ANTENATAL MONITORING OF THE HIGH RISK FETUS

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ABSTRACT

Fetus may be at high risk of perinatal mortality or morbidity or childhood morbidity either due to congenital malformations, genetically inherited disorders, chromosomal aberrations or due to antenatal and/or intrapartum hypoxia. Environmental hazards of infection, radiation and drug ingestion or maternal medical disorders are associated with some risk to the fetus. So it is important to identify those at risk by obtaining a detailed medical and family history. Maternal age and past obstetric history would also suggest the high risk nature of the pregnancy. A detailed clinical examination of the mother and the pregnancy will add further information.

It is equally known that patients with no risk factors prior to pregnancy become at risk if they develop obstetric disorders of antepartum haemorrhage, pregnancy induced hypertension or diabetes. Therefore not only initial surveillance but continued care is important to identify those at risk. It is good practice to rule out congenital malformations, recognise multiple pregnancy and determine the gestational age in the early second trimester (18 – 21 weeks) by an ultrasound scan. This is of value in giving optimal care when a pregnancy turns from low to high risk. Aspects of monitoring the high risk fetus by simple clinical means and by appropriate technology is discussed.

Key Words: High risk, fetal monitoring, ultrasound.

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Assessment of fetal growth

Pregnancies associated with intra-uterine growth retardation (IUGR), have a small fetus, small placenta, and oligohydramnios and present with a small total uterine volume. Progressive growth of the uterus and hence the fetus can be monitored by serial symphysial fundal height measurements. Between 28 and 34 weeks of gestation symphysal fundal height 3 weeks below the norm for that gestational age when dates are reliable and suboptimal growth of the symphysial fundal height on serial measurements (less than 2cm increase in 4 weeks) suggest the possibility of intrauterine growth retardation. Using this method Belizan and workers were able to accurately diagnose IUGR in 86% of suspected cases (1).

A recent survey (2) of 86 reports of IUGR published between 1975 and 1983 reported that methods based on symphysial fundal height measurements have sensitivities varying from 46% to 86% with a mean of 67%. This is comparable to endocrine tests and ultrasound examinations of fetal wellbeing and growth with mean sensitivities of 63% and 67% respectively. A Swedish study (3) reported that fundal height measurements are superior to ultrasound measurements of the biparietal diameter in the diagnosis of IUGR.

Approximately 40% of cases suspected of IUGR by symphysial fundal height measurements turn out to be averagely grown infants at delivery. Main reasons for this error are maternal obesity, wrong dates, late booking and irregular antenatal visits.

Normograms of symphysial fundal height constructed taking race and stature into consideration is of better value (4). The increase in growth observed on repeated measurements with the progress of gestation gives better information than an isolated single measurement. Such objective measurement has little inter or intra-observer variation (5). When the measured height is much greater than expected, multiple pregnancy, polyhydramnios or tumour should be suspected after ruling out wrong dates.

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Ultrasound methods

When there is clinical suspicion of growth retardation or there is past history of unexplained stillbirth or neonatal death, or high risk factors of severe hypertension or past history of growth retardation, serial ultrasonic measurements of the fetus would help in management. Serial biparietal diameter is of little value as it is a late sign because of the brain sparing effect. Abdominal circumference issues the early warning. Head circumference to abdominal circumference ratio and femur length help in identifying growth retardation from constitutionally small fetus. Normograms for such parameters are available and plotting of the observed values on the normogram and assessment of amniotic fluid volume should be an integral part of the examination. The slow increments of growth and possible error in measurements make serial measurements more meaningful when done every 3 weeks rather than at earlier intervals. Twin pregnancies, patients with antepartum haemorrhage and threatened preterm labour are other candidates who would benefit by such examinations which includes fetal weight estimation. Study of growth curves and liquor volume observed would help in identifying those with growth retardation from those with wrong dates or constitutionally small fetuses.

Biochemical Methods

Serial measurements of human placental lactogen, 24 hour excretion of urinary estriol and pregnancy specific protein (6, 7) are of some value. These biochemical markers represent fetal health of the immediate past and not of the present as the results are that due to metabolism in the past few days. A wide range of values are observed for the same gestation making serial measurements necessary to derive meaningful conclusions. The period of gestation should be known for interpretation of results. In addition to these the problem of sample collection and need for laboratory technology and personnel has made biochemical methods of fetal monitoring less favourable to biophysical methods.

Biophysical Methods

Fetal movement chart

Fetal activity in the form of fetal movements has been found to be a reliable indicator of fetal health (8). One that is commonly practised is the 'count to ten' fetal movement chart where 10 episodes of fetal activity are expected within a period of 12 hours (9). Many mothers feel 10 movements within a few hours. The very ones who are at risk are busy with manual work or otherwise and find it difficult to count even for a few hours. It is one of the cheapest forms of fetal surveillance and is applicable in any part of the world. There are a few disadvantages with this method. Anxious mothers may report less than optimal movements which may lead to unnecessary interference. The ones with less intelligence or the ones too busy may not come up for attention even with less movements and when they do report, the situation may be too late to interfere resulting in poor fetal outcome. A small percentage of mothers find difficulties in perceiving the fetal movement for whom this method may not be suitable. Disadvantages of this method are few and with motivation, fetal movement charts have been found to be dependable.

