reported a case of gallbladder perforation in a 35 years old female with history of cholelithiasis. If cholecystectomy had been done after diagnosis of cholelithiasis this serious complication might be avoided. Necrotizing fasciitis continues to carry a very high mortality and prolonged morbidity. There is a report of gallbladder perforation leading to necrotizing fasciitis of the anterior abdominal wall. The only organism isolated was Escherichia Coli, cultured from necrotic tissue23. One of our reported case is 65 years old man and perforation of gallbladder occurred in the fundal region from acalculus cholecystitis and resulting in adjoining parietal collection. Spontaneous perforation of the gallbladder is an uncommon and serious complication of cholecystitis. There is a reported case of spontaneous rupture of the gallbladder from acute cholecystitis of a 36-year-old multipara at 10 weeks' gestation in Women's Hospital of the Los Angeles, USA24. Similarly a 79 years old man with severe epigastric pain was admitted to a hospital in Japan, ultrasonography and CT revealed a slightly distended gallbladder with a small amount of free intra-abdominal fluid. At emergency laparotomy the diagnosis of idiopathic perforation of the gallbladder was established. The gallbladder contained no stones and a bile culture was negative25. Gall bladder perforation might have a poor prognosis if not diagnose

early in the course. Both CT and ultrasonography have been used until now extensively for the diagnosis of acute cholecystitis, but diagnosis of perforation is always difficult. Magnetic resonance, by its superior soft tissue resolution and multiplanar capability, is a better modality than ultrasonography and CT. Magnetic resonance imaging demonstrates the wall of the gall bladder and defects much more convincingly. In case of acute cholecystitis, if perforation is suspected and CT and ultrasonography are not conclusive, MR should be the modality of choice. It can be used as a first line of investigation, but it is not cost-effective26. In the elderly patient with acute cholecystitis who has a long history of gallbladder disease, cholecystectomy should be performed early, before gangrene and perforation of the gallbladder can occur20. Correct and early diagnosis of gallbladder perforation is important for the treatment and prognosis. Ultrasound examination is an easy technique for diagnosis of this diseases, high resolution probe with wide range of frequency can provide better information and more accurate diagnosis. To avoid acute emergency with unexpected morbidity and mortality from gallbladder perforation elective cholecystectomy is preferable for patients with cholelithiasis. In all patients with acute upper abdominal pain ultrasound evaluation as early as possible can provide valuable and often specific diagnostic information which is helpful for proper management.

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Significance of Presence of ring down Artifacts Posterior to right Hemidiaphragm : A case Report

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Ring down artifacts posterior to right hemi-diaphragm found during upper abdominal ultrasonography reflected pulmonary parenchymal disease. Though radiology is the first and right choice of investigation in any pulmonary pathology, sometimes prediction of pathological lesion could be made incidentally during abdominal sonography. We presented a patient with such ring down artifacts found during ultrasonography of hepatobiliary system who presented with acute right hypochondriac pain.

A 46 year old male was admitted to Md. Ali Hospital, Bogra with acute right hypochondriac pain and dyspepsia. There were no accompanying complaints regarding fever or cough. On admission, physical examinations were non-specific, except few ronchi over right chest. First investigation advised to the patient was ultrasonography (USG) of hepatobiliary system with the provisional diagnosis of acute cholecystitis. USG of the patient was done within 10 hours of admission in the hospital.

USG of hepatobiliary system was done in HP Imagepoint Hx and ALOKA SSD 1100 ultrasonography machine using 3.5 MHz. Curvilinear probe. No. definite USG evident upper abdominal organic abnormality could be detected in initial stage. However, multiple ring down artifacts were seen below the echogenic right hemi-diaphragm (Fig. 1).

Chest radiography was done within 1 hour after USG study, which shows non-specific interstitial pneumonia with fibrosis.

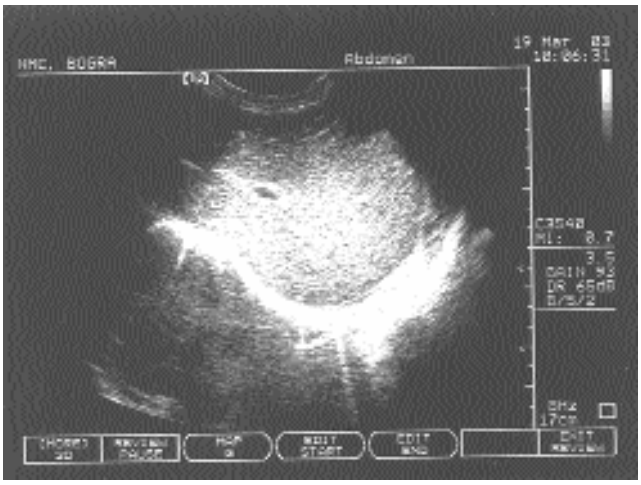

Fig.-1 : Shows ring down artifacts posterior to the right Hemi-diaphragm.

