
A Retrospective Study of the Accuracy of Sonographic Chorionicity Determination in Twin Pregnancies

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The aim of this study was to determine the accuracy of sonographic chorionicity determination in the largest sample of twin pregnancies to date. We retrospectively analyzed 463 twin pregnancies delivered over a 6-year period to determine in each case what the antenatal sonographic prediction of chorionicity was, and then what the subsequent post partum pathological diagnosis of chorionicity was. Out of 436 twin pregnancies, 428 were correctly diagnosed for chorionicity as confirmed by pathology reports. Sonography as a screening tool for monochorionic twin pregnancies has a sensitivity of 100%, a specificity of 97.9% and a predictive value positive of 88.2%. Transvaginal scanning in the first trimester determined twin chorionicity with a sensitivity and a specificity of 100%. This study has confirmed in the largest sample to date that sonographic chorionicity determination is best done in the first trimester using vaginal scans, where it has 100% accuracy.

For many years it has been possible to determine the chorionicity of twin pregnancies prenatally by ultrasound. It has been widely recommended that this be done routinely (Fisk & Bryan, 1993; Monteagudo et al., 1994). This is because perinatal mortality and morbidity are three- to fivefold higher in monochorionic compared to dichorionic pregnancies and the knowledge of chorionicity alters antenatal management. However there is evidence that routine prenatal determination of chorionicity is not standard practice (Fisk & Bryan, 1993). This may simply be due to a lack of appreciation of the relative ease and accuracy of sonographic chorionicity determination. Doubts over the success of chorionicity scanning, and criticism that its accuracy remains to be determined on a large sample have persisted in the literature (Crowther, 1996). Because of this the results of routine scanning for chorionicity in all twin pregnancies over a 6-year period were retrospectively reviewed, and, by comparison with the post partum pathological examination of the placentas and membranes, the accuracy of the prenatal scanning

determined. This has resulted in the largest study to date to assess the accuracy of twin chorionicity determination by ultrasound scan.

Materials and Methods

The notes on all twin pregnancies delivered between the January 1, 1993 and December 31, 1998 were retrospectively analyzed. Twin pregnancies that had some antenatal care at University Malaya Medical Centre but were delivered outside the hospital, and those that miscarried were not included in the study. There were 464 such deliveries of which only 436 case files (93.9%) were retrieved from medical records. There were a number of reasons why 28 medical records were unavailable, the most common being an admission under another clinical department at the time the study was performed.

For each of the 436 available case files, the following details (where the information was available) were recorded: 1) the gestational age and the chorionicity as determined by antenatal ultrasound scanning; and 2) the pathological report of chorionicity as determined by post partum examination of the placentas and membranes.

The aim was to compare the initial diagnosis of chorionicity based upon the sonographer's interpretation of the antenatal scan with the actual chorionicity as confirmed by the post partum pathology reports.

The Ultrasound Unit uses real-time linear array ultrasonography. Abdominal transducers (3.5 MHz) are used routinely unless the gestation is very early and/or the findings are not clear, in which case a transvaginal probe is employed. The diagnostic ultrasound system used was the Toshiba CAPASEE II, Model SSA-220A. This system possesses convex and linear high-sensitivity electronic transducers with both transvaginal and transabdominal probes. This

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machine is manufactured in Malaysia by Abex Medical Systems.

Certain criteria were used to determine the chorionicity at antenatal ultrasound scanning. In the first 10 weeks of the pregnancy, the amnion can normally be distinguished from the chorion with an intervening cavity between the two membranes (the extra embryonic coelom; Warren et al., 1989). Thus before 10 weeks' gestation the number of visible chorionic membranes were counted to establish the chorionicity. After 10 weeks we tried to identify discordant external genitalia or separate placental discs, as these confirmed dichorionicity. If the genitalia were the same and a single fused placental mass was seen, the thickness of the intertwin septum and the shape of its junction with the placental mass were relied upon. A thick septum with a wedge-shaped junction demonstrating the twin peak or lambda sign identified a dichorionic twin. A thin septum with a T-shaped junction identified a monozygotic twin (Barss et al., 1985).

Following delivery of the twins, all placentas were sent to the pathology department for a histological examination in order to confirm the chorionicity.

Results

All 436 twin pregnancies studied had placentas and membranes sent to pathology post partum and reports of chorionicity and amnionity were available for all these cases.

Pathology reports showed that of the 436 twin deliveries, 60 were monozygotic and 376 were dichorionic. Of the 436 cases, 428 scans correctly diagnosed the chorionicity as confirmed by the pathology reports. This gives an overall accuracy of 98.2%.

Table 1 gives the gestational age when the ultrasound scan could first confirm chorionicity, and for each age group details whether the diagnosis was correct and whether an abdominal or transvaginal probe was used.