Electronic Fetal Heart Rate Monitoring — The Non-Stress Test

A recording of the fetal heart rate (FHR) pattern for a period of 20 to 30 min called the non stress test (NST) has become one of the most popular methods of antenatal fetal surveillance. Definitions of normal or reactive, suspicious and abnormal FHR patterns have been described recently by the FIGO working committee on FHR monitoring (10). A normal or reactive FHR trace is one with a baseline between 110 to 150/min, baseline variability > 6, no decelerations and two FHR accelerations of 15 beats above the baseline for 15 secs in a 20 min trace. In the antenatal period absence of accelerations in a 40 min trace is termed nonreactive and warrants further action. Pooled results of 4 studies of NST's involving 10,169 patients revealed satisfactory outcome with a false negative rate of 7 per 10,000 cases (11 — 14). In order to reduce the number of non reactive NSTs fetal vibroacoustic stimulation has been employed (15) which produces fetal heart rate acceleration on applying a vibroacoustic stimulus. The perinatal outcome based on the results of the FHR tracing obtained after vibroacoustic stimulation has been shown to be as reliable as the results of the NST (16).

Maternal Perception of Sound Provoked Fetal Movement (mp SPFM)

With vibroacoustic stimulus the fetus exhibit a flexion-extension type of limb movements or a startle reflex indicating an intact central nervous system and a somato-motor sensory pathway (17 — 18). Based on this concept Westgren et al (1987) (19) correlated maternal perception of sound provoked fetal movement (mp SPFM) to the results of the NST performed immediately after eliciting the SPFM.

Results of a recent study (20) involving 1,097 patients are given below.

Table 1: Results of mp SPFM in relation to the results of the NST

mp SPFM	FM Present n = 1009	FM Absent n = 88	Total n = 1097
NST-Reactive	1006 (99.7)	78 (88.6)	1084 (98.8)
NST-Non-Reactive	3 (0.3)	10 (11.4)	13 (1.2)

% is given with ( )

The sensitivity of the test was 92.8%, specificity 76.9%, positive predictive value 99.7% and negative predictive value 11.9%. Though it has a low negative predictive value when the mp SPFM is positive the chances that the fetus is in good health is high. The 3 cases who had positive mp SPFM but had a non reactive NST were cases under 33 weeks of gestation and were on multiple antihypertensive therapy for severe pre-eclampsia which is a factor known to decrease variability and the lack of fetal heart rate accelerations (21).

It may be possible to use mp SPFM as a test of fetal well being in high and not extreme risk situation but prior to such use the problem of habituation (22) by the fetus to such stimulus has to be evaluated. Except for the lack of objective recording, mp SPFM appears to be a simple and inexpensive method to evaluate fetal wellbeing especially in centres with financial constraints where NST is not possible on every high risk case.

Assessment of liquor volume

Fetal urine contributes significantly to liquor amnii after 18 weeks of gestation. Severe oligohydramnios is a common finding in bilateral renal agenesis. With diminished placental function and reduced renal perfusion the liquor volume decreases. Fetal compromise that is due to gradual decline in placental function can be monitored by assessing the liquor volume. Clinical evaluation can be deceptive in cases with decreased liquor. Impression of the liquor volume on ultrasound examination is fairly sensitive but objective assessment of the vertical depth of the largest pocket of liquor after excluding loops of cord or addition of the vertical pockets in the 4 quadrants of the uterus (amniotic fluid index) correlates better with perinatal outcome. An amniotic fluid index of < 5cm is suggestive of reduced placental function and delivery of the fetus is desired if the maturity poses no problem. Similarly a vertical pocket < 1cm in the largest pool is an indication for delivery. In post term pregnancy or that complicated by severe growth retardation the decline in fluid volume can be up to a third every week and twice weekly assessments are advisable in these situations.

Measurement of blood flow velocity waveforms

It is not possible at times to deliver a fetus at risk of progressive hypoxia because of prematurity although tests of biophysical profile, amniotic fluid index and NST suggest possible compromise. Measurement of blood velocity waveforms in the umbilical artery and fetal aorta are of value in these situations. Measurement of mean blood flow velocity is difficult because of the variant angle between the ultrasound beam and the direction of movement of the blood flow and calculation of flow volumes is difficult because of inaccuracy in measuring the diameter of the vessel. With increasing placental compromise the diastolic phase of blood flow velocity waveform decreases and can be detected when looking at the waveform. Based on the systolic and diastolic peak and duration A/B ratio, pulsatility and resistance index can be calculated and nomograms for various gestations are available. With further deterioration there is no diastolic flow and still later reverse flow can be observed. When there is absent end diastolic flow in the umbilical artery, fetal blood acid base determination or fetal internal carotid blood flow studies would give more information and may be of value in timing the delivery.

Biophysical profile

Evaluation of more than one biophysical parameter to assess fetal health gives better dividends. Fetal movements, tone, breathing and amniotic fluid volume observed by the scan and NST constitute the 5 components and for each a score of 2 or 0 is given. Based on the score obtained management policy can be planned. When NST is not reactive (which may be commoner in the preterm period) it would be wise to assess the fetal biophysical profile. When the biophysical profile is less than 2 once or

less than 4 twice 6 to 8 hours apart delivery of the fetus is indicated unless further evaluation is possible with fetal blood flow velocity waveform studies.

CONCLUSION

Knowledge of managing high risk pregnancy is increasing with advanced technology and better understanding of fetal physiology. Main aim should be that of identifying those patients at risk and to monitor the fetus with appropriate technology. Lack of knowledge and experience leads to a situation of technological imperative. Medical personnel should resist this temptation as more harm can be caused. Whatever monitoring plan is instituted fetal demise or morbidity, due to acute obstetric events like abruption, unrecognised infective or metabolic causes and that due to gross prematurity is difficult to eliminate. Barring this, history and clinical examination should identify those at risk and early second trimester scan should exclude fetal abnormalities. Subsequent follow up and care even of a high risk fetus should result in a healthy neonate.

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