THE ROLE OF OBSTETRIC ULTRASOUND IN PRIMARY HEALTH CARE AT A SECONDARY HOSPITAL IN SOUTH AFRICA.

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Thesis submitted in fulfilment of the Mtec. Radiography. Ultrasound. In the faculty of Science at the Peninsula Technikon.

Date of submission: 14 October 2000

SYNOPSIS

Ultrasound has, until recently, been regarded as a sophisticated diagnostic modality, reserved for tertiary health care. In reality, it is a cost-effective, reliable and safe modality that is highly suited to primary health care. Secondary level centres provide the only access to ultrasound for many of the obstetric primary health care patients, as primary health care has limited ultrasound resources. The increasing monthly statistics, at one secondary centre, bares witness to the need for ultrasound in primary health care.

At the time of this study ultrasound scans were not routine for every obstetric patient. Experience indicates that only the patients who clinically suggest a possible risk are referred for ultrasound to confirm, or rule out problems. However, there are a number of complications, which have little or no early clinical indications. [Palmer,1995:285] This means that many of the problems encountered are often in late gestation and they have a marked bearing on the obstetric management of the patient.

This was a retrospective study, of approximately 1000 patients attending an ultrasound department at a secondary centre. Most of the obstetric patients that were sent for an ultrasound examination came from the primary health care centres in the region. The management of these patients must sometimes be continued at either a secondary or a tertiary centre, as a result of the ultrasound findings. This is to enable these patients to receive the optimal care that is required for the particular condition, during the pregnancy.

There were four hypotheses that were tested. The first was to show that ultrasound influenced the management of a portion of the 1000 patients in the study. The results proved this with ultrasound having ruled out suspected problems in 212 patients and having identified unsuspected problems in 273 patients. This meant that these patients could either be returned to primary heath care or transferred from primary to a higher-level health centre.

The second hypothesis was disproved showing that the mean gestational age of the patients attending the ultrasound department was not in the second trimester but rather in the third trimester. The mean gestational age was 30+ weeks. The earliest gestational age recorded was 6 weeks and the latest at 42 weeks.

By identifying the clinical indications that the patient was referred for an ultrasound scan the third hypothesis was proved showing that there is a role for ultrasound. Ultrasound is important as a valuable adjunct to the clinical examination, as ultrasound will confirm or rule out a clinical suspicion. More importantly it will identify an unsuspected condition.

Finally to show that there is an important role for ultrasound in primary health care in South Africa. The results from the first hypothesis help to illustrate the importance of identifying possible serious conditions that require patient transfers. By identifying these early the patient can be moved from primary health care at the appropriate time. There were 89 patients that ultrasound confirmed a clinical diagnosis and 214 patients that ultrasound ruled out a clinical suspicion. What is more striking is that ultrasound made an unexpected diagnosis in 271 patients.

To allow the patient to receive the optimal care during her pregnancy be it in primary secondary or tertiary health care, ultrasound must play an important role.

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Section I

1. Introduction

This study will attempt to show that there is a role for ultrasound to play in primary health care. The thesis will hopefully show that ultrasound can influence patient management and thereby influence the care of the patient in primary health care. By identifying the mean gestational age and classifying the clinical indications for the patient being sent for ultrasound, this study will try to illustrate when and why in the pregnancy an ultrasound scan is most commonly performed. When used as an adjunct to the clinical examination it is hoped to show that ultrasound can answer questions safely, accurately and with little stress to the patient.

Selective ultrasound scans performed specifically only in the presence of risk factors and clinical symptoms is well known. [Johnson, 1998, 964]. At the time of writing this project selective ultrasound was being employed in primary health care. This project has undertaken to examine the more common high-risk situations.

All pregnant women require care, however the needs of these women are not the same. In order to match the needs of the individual to the care required the care is divided into primary, secondary and tertiary care. [Woods, 1993:3]

Primary care is available to all pregnant mothers in the Western Cape, as it is throughout South Africa. The care provided in a primary care centre is adequate for a low risk patient who is healthy and has only minor problems. About 60 % of mothers in a community will require primary care only. [Woods, 1993: 3] Those patients that are at risk of perinatal complications are no longer regarded as low risk and therefore need secondary or tertiary care. Tertiary care requires highly specialised staff and sophisticated equipment to deal with patients with complicated problems. [Woods, 1993:4] Obstetric ultrasound has, until recently, been regarded as a sophisticated diagnostic tool, largely reserved for tertiary health care. In reality it is a cost effective, reliable and safe procedure that is highly suited to primary health care.

One situation that is specifically not evaluated, is HIV and AIDS. The reason for this is that obstetric ultrasound at this point does not have a direct role to play in the patient management of these patients. This relatively recent disease is prevalent amongst pregnant women and the transmission of HIV from mother to child is critical to consider. The exact rates of the transmission at the different stages of pregnancy and delivery remain unknown at this time. [Boer et al, 1998, 288] Transmission rates are thought to be higher among Africans, probably due to transmission during breast-feeding. Ultrasound, can however, play a role in the complications of the pregnant HIV patient, such as pre-term delivery that is thought to be increased. There is also thought to be a moderate decrease of the birth weight of an HIV infected fetus. [Boer et al, 1998, 228] Ultrasound could help to monitor the growth of this fetus. As advances are made with this disease there is sure to be a role for obstetric ultrasound in this area of obstetrics.

2. Antenatal Ultrasound.

Ian Donald was the first to introduce ultrasound to obstetric care in 1958. It is now regarded as one of the major landmarks of modern medicine. In North America, Great Britain and most of Western Europe virtually all pregnant women will undergo at least one ultrasound. [Johnson, 1998:961]

The development of antenatal ultrasound over the last few decades has helped to give the patient the optimal obstetric care she can expect today when she books for her first antenatal visit. Prior to the development of ultrasound the term of pregnancy could be full of problems with certain surprises such as twins or fetal abnormalities causing great difficulties for the clinician. With the advent of ultrasound many of these surprises can be avoided or well prepared for by altering patient management. With an experienced operator real time ultrasound has become an interregnal part of perinatal medicine, its versatility and portability makes it ideal for a busy obstetric unit. The ultrasound unit can be moved to the patient in labour ward if the patient is unstable. The interchangeable probes for transvaginal work such as in the presence of placenta praevia, allow the operator to examine the cervix optimally [Laing, 1996:711]; thereby enhancing the capabilities of this standard workhorse of an obstetric hospital. [Queenan, 1993:72]

Ultrasound can be utilised throughout pregnancy both in routine ultrasound scans and in the emergency situation, initially establishing viability in early first trimester to estimating a fetal weight prior to delivery. There are many sudden and unexpected obstetric emergencies that demand prompt extensive action. [Leveno, K, 1990:405]. Ultrasound can help to evaluate and diagnose many of these situations. Leveno states that: 'the only pregnancy that is *not* an emergency is one that delivers normally with no complications and this can only be established with certainty, after the fact.' [1990:405].

3. Routine Ultrasound

There is controversy as to whether every pregnant patient should have an antenatal ultrasound. The main factor against a routine ultrasound scan is the cost element. Certainly in first world countries such as the United States of America and the United Kingdom, part of the obstetrical care is to offer a routine ultrasound scan. The number of these routine scans during the term of pregnancy differs between countries, from a single routine scan to as many as a three stage-screening programme. [Bucher C, et al, 1993]. Here in the Western Cape only patients who are deemed to be 'high risk' are sent for ultrasound. The main reason for this is the lack of ultrasound facilities and trained personnel available in primary health care. For the most part, ultrasound is based at secondary and tertiary hospitals. Ideally to have the ultrasound facility available for the patient at the primary heath centre would save many patients the inconvenience and expense of travelling to the secondary or tertiary heath centres. For many women in first world countries the routine ultrasound is part of the package of routine antenatal care. [Roberts et al, 1998, 960]

The routine ultrasound scan between 16-20 weeks is invaluable [Queenan, 1993:72]. Real time ultrasound is able to detect an intrauterine gestational sac from about five weeks and viability can usually be confirmed at five to six weeks. [Chamberlain, 1992:29]. A routine ultrasound scan improves dating and which can reduce the number of induced labours when gestation has been overestimated, it is accurate in detecting fetal growth retardation, in identifying multiple gestations and in helping to diagnose severe malformations. [Bucher H, et al 1993, 13]. In one study the main reason for starting the screening programme was to improve the antenatal detection of twins in time to prevent preterm delivery, however as the study progressed other priorities became apparent such as the early estimation of gestational age and the detection of intrauterine growth problems. [Grennert, et al, 1978: 5]. It must be remembered that when a routine ultrasound is carried out it is never for one reason and the whole spectrum of risks and benefits should be considered.

It is generally agreed that routine ultrasound during pregnancy is extremely useful in the dating of the pregnancy, in detecting growth abnormalities, multiple pregnancies, severe malformations, placenta praevias and other scenarios. However, the routine ultrasound scan per se does not improve the outcome of the pregnancy in terms of live births or prenatal morbidity. [Bucher, et al,1993:13] These factors are influenced by clinical factors. The ultrasound scan has considerable clinical benefit, particularly in the asymptomatic group of these patients. [Barik et al, 1993, 559]. The Helsinki ultrasound trial in 1990 agreed with this and stated that routine ultrasound screening improved the management of the pregnancy. It was of benefit to the children and the adverse affects were negligible. [Kemppainen et al,1990:390]. Perinatal mortality was found to decrease but this was felt to be because of the increase induced abortions. This was due to the ultrasound detection of major fetal malformations. [Kemppainen et al, 1990: 390]

Berkowitz found that in the United States women from the lowest socio-economic group were most likely to be at risk for perinatal complications, therefore many of these patients would qualify for a clinically indicated scan. [Berkowitz, 1993: 875]. This group commonly have their heath care funded by the state. The higher socio-economic group whose risk was found to be less, chose to have elective ultrasound scans not necessarily part of routine health care. [Berkowitz, 1993: 875]. Perhaps a parallel can be drawn from this lowest socio-economic group in the USA to the primary health care setting in the Western Cape. This would then illustrate that with a routine ultrasound scan some of the perinatal complications could be identified prior to the clinical manifestation, thereby aiding patient management.

The adverse affects of routine screening are extremely small and seem to be confined to the diagnoses of false positives. (A false positive is when an anomaly is diagnosed and the fetus is in fact not affected.) The result of this is two fold. Firstly it can initiate extreme and unnecessary psychological distress to the parents. Secondly there is the cost factor, which is involved in an attempt to confirm or rule out this diagnosis. [Roberts et al, 1998: 962]. This probably supports Dr M. I. Evans' statement that ultrasound is very useful in experienced hands and extremely wasteful in inexperienced hands. [Freundlich, 1997: 2].

There is no gold standard for a routine ultrasound scan to refer to. This is probably due to the difference in the scanning capabilities of people carrying out ultrasound scans. An ultrasound scan performed between 16-18 weeks gestation is suitable for accurate dating of the fetus as well as an optimal time for studying fetal morphology. [Campbell, 1985:619] This makes the generally acceptable time for a routine scan to be between 16-20 weeks gestation. All obstetric ultrasound scans should be performed by someone who is trained and accredited in obstetric ultrasound. [Johnson, 1998:963]. At this secondary hospital radiographers who have specialised in ultrasound were responsible for the ultrasounds. The ultrasound machine used for this study was a Toshiba Cappase. A 3.5mHz curvy-linear transducer was used to ensure good penetration with adequate resolution. If transvaginal work was needed such as with establishing viability in early first trimester, assessing intracranial structures in a low cephalic presentation or to visualise the internal os in relation to the placental edge in placenta praevia, a 7.5mHz transvaginal transducer was also available.

Section II

High Risk Pregnancies.

In the United States of America more than 70% of all pregnancies have an ultrasound examination [Freudlich 1997:1]. This is not the situation in developing countries where only high-risk patients are referred for ultrasound to confirm or rule out problems. A high-risk pregnancy is any pregnancy in which there is a maternal or fetal factor that may adversely affect the outcome of the pregnancy. [Queenan, 1994:xvii]. To try and improve the outcome of these pregnancies a number of risk factors have been identified to help the doctor classify certain patients who will fall into problem categories, e.g. diabetes, epilepsy, etc. This helps to limit the problems experienced in pregnancy and labour. There are however a number of high risk conditions such as placenta praevia, multiple births etc which are extremely difficult to predict. [Queenan, 1994:xvii]. Ultrasound can help with these high-risk patients by identifying the factors prior to the onset of symptoms: thus helping to mitigate some the problems associated with these high-risk pregnancies. This will ultimately improve the outcome.

Part of antenatal care is to try to detect asymptomatic disease [Backe et al 1994: 690]. Backe et al mentions five important pregnancy disorders that increase risks during pregnancy and delivery: -

1. Pre-eclampsia or gestational hypertension.
2. Intra-uterine growth retardation.
3. Breech presentation.
4. Multiple pregnancies.
5. Placenta praevia.

Ultrasound can assist in some way with the identification and management of each of these obstetrical problems.

1 Preeclampsia

Preeclampsia is also referred to as gestational proteinuric hypertension [Woods, 1993 3/5]. and toxaemia of pregnancy [Dahnert, 1993:643]. According to the Dirckx concise medical dictionary preeclampsia is said to be the development of hypertension with proteinuria or oedema or both, because of pregnancy or as a result of a recent pregnancy. It is more common after 20 weeks gestation but can occur before this in the presence of trophoblastic disease. [Dirckx concise CD ROM]. Some authors feel that because oedema occurs in more than 40% of all pregnancies it is not a sensitive pointer for preeclampsia. [Chamberlain, 1996:56]. Eclampsia is a complication of preeclampsia; this is when one or more convulsions occur which cannot be attributed to other cerebral problems such as epilepsy. [Dirckx concise CD ROM].

Delivery of the fetus and the placenta is the most effective treatment for preeclampsia. This is most advantageous later in gestation. The two most important factors that direct the patient management is the severity of the preeclampsia and the gestational age. [Sibai, 1994:377]. This is where ultrasound can play an important role. The decision as to whether and when to intervene and deliver a preterm infant who will require intensive care therapy is an extremely difficult one and sometimes controversial, especially when the fetus is between 28-33weeks. [Sibai, 1994:378].

The normal blood pressure during pregnancy is a systolic of less than140mmHg and the diastolic of less than 90mmHg. Blood pressure will usually fall in the second trimester and rise in the third trimester. Gestational hypertension is defined as a diastolic of more than 90mmHg and a rise of more than 15mmHg during the pregnancy. [Woods, 1993: 3:1/93].

Proteinuria is when the urine contains protein. Normally there should not be any or only a trace of protein present in the urine. The protein is usually measured with a reagent strip. Protein present in the urine and not in the presence of hypertension is often due to renal disease. [Woods, 1993: 3:1/93].

Those patients thought to be more at risk for developing preeclampsia are: -

- primigravidas
- chronic hypertension
- maternal age 35 years and over
- multiple pregnancies
- diabetes
- past history of preeclampsia
- excessive weight gain due to generalised oedema. [Woods, 1993:3/5].

This disease is seen far more commonly in primigravidae than in multigravidae. [Chamberlain, 1996:56]. The occurrence of preeclampsia seems to vary between authors and seems to be between 5% (in the western Cape) [Woods, 1993: 3/3] and 10% [Kumar et al, 1995:275] of all pregnancies. Hypertension that occurs in the early stages of pregnancy is usually essential hypertension often due to renal disease. [Kumar et al, 1995: 620]. It is important to rule out any renal disease before Preeclampsia is considered. It is only when it occurs after 20 weeks that it is labelled as preeclampsia.

1.2 The Role of Ultrasound in Preeclampsia

Preeclampsia is specific to pregnancy and carries risks to both the unborn fetus and the mother. The possible problems which affect a mother with preeclampsia are:

- Cerebral vascular accident
- Renal failure
- Heart failure
- Coagulation failure
- Liver failure

- Adrenal failure
- Eclampsia

The risks to the fetus are:

- Asymmetrical growth retardation.
- Placental abruption
- Preterm delivery. [Chamberlain et al, 1992: p 55].

When considering the problems to the mother, ultrasound does not play a particularly important role in its primary health care setting but it can play a huge role in the monitoring of the unborn fetus. Most patients who have severe preeclampsia will usually be transferred to a tertiary institution to monitor their condition more closely. To help the obstetrician prior to transfer, an experienced ultrasonographer can help identify and establish the extent of existing renal, hepatic and to a lesser extent cardiac problems. Some symptoms and features of these diseases are recognised on ultrasound. Those considered stable enough to remain within the realm of primary or secondary health care can benefit from regular visits to an ultrasound department, such as that of a secondary hospital.

Of the three risks to the fetus, ultrasound is probably the most involved with intrauterine growth retardation (IUGR).

1.2.1 Asymmetrical Growth Retardation.

IUGR can be divided into symmetrical and asymmetrical. Asymmetrical growth retardation is common in mothers with preeclampsia and is essentially a problem of fetal malnutrition. [Patrick, 1995: 271]. Asymmetrical IUGR is said to be a disproportional reduction of the fetal measurements because the uteroplacental blood is diverted to the fetal brain (brain sparing), occurring after 26 weeks gestational age. [Dahnert, 1993:638].
One of the ways to identify and monitor asymmetrical growth retardation is with regular ultrasounds and plotting the growth on suitable graphs. This is easily and is regularly performed in an ultrasound department. The regular measurements are repeated with 2-3 week intervals and plotted on a graph, which shows both the 5^{th} and the 95^{th} percentiles. The two measurements thought to be the most sensitive are the AC (abdominal circumference) and the EFW (estimated fetal weight) calculated from the linear measurements.[Dahnert, 1993:638] These are suggestive of IUGR when they fall below the 10^{th} percentile. The HC (head circumference): AC ratios, which are above the 95th percentile as well as reduced liquor, are also considered pointers to IUGR. A Granum placental grading of III assessed with ultrasound is also suggestive. [Dahnert, 1993:638].