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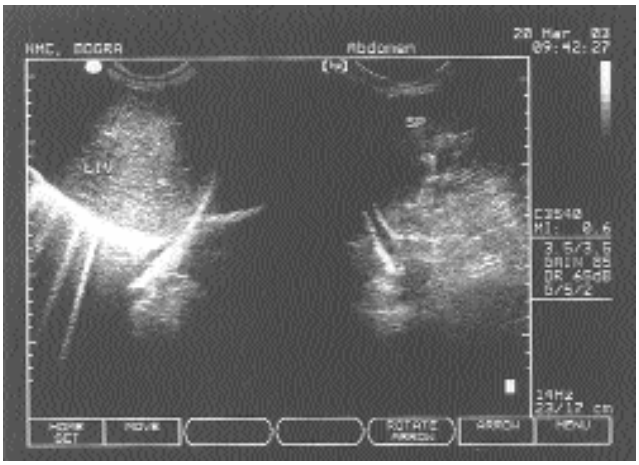

Fig.-1 : Shows ring down artifacts posterior to the right Hemidiaphragm.

DISCUSSION

Ultrasonography is usually not recommended for diagnosis of any pulmonary pathology. Because pulmonary air concentration and overlying bony cage interfares with progression of ultrasound beam and only reverberation artifacts will be returned from the surface of the lung 1. However radiology is always the first choice of investigation for any suspected chest / pulmonary pathology. But when the patient's complaints and physical examination pointing the provisional diagnosis of abdominal pathology, no one suggests for chest radiology in the first instances.

During sonography of hepatobiliary system. one can encounter multiple ring down artifacts trailing from the posterior surface of right hemi-diaphragm. Ring down artifacts have been regarded to be associated commonly with gas collections in the upper abdomen. Many of such types of ring down artifacts may be encountered during abdominal sonography with a poorly prepared patient. This artifacts disappear with the change of posture of the patient 2,3. The ring down artifacts appear when a great mismatch or a big difference occurs in acoustic impedance between two kinds of tissues, for example between air and water4. The soft tissue - gas interference produce strong artifacts. The interface has two effects. First, since it reflects 99 % sound beam and produce strong reverberation artifacts parallel to the transducer, the interface totally obscures the underlying lung tissue. Secondly, it generates showers of vertical echo that are projected into the underlying tissue. stretching down to the edge of the screen of an ultrasonographic machine4,5,6. Lichtenstein and colleagues found such ring down artifacts in 28 % of normal subjects7.

Although it may be of no significant value afterwards, ring down artifacts posterior to the right hemi-diaphragm,, which may be found incidentally during USG of upper abdomen, may predict pulmonary pathology.

So, in conclusion we try to point out that such ring down artifacts should be taken into account when found during upper abdominal USG, because it may be useful in prediction of pulmonary pathology in patients, who presented themselves without any specific pulmonary symptoms.

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Eleven years follow-up of Renal Hydatid Cyst

M. A. Taher

Renal hydatid cyst is rare in Bangladesh. Therefore, we like to report a case of renal hydatidosis followed for eleven years.

CASE REPORT

A 48-year-old Muslim male hailing from Nilphamari district presented at Nuclear Medicine Centre (NMC) Dinajpur with pain and progrssively enlarging lump in left loin of about 6 months duration since December 1991.The lump was taken note of because of heaviness in the left abdomen. There was no urinary or bowel disturbance.

EXAMINATION

His pulse was 84/min and BP was 138/95 mmHg A lump of 20x16cm size located in left hypochondrium to lumbar region, with well-defined margins, smooth surface and variable consistency was felt, which was bimanually palpable. Chest revealed nothing abnormal and all the other systems were normal clinically.

INVESTIGATIONS

Ultrasonography (USG) revealed a huge multicystic left kidney. It was, functioning poorly as shown by hippuran (1-131) renogram and DTP A (Tc-99m) renal scan.

MANAGEMENT

After exploration,partial nephrectomy was done on 23 July 1992 to remove the hydatid cysts. The patient was put on a long course of mebendazole (720 tablets of 100mg).