In eight cases the prediction of chorionicity was incorrect. In five cases the error was made in the second or third trimesters. In each of these cases, either no scan was performed in the first trimester, or chorionicity failed to be mentioned at the first trimester scans. Four of these scans were performed abdominally and one was performed vaginally. Three errors were made in the first trimester. All three cases were scanned abdominally. All eight errors consisted of a misdiagnosis of monozygoticity while the histology reports confirmed each of these pregnancies as being dichorionic. All 60 monozygotic pregnancies (Table 1) were correctly identified as such. Thus ultrasound scanning as a screen for monozygoticity has a sensitivity of 100% (60/60), a specificity of 97.9% (368/376) and a predictive value positive of 88.2% (60/68). Transvaginal screening contributed to fewer errors than transabdominal scanning (of the eight errors only one was obtained using a vaginal scan —

Table 1

Number of Errors in Chorionicity Diagnosis Subdivided by Gestational Age and Type of Scan Probe Used

| | Gestational age (weeks) | Number of twins | Abdominal or vaginal scan | Number of errors |
|-----------------------------------|-------------------------|-----------------|---------------------------|------------------|
| First trimester | 0–2 | 0 | 0 | 0 |
| | 3–5 | 23 | 23 vaginal | 0 |
| | 6–8 | 141 | 3 abdominal | 3 |
| | | | 138 vaginal | 0 |
| | 9–11 | 112 | 112 vaginal | 0 |
| 12–14 | 68 | 25 abdominal | 0 | |
| | | 43 vaginal | 0 | |
| First trimester total | | 344 | 28 abdominal | 3 |
| | | | 316 vaginal | 0 |
| Second and third trimesters | 15–20 | 17 | 17 vaginal | 0 |
| | 21–26 | 28 | 28 vaginal | 0 |
| | 27–32 | 21 | 16 abdominal | |
| | | | 5 vaginal | 0 |
| | 33–38 | 23 | 15 abdominal | 1 |
| 38–42 | 3 | 8 vaginal | 1 | |
| | | 3 abdominal | 2 | |
| Second and third trimesters total | | 92 | 34 abdominal | 4 |
| | | | 58 vaginal | 1 |
| Overall total | | 436 | 62 abdominal | 7 |
| | | | 374 vaginal | 1 |

Table 1). Vaginal scanning in the first trimester had 100% accuracy in determining chorionicity. Thus as a screen for monochorionicity, first trimester vaginal scanning has a 100% sensitivity and specificity.

Discussion

This is the largest study of the accuracy of sonographic chorionicity determination to date. The results compare very favorably with previous studies. Sepulveda et al. (1996) reported 100% accuracy in a study of 369 twin pregnancies. Other studies with large sample sizes ($n = 100$ to $n = 200$) have shown correct ultrasound predictions of chorionicity in 91% to 100% of cases (Carroll et al., 2002; Hill et al., 1996; Scardo et al., 1995). Results confirm that ultrasound scanning is an excellent screening test for monochorionic pregnancies, with an overall sensitivity of 100% and a specificity of 97.9%. The positive predictive value for the ability for ultrasound to identify a monochorionic twin pregnancy is 88.2% (60/68).

Chorionicity determination has long been described as being more accurate in the first trimester (Monteagudo et al., 1994). This study has highlighted both the importance of early first trimester scanning in twin pregnancies, and the high degree of accuracy obtained by using transvaginal scans at this trimester. All three errors made in the first trimester were from abdominal scans, and abdominal scanning in fact accounted for most of the errors made at all gestational ages (Table 1). Vaginal scanning in the first trimester demonstrated 100% accuracy and should be the method of choice in twin chorionicity determination.

More errors occurred with second and third trimester scans than with first trimester scans (Table 1). Second and third trimester chorionicity determination is more difficult even if vaginal scanning is employed (one of five errors was performed by a vaginal scan). Many of these patients had twin-twin complications that made this diagnosis even more difficult. For example, one patient was referred at 32 weeks because of intrauterine growth retardation and oligohydramnios in both twins, with severe maternal nephropathy and worsening preeclampsia. The lack of amniotic fluid and small size of the twins made identification of the septum and its junction almost impossible. The ultrasound scan report on admission commented on the difficulty in estimating chorionicity at this gestation and made a probable diagnosis of a monochorionic diamniotic pregnancy. Soon after this, the twins were delivered by caesarean section and the pathology report showed a dichorionic diamniotic pregnancy. All five cases incorrectly diagnosed in the second and third trimester had similar technical problems. The problem of twins presenting late in the pregnancy with clinical indications for chorionicity determination, but also having at this stage intrauterine problems that make this determination impossible, is a common one (Fisk, 1995). As

a result of this there has been a widespread recommendation to not only screen for chorionicity routinely, but also to do this at the very first scan that confirms the multiple pregnancy in order to reduce diagnostic error (Fisk & Bryan, 1993). It should be noted that even in the third trimester, despite these problems, 94.6% accuracy (87/92) was achieved. This high success rate for most gestations is supported by other studies (Barss et al., 1985).

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