If Doppler facilities are available this is thought to be useful in the identification and monitoring of preeclampsia. Preeclampsia is associated with an abnormal uterine artery Doppler velocimetry. The RI (resistive index) of the uterine artery should be measured and recorded weekly. [Chamberlain 1992: 59]. One of the most important applications of this investigation would be to screen pregnancies at risk of preeclampsia. [Romero et al, 1996:317]. Preeclampsia is associated with impaired trophoblasitic invasion of the myometrial potion of the spiral arteries.

Thus a continual high RI after 24-26 weeks can indicate abnormal placenta and thus a patient at risk of preeclampsia. [Romero et al, 1996:317].

1.2.2 Abruptio Placenta.

This is a condition in which there is premature detachment of a normally situated placenta. [Dirckx, CD ROM 1997]. This term is usually reserved for a clinical setting which describes a syndrome of acute separation of the placenta, severe haemorrhage, pain and hypovolemic shock. [Spirt, 1996: 198]. Most patients are not considered stable enough to undergo an ultrasound examination and those that do have to be considered an obstetric emergency; this requires rapid assessment while in the ultrasound department. One of the most important undertakings of the ultrasound scan is to establish viability of the fetus and give the doctor some idea of the size / gestational age if this is unknown (such as with an unbooked patient). This is because usually there is fetal demise in this scenario and if the fetus is still viable it must be delivered immediately. [Woods, 1993:4/4]. The ultrasound features of an abruptio placenta show the placenta as an ill defined, echogenic, retro placental collection causing the placenta to appear thickened and inhomogeneous. [Spirt, 1996:198].

Abruptio placenta is almost always the cause of an antepartum haemorrhage with fetal distress and often fetal death. [Woods, 1993: 4/3]. The hypovolaemia can lead to shock and to renal shutdown in severe cases it can result in maternal death. [Chamberlain, 1992: 220]. The patient is usually in severe abdominal pain with the uterus being tonically contracted and hard. [Woods, 1993,4/5].

1.2.3 Preterm Labour.

A preterm infant is one that has completed less than 37 weeks gestational age. [Dirckx, CD ROM 1997]. Preterm labour is when there are regular uterine contractions before 37 weeks of pregnancy, together with cervical dilatation and or rupture of membranes. [Woods, 1993:5/1].

In this study the statistics show that out of the 1090 patients who came for ultrasound scans only 2.2% where sent because of known GPH or pre-eclampsia. Dahnert quotes the incidence to be 5% of pregnancies. [1993: 643]. As these scans were carried out at a secondary health centre the majority of the patients with GPH were probably transferred to be treated at a tertiary centre, hence the low figures.

2 Intrauterine Growth Retardation. [IUGR].

IUGR is said to be the process that results in the fetus being born with a weight below the 10^{th} percentile for gestational age. It is not usually detectable before 32-34 weeks gestation. [Dahnert, 1993:638]. Chamberlain et al feels that IUGR has no useful definition and is thought that it is present in the presence of a pathology that is slowing fetal growth, if the pathology were to be removed there would be a resumption of normal fetal growth. [1992:48]. It is difficult to determine whether a baby has truly suffered from IUGR.

IUGR is one of the more commonly recognised abnormal fetal conditions; it occurs in 5-10% of pregnancies and is thought to be a factor in 26% of stillbirths. [Manning, 1995:517]. When confirmed to be present it will increase the perinatal mortality and morbidity. [Manning, 1995:517]. It is also thought that IUGR increases the risk of asphyxia, polycythemia, hypoglycemia, they are prone to meconium aspirations and long term development problems. [Queenan, 1994:402]. However if recognised early the adverse affects can often be minimised. With this in mind it is important to recognise the value of the accurate diagnosis of IUGR. Ultrasound can help by allowing the clinician an inside view of the uterus by supplying many ultrasound facts pertinent to the fetus and uterine surroundings.

Normal fetal growth is if the estimated fetal weight is within the expected range for the gestational age. It is said to be abnormal if the assessed weight is greater or less than expected. The most *common cause* for an incorrect assessment of fetal weight is incorrect menstrual dates. [Woods, 1993: 2/1].

IUGR is divided into symmetrical and asymmetrical depending on the time of the onset of the growth inhibition. If IUGR is thought to begin early in pregnancy i.e. in the first or early second trimester then the fetus appears small but normally proportioned. However when it occurs later in pregnancy then asymmetrical IUGR becomes evident. [Patrick, 1995:271]. Asymmetrical IUGR is characterised by brain sparing at the expense of the fetal skeleton, soft tissues and internal organs. It is particularly evident in the liver, which is small. [Patrick, 1995:271]. A more or less normal sized skull but a small fetal trunk shows this. [Sanders, 1991:119].

2.1. Factors Influencing IUGR.

The factors that are associated with IUGR can be divided into fetal and maternal. When concerned about IUGR it is important to be aware of both factors and investigate where possible, ultrasound can help in this regard to rule out or confirm a clinical finding.

2.1.1 Maternal Factors.

- low maternal weight.
- tobacco smoking.
- excessive alcohol intake.
- strenuous physical work.
- poor socio-economic conditions.
- preeclampsia and chronic hypertension.

2.1.2 Fetal Factors.

- multiple pregnancies.
- chromosomal abnormalities e.g. Trisomy 21.
- severe congenital malformations.
- chronic intrauterine infections e.g. syphilis. [Woods, 1993:2/2].

2.2 The Role of Ultrasound in IUGR.

IUGR is notoriously difficult to identify and diagnose. Signs of IUGR are often seldom evident until well into the second trimester. [Patrick, 1995:271]. It is essential to try and make the diagnosis of IUGR to help limit the problems with an increased risk at delivery and possible stunted growth and intellect at a later age. [Sanders, 1991:120]. As the diagnosis of IUGR can often result in intervention [Manning, 1996:518] it is essential for the ultrasonographer and the obstetrician to understand the findings that can point to IUGR. In cases of severe IUGR there is the possibility of intra-uterine death; delivery in cases of severe IUGR is always an option if the size / gestational age indicate viability. [Woods, 1993:2/5]. One of the common ways that a patient will enter the ultrasound department for possible IUGR is when there is a discrepancy between gestational age and uterine size. Undoubtedly one of the factors that ultrasound can help to accurately establish is the gestational age. [Manning, 1996:523]. This is essential especially with symmetrical IUGR as if gestational age is underestimated then this disease will be missed. Early gestational ultrasound will help to alleviate this problem. [Queenan, 1994:406].

Once IUGR is suspected one of the important factors to help with diagnosis and monitoring is to try to assess the fetal weight.

This can be done using three methods: -

- measure the uterine size
- palpate the fetal head and body on abdominal examination
- to assess the size of the fetus using *antenatal ultrasound.*

[Woods, 1993:2/4].

In this study one of the more common reasons for sending the patient for as ultrasound scan was to establish a gestational age. The frequency was 24%, and while not all these patients were suspected as suffering from IUGR it is still essential for the obstetrician to be able to establish an accurate gestation age. The frequency for known growth scans was 15.5%.

The gestational age of the fetus is paramount, as the weight percentiles are calculated with reference to the gestational age. Fetal age is determined by fetal morphometrics. [Manning, 1996, 518]. For this reason an accurate gestational age is very important. The easiest way to establish accurate gestational ageing is with an early ultrasound scan i.e. in the first or early second trimester. As already mentioned incorrect menstrual dates are the most common cause for suspected IUGR. A routine early ultrasound for patients who are at risk for IUGR such as those mentioned above (see 2.1 and 2.2) would help to establish a correct gestational age making the diagnosis of IUGR easier later in pregnancy.

As IUGR is associated with some congenital abnormalities an ultrasound scan is important to help rule out any fetal abnormalities. [Woods.1993 2/5].

At this ultrasound department regular serial ultrasounds are carried out on patients who the obstetricians feel are at risk, such as a heavy smoker. Clinical indications such as reduced fundal height, little or no weight gain of the mother, reduced fetal movement, etc, suggest possible

IUGR and these conditions would require regular ultrasound scans. The results of the measurements carried out on the fetus are matched with the appropriate gestational age and plotted on the relevant graphs. The 95th and the 5th percentile are marked on the graph and the measurement is plotted relevant to these values. If the measurement falls below the 5th-10th percentile for the correct gestational age then IUGR can be considered. [Dahnert, 1993:639]. Other ultrasound pointers, which help to assess a patient for IUGR, are the EFW (estimated fetal weight); this is usually part of routine measurements carried out during an ultrasound scan. The HC: AC ratio is above the 95th percentile, with asymmetrical IUGR the FL: AC will also be raised. The amniotic fluid is reduced and the placenta has a grade III Granum placenta. [Dahnert, 1993: 638]. If Doppler facilities are available this can be a helpful indicator. The RI [resistive index] of the uterine artery is usually measured and recorded weekly. [Chamberlain 1992: 59]. There are a number of measurements that can be carried out but as this secondary institute does not have Doppler it was not considered in this study.

The accurate diagnosis and management of IUGR can reduce the mortality and morbidity associated with this disease. [Manning, 1996:523]. The ultrasound department's accurate scanning and recording of measurements, together with the clinical assessment, can help the patient to overcome the problems associated with IUGR.

2.2.1 Placental Morphology

During pregnancy the appearance of the placenta on ultrasound changes. In early second trimester the placenta has a fine, echogenic pattern with a well-defined chorionic plate. Gradual changes occur during pregnancy and these may include undulations in the chorionic plate, calcifications, sonolucent areas that represent venus sinuses. [Reece et al, 1994:209]. The changes in the placenta have been graded according to the degree of change. This is called the Grannum classification and is divided into four grades: -

- Grade 0: The placenta is homogeneous and smooth, with a smooth, straight line of chorionic plate.
- Grade I: The placenta is less homogeneous with scattered bright placental echoes. The chorionic plate has subtle undulations. The basal layer is still devoid of densities.
- Grade II: The placenta has randomly dispersed echogenic densities. The basal layer shows bright linear echoes parallel to the basal plate. The chorionic plate becomes more indented and there may be comma-like extensions into the body of the placenta, but they do not reach all the way to the basal plate.
- Grade III: The extensions from the chorionic plate reach all the way to the basal plate effectively dividing the placenta into cotyledons. There must be at least two these extensions to constitute a grade III placenta. The centre of the cotyledons can often have sonolucent or fall out areas. The basal plate echogenicities persist and can increase.
  - [Reece et al, 1994:209].

Grade 0 placentas are usually seen less than 30 weeks gestation, while grade I can be seen any time during pregnancy. Grade II is seldom seen in gestations less that 32 weeks and grade III rarely seen at less than 34 weeks. [Dahnert, 1993:624].

The texture of the placenta of a fetus with IUGR may differ from a normal placenta of the same gestational age. Premature aging of the placenta occurs with IUGR, and this can be helpful for the sonographer when there is no accurate dating available. [Queenan, 1994:408]. The ultrasound report often contains a comment on the maturity of the placenta to help the clinician with diagnosing IUGR.

2.2.2 Amniotic Fluid.

The amount of amniotic fluid is also helpful when assessing a fetus for IUGR. Both polyhydramnios and oligohydramnios may occur in IUGR but oligohydramnios is far more common. [Queenan, 1994: 408]. In second and third trimester (when IUGR is more common) the majority of the amniotic fluid is produced by fetal urine, fetal lungs and the amniotic membrane. In IUGR there is 'brain sparing' when blood is diverted from the abdomen to the brain, hence there is reduced renal perfusion and decreased urine output. [Dahnert, 1993:612].

At this secondary institute the amniotic fluid index [AFI] is used, this is determined by adding together the vertical pockets of the four quadrants of the uterus. Oligohydramnios can be diagnosed if the AFI less than 5, and polyhydramnios is when the AFI is greater than 25. [Dahnert, 1993:612]. Personal experience at a secondary institute found that if a AFI was found of less than 10 it could be helpful to recall the patient within three weeks to check the AFI and do a follow up growth scan. An incidental finding of oligohydramnios was always referred to the clinician in an attempt to establish the cause. A deviant growth pattern along with a decreased AFI can suggest IUGR. Some other causes of oligohydramnios in which ultrasound can help are : -

- Fetal demise
- Renal abnormalities of the fetus
- Premature rupture of membranes
- Post dates i.e. a mature fetus

[Dahnert, 1993:638]

It was established during this study that the evaluation of AFI was the most common reason to send a patient for ultrasound the frequency being 28.6%. This illustrates how important the evaluation of AFI is to the referring doctors. Ultrasound is one way to accurately monitor and assess the liquor.

2.2.3 Ancillary Ultrasound Features of IUGR

These 'soft' signs of IUGR are difficult to identify and the more experienced the sonographer the easier it is to comment on these features. The assessment of fetal fat layers can be useful. After 24 weeks there is normally an echolucent layer of fat seen subcutaneous, this is best assessed posterior to the fetal neck, the fetal thigh and fetal scalp. In a growth retarded fetus these layers are often diminished or missing. The fat layers can be measured but most authors feel subjective assessment by an experienced sonographer is as useful. [Manning, 1996:530].

The use of fetal echocardiography in the diagnosis of IUGR is equivocal. Manning quotes de Vore as describing right sided dilatation as a finding in fetuses with asymmetrical IUGR. [Manning, 1996:531]. As fetal echocardiography is a subspecialty of obstetric ultrasound, these findings are perhaps difficult to perceive in the primary and secondary health care setting and is and should perhaps be reserved for tertiary health care.

3 Breech Presentation and other Presentations.

Breech presentation is the presentation of any part of the pelvic extremity of the fetus, the buttocks, knees, or feet. Frank breech presentation occurs when the fetus presents by the pelvic extremity; the thighs may be flexed and the legs extended over the anterior surfaces of the body; in full breech presentation, the thighs may be flexed on the abdomen and the legs upon the thighs. In a footling presentation, the feet may be the lowest part; in an incomplete foot presentation, incomplete knee presentation, one leg may retain the position which is typical of one of the above-mentioned presentations, while the other foot or knee may present. [Dirckx, CD ROM 1997].

Cephalic presentation, also known as a vertex presentation, is when the head is the presenting part in the cervical region. This is the most common presentation and regarded as a normal presentation. [Sanders, 1991:95]. Another malpresentation is a shoulder presentation, this is a transverse lie when the fetal trunk and head are at the same level and the fetal shoulder presents. [Sanders, 1993: 95]. This occurs in 0.3% of all deliveries. [Chamberlain, 1992: 158].

Breech presentation is seen 2-3% of all labours. It is more frequently seen in preterm deliveries. Breech presentation can occur in about 25% of pregnancies before 32 weeks but often corrects itself before the fetus reaches term. [Chamberlain: 1992:154]. Some of the causes of a breech are: -

- Increased ratio of amniotic fluid to fetal size, this allows for freer movement.
- Extended legs prevent flexion of the fetal trunk so preventing turning of the fetus.
- Multiple fetuses [e.g. twins]. can interfere with each other's movements.
- Something such as a placental praevia or fibroids may be filling the lower segment.
- Fetal malformations such as hydrocephalus will prevent the fetus from turning and presenting cephalically.

[Chamberlain, 1992: 154].

The diagnosis of a breech presentation is often suspected clinically when the obstetrician cannot feel the head in the lower section. If the patient is in labour a vaginal examination will confirm there is no head in the pelvis. Otherwise the only way to be absolutely sure it is a breech presentation is with an ultrasound scan (an x-ray would also confirm but not considered an option if ultrasound is available). [Chamberlain, 1992:157].

3.1 The Role of Ultrasound in the breech presentation.

As already stated, one-way to be absolutely sure of the position of the fetus is with an ultrasound scan. Often the doctor is confident that the fetus is a breech presentation but the problem then comes as to reason for the malpresentation. Ultrasound can often answer this question as well as confirm that it is a breech presentation. What is also important is to try and give an idea of the type of breech, such as a footling breech or an extended breech. This is essential for patient management as the position of the fetus can influence the decision as to whether or not a caesarean section is required and therefore a transfer to secondary or tertiary health care.

From about 33weeks gestation some authors feel an ECV (external cephalic version) is worthwhile trying. [Chamberlain, 1992:155]. Ultrasound plays a role prior to an attempt to perform an ECV. It is important to give an ultrasound estimate of fetal size and the amount of liquor present. If the liquor is too reduced it will prevent the fetus from turning easily. If the estimated ultrasound fetal age or size is thought to be greater than 38 weeks gestation then the probability of a breech delivery must be considered. [Chamberlain, 1992: 156]. After the completion of an attempted ECV a repeat ultrasound will confirm the present fetal presentation and assure the mother of continued fetal viability.

Ultrasound also plays an important role in diagnosing possible reasons for the breech presentation, such as undiagnosed twins, fetal abnormalities and - one of the most important - the presence of placenta praevia. [Chamberlain, 1992:156]. The ultrasonographer should be alerted as soon as she notes the breech presentation to try and assess the scan for the reason for the malpresentation. It is essential for patient management to prepare for possible multiple births or for problems more sinister such as a placenta praevia. Placenta praevia can be life threatening to both the fetus and the mother.