Fig.-1 : Renal Hydatid Cyst.

FOLLOW-UPS

The patient was symptom-free for many months. Post-operative scan on 21 January 1993 showed a small left kidney with uniform concentration of DTP A. On 10 July 1995 he presented at NMC Rangpur with recurrence of symptoms. A multiloculated cyst was seen by sonography in the left loin, DTPA renal scan showed a normal right kidney and poorly visualised left kidney. The patient could not afford repeat surgery, received, albendazole 800 mg/day orally for 15 days and improved considerably. He refused further treatment, but came again on 30 May 2002 with a lump in left loin. The patient gave a history of occasional albendazole therapy (400

mg daily for 2 weeks). USG showed that the lump was a multiloculated cyst of 120X153 mm in size. The patient was given albendazole 800 mg twice daily for 15(fifteen) days. He was improved and USG on 19 August 2002 showed further reduction of the size of lump (98X115 mm). On January 22, 2003, he was clinically well and UGS showed no cyst. Although we have no laboratory proof, but we assumed from therapeutic success that it was a recurrence of echinococcosis.

DISCUSSION

Echinococcal infection in adults are mostly in the liver (54-77)%. Pulmonary hydatidosis (9-300%) ranks second to liver. Hydatid cysts are commonly found in liver and cause compression of liver cells which can lead to biliary stasis and cholangitis due to secondary infection.

Lung cysts are more spherical than those in the liver and their rupture can result in hemoptysis from bursting of pulmonary capillaries. The small percentage of organisms that escape liver and lung may enter the systemic circulation and infest any organ [e. g. heart, kidney, orbit, breast, skeletal muscles, spleen, thyroid gland (0.1%), urinary bladder] and none has escaped from being infested(1-10). In sheep-raising districts, hydatid cyst of the kidney is common, occasionally the patient complains of passing "grapeskin" (ruptured daughter cysts) in the urine (11), but renal hydatid cyst is rare in Bangladesh and therefore we like to report the present case. Patients with recurrent hydrated cysts (or polycystic disease) are often treated by mebendazole or albendazole or percutaneous treatment and ultrasound is a useful way to monitor progress. Bezzi et al. (1987) followed 141 abdominal hydatid cysts (108 in the liver) in 63 patients treated by these <drugs, however, 400% remained sonographically unaltered(12). Radionuclide studies may help in these situations. Ultrasound findings in hydatid cyst may be pure fluid collection, split wall, septa, heterogeneous echo or reflecting thick walls (13). Mebendazole (40-50 mg/kg/day) for at least 3 months or more effectively albendazole 10-15 mg/kg/day in several monthly courses separated by intervals of 14 days (14) has been used for inoperable hydatid disease and to reduce the infectivity of cysts preoperatively. Double percutaneous aspiration and ethanol injection(D-PAI) of hydatid cyst is an effective treatment, but there is a risk of anaphylactic shock, occasionally fatal-two deaths were reported by Giorgio et al. and Men et al.(15-17), although they used mebendazole(3g/d) or albendazole(800mg/d) 1 week before and 3 weeks after D-PAI and betamethasone(12mg/d IV) as prophylaxis for allergic reactions for 3 days before and 2 days after each PAI session.

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A Preliminary report of 204 normal patients. Bangladesh J Ultrasonogr 2000; 7 : 5-9

JOURNAL ARTICLE : MORE THAN THREE AUTHORS

2. Keogan MT, Kliewer MA, Hertzberg BS, et al. Doppler sonography in the evaluation of corporovenous competence after penile vein ligation surgery. J ultrasound Med 1996; 15 : 228-33

BOOK

3. Hayden CK, Swischuk LE. Pediatric ultrasonography, 2 ed. Baltimore, Williams & Wilkins 1992; 132-7

CHAPTER IN A BOOK

4. Filly RA. Ultrasound evaluation of the fetal neural axis. In : Callen CW, ed. Ultrasonography in Obstetrics and Gynecology, 2 ed. Philadelphia, WB Saunders 1988 : 95-100

EDITED BOOK

5. Clark RL, ed. Cancer patient care. Chicago, Year Book 1976 : 80-5

PROCEEDINGS

Yu CJ, Yang PC, Wu HD, et al. Ultrasound study in unilateral hemithorax opacification : Image comparison with computed tomography. Proceedings of the 17th World Congress on Diseases of the chest, 13-18 June 1993 Amsterdam, The Netherlands 1993 : 203-5.

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