There are a number of risks to the fetus in a breech delivery; prenatal mortality is increased by two or three times. [Chamberlain, 1992:158]. One third of the deaths of breech deliveries are a result of prematurity. Hypoxia can also be a problem with too slow delivery of the head and if the head is delivered too quickly there is the risk of intracranial damage e.g. a subdural haematoma [Chamberlain, 1992:158]. A caesarean section is considered if vaginal delivery is thought too hazardous and again ultrasound is important to assess the fetus for size, abnormalities etc. It is essential for the ultrasonographer to present the obstetrician with as much accurate information as possible, which will help with the patient management and possible transfer from primary or secondary to tertiary health care.

This study divided the possible abnormal presentation as a reason for the ultrasound scan between 'position' and 'lie'. The frequency with which these occurred was 5.8% and 5.3% respectively, this makes the total for possible abnormal presentation to be 120 patients (11.1%, n=1090). Ultrasound confirmed an abnormal presentation in 28 patients (23% n=120). However, ultrasound was also responsible for the unexpected diagnosis of an abnormal presentation in 229 patients (21.1%, n=1090).

A diagnosed breech that has had antenatal care has a better maternal outcome than an undiagnosed breech. [Cockburn et al, 1994: 156] With good care in the clinic and ultrasound performing a role in the patient management the result for the breech presentation is good.

4 Multiple Pregnancies.

A multiple pregnancy is a condition of bearing two or more fetuses simultaneously. [Dirckx, CD ROM 1997]. Multiple pregnancies are considered rare but do vary with racial groups. They are considered for example to be more common in West Africa than in Europe. [Chamberlain, 1992:196]. With the increased use of ovulation induction agents and with the increasing maternal age at the time of conception, this has increased the occurrence of multiple pregnancies. [Cullinan, 1996:547].

Dahnert quotes the incidence of multiple gestations to be 1% of all pregnancies and 5%-50% of them are undiagnosed at term. [1993:624]. Perinatal mortality in multiple births is at least twice that for singletons. With active attention to detail and serial ultrasound scans success can be attained in managing multiple gestations [O'Grady, 1994:433].

Twins are divided into monozygotic and dizygotic. Monozygotic are what are sometimes called 'identical twins' and account for +/- 30% of twins. It is when a single fertilized ovum divides and 2 fetuses result. Monozygotic are further divided into

- Dichorionic diamniotic (separation occurs at +/- 60 hours after fertilization).
- Monochorionic diamniotic, this is the most common. (Separation occurs between the 4^{th} –8^{th} days after fertilization).
- Monochorionic monoamniotic (separation occurs between the 8^{th} – 13^{th} after fertilization.)

[Dahnert, 1993:625].

Dizygotic twins, fraternal twins or 'non identical' twins occur when there is separate fertilization of two ovum by two separate spermatozoa. Dizygotic twins account for about 70% of all the twin pregnancies. The incidence of dizygotic twins is influenced by: -

- Use of ovulation stimulating agents
- Advanced maternal age
- Maternal history of twinning
- Increased parity
- Maternal obesity
- Race [more common in black races].

[Dahnert, 1993:626].

4.1 The Role of Ultrasound in Multiple Pregnancies.

The importance of the ultrasound scan in the evaluation of possible multiple pregnancies cannot be understated. The high incidence 5-50% [Dahnert, 1993:625] of undiagnosed twins at term coupled with the increase in problems that can be identified on ultrasound associated with twin pregnancies high lights this importance. Once the diagnosis of a multiple gestation is made, ultrasound continues to play a very important part in the management of these pregnancies. In late gestation ultrasound is important to assess the size, position and lie of the fetuses to help prepare and plan the best mode of delivery for the patient. Clinically the patient often presents with her pregnancy appearing more advanced than the dates. As one of the most common reasons for this is incorrect dates ultrasound is the only way to rule this out and identify a multiple pregnancy. Other reasons for a uterus too large for dates could be polyhydramnios, a large fetus, and an additional mass to the uterus (such as a fibroid) and a possible large placenta. [Sanders, 1991:124]. Ultrasound can help in identifying or ruling out these situations. Some patients who are thought to be at greater 'risk' of a multiple gestation can be screened with a routine early (within the first trimester) ultrasound to rule out or confirm possible multiple gestations. Those patients are: -

- If the patient has a family history (especially maternal) of dizygotic twins
- A past obstetric history of twins
- Hyperemesis in early pregnancy.

[Chamberlain, 1992:1999].

Into this group of patients sometimes fall the molar pregnancies, often presenting clinically with an enlarged uterus, hyperemesis gravidarum and hypertension. These are clinical features that can suggest a possible multiple gestations too. Ultrasound is valuable in identifying a hydatidiform mole. This is when the pregnancy is marked by a neoplasm within the uterus, whereby part or all of the chorionic villi are converted into a mass of clear vesicles. [Dirckx, CD ROM 1997]. This is a diagnosis that can be made on ultrasound with the classical appearance of a hydatidiform mole easy to identify. The multiple micro cysts are seen within the uterine cavity and there is often enhancement and shadowing seen posterior to the uterus. [V/D Westhuizen, 1994:166].

Once a multiple gestation is confirmed the staff involved with the patient can be alerted to be extra vigilant for problems associated with this condition. A condition called the vanishing twin syndrome occurs when one twin in a multiple gestation fails to develop and is absorbed. [Chamberlain,1992:199].

A common condition amongst twins is IUGR and is identified in 25% of twin gestations. This is ten times higher than in singleton pregnancies. [Cullinan, 1996:547]. For this reason twins should be scanned every three to four weeks after 28 weeks gestation. [Dahnert: 1993:626] This is one reason why it is helpful for the patient to attend a clinic with ultrasound facilities available and ultrasonographers experienced at identifying growth-related problems. Up until 30-32 weeks gestation the growth of the individual twins are similar to that of a singleton, thereafter the weight gain of both twins will equal that of the singleton pregnancy. [Dahnert: 1993:626]. This is the time period that serial ultrasound scans can help to identify possible IUGR of one or both twins. At this secondary institute, this is the policy followed when twins are identified. Serial growth scans of twins can also help to identify discordant growth between the fetuses. This is when at birth the weight difference between the neonates is greater that 25%. There are two causes; IUGR of one fetus and the presence of twin-to-twin transfusion syndrome. [Dahnert, 1993:626] It has already been discussed how ultrasound can both play a role in identifying and monitoring IUGR.

Twin-to-twin transfusion syndrome is when there is direct vascular anastomosis, arterial or venous, between the placental circulation of twins. [Dirckx, CD ROM 1997]. This occurs in monochrionic diamniotic twins. They have separate amniotic sacs but a common chorionic sac. There are 100% vascular communications in common monochorionic placentas [Dahnert, 1995:625]. In twin-to-twin transfusion syndrome one twin grows at the expense of the other and asymmetrical growth occurs. [Sanders,1991:126]. The donor fetus is small and anaemic while the larger or recipient is polycythemic and has normal or increased weight (for GA). [Cullinan, 1996:557]. On ultrasound the smaller fetus has features of IUGR while the larger twin can develop fetal ascites (due to early cardiac failure), pleural and pericardial effusions. Polyhydramnios occurs with the large twin and oligohydramnios is present with the small twin. [Sanders, 1991:126]. It is essential to document these features when seen on ultrasound so as to help diagnosis and the management of this syndrome. Just the presence of discordant growth is not sufficient to diagnose twin-to-twin transfusion syndrome but must be considered in the presence of polyhydramnios with the bigger fetus. [Cullinan, 1996:559].

There is a small subdivision of this called the 'stuck twin' syndrome. The 'stuck twin' is the smaller one and has little or no amniotic fluid and appears not to move. It can be difficult to see the surrounding membrane. It appears stuck in a position relative to the uterus. [Cullinan, 1996:557]. Some authors feel it is fatal unless recognised by ultrasound so that intervention can occur. Liquor is aspirated from the sac with polyhydramnios to relieve the pressure on the 'stuck twin'. [Sanders,1991:126].

Multiple pregnancies can be very difficult to identify on ultrasound so a comprehensive real-time survey must be carried out on the entire uterus. Ideally an ultrasound during the first trimester is helpful to identify zygoticty and ensure accurate dates. A standard routine ultrasound at 18-22 weeks is essential (particularly if a first trimester scan is not available) to confirm a viable multiple pregnancy, establish baseline for growth and the number of placentas and their position. An idea of zygoticty is also helpful.

Diamniotic dizygotic twins can be distinguished on ultrasound if –

- The fetuses are different sexes.
- Two placentas are noted (provided a succenturiate lobe is not present.)
- The membrane that separates the two amniotic cavities has at least 3 components, this can be very difficult to be sure of on ultrasound.

Monozygotic diamniotic twins will probably be present if-

- A single placenta is present.
- 2 or less membranes are seen separating the amniotic cavities.
- The fetuses are of the same sex.

[Sanders, 1991:125]

It is easy on ultrasound to call a single placenta to support monozygotic diamniotic twins when in fact it is a dichorionic pregnancy with a fused placenta.[Dahnert, 1993:624]. This is sometimes easier to tell early in pregnancy and supports a first trimester scan for possible twins.

Multiple pregnancies may be twins (1 in 85), triplets (1 in 7600) or quadruplets (1 in 70 000). [Dahnert, 1993:625]. Congenital abnormalities are twice as common in multiple births than in singleton. [O'Grady, 1994:435]. This must always be considered when scanning twins and certain anomalies such as anacephalus and hydranencephalus are commoner in twins. [Sanders,1991:126]. With the confirmation of a multiple gestation the patient is usually prepared to be transferred from a primary health centre to a secondary health centre (or to a tertiary centre, if warranted) from about 28 – 32 weeks gestation or earlier if there are problems with the mother or fetus.

Multiple gestations are at greater risk for some complications than singleton pregnancies. There is a greater risk of an APH (ante partum haemorrhage) due to placenta praevia or abruptio placenta. Polyhydramnios is common, 10 time more so in monozygotic twins. 50% of multiple pregnancies will experience preterm labour before 37 weeks and preeclampsia is 3 times more common than singleton pregnancies. [Chamberlain, 1992:199]. While ultrasound cannot always identify the exact risk, pointers and often a diagnosis can be made with the help of ultrasound.

Conjoined twins are rare and occur in 1:50000 – 1:100000 pregnancies, there is a 70-75% mortality at birth or within the first 24 hours. [Cullinan, 1996:555]. This occurs in monochorionic monoamniotic twins and ultrasound is very important in diagnosing this condition. This can be very difficult as the fetuses assume peculiar positions often with hyper-extended spines and intertwined limbs. [Cullinan, 1996:556]. The important features the sonographer is to be aware of are that the fetus are inseparable, the fetal skin contour is difficult to identify, there are more than three vessels in the uterine artery and the fetuses are often in a breech position. [Cullinan, 1996:556]. Ideally this sort of patient would be immediately transferred to tertiary care and the sonographer can help be giving as much information as possible to the attending doctor in an attempt at the classification e.g. thoracopagus ('face to face' fusion), viability and position of the fetuses can be helpful whilst the patient awaits transfer.

The frequency, in which multiple pregnancies were the reason for the ultrasound in this study, was 80 patients (7.3%,n=1090). In the results it was found that ultrasound diagnosed 79 multiple pregnancies (7.2%n=1090) altogether. Dahnert quotes twins to be 1% of all births [1993:638]; these higher figures are probably due to the fact that this secondary centre is a referral centre for twins thereby skewing the results.

5 Placenta Praevia.

This is a condition in which the placenta is implanted in the lower segment of the uterus, extending to the margin of the internal os of the cervix or partially or completely obstructing the internal os. [Dirckx, CD ROM 1997]. When the lower segment starts to form or the cervix begins to dilate, the lower edge of the placenta becomes partially separated, causing the bleeding. [Woods, 1993:4/6]. Placenta praevia starts with the abnormally low implantation of the ovum and occurs in about 0.5% of all deliveries. [Dahnert, 1993:642]. It is more commonly seen in patients: -

- Who have a previous uterine scar from an operation such as a caesarean section or a myomectomy
- Older women.
- Multiparous women. [Dahnert, 1993:643].

The patient usually presents with painless vaginal bleeding, the blood is bright red and fetal movements are present. This usually occurs in third trimester (around 34 weeks) when the lower segment begins to form, [Woods, 1993:4/7] but can occur as early as 20 weeks. [Dahnert, 1993:643]. Clinically the uterus is not tender and is soft, the opposite of an abruptio placenta. It is important to stabilise the patient and often the sonographer will be called to labour ward to perform a 'mobile' ultrasound depending on the condition of the patient. Placenta praevia is potentionally fatal to both the mother and fetus and must be treated as an emergency. An effort should be made to ensure that such a patient should not be kept waiting in the ultrasound department and the scan is carried out as efficiently as possible.

5.1 The Role of Ultrasound in Placenta Praevia.

The diagnosis of placenta praevia is often suspected from the clinical examination and the history given by the patient, however, ultrasound is important to confirm or rule out this diagnosis, especially as the confirmation will have a huge impact on patient management. [Woods, 1993:4/7]. If suspected, an ultrasound scan should be performed as soon as possible. [Chamberlain, 1992:78]. The patient must be transferred to a secondary or tertiary care where there are Caesarean section facilities available. Once the bleeding has stopped a routine ultrasound must be carried out in order to localise the position of the placenta and also of importance give an idea of fetal age / size. This is significant because of the possibility of a pending caesarean section.

The placenta praevia can be graded on ultrasound as to the position of the placenta with relation to the os.

- Grade I – a low-lying placenta, within 3cm of the os. This is not a placenta praevia.
- Grade II – marginal, when the placental edge is impinging on the os.
- Grade III – partial, when the placental edge is partially covering the os.
- Grade IV – complete, when the placenta completely covers the os.

[Sanders, 1991:112].

On ultrasound some authors feel there are just 2 classifications: -

- Minor – the equivalent of Grade I and II
- Major- the equivalent of Grade III and IV

[Chamberlain, 1992:76].

When carrying out an ultrasound examination of the placenta it is important to visualise both edges of the placenta and their position relevant to the internal os. This is easier with an anterior placenta as the fetus does not obstruct (cause shadowing) of the ultrasound beam. As already mentioned the ultrasonographer should always be alerted with an abnormal presentation, as placenta praevia can be the cause.

Placenta praevias are overcalled with a false positive rate of 5-7%. [Dahnert, 1993:643]. This is due to:

- migration of the placenta.
- overfilled urinary bladder.
- focal myometrium contraction.

5.1.1 Migration of the Placenta.

This is a term used to describe the apparent change of position of the placenta during pregnancy, from a low-lying position to a position that is well clear of the os. [Sanders, 1991:109]. This is due to the differential growth rates of the lower uterine segment and the placenta [Dahnert: 1993:642].

5.1.2 Overfilled urinary Bladder.

It is often helpful when scanning for placenta praevia to have some fluid in the bladder to help identify the internal os. This however can also prove a pitfall if the bladder is overfull as it can suggest a praevia because the anterior wall is compressed against the posterior wall. [Sanders, 1991:116]. This must also be remembered when doing routine scans at any gestation, as it is often the cause for the overcalling of placenta praevia and easily rectified by voiding the bladder. [Spirt, 1996:199].

5.1.3 Focal Myometrium Contraction.

This is when the myometrial thickness exceeds 1.5cm in the region of the lower segment. [Dahnert, 1993:643]. Waiting for the contraction to subside easily rectifies this.

While the false positive diagnosis is more common it is more devastating for the patient if a false negative diagnosis of placenta praevia is called, (+/- 2% on ultrasound) [Dahnert, 1993:643]. This is because placenta praevia is potentially fatal for both the fetus and the mother. The reasons for calling a false negative are mostly scanning related i.e. not identifying the placental edge or not being able to visualise it in relation to the os. Often shadowing from the fetal head

will obscure a low-lying posterior placental edge, or if the placenta is lateral. [Dahnert, 1993:643]. Both these can be rectified by altering the position of the patient e.g. trendelenburg position or by using oblique scans. It cannot be stressed how important it is for the ultrasonographer to be absolutely sure of the placental position. If the placental edge and the os cannot be identified then translabia sonography can be tried. [Spirt, 1996:200]. Transvaginal ultrasound can also be carried out but someone with experience of tranvaginal scanning for placenta praevia should do this, as it too is potentially harmful as it can initiate bleeding. [Chamberlain 1992:78]. Vaginal sonography is particularly useful in differentiating between a marginal (grade 2) and a partial (grade 3) placenta praevia. [Lockwood, 1994:485].

If a woman has bled during her pregnancy and the cause is proved to be placenta praevia, the patient often has to remain in hospital until delivery. [Chamberlain, 1992:78]. The patients will usually be at a secondary or tertiary hospital where there is ultrasound available to easily assist with the monitoring of both the fetus and the placenta. At about 38weeks a final ultrasound is done and a decision taken as to the grade of the placenta and if it is safe enough to wait for the woman to go into labour and deliver vaginally. [Chamberlain, 1002:78].

Due to placental migration many 'low-lying' placentas are called at an early ultrasound scan and it is essential to have a follow up scan of these patients. About 5% of patients will have an 'early low' placenta at 16-20 weeks gestation, while at delivery only about 0.5% are found to have placenta praevia. [Chamberlain, 1992:77]. The majority of the patients therefore will have placental migration. It is the ultrasound department's responsibility to ensure the 'early low' placentas are followed up with repeat scans at 28-32 weeks gestation. By 34 weeks if it is still low the patient should be recalled every 2 weeks to review the placental edge and the fetus. [Chamberlain, 1992:77]. If the placenta praevia is deemed severe enough but the patient remains asymptomatic i.e. no vaginal bleeding then an elective caesar can be planned, however, if bleeding occurs it is often necessary to do an emergency Caesar.

In most of the first world countries today maternal death due to placenta praevia is rare, however this is not the case in the developing world where facilities such as ultrasound are few and far between. The major cause of death with these patients is haemorrhage either antepartum or postpartum. [Chamberlain, 1992:79]. For the fetus the main risk is the age /size of the fetus when the incident occurs that requires delivery i.e. pre-term disease if the fetus is not mature enough when it becomes necessary to deliver the fetus. [Chamberlain, 1992:79]. The WHO Safe Motherhood Initiative (SMI) globally hoped to reduce maternal deaths by at least half by the year 2000. [Anonymous, 1992:12] As ultrasound is fundamental in the antenatal diagnosis of placental praevia, certainly in developing countries, it could help the SMI achieve this goal.

Section III

Additional Considerations.

There are a number of situations, which may not classify the patient as high risk but in need of more attentive care in the clinic. This could necessitate the possible transfer to a secondary or tertiary health care centre. A patient with a previous Caesar is such a case. This patient should be prepared for her antenatal care in the third trimester to be carried out at a secondary centre. There she can be evaluated for a repeat Caesar or possible trial of labour.

This study did not address fetal abnormalities as an issue in isolation. However, fetal anomalies play a big role in any obstetric scanning department so they cannot be ignored. Fortunately in the ultrasound department at this secondary heath centre there are very good referral lines open for the ultrasonographer to follow. A fetal abnormality is seldom followed up at the secondary centre as they are referred to the fetal / maternal medicine clinic at the tertiary heath centre. By virtue of this statement we can say that any possible fetal anomaly identified is labelled as 'high risk' and referred to a tertiary centre. From the tertiary centre it can be referred back to secondary or primary heath care or remain at the tertiary centre depending on the type or severity of the abnormality.

1. Previous Caesarean Section.

A Caesarean section is the delivery of the fetus by surgical means through the abdominal wall. [Chamberlain, 1992:191] Chamberlain quotes that the frequency of Caesarean sections in the United Kingdom is about 5-15%. Today the risk of the mother dying during the operation is small. [Quilligan, 1994: 521]. The indications for the Caesarean section vary with the most common being disproportion, fetal distress, pre-eclampsia and placenta praevia. Other reasons are disorderly uterine action, malpresentations and previous Caesar. Previous Caesar represents about 10% of the Caesarean sections done. [Chamberlain, 1992:191] The main worry of a patient who has undergone a previous Caesar is the possibility of uterine rupture if allowed to enter into active labour. With the widespread use of the low transverse incision as opposed to the classical Caesarean section, the risk of rupture has been reduced. [Quilligan, 1994:521] In the cases where it is still seen it is usually associated with poor obstetric management. Some obstetricians feel that those patients who have had a previous Caesar and have no reason for a repeat Caesar are good candidates for trial of labour. [Quilligan, 1994:522] This should always be carried out at a secondary or tertiary centre so that an emergency Caesarean section can be done if necessary. It should be remembered that the incidence of uterine rupture increases with increasing parity. [O'Connor et al, 1993:31] The upper section of a uterine scar can rupture during pregnancy whilst the lower section usually only ruptures in labour. [Mohamed, 1987:194] Rupture of the gravid uterus remains uncommon but can be a major obstetric emergency. Prevention of this happening in the group of patients with previous Caesars begins at all levels of health care. [Mohamed, 1987:194]. In the next pregnancy the patient should be encouraged to book early and be educated as to understanding what her history can lead to. Ultrasound can help in accurately establishing a gestational age early in pregnancy and help in estimating a fetal size nearer the time of delivery. Gestational age is important if an elective Caesar is planned to avoid iatrogenic

prematurity. Unfortunately there are instances when premature infants are delivered by repeat elective Caesar.[Quilligan, 1994:522] Ultrasound can help to limit these cases.

2. Fetal Abnormality

Fetal and maternal medicine has been part of antenatal medicine since the beginning of the last century. From that time one of antenatal medicines' main objectives was the diagnosis of monsters before birth. [Chamberlain, 1990: 1] With the advent of ultrasound the potential for prenatal diagnosis of fetal abnormalities has increased dramatically especially over the last decade. Invasive procedures such as amniocentesis can be directed at those patients considered at risk, such as increased maternal age and family history. It must be remembered that the majority of fetal abnormalities are unexpected. [Whittle, 1995:30]. Major structural pathology is detectable in about 2%-3% of newborns. Of these 20-30% will result in perinatal death. [Wladimiroff, 1996: 116].

A congenital abnormality is a departure from the normal architecture of a system or an organ. Malformations can be considered as the result of developmental arrest of the primordium: incomplete morphogenesis, redundant morhpogenesis or aberrant morphogenesis. [Romero et al, 1996: 343]. (The primordium is an aggregation of cells in the embryo indicating the first trace of an organ or structure. [Dirckx, CD ROM 1997]. A deformation refers to an abnormal form, shape position of part of the body. A disruption is a morphological defect of an organ or part of an organ resulting from a breakdown of normal development. . [Romero et al, 1996: 343]. A syndrome is a pattern of multiple anomalies that are pathogenically linked. [Romero et al, 1996: 346]. It is generally thought that the earlier the malformation is initiated the more complex the anomalies. [Romero et al, 1996:343]. Whilst the aetiology can be divided into two major groups, for the most no obvious cause is identified.

1] Genetic: - Multifactor
- Chromosomal

2] Environmental:
- Infections.
- Hormones.
- Drugs.
- Physical injuries.
- Nutritional deficit.
- Oxygen deficit.

[Chamberlain, 1992:236]

In appendix 1 (see pg 63) the tables for major and minor fetal abnormalities show that these tables are long and detailed. Many of these abnormalities are not visible on ultrasound and are only diagnosed after birth. However ultrasound does have an important role to play in identifying some of the abnormalities.

The Role of Ultrasound in the Diagnosis of Congenital Abnormalities.

Identification of the abnormal is achieved by noting the departure from normal fetal anatomy. There are a number of ultrasound features that can help the ultrasonographer: -
1] the absence of normal anatomical structures.
2] a disruption of shape, outline, location or size.
3] abnormal sonographic texture.
4] presence of an abnormal structure.
5] abnormal fetal biometry.
6] abnormal fetal motion. [Romero et al, 1996: 350].

Important factors which depend on the identification of abnormalities are the sonographers' knowledge of normal fetal anatomy, the natural history of the disorder and an understanding of the ultrasound machine to gain the optimum use from it. [Romero et al, 1996:350].
It is important for the ultrasonographer to understand the ramifications of identifying a potential abnormality. For example an absent fetal urinary bladder can point to a simple empty bladder (post micturition) or something more sinister such as renal agenesis or non-functioning kidneys such as multi-cystic dysplastic kidneys.

The early ultrasound detection of fetal structural anomalies has the potential to reduce perinatal morbidity and mortality. This is done by virtue of the fact that some perinatal or neonatal deaths are converted into elective terminations of pregnancy. So too, by optimising the delivery situation morbidity may be reduced with a major but perhaps non-lethal anomaly. [Wladimiroff, 1996:112]. If possible abnormalities should be identified before 23-24 weeks gestation. This means that if the abnormality is incompatible with normal life a therapeutic abortion can be offered. [Sanders, 1991:133]. The discovery is still important if the abnormality is ascertained later in gestation so that optimal delivery and neonatal care can be arranged. [Sanders, 1991:133]. A therapeutic abortion is not always the choice of the patient. Early detection does allow the patient the full range of options and to prepare physically and emotionally. The level of the sonographer's accuracy for the detection of fetal abnormalities using ultrasound is determined by experience, the quality of the equipment used and the time spent on each examination. [Wladimiroff, 1996:110]. Prenatal diagnosis is a very powerful tool that must be used with caution and knowledge. It must be noted that false positives can cause the parents anxiety and stress. [Boyd et al, 1998:1577]. One potential hazard, which should be considered, is the possible termination of a normal pregnancy. [Chitty et al, 1991:1166]. This is an extreme scenario but illustrates the importance of referral to tertiary centres before acting on ultrasound soft signs without confirmation.

At the National Institutes of Health Consensus Meeting in Washington in 1984, it was stated that 56% of the fetuses detected with fetal abnormalities after 22 weeks gestation had no listed indication for the ultrasound examination. Many of the malformed fetuses are also the first in the family. In one study only 25.8% of the pregnancies had a clinical suggestion of a fetal abnormality. [Rosendahl et al, 1989: Obstet Gyn:73:947]. In many countries a fetal abnormality ultrasound scan is often included as part of a package of routine antenatal care. [Roberts et al, 1998:960].

It was found in this study that there were 45 patients (4.1% n=1090) who were sent for ultrasound because a fetal abnormality was suspected. The ultrasound results showed that there were about 21 patients in which some form of fetal abnormality was suggested at the ultrasound scan. These were not all thought to be severe and some were followed up at the secondary heath centre. The abnormalities that were more severe were sent through to the tertiary centre to the fetal abnormality clinic. There the diagnosis was confirmed and patient management continued. At this clinic the patient can receive the physical and emotional support needed such as genetic counselling, karyotyping, specialist ultrasounds, etc. The ultrasound department also identified four patients who were over 40 years of age and less than 20 weeks gestation. Patients who have these criteria fall into a category, which allows them to have a routine amniocentesis. This is to try and help to identify the fetuses that are at risk from trisomy 21 and other genetic abnormalities, which are associated with increased maternal age. The ultrasound results of these patients did not indicate possible fetal abnormalities but due to the maternal ages these patients were referred to the tertiary heath centre for routine amniocentesis.

Of the 21 patients reported to have some form of abnormality, some were followed up at the secondary centre, such as hydroceles. Mild pylectasis in isolation was usually reviewed with follow-up ultrasounds at the secondary centre. The moderate and severe cases of renal obstruction were referred to the tertiary centre for further management. The cases of ventricularmegaly, cardiac problems or asymmetrical growth in twins were referred immediately to tertiary centre.

2.2 Table 1.

Fetal Abnormalities seen during the study Period. (n=1090)

Urogenital Tract		
Obstructive uropathy	Mild	Moderate –Severe
	3 patients	4 patients (1 with marked Hydronephrosis)
Hydrocele	Bilateral.	Unilateral.
	4 patients	1 patient
Fetal Head		
Hydrocephalus	Mild	Moderate-Severe
	2 patients	1 severe patient
Placenta		
Chorioangioma	1 patient	

Fetal Thorax		
Cardiac		
Pericardial effusion	1 patient	
Bradycardia	1 patient	
Other		
Asymetrical growth in twins	1 patient	
Absent lower limb movement	1 patient	
Thickened tissue noted over sacral area.	1 patient	

2.3 Discussion of the Fetal Abnormalities Seen During this Study Period.

2.3.1. Obstructive Uropathy

Hydronephrosis is when the kidney is obstructed and the collecting systems dilate. [Sanders, 1991:159] There are varying degrees of obstruction. The transverse anteroposterior diameter is usually measured when assessing a dilated renal pelvis. Slight (<5mm) splaying of the pelvis is acceptable as within normal limits. A measurement of between 5mm-10mm is regarded as mild, but requires follow up ultrasound scans. [Sanders, 1991:159] Hydronephrosis is not usually present at this point. At this secondary centre it was perhaps a little over cautious as 8mm was regarded as the cut off for mild obstruction. If a measurement of between 8-10mm was noted it was usually referred so as not to miss possible evolving hydronephrosis. [Benson et al,1996:435]. Between 10-15mm was taken as moderate and greater than 15mm as severe. These measurements are for more than 20 weeks gestation. In all the above cases were the gestation was greater than 20 weeks. It is important to take careful note of the amniotic fluid in these cases as obstructive uropathies are associated with oligohydramnios.

It must be remembered that there is an association of mild hydronephrosis and trisomy 21. Up to one quarter of fetuses with trisomy 21 have mild hydronephrosis in the second trimester. This is compared to only 2-3% of normal fetuses. Isolated hydronephrosis i.e. in the absence of other abnormalities associated with Trisomy 21 reduces the risk to 1 in 340. [Benson et al, 1996:436]

2.3.2. Hydrocele

A hydrocele is when there is a collection of fluid between the layers of the tunica vaginalis in the scrotum. Hydroceles can be associated with ascites but when seen in isolation has little clinical significance. [Benson,1996: 444]

2.3.3. Hydrocephalus

Hydrocephalus is a condition in which there is an excessive accumulation of fluid resulting in dilation of the cerebral ventricles and raised intracranial pressure; may also result in enlargement of the cranium and atrophy of the brain. [Dirckx concise CD ROM].

Hydrocephalus can be classified as: -

1] Aqueductal stenosis (most common)
2] Communicating hydrocephalus
3] Dandy-Walker syndrome.
[Reece et al, 1994: 46]

Hydrocephalus can vary from the very severe where there is virtually no cerebral tissue remaining to mild ventricularmegaly which needs to be detected with measurement. Assessment of the posterior horn is regarded as the most sensitive indicator for diagnosing early hydrocephalus. [Cameron et al, 1995:128] There are different ways to assess the ventricles and at this secondary centre two methods were usually used. The lateral ventricular ratio (VR) and the width of the atrium. The VR changes with gestation. Before 20 weeks gestation the VR can be up to 50% thereafter it decreases to about 33%. [Cameron et al, 1995, 128]. This measurement is not thought accurate by some authors and the width of the atrium is favoured as more sensitive. The atrium width measurement is more or less standard throughout gestation. Between 15-40 weeks gestation a measurement of less than 10mm is regarded as normal. A diameter of greater than 15mm is thought to be severe dilatation. [Pilu et al: 1996:377] The level at which the width is measured is on an axial cut of the head at the point where the choroid plexus (seen as bright and echogenic) fills the lumen of the atrium. [Pilu et al: 1996: 376]

The two cases of mild hydrocephalus with (VR=50%) and atrial diameter =12mm and 13mm respectively, were referred to the tertiary hospital for follow up and patient management. The one case of severe hydrocephalus was associated with a mixed echo mass in the midline and several bright echogenic areas at the periphery of the brain. The ultrasound report from the secondary centre suggested possible intracranial haemorrhage with possible infarction. This patient was referred immediately to the tertiary centre where she was monitored carefully until delivery. The fetus was one of a pair of twins. At delivery the normal twin delivered without incident and the other was still born. At post mortem the diagnosis suggested from the secondary centre was confirmed.

2.3.4. Chorioangioma

This is one of the nontrophoblastic primary tumours of the placenta and is more common than the teratoma. [Spirt, 1996: 182] The chorioangioma is a benign tumour of placental blood vessels (hemangioma), usually of little clinical significance. Large tumours may be associated with placental insufficiency and fetal hydrops. [Dirckx concise CD ROM]. These tumours can vary in size with the large ones protruding into the amniotic cavity. Doppler is useful to demonstrate the vascularity of the lesion and to monitor for possible placental insufficiency. The patient identified at the secondary centre was referred to the tertiary centre for follow up ultrasound scans and Doppler assessments.

2.3.5.Cardiac Abnormalities Identified.

Pericardial Effusion

A pericardial effusion is when there are increased amounts of fluid within the pericardial sac. [Dirckx concise CD ROM]. This may result from any type of cardiac failure. A pericardial effusion is often associated with fetal hydrops. When assessing the fetal heart for a pericardial effusion note that the heart is often enlarged and the lungs are displaced posteriorly. [Sanders, 1991:180]

Bradycardia.

Sinus bradycardia in a fetus is defined as a fetal heart rate of less than 100 beats per minute. A bradycardia is often seen in early gestation but should not be seen after 26 weeks gestation. If it is seen it may be due to fetal distress or cord compression. [Sanders, 1991:129] One point the sonographer should take care to remember is that direct pressure from the probe over the heart can cause a bradycardia. [Sanders, 1991:129] The patient identified at the secondary centre was 30 weeks gestation and was sent to labour ward for immediate fetal monitoring. The patient later delivered the same day a live infant of 1090grams who was transferred to neonatal ICU. No cardiac abnormality was identified.

2.3.6. Other

The asymmetrical growth in the twins was referred to the tertiary centre to ensure a twin-twin transfusion syndrome was not missed. The patient was followed up at tertiary centre.
There was one case where thickened tissue was noted over the sacral area. This was referred to the tertiary centre for follow up. After delivery the geneticists thought it could have been one of the more rare chromosomal abnormalities. Unfortunately conformation of the diagnosis was not available due to record loss.

3. Gestational Age

The most accurate method of calculating the length of the pregnancy is to know the exact date of conception. Delivery is expected 38 weeks (266 days) after this. This is not practical as most women are unaware of the date of conception. [Chudleigh et al, 1992: 77]. Owing to this other methods are employed to help establish the gestational age.

The menstrual age is calculated from the first day of the last menstrual period (LMP). Gestational age is usually calculated from the theoretical time of ovulation plus two weeks. [Jeanty, 1996:137] Incorrect menstrual dates are the most common cause for an abnormal assessment of fetal growth. [Wood, 1993:2/1] To accurately assess the gestational age an early ultrasound is ideal but not always available. Some authors feel that until an accurate gestational

age is established the patient should be regarded as a high-risk patient. To establish the reliability of the LMP the patient should be: -

- sure of her last known period.
- know her cycle was regular.
- was not on oral or injectable contraceptives two months prior to conception.
- not had any bleeding early in pregnancy.

[Chamberlain, 1992:29]

Any of the above criteria render the LMP inaccurate and hence a problem for the obstetrician. There are other ways to establish the gestational age such as palpation of the uterus and the date of quickening; quickening is the date when the mother first feels movement. [Sanders, 1991:95] For gestational aging this can be inaccurate as there can be a wide range, as much as eight weeks in one study. [Grennert et al, 1978:11] Palpation can also be hindered but physical factors such as obesity and polyhydramnios increasing the inaccuracy of the gestational age. Ultrasound can help with correcting this. In this study approximately 2% of the patients were sent for ultrasound because of obesity (n=1090).

Queenan et al quote that the single most important task of any obstetrician is to establish an accurate gestational age and to estimate the date of delivery. [1996:73] His opinion is that all obstetrical problems and clinical judgements are based on this understanding. In the past prior to the availability of ultrasound the estimation of gestational age could often be inaccurate and thereby increasing certain risks to the fetus and mother, such as misclassification as preterm or post term and the possible unnecessary tests and management which accompany these titles. [Berg et al, 1996: 134] Also in the study of neonatal physiology the age of the neonate and the birth weight in relation to the age are important factors to consider. [Grennert et al, 1978: 5]

The early scan in pregnancy that is within the first trimester is mainly for dating, assessing viability, nuchal translucency examination and to rule out a possible ectopic. Accurate dating is essential for the effectiveness of other tests. That is for genetic amniocentesis for fetal abnormalities, for helping to identify growth problems later in pregnancy and it can lead to fewer pre-term inductions. [Roberts et al, 1998:961] An ultrasound in second trimester can still be accurate for dating and is useful for identifying the number of fetuses, visualising the placental position, assessing the amount of amniotic fluid and for detecting certain fetal anomalies.

Most authors agree that if a patient is to receive one ultrasound scan as a routine it should be between 18-20 weeks gestation. This is still early enough to acquire accurate dating and the fetus is large enough to study the fetal morphology. [Campbell et al, 1985: 614]. In this study one of the main clinical reasons for the ultrasound was to identify the gestational age,(+ / - (272 patients 25% n=1090). The mean gestational age calculated from the ultrasound results was +/- 30 weeks gestational age. This shows that if a single routine scan was offered in second trimester for the accurate determination of gestational age it could prove useful later in pregnancy.

A fetus that remains in utero after the expected date of delivery is thought to be at increased risk. [Boyd et al, 1988: 334] An important concern of a post term pregnancy is the authenticity of the dating. Boyd et al found that the LMP was inaccurate in 40% of pregnancies and even more so in pregnancies that seem prolonged. [1988,337]. Queenan et al states that about 45% of

a middle class population where felt to have an unreliable menstrual history. He also states that in indigenent patients this will be increased to 90-100% of all pregnancies. [1996:73,74] In this study of the 1035 patients that were recorded in the secondary centre ultrasound department only 162 patients (15.65%) were able to give a LMP. The reason for the patients not being able to give an accurate LMP could be due to a lack of knowledge of its importance. This can certainly be overcome but requires education, time and the feasibility of being able to reach all the patients prior to them falling pregnant. Ultrasound, however, is becoming more available within this economic sector and an early ultrasound is the accepted and accurate method of verifying gestational age. [Boyd et al, 1988.337] An ultrasound scan should be performed at the most optimal time for dating i.e. prior to the 20^{th} week of gestation. [Queenan et al, 1996:74]. It is felt that a BPD (bi parietal diameter) measurement done between 18-22 weeks is as accurate as a CRL (crown rump length) done in first trimester. [Campbell et al, 1985: 613]

Most authors agree that all pregnant women should have the gestational age confirmed with an ultrasound scan. It is felt that even when the menstrual history is faultless an ultrasound scan for gestational age is justified. [Chudleigh et al, 1992: 93].

Section IV

Data Results

Mr A. Latief, who is a senior officer in the mathematical statistics department at the University of the Western Cape did the data analysis. The computer software package used was. Statistical Package for Social Science [S.P.S.S.]. The data was recorded using the Microsoft Excel package and some of the excel statistical entities were employed. The data analysis was mainly qualitative with a small amount of quantative analysis.

There were 1090 patients that were recorded to have passed through the ultrasound department in the time selected for this study. There were problems regarding follow up on many of the patients. Delivery details were available on 624 patients. It is difficult to be absolutely sure as to why this was a problem. Certainly one reason was that the recording of the patients' name, different spelling and poor handwriting created difficulties. Culturally too, the patients sometimes use different names when they attending different clinics; more over, the patients did not always return to the clinic from where they had come. The filing system is in the process of being computerised and the record clerks seem to be understaffed and unable to assist with location of files. This is perhaps a reflection of the rationalisation, which must occur in all sections of the work place today; this made follow up difficult. However, with computerised records, research in the future should be much easier and more accurate. Delivery details were not available for all 1090 patients; however there was other data that showed that ultrasound did influence the management of many of the patients.

1. The Influence of Ultrasound.

1.1. Hypothesis no: 1

It is hypothesized that the ultrasound scan influenced the obstetric management of a significant portion of the 1000 patients in this study.

In the situation in which this study was carried out the majority of the ultrasound scans were requested because of a clinical reason, i.e. indication-based scanning is employed. The following discussion illustrates how ultrasound influenced the management of some of the patients.

Multiple pregnancies are regarded as a high-risk pregnancy and usually deliver at a secondary or tertiary institute. Some patients are suspected clinically of having a multiple pregnancy if:-

- The patient has a family history (especially maternal) of dizygotic twins
- A past obstetric history of twins
- Hyperemesis in early pregnancy.

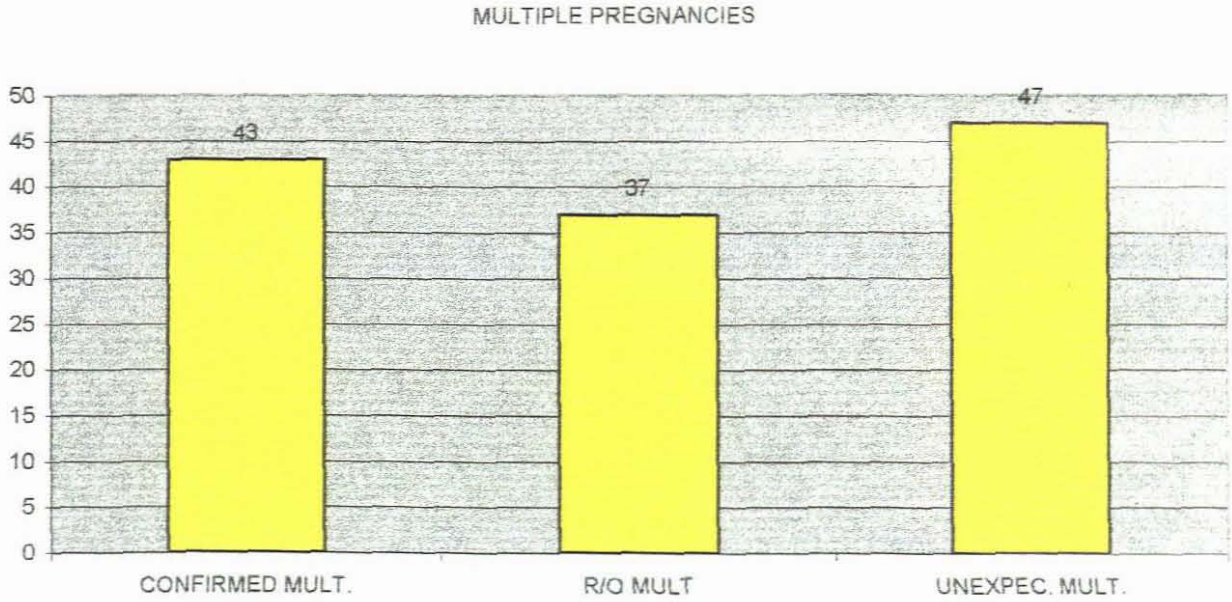
[Chamberlain, 1992:1999].

In this study 80 patients (7.3%, n=1090) came for ultrasound because clinically a multiple pregnancy was suspected. Of these 80 patients there were 37 patients (46% n=80) that ultrasound proved to be singleton pregnancies. These 37 patients in which ultrasound had ruled out a

multiple pregnancy, could then be returned to primary heath care. Ultrasound confirmed a twin pregnancy in 43 (53% n=80) of the remaining patients. There were a further 36 patients (3.3 % n=1090) of whom ultrasound diagnosed an unsuspected twin pregnancy.

Once the multiple pregnancy is diagnosed then these patients could then be assessed for the problems associated with a multiple pregnancy and prepared to deliver at a secondary or tertiary hospital.

CHART 1: Influence of Ultrasound on Identifying Multiple Pregnancies.



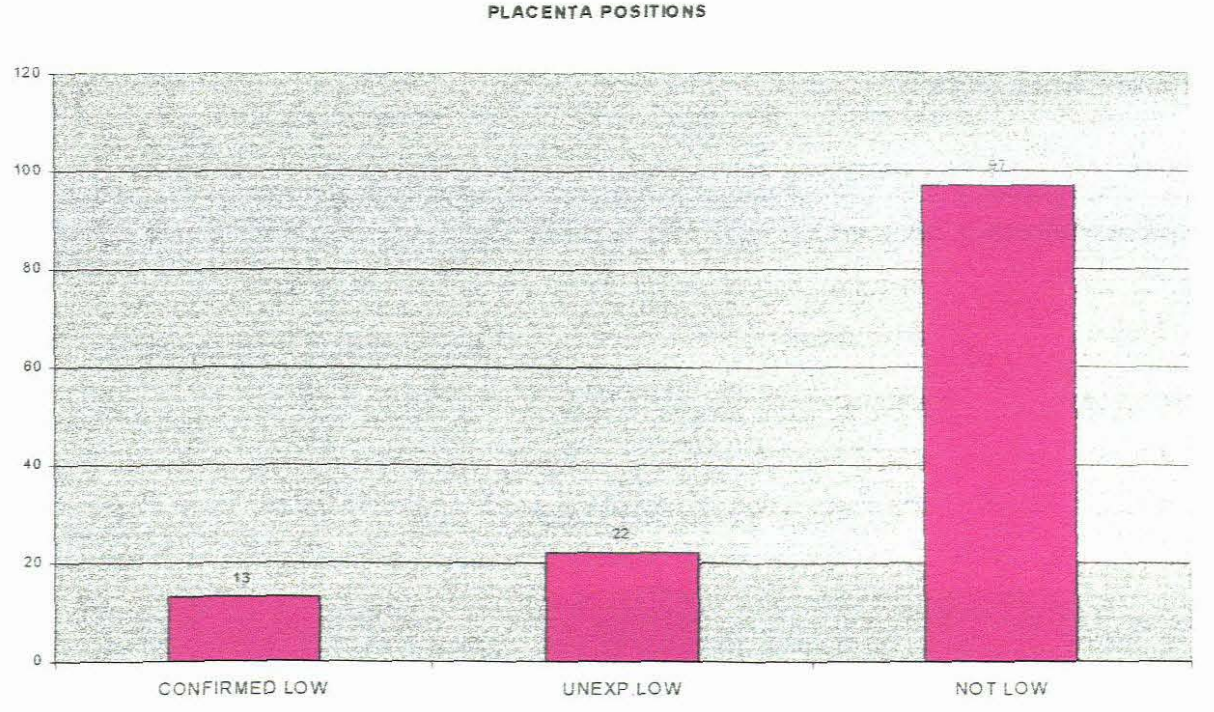
CONFIRMED MULT. – Confirmed multiple pregnancy.
R/O MULT. - Multiple pregnancy ruled out.
UNEXPEC. MULT. – Unexpected multiple pregnancy identified.

Placenta praevia is potentially a very dangerous condition. Ultrasound is probably the only way to be absolutely sure prior to delivery as to whether the placenta is low or not. As there can be other causes for antepartum bleeding it is important to establish if a praevia is present or not. In 30% of these patients, the cause for bleeding at this time in pregnancy is never found. [Chamberlain 1992: 75]. It is essential to rule out or confirm placenta praevia. Clinically the patient can present with recurrent painless bright red vaginal bleeding, a persistent malpresentation or a high head late in pregnancy. [Chamberlain, 1992:76].

In this study there were 80 patients (7.3% n=1090) who were sent for ultrasound to check specifically for the position of the placenta. There were 49 patients (4.5%, n=1090) who had bleeding per vagina of which placenta praevia could have been the cause. In total this represented 129 patients (11.8%). When the results were assessed there were 19 entries missing these probably represent intra uterine deaths, patients who are not pregnant or the pregnancies are too early to note the placental position.

Of the 129 there were 97 patients (75%, n=129) found on ultrasound not to have low placentas. These patients, once stabilised, could be returned to primary health care as the concern of placenta praevia had been ruled out. There were 13 patients (10%, n=129) where ultrasound confirmed the low placentas. These patients could be transferred from primary health care to a secondary or tertiary heath care centre for the follow up ultrasound scans and care required. This was also the case for the 22 patients (2%, n=1090) in which low placentas were found incidentally.

CHART 2: Influence of Ultrasound on Identifying Low Placental Position.



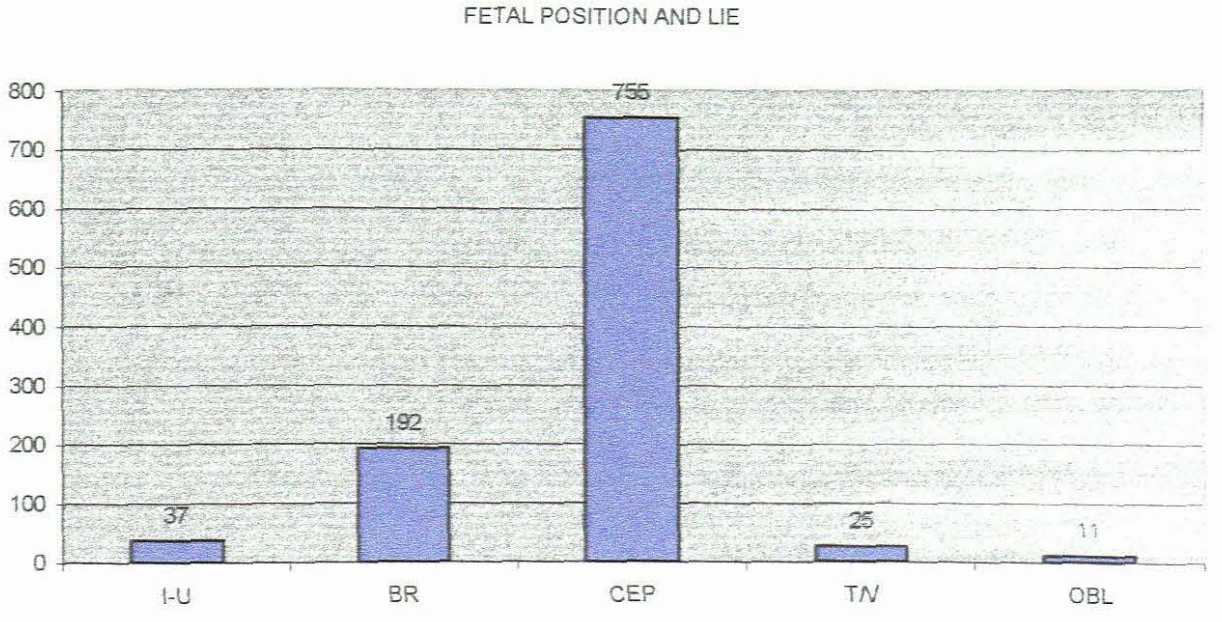
CONFIRMED LOW – Placenta position is confirmed as being low.
UNEXPECTED LOW – Placenta position is unexpectedly found to be low.
NOT LOW – Placenta position was found not to be low.

In some of the patients whom have low placentas early in pregnancy migration of the placenta can occur. This is a term used to describe the apparent change of position of the placenta during pregnancy, from a low-lying position to a position that is well clear of the os. [Sanders, 1991:109]. This is due to the differential growth rates of the lower uterine segment and the placenta [Dahnert: 1993:642]. For this reason all the patients found to have low lying placentas before 28 weeks gestation have to have repeat ultrasounds to confirm the placental position. The patients usually have the repeat ultrasound at 28 weeks; if it remains low the ultrasound is repeated between 32-36 weeks. By identifying the low placenta early we can allow the clinical management to prepare for a possible Caesarean section. It is also important for the patient to be

aware so that if she starts to bleed she understands the importance of obtaining hospital treatment immediately.

For some patients an abnormal presentation will result in a possible Caesarean section. This is important for patient management and for preparation for the patient. Of the 1090 patients that came for ultrasound 63 patients (5.8%) came because an abnormal position and 57 patients (5.3%) because an abnormal lie was suspected. In total this was 120 patients (11%, n=1090). In the results there were 66 missing entries due to incorrect entries, fetal death or too early to record the position of the fetus. It was found that in the case of 40 patients (33.3%, n=120) ultrasound ruled out an abnormal presentation. Many of these patients could then be returned to primary heath care (if abnormal presentation was the only reason for removing these patients from primary heath care). An abnormal presentation was confirmed in 28 patients (23%, n=120). More notably a further 201 patients (18.4%, n=1090) were shown on ultrasound to have an unexpected abnormal presentation, mostly breech presentations. This could be due to the fact that the fetus can still turn itself prior to 33 weeks, and so is not considered a problem until later in gestation. Another reason could be the lack of the need for faultless palpation, as ultrasound will always give an accurate answer to the question of a possible abnormal presentation.
The graph below represents the break down of the type of abnormal presentations that was identified on ultrasound.

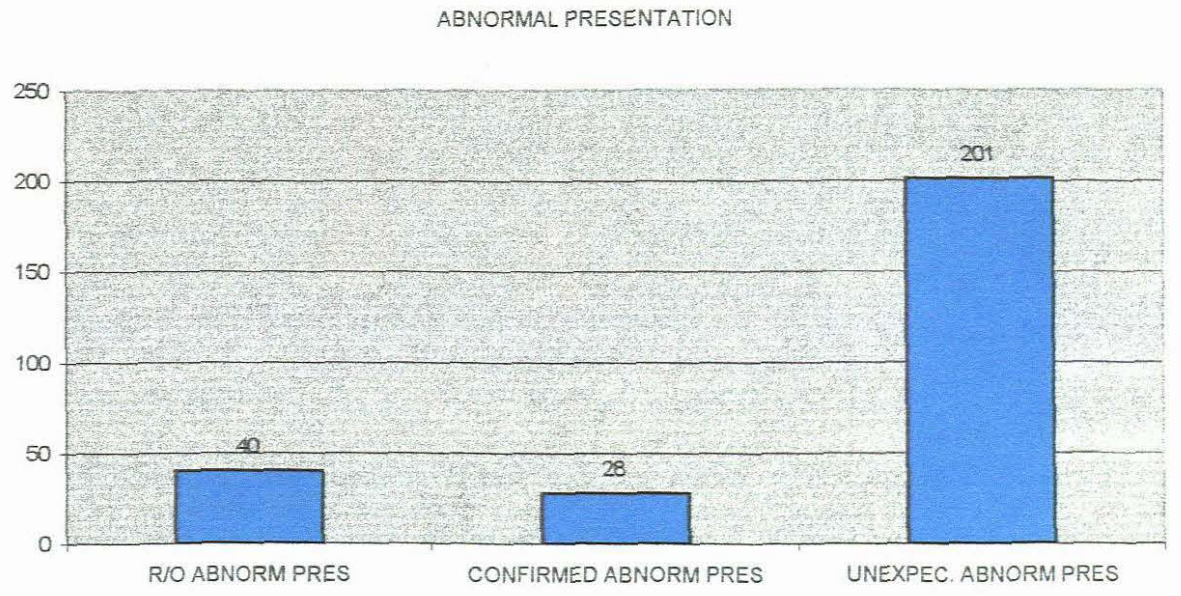
Chart 3: Different Fetal Presentations.



I-U- intra-uterine BR-breech CEP-cephalic T/V- transverse OBL-oblique

The chart below shows how ultrasound confirmed or ruled out an abnormal presentation.

Chart 4: Influence of Ultrasound on Identifying Abnormal Presentations.

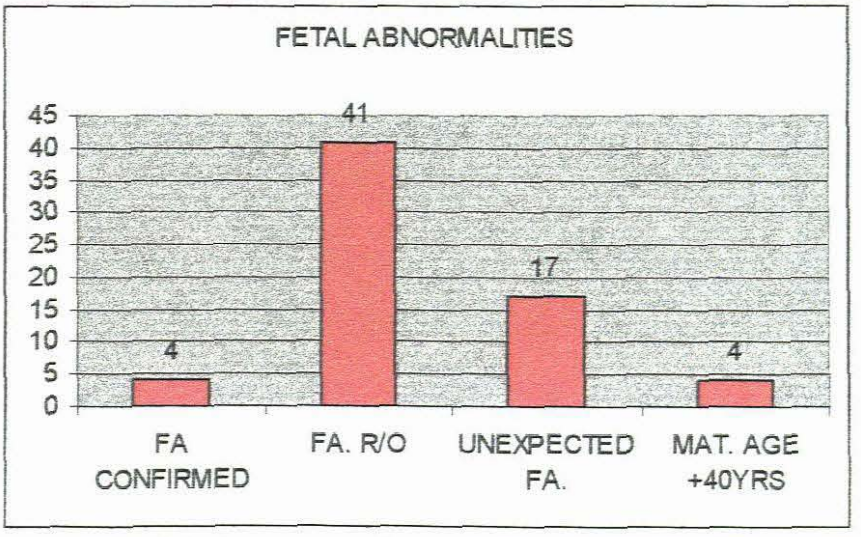


R/O ABNORM PRES – An abnormal presentation was ruled out.
CONFIRMED ABNORM PRES – An abnormal presentation was confirmed.
UNEXPEC. ABNORM PRES – An abnormal presentation was unexpectedly identified.

Once a fetal abnormality is identified it will necessitate the removal of the patient from primary health care to secondary or tertiary depending on the severity. A small hydrocele that is reported at ultrasound need not be referred to a tertiary centre. It is explained to the mother and suggested that the primary health centre check the baby after delivery. Mild hydronephrosis can be reviewed in the secondary health centre. A more severe abnormality such as acute hydronephrosis or ventricularmegaly is referred immediately to a tertiary centre. There were, in this study 45 patients (4.1% n=1090) who were sent for ultrasound because a fetal abnormality was suspected. Of these patients four (8.8% n=45) were confirmed with an abnormality. These four were all obstructive uropathies. One was mild bilateral (L=6mm and R=7mm), two were moderate (one unilateral R=9mm and one bilateral R=10mm and L=11mm) and one was severe, unilateral (L=26mm). There was one case in which polyhydramnios was confirmed, but no cause was seen on ultrasound. One case suggested a possible abnormality in the fetal head, and this was referred to the tertiary centre for more detailed scan. An abnormality was not confirmed and the patient was returned to primary health care. There were 41 patients (91%, n=45) that could be returned to primary health care.

There were a further 17 (1.5% n=1090) patients which ultrasound identified as having unexpected fetal abnormalities. Whilst some of these were considered mild, 16 patients needed follow up at a secondary or tertiary centre. Four patients were identified as needing genetic amniocentesis because maternal age was more than 40 years. This is a total of 20 patients (1.8%, n=1090) that required follow up in a secondary or tertiary health care centre.

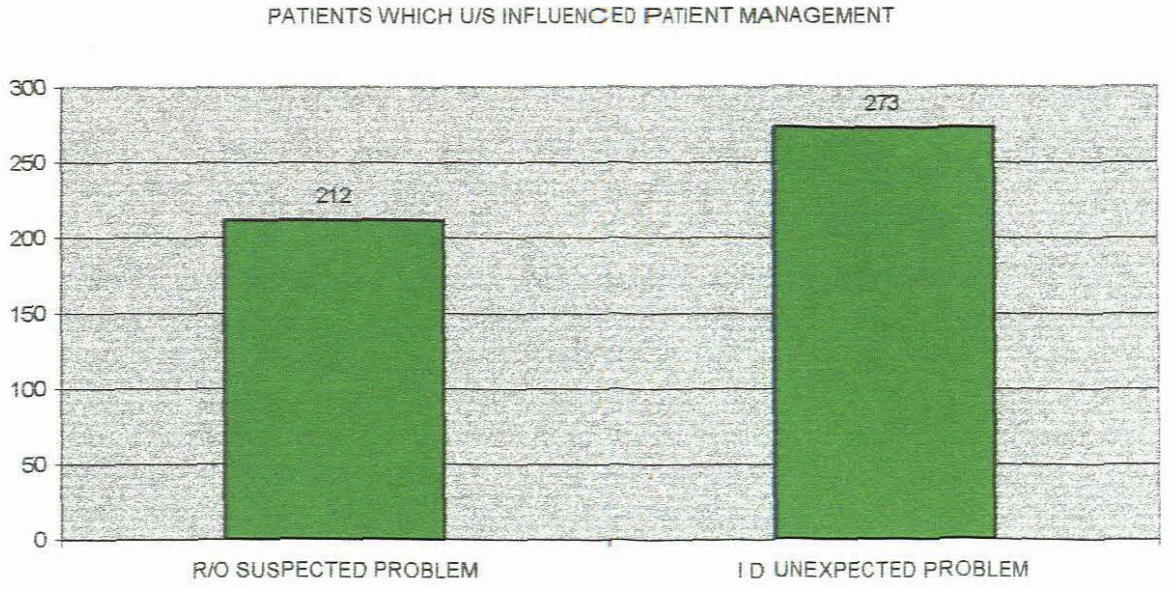
Chart 5: Influence of Ultrasound on Identifying Fetal Abnormalities.



FA CONFIRMED – Fetal abnormality was confirmed.
FA . R/O – Fetal abnormality was ruled out.
UNEXPECTED FA- unexpected fetal abnormality was identified
MAT.AGE +40YRS – Maternal age was found to be more than 40 years and therefore required transfer for genetic amniocentesis.

With these cases above ultrasound helped to rule out certain problems that allowed the patients to be returned to primary health care and thereby influenced patient management. In total this amounts to 212 patients (19.4% n=1090). There were 273 patients (25.1% n=1090) in which ultrasound found an unexpected result that altered patient management. This could change the patient from possible delivery at a primary health care centre to a secondary or tertiary centre. These patients fall into the high-risk category by virtue of the ultrasound diagnoses.

Chart 6: Illustrates those Patients that Ultrasound Influenced Patient Management.



R/O SUSPECTED PROBLEM – Ruled out suspected problem.
ID UNEXPECTED PROBLEM –Identified unexpected problem.

1.2. Table 2 : Summary Illustrating Where Ultrasound Influenced Patient Management.

Indication for u/s scan	Patients sent for u/s (n=1090)	Confirmed on u/s	Ruled out on u/s	Unexpected find on u/s (n=1090)
Multiple pregnancy	80 (7.3%)	44 (55%) n=80	36 (45%) n=80	31 (2.8%)
Placenta praevia	129(11.8%)	13 (10%) n=129	97 (75%) n=129	22 (2%)
Abnormal presentation	109 (10%)	28 (25%) n=109	40 (36%) n=109	201 (18.4%)
Fetal Abnormality	45 (4.1%)	4 (8.8%) n=45	41 (91%) n=45	17 (1.5%)

This proves the first hypothesis, that ultrasound influenced the obstetric management on a proportion of the patients who passed through ultrasound.

2 Gestational Age.

2.1. Hypothesis no: 2

It is hypothesized that the mean gestational age when an ultrasound is carried out is within the second trimester of pregnancy [i.e. between 13 and 26 weeks].

Part of the quantative analysis included the evaluation of the gestational age. The data was first divided up into the three trimesters. First trimester being 1-12 weeks, second trimester 13-26 weeks and third trimester 27-40 weeks. There were 1090 data entries with 185 missing entries. That is there was no gestational age found in the ultrasound results. Part of these missing entries would include patients who were not pregnant, those who had intrauterine deaths and missed entries. The earliest scan was done at 6 weeks and the latest at 42 weeks. The mean gestational age was 30+ weeks with a standard deviation of 7 weeks.

The valid percentages were as follows:

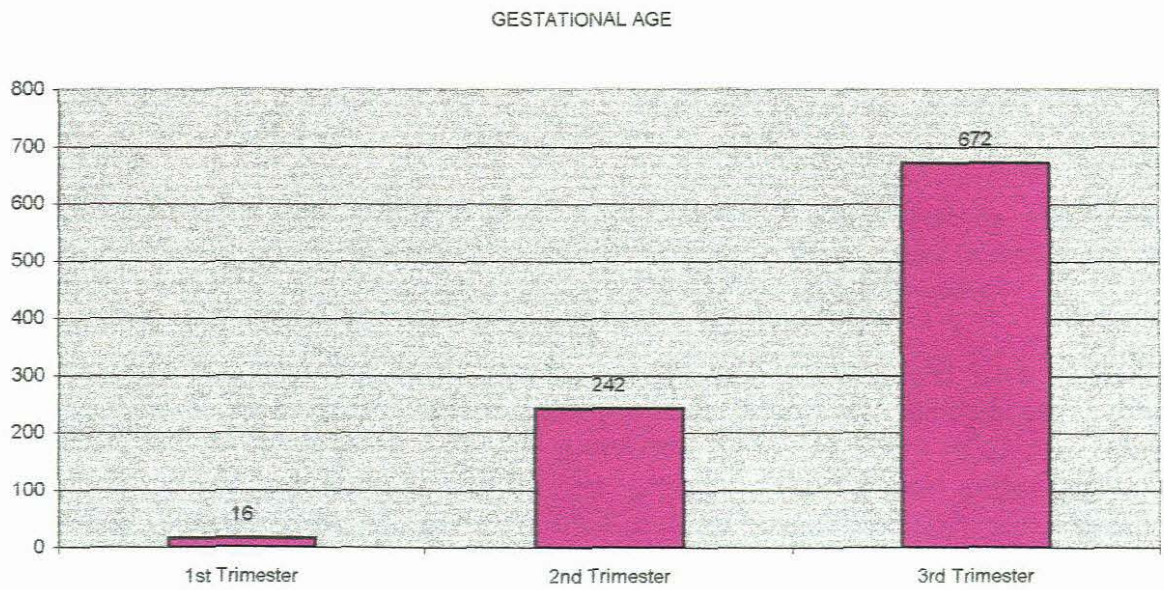
First trimester: - 1.7%
Second trimester: - 26%
Third trimester: - 72.3%

The majority of the ultrasound scans were done in the third trimester the most being done between 32 and 36weeks. It is generally believed that if a routine ultrasound scan is offered it would be in the second trimester. (A routine scan should be between 18-20 weeks gestation. this is still early enough to acquire accurate dating and the fetus is large enough to study the fetal morphology. [Campbell et al, 1985: 614]). In this study the most common time for an ultrasound scan was late in the third trimester. The main reason for this is probably due the fact that many of the patients are late bookers and the gestational age is unknown. This is collaborated by assessing the frequency tables for the requests where one of the most common clinical indications is for an unknown gestational age.

By considering the chart below which represents the three groups of gestational ages. It can be easily recognised that the second hypothesis is disproved.

i.e. the mean gestational age for an ultrasound scan is *not* within the second trimester [13-26 weeks] but in third trimester. [28-40 weeks]

Chart 7: Gestational Age Divided into the Three Trimesters.



3 Clinical Indications.

3.1. Hypothesis no: 3

It is hypothesized that by identifying the clinical indications for the ultrasound, a role for this modality can be established / identified.

The clinical indications were collected in the Microsoft excel programme under the title 'requests'. The indications were divided up into the following headings with their relative percentages.

Amniotic fluid index – 28.7%
Gestational Age – 25.2 %.
Growth scans – 15.5%
Estimated fetal weight – 12.1%
Baseline – 11.7%
Possible Multiple pregnancy – 7.3%
Placental position – 7.3%
Dates versus palpation – 7%
Previous Caesar - 6.8%
Post dates – 5.3%
Lie – 5.3%
Position – 5.8%
Bleeding per vagina – 4.5%
Possible fetal abnormality – 4.1%

Fetal well-being – 3.8%
Gestational proteinuric hypertension – 2.3%
Obesity – 2.1%
Intrauterine death - .2%
Pre-term labour – 1.5%

The ultrasound scans were used to confirm or rule out the clinical indications. There were some incidental findings such as abnormal presentations, multiple births, intrauterine deaths, placenta praevias etc, which help to add weight to the usefulness of the ultrasound scan.

The three most common reasons for sending the patients for ultrasound were: amniotic fluid index, gestational age and growth scans. These are all associated with third trimester problems. It is probably fair to say that an unknown gestational age is pertinent to all three trimesters, although it probably is more critical in late gestation. An accurate gestational age is of tremendous value clinically, whether established early or late in the pregnancy. The amount of amniotic fluid is an important index later in pregnancy but also has a role to play throughout the pregnancy. Identifying polyhydramnios or oligohydramnios at any point in gestation is helpful clinically.

Only 11.7% of the scans were baseline scans, these represent the routine 18-22 week scan. It was in this group of scans that the second hypothesis i.e. the mean gestational age would find the bulk of the data to help prove / disprove this hypothesis.

The next group of around of 7% consists of possible twins, a difference between dates and palpation and those patients who have had a previous Caesarean section. For patients who had had a previous Caesarean the gestational age is particularly important, as many of these patients will have to have another Caesarean. This is usually an elective Caesarean, so the optimal time is chosen for both the fetus and the mother.

In this study 80 patients (7.3%) were referred to ultrasound to check the placental position. Those who were bleeding per vagina accounted for 50 patients (4.5%). Placenta praevia is an important reason for an ultrasound. For many patients this is a follow up, but for those who present with active bleeding per vagina it can be an emergency which ultrasound can help to evaluate.

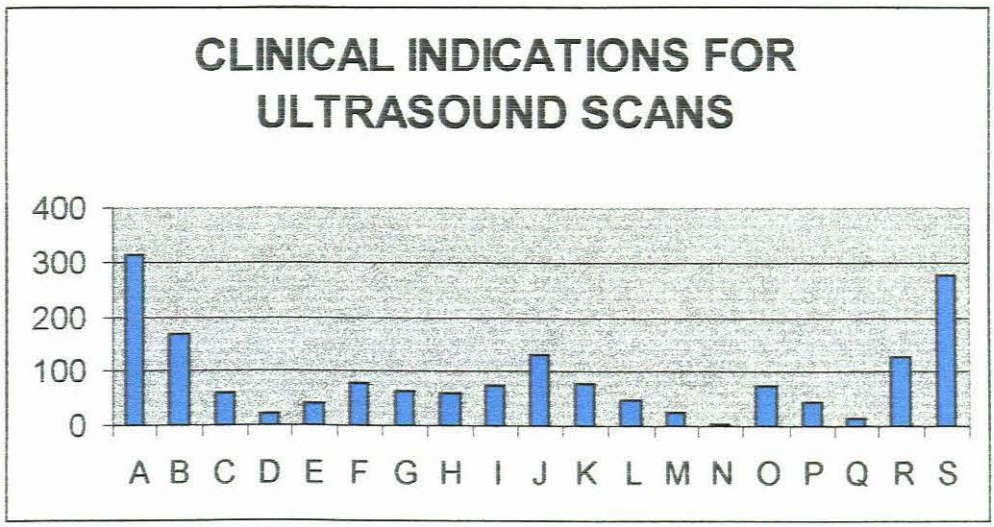
A possible abnormal presentation fell under the headings of position and lie and had a frequency of between of about 65 patients (5%-6%.)

Patients who were thought to be post dates accounted for 5.3% of the reasons for ultrasound. This runs hand in hand with the estimated fetal weight and amniotic fluid index, which is important in late gestation.
Suspected fetal abnormality and fetal well being both fell into the range of about 44 patients (4%) of the requests. Whilst ultrasound can be ideal to identify a fetal abnormality early in pregnancy this is not always the situation. The ultrasound soft signs as well as clinical features

are often more easily identified later in pregnancy. An example of this is achondroplasia in which there is a fall off in growth only after 24 weeks gestation. [Chapman et.al, 1995:491]

The rest of the requests represent the groups between 10-20 patients (1%-2%). These were known gestational proteinuric hypertension, maternal obesity, possible intrauterine death and pre term labour.

Chart 8: The Clinical Indications for the Ultrasound Scans.



A -Amniotic fluid index
B -Growth scans
C- Post dates
D - Obesity
E - Fetal well-being
F - Possible Multiple pregnancy
G- Position
H – Lie
I - Dates versus palpation
J - Estimated fetal weight
K - Placental position
L - Bleeding per vagina
M - Gestational proteinuric hypertension
N - Intrauterine death
O - Previous Caesar
P - Possible fetal abnormality
Q - Pre-term labour
R - Baseline
S -Gestational Age

Having assessed the frequencies of this study it can be shown that there is certainly a role for ultrasound in late second and third trimester. However, some of those problems such as placental position or an unknown gestational age, (which accounts for more than quarter of the clinical reasons for referral to ultrasound), could be diagnosed early in pregnancy. This has the potential for allowing the patient not to be classified as high risk.

Thus the third hypothesis is proved, by identifying the clinical indications the role for ultrasound is recognised.

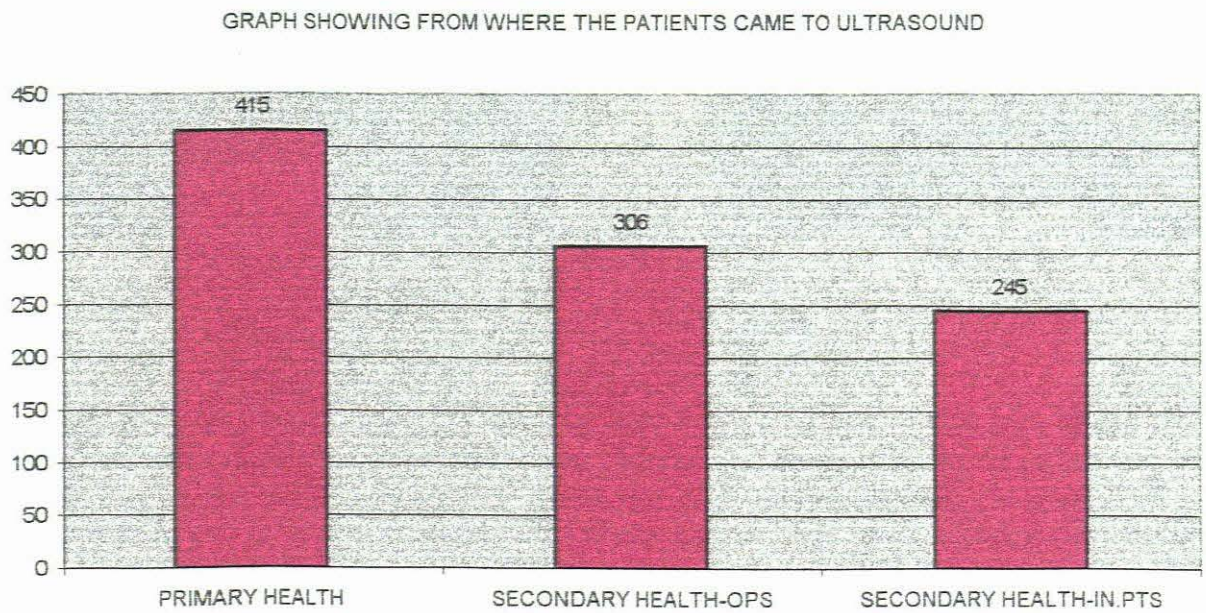
4 The Role of Ultrasound

4.1. Hypothesis 4

It is hypothesized that there is an important role for obstetric ultrasound in primary health care in South Africa.

Primary health care can provide adequate heath care for all low risk patients or those patients who have only minor problems.[Woods,1993:3]. As soon as a problem is suspected the possibility of the patient being transferred to secondary or maybe tertiary health care is raised. Ultrasound helps to answer these questions by confirming or ruling out the suspicion. Secondary health care is described as being between tertiary and primary care. The cost per patient is higher and is usually provided in a hospital. [Woods,1993:3]. Tertiary care is found within big sophisticated hospitals that serve large areas. It incorporates expensive and specialised equipment and staff. [Wood, 1993:4].

Chart 9: Centres From Where the Patients Came to Ultrasound.



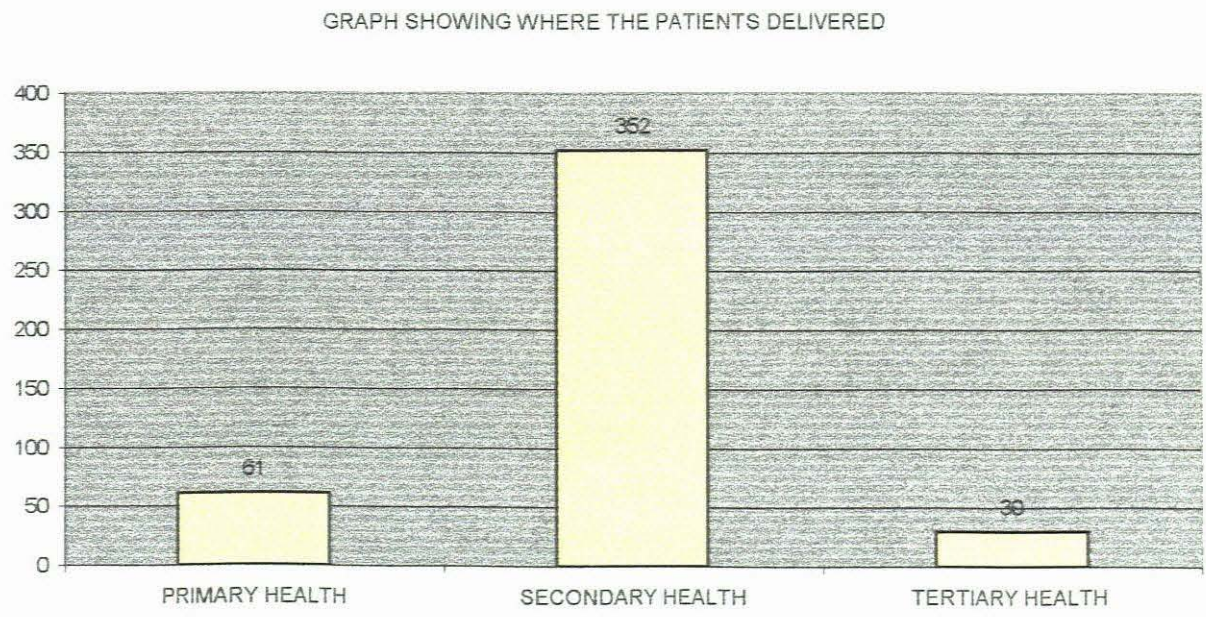
PRIMARY HEALTH – patients from primary health care centres.
SECONDARY HEALTH-OPS – out patients from secondary health centre.
SECONDARY HEALTH – IN. PTS.- ward patients from the secondary health centre.

It must be remembered that the secondary centres also provide primary health care for the patients who are living in the area as well as secondary care for patients referred from the primary centres. [Wood, 1993:4]. There were 415 patients (38% n=1090) referred directly from primary health centres. If it is assumed that the out patients from the secondary centre are also

primary care patients then 721 patients (66.1% n=1090) were referred from primary health care. The remaining 245 patients (22% n=1090) came from the secondary health centre as ward patients. The remaining 12 % (n=1090] represent the entries that were entered incorrectly or inadequately.

Unfortunately as most of the delivery results were unavailable for many of the primary health centre deliveries the results are skewed. The graph below shows these results but it is perhaps not reflective of the situation.

Chart 10 : Centres Where Patients Delivered.



It is important to know in advance about certain conditions and this is part of the role of ultrasound . Ultrasound allows a window to be opened into the pregnant uterus and to that of the unborn fetus. In the present situation in which this study was undertaken the ultrasound scans are, to a large extent symptom based. That is the patient must have a clinical reason for the ultrasound scan to be requested. Returning the patient to primary health care or transferring the patient to secondary or tertiary care acquires the optimal care for each patient.

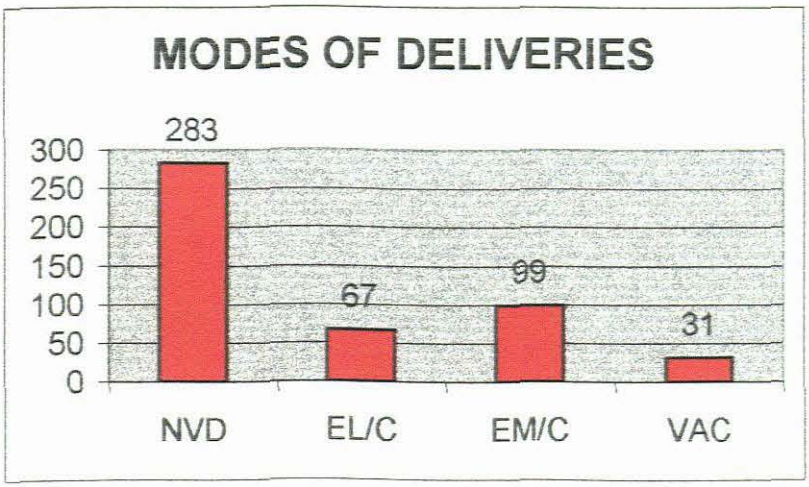
One cannot detract from the importance in ultrasound's role in the care of the pregnant patient and in identifying some high-risk conditions. This has been discussed in detail earlier in this project. Most authors agree that where ultrasound comes into its own is with the diagnosis of multiple gestation, accurate dating, detecting deviant fetal growth and in detecting severe malformations. [Bucher, 1993: 13]. Its usefulness in identifying the gestational age is significant, especially when the palpation is difficult or the dates are unknown. This is exacerbated by late bookings. A late booker is when the patient first attends the obstetric clinic and is 20 weeks or

more pregnant. [Sanders, 1991:95] The importance of knowing the gestational age cannot be understated. It will impinge on virtually all problems associated with pregnancy.

The later the gestation is the more important the fetal size becomes. One way of estimating the fetal weight is with ultrasound. In this study 132 patients (12.1%, n=1090) were sent for ultrasound to establish an estimated fetal weight. This can help the delivery staff to prepare for a small infant. In the United States one study showed that black infants were at higher risk of being born prematurely and at low birth weights. [Brett et al, 1994: 41]. If this is the case in the Western Cape then ultrasound is important to help with the preparation for delivery. Ultrasound will also aid the patient management if a very large infant is expected as preparation for a possible Caesar can be done. Gestational age or fetal size is important if an elective Caesar is planned to avoid iatrogenic prematurity. [Quilligan, 1994:522]. Ultrasound can help to limit these cases. Obtaining the delivery details for this study was difficult and only 623 birth weights were available. These showed that the weights varied from a minimum of 300g to a maximum weight of 4960g, with a mean of 2906g. (SD= 760g).

The chart below shows the break down of the mode of delivery. The most is represented by normal vaginal delivery.

Chart 11: Mode of Delivery.



NVD- normal vaginal delivery
EL/C- elective Caesar
EM/C- emergency Caesar
VAC- vacuum extraction

By assessing the details of whether ultrasound affected the patient management (hypothesis1) this supports the important role for ultrasound in primary health care. The four issues discussed (multiple births, placenta praevia, abnormal presentation and fetal abnormalities) show how

ultrasound confirmed, ruled out or made an unexpected diagnosis. There were 89 patients (8% n=1090) in which ultrasound confirmed the clinical diagnosis and 214 patients (20% n=1090) in which it ruled out the clinical suspicion. What is more striking is the 271 patients (24.7% n=1090) that ultrasound made an unexpected diagnosis. This data indicates that obstetric ultrasound has an important role to play in primary health care.

Section V.

Conclusion

At the time that this study was carried out it was the hospital policy that ultrasound scans were requested if there was a clinical reason that suggested the patient could be classified as high risk. Ultrasound was used as an adjunct to the clinical assessment of the patient to help grade the patients. This study showed that ultrasound could help to confirm a diagnosis, contradict the clinical suggestion or answer a clinical question. The other category is the group of patients in which ultrasound made an unexpected diagnosis that had not been suspected clinically. It is perhaps in this group of patients that the ultrasound results appear the most dramatic. This would certainly support the practice of many western countries that include routine ultrasound as a part of the standard antenatal programme. However, it must be remembered that all the ultrasound results allowed the medical treatment of the patient to be carried out with greater assurance and knowledge, ultimately allowing the best possible treatment for the patient.

In summary the four hypothesizes can be reviewed. It is the opinion of the author that the data shows that the ultrasound scan managed to influence 100% of the patients that passed through the ultrasound department. In that with each patient the ultrasound scan confirmed a clinical diagnosis, refuted the clinical judgement or found an unexpected condition. It can be argued that by confirming a clinical assessment ultrasound perhaps did not influence the patient management. However it must certainly add to the confidence of the group of medical personal under which the patient falls. It may, too, help answer questions that could occur later in pregnancy.

In this study the results of the patients who came for ultrasound scans showed a mean gestational age of 30+ weeks. If one was to offer a single routine scan it is usually suggested to be during the second trimester around 18-20 weeks. [Chudleigh et al, 1992: 240]. This brings up the question; is this the correct time to offer the single routine scan and should it not be later in third trimester? This is not the answer to consider, as it must be remembered that the majority of the patients in this study presented with a clinical problem before being sent for an ultrasound. Many obstetrical problems only present clinically late in gestation. An example of this is possible placenta praevia which is usually only suspected after 28 weeks gestation. Problems such as unknown gestational age which, was one of the most common clinical reasons (25%) for sending a patient for ultrasound could be answered with an ultrasound early in gestation. Unknown gestational age is exacerbated later in gestation. Some authors feel that if a women books after 24 weeks gestation she will require at least two ultrasound scans to confirm / establish the gestational age. [Chudleigh et al, 1992: 241] This would increase the amount of work substantially and there by the costs of ultrasound in primary heath care.

Selective ultrasound scans in the presence of risk factors and clinical symptoms are well known. [Johnson, 1998: 964]. In this study the clinical reasons for sending the patients for the ultrasound scans were divided into nineteen categories. These were decided from the ultrasound request forms. In many of these clinical situations ultrasound will help to contribute to the improvement of the maternal and fetal outcome. [Johnson,1998:964]. It can be seen from the list below that all of the categories the clinical reasons were put into from this study appear on this list. This suggests that these are probably the common causes for selective ultrasounds in most institutions who employ selective ultrasound.

The Consensus Development Conference sponsored by the National institute of Childs Health and Human Development has suggested the following clinical reasons for sending a patient for an ultrasound scan:

1] Gestational aging, either to confirm known dates or identify with unknown dates.
2] Evaluation of fetal growth.
3] Vaginal bleeding.
4] Fetal presentation.
5] Suspected multiple pregnancy.
6] Adjunct to amniocentesis.
7] Dates versus palpation discrepancy.
8] Pelvic mass.
9] Suspected hydatidiform mole.
10] Adjunct to cerclage placement.
11] Suspected ectopic.
12] Adjunct to specialized procedures such as fetoscopy.
13] Suspected intra-uterine death.
14] Suspected uterine abnormality.
15] Intra-uterine contraceptive device localization.
16] Ovarian follicle development surveillance.
17] Fetal well-being.
18] Observation of intrapartum events.
19] Polyhydramnios or oligohydramnios.
20] Suspected abruptio plancenta.
21] Estimated fetal weight evaluation.
22] In the presence of abnormal serum alpha-fetoprotein value.
23] Follow up observation of fetal abnormality.
24] Follow up observation of placenta praevia.
25] History of previous congenital abnormality.
26] Serial evaluation of fetal growth.

[Johnson, 1998: 964]

There is no doubt that ultrasound is an ideal modality for use in primary health care. It is non-invasive, relatively inexpensive and portable. The portability could make the use of one ultrasound unit used for several primary health care units feasible. This too would bring the

examination to the patient rather than the patient being required to travel to the secondary or tertiary centre. One of the problems of operating any heath centre be it primary, secondary or tertiary is to try and achieve the best care with the minimum cost. The fact that there is now a source of trained ultrasonographers available adds to the lowering the cost of operating an ultrasound unit. Apart from ultrasonographers the other group of personal trained to carry out obstetric ultrasound are specialist doctors such as radiologists or obstratritions. The salaries of the ultrasonographers are considerably lower than that of the medical personal.

An individual trained and accredited in obstetric ultrasound should only carry out the ultrasound scans. [Johnson, 1998:963] These are usually radiographers who have specialized in ultrasound and hold a B.tech ultrasound. One of the pitfalls that a unit should guard against is the use of non-trained ultasonographers. This is a temping situation for any department that is trying to cut costs. The fact that the examination is safe and non-invasive allows for a secure setting for the untrained person to be instructed in. This can lead to misdiagnosis and a host of problems associated with incorrect interpretation of the images, which will ultimately increase costs, emotional distress, etc.

Ultimately there is a huge role for ultrasound to play in the primary heath care setting. Simply if used as an adjunct to the clinical assessment it shows how important ultrasound is with the confirmation, contradiction or unexpected diagnosis. Ultrasound helps with the management of the patient by helping the clinician direct the patient to remain in the primary setting or be transferred to secondary or tertiary. Ultrasound can also monitor the patient as the pregnancy progresses. With accurate gestational aging ultrasound helps to judge the most advantageous time to transfer a potential or known high risk patient to a secondary or tertiary health centre.

Ultrasound allows the unborn fetus to be visualised without harm to itself or the mother. Visualizing the fetus answers many questions the importance of which cannot be understated.

Section VI

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Section VII

6.1. Appendix 1.
Tables of Malformations.

6.1.1. Table of Major Malformations. [Romero et al, 1996:348].

Central nervous System	
hydrocephalus	Encephalocele
Anencephaly	Macrocephaly
Microcephaly	Cebocephaly
Meningocele	
Craniofacial	
craniostenosis	cleft lip / palate
Micrognathia	Low nasal bridge
choanal atresia	broad nasal bridge
hyper - hypotelorism	Prognathism
protruding forehead	Macroglossia
beaklike nose	cranial asymmetry
Absent ramus of the mandible	
Eye	
cataract / corneal opacity	Microcornea
coloboma of iris	retinal dysplasia
Microptlmia	Anophthalmos
Myopia	cyclopia
blue sclerae	aniridia
Glaucoma	
Ear	
low set ear	*severely malformed*
low ear canal	
Skin	
webbed neck	multiple haemangiomas
Kidney	
polycystic kidney	multicystic kidney disease
hydronephrosis	megaureter
horseshoe kidney	prune-belly syndrome
duplicated ureters	ureteropelvic junction obstruction
bilateral / unilateral renal agenesis	posterior urethral valves
Heart	
atrial septal defect	pulmonary stenosis
ventricular septal defect	aortic stenosis
tetralogy of Fallot	cardiomyopathies
atrioventricular septal defect	total anomalous venous return
univentricular heart	*ectopia cordis*
hypoplastic left heart syndrome	tumours of the heart

hypoplastic right ventricle
complete transposition of the great vessels
corrected transposition of the great vessels
double outlet right ventricle
Truncus arteriosus
coarctation of aortic arch
single ventricle
supravalvular aortic stenosis
asymmetric septal hypertrophy
endocardial fibroelastosis
Ebstein's anomaly
cardiosplenic syndromes

Gastrointestinal Tract

intestinal atresia
imperforate anus
Omphalocele
Gastroschisis
Hepatomegaly
Splenomegaly
pyloric stenosis
malrotation of colon
anal atresia with rectovestibular fistula
biliary atresia
megagcystis-microcolon-intestinal hypoperistatsis

Genital Tract

severe hypospadias
common cloaca
abdominal cryptorchidism
inguinal cryptorchidism
ambiguous genitalia
bifid scotum
unicornate uterus
absence of uterus
double vagina
duplication/anomalous insertion of fallopian tubes
hypoplastic ovaries
uterine cysts
vaginal atresia
ovarian cysts

Skeleton

absence of radius
absence of fibula
short femurs
malleable bones
congenital dislocated hips
sacral agenesis
sirenomelia
hypoplasia of clavicals
small thoracic cages
rib defects
scoliosis, kyphosis
short limbs
elbow dysplasia
narrow pelvis
joint inflammation / cotractures
absence of pubic rami
vertabral malformation
hemivertabrae
phocomelia
demineralisation of bones

Hand

polydactyly
syndactyly
clinodactyly
complete cutaneous syndactyly
absence of thumbs
short hands
absence of metacarpals
absence of of distal phalanx
broad fingers
Streeter's bands or deformity
ectrodactyly
oligodactyly

Foot

polydactyly
syndactyly
equinovarus / clubfoot
severe calcaneovalgus
absence of nails

Other

sacral teratoma	absence of sternocleidomastoid muscle

6.1.2. Table of Minor Malformations. [Romero et al, 1996:350].

Craniofacial

borderline small mandible	lower lip pits
flat occiput / occipital spur	microstomia
prominent occiput	Macrostomia
small or short nose	Cleft or irregular tongue
prominent nose	anadontia, hypodentia
hypoplasia of nares	irregular placement of teeth
abnormal filtrum	neonatal teeth
prominent full lips	dental cysts

Eye

inner epicanthal folds	prominent eyes
upward lateral slant of palpebral fissures	ptosis of eyelid
short palpebral fissures	*Strabismus*
small inner canthal distance	Nystagmus
sparse eyebrows	Lens dislocation
shallow orbital ridges	retinal pigmentation
prominent sub-orbital ridges	Iris, unusual patterning or coloration

Ear

lack of usual folds or helix	double lobules
severe slant away from eye	incomplete helix
preauricular skin tags	absent tragus
small,large or asymmetrical ears	separate lobule
auricular sinus	

Heart

premature atrial or ventricular contractions	atrioventricular block
supraventricular tachyarrythmias	

Abdominal

unusual diastasis recti	Meckel's diverticulum
umbilical hernia	heterotropic pancreatic or splenic tissue

Genital

ectopic testes	Hypogenitalism
Micropenis	hypoplasia of labia majora

Skin

Hemangioma	loose redundant skin
pigmented nevi	cutis marmorata
mongoloid spots	Telangiectasis

café-au-lait'
high placed nipples
alopecia of the scalp

Hirsutism
deep sacral dimple, pilonidal cyst
eczema-like skin disorder

Hand

simian creases
other crease patterns
clinodactayly fith finger

rudimentary polydactaly
duplication of the thumb nail
clenched hand

Foot

partial syndactyly
recessed fith toes

posterior prominence of heel
prominent calcaneus

Other Skeletal

prominent sternum
depressed srernum
shieldlike chest

genu recurvatum
cubitus valgus
Joint hypermolility

6.2. Appendix 2
Frequency Tables.

Frequencies

Statistics

		PREV	AFI_A	GRO	PST_D	OBE	FWB	MUL
N	Valid	954	313	169	58	23	41	80
	Missing	136	777	921	1032	1067	1049	1010

Statistics

		POS	LIE	DVP	EFW	PL	PV	GPH
N	Valid	63	58	76	132	80	49	25
	Missing	1027	1032	1014	958	1010	1041	1065

Statistics

		IUD	PC_S	FA_A	P_LAB	B_L	GA_A
N	Valid	2	74	45	16	127	275
	Missing	1088	1016	1045	1074	963	815

Frequency Table

PREV

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	733	67.2	76.8	76.8
	1.00	221	20.3	23.2	100.0
	Total	954	87.5	100.0	
Missing	System	136	12.5		
Total		1090	100.0		

AFI_A

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	313	28.7	100.0	100.0
Missing	System	777	71.3		
Total		1090	100.0		

GRO

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	169	15.5	100.0	100.0
Missing	System	921	84.5		
Total		1090	100.0		

PST_D

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	58	5.3	100.0	100.0
Missing	System	1032	94.7		
Total		1090	100.0		

OBE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	23	2.1	100.0	100.0
Missing	System	1067	97.9		
Total		1090	100.0		

FWB

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	41	3.8	100.0	100.0
Missing	System	1049	96.2		
Total		1090	100.0		

MUL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	80	7.3	100.0	100.0
Missing	System	1010	92.7		
Total		1090	100.0		

POS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	63	5.8	100.0	100.0
Missing	System	1027	94.2		
Total		1090	100.0		

LIE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	58	5.3	100.0	100.0
Missing	System	1032	94.7		
Total		1090	100.0		

DVP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	76	7.0	100.0	100.0
Missing	System	1014	93.0		
Total		1090	100.0		

EFW

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	132	12.1	100.0	100.0
Missing	System	958	87.9		
Total		1090	100.0		

PL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	80	7.3	100.0	100.0
Missing	System	1010	92.7		
Total		1090	100.0		

PV

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	49	4.5	100.0	100.0
Missing	System	1041	95.5		
Total		1090	100.0		

GPH

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	25	2.3	100.0	100.0
Missing	System	1065	97.7		
Total		1090	100.0		

IUD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	2	.2	100.0	100.0
Missing	System	1088	99.8		
Total		1090	100.0		

PC_S

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	74	6.8	100.0	100.0
Missing	System	1016	93.2		
Total		1090	100.0		

FA_A

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	45	4.1	100.0	100.0
Missing	System	1045	95.9		
Total		1090	100.0		

P_LAB

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	16	1.5	100.0	100.0
Missing	System	1074	98.5		
Total		1090	100.0		

B_L

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	127	11.7	100.0	100.0
Missing	System	963	88.3		
Total		1090	100.0		

GA_A

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	275	25.2	100.0	100.0
Missing	System	815	74.8		
Total		1090	100.0		

Frequencies

Statistics

		POS	PRE
N	Valid	63	1024
	Missing	1027	66

Frequency Table

POS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	63	5.8	100.0	100.0
Missing	System	1027	94.2		
Total		1090	100.0		

PRE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	38	3.5	3.7	3.7
	2.00	193	17.7	18.8	22.6
	3.00	757	69.4	73.9	96.5
	4.00	25	2.3	2.4	98.9
	5.00	11	1.0	1.1	100.0
	Total	1024	93.9	100.0	
Missing	System	66	6.1		
Total		1090	100.0		

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
PRE * POS	59	5.4%	1031	94.6%	1090	100.0%

PRE * POS Crosstabulation

			POS	
			1.00	Total
PRE	2.00	Count	25	25
		% within POS	42.4%	42.4%
	3.00	Count	33	33
		% within POS	55.9%	55.9%
	5.00	Count	1	1
		% within POS	1.7%	1.7%
Total		Count	59	59
		% within POS	100.0%	100.0%

Frequencies

Statistics

Placental Position (PLA)

N	Valid	958
	Missing	132

Placental Position (PLA)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not Low	923	84.7	96.3	96.3
	Low	35	3.2	3.7	100.0
	Total	958	87.9	100.0	
Missing	System	132	12.1		
Total		1090	100.0		

Frequencies

Statistics

		GA_B	GA_B_GRP
N	Valid	930	930
	Missing	160	160

Frequency Table

GA_B

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6	1	.1	.1	.1
	7	2	.2	.2	.3
	8	2	.2	.2	.5
	9	1	.1	.1	.6
	10	3	.3	.3	1.0
	11	4	.4	.4	1.4
	12	3	.3	.3	1.7
	13	8	.7	.9	2.6
	14	8	.7	.9	3.4
	15	2	.2	.2	3.7
	16	6	.6	.6	4.3
	17	10	.9	1.1	5.4
	18	11	1.0	1.2	6.6
	19	18	1.7	1.9	8.5
	20	19	1.7	2.0	10.5
	21	28	2.6	3.0	13.5
	22	41	3.8	4.4	18.0
	23	25	2.3	2.7	20.6
	24	14	1.3	1.5	22.2
	25	26	2.4	2.8	24.9
	26	26	2.4	2.8	27.7
	27	57	5.2	6.1	33.9
	28	45	4.1	4.8	38.7
	29	32	2.9	3.4	42.2
	30	43	3.9	4.6	46.8
	31	36	3.3	3.9	50.6
	32	67	6.1	7.2	57.8
	33	51	4.7	5.5	63.3
	34	57	5.2	6.1	69.5
	35	55	5.0	5.9	75.4
	36	63	5.8	6.8	82.2
	37	52	4.8	5.6	87.7
	38	24	2.2	2.6	90.3
	39	29	2.7	3.1	93.4
	40	34	3.1	3.7	97.1
	41	7	.6	.8	97.8
	42	20	1.8	2.2	100.0
	Total	930	85.3	100.0	
Missing	System	160	14.7		
Total		1090	100.0		

GA_B_GRP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< 28 weeks	360	33.0	38.7	38.7
	> 28 weeks	570	52.3	61.3	100.0
	Total	930	85.3	100.0	
Missing	System	160	14.7		
Total		1090	100.0		

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Placental Position (PLA) * GA_B_GRP	888	81.5%	202	18.5%	1090	100.0%

Placental Position (PLA) * GA_B_GRP Crosstabulation

			GA_B_GRP		
			< 28 weeks	> 28 weeks	Total
Placental Position (PLA)	Not Low	Count	304	550	854
		% within Placental Position (PLA)	35.6%	64.4%	100.0%
	Low	Count	29	5	34
		% within Placental Position (PLA)	85.3%	14.7%	100.0%
Total		Count	333	555	888
		% within Placental Position (PLA)	37.5%	62.5%	100.0%

Frequencies

Statistics

		S_M	Intra-Uterine Death checked
N	Valid	981	2
	Missing	109	1088

Frequency Table

S_M

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	902	82.8	91.9	91.9
	Multiple	79	7.2	8.1	100.0
	Total	981	90.0	100.0	
Missing	System	109	10.0		
Total		1090	100.0		

Intra-Uterine Death checked

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	.2	100.0	100.0
Missing	System	1088	99.8		
Total		1090	100.0		

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Gastational Age	930	6	42	29.96	7.13
Valid N (listwise)	930				

Frequencies

Statistics

trimester

N	Valid	930
	Missing	160

trimester

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 to 12 weeks	16	1.5	1.7	1.7
	13 to 26 weeks	242	22.2	26.0	27.7
	27 to 42 weeks	672	61.7	72.3	100.0
	Total	930	85.3	100.0	
Missing	System	160	14.7		
Total		1090	100.0		

Frequencies

Statistics

		MOU_WARD	Hospital delivered
N	Valid	994	595
	Missing	96	495

Frequency Table

MOU_WARD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ANW	255	23.4	25.7	25.7
	MMH	315	28.9	31.7	57.3
	KHAY	116	10.6	11.7	69.0
	MP	182	16.7	18.3	87.3
	GUGS	126	11.6	12.7	100.0
	Total	994	91.2	100.0	
Missing	System	96	8.8		
Total		1090	100.0		

Hospital delivered

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MMH	510	46.8	85.7	85.7
	MP	38	3.5	6.4	92.1
	GSH	30	2.8	5.0	97.1
	KMOU	12	1.1	2.0	99.2
	GUGS	5	.5	.8	100.0
	Total	595	54.6	100.0	
Missing	System	495	45.4		
Total		1090	100.0		

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
MOU_WARD * Hospital delivered	530	48.6%	560	51.4%	1090	100.0%

MOU_WARD * Hospital delivered Crosstabulation

Count

		Hospital delivered					
		MMH	MP	GSH	KMOU	GUGS	Total
MOU_WARD	ANW	124	5	4	1	1	135
	MMH	150	5	10	2		167
	KHAY	56	1	1	8	1	67
	MP	69	27	6			102
	GUGS	49		7		3	59
Total		448	38	28	11	5	530

Frequencies

Statistics

Mode of delivery

N	Valid	480
	Missing	610

Mode of delivery

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	EM/C	99	9.1	20.6	20.6
	NVD	283	26.0	59.0	79.6
	VAC	31	2.8	6.5	86.0
	EL/C	67	6.1	14.0	100.0
	Total	480	44.0	100.0	
Missing	System	610	56.0		
Total		1090	100.0		

Descriptives

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Birth weight	481	300	4960	2900.51	768.96
Valid N (listwise)	481				

Frequencies

Statistics

Weight groups

N	Valid	481
	Missing	609

Weight groups

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< 1 kg	9	.8	1.9	1.9
	< 1.5 kg	26	2.4	5.4	7.3
	< 2.5	91	8.3	18.9	26.2
	< 5 kg	355	32.6	73.8	100.0
	Total	481	44.1	100.0	
Missing	System	609	55.9		
Total		1090	100.0		

When we are born we cry that we are come to this great stage of fools!

[King Lear IV. Vs. 183]