How do we evaluate amniotic fluid volume in twins?

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Abstract
Introduction
Twin pregnancies are at increased risk, compared to singleton pregnancies, for spontaneous abortions, malformations, low birth weight neonates, and preterm deliveries. Additionally the pregnancies are at greater risk for gestational diabetes, hypertension/preeclampsia, acute fatty liver, and placental abruption. Because of these increased risks for pregnancy complications and adverse pregnancy outcomes, the assessment of amniotic fluid volume is even more important in twin pregnancies during the foetal anatomic survey, growth assessment, and as a component of antenatal testing. This paper discusses the different methods we have to evaluate amniotic fluid volume in twins.

Short Communication
The amniotic fluid volume in twins is estimated by many different techniques including amniotic fluid index, single deepest pocket, 2-diameter pocket, and subjective assessment method.

Conclusion
Twin pregnancies are at significantly higher risk for pregnancy complications, perinatal morbidity and mortality compared to singleton pregnancies. The amniotic fluid volume can be measured accurately in each sac but the techniques to measure those fluid volumes are impractical for everyday use.

Introduction
Normal amniotic fluid volume in twins
In order to be able to evaluate abnormal amniotic fluid volume in twin pregnancies, normal volume must first be defined. The only study that was embarked upon to address this question, evaluated amniotic fluid volume between 27-38 weeks in diamniotic twin pregnancies.¹

The investigators observed that the volumes per individual amniotic fluid sac ranged from 155 – 5430 ml with a mean of 877 ml which is similar to what observed in singleton pregnancies. The volumes of each sac were determined by the validated dye-detemined volume techniques of Charles and Jacoby.²

This technique is invasive and requires laboratory support and is not practical for the day to day assessment of amniotic fluid volume. The need for a more viable alternative has led to the ultrasound estimate of amniotic fluid volume.

Several ultrasound methods have been used to estimate the amniotic fluid volume in twins including the amniotic fluid index, single deepest pocket (SDP), two diameter pocket (2DP) and the subjective assessment of the amniotic fluid volume. The aim of this paper was to discuss the methods that can be used to evaluate fluid volume in twins.

Short Communication
The authors have referenced some of their own studies in this short communication. These referenced studies have been conducted in accordance with the Declaration of Helsinki (1964) and the protocols of these studies have been approved by the relevant ethics committees related to the institution in which they were performed.

All human subjects, in these referenced studies, gave informed consent to participate in these studies.

Ultrasound estimate of amniotic fluid volume in twin
Amniotic Fluid Index (AFI)
In singleton pregnancies, the estimation of the amniotic fluid volume by the AFI is customarily done by the technique described by Phelan.³ The uterus is divided into 4 quadrants: by the umbilicus transversely into upper and lower quadrants and by the linea nigra into the right and left halves. With the ultrasound transducer held perpendicular to the floor, the largest vertical pocket of fluid within each quadrant without an aggregate of cord or foetal small parts is measured in centimetres.

To be a measurable pocket, the pocket must be at least 1 cm in the horizontal measurement throughout the pocket (Figure 1 and Figure 2). A depth of 0-5 is labelled as oligohydramnios, 5-24 or 5-25 as normal, and ≥ 24 or ≥ 25 as hydramnios. In twin pregnancies, the summed AFI has been used by a number of investigators to estimate the amniotic fluid volume.⁴ ⁵ ⁶ This estimate is done in a manner similar to the technique used in singleton pregnancies by dividing the abdomen into four quadrants. The largest pocket in each quadrant is measured and summed giving the summed AFI.

Membrane placement is not taken into consideration in measuring the summed AFI (Figure 3). When the accuracy of the summed AFI was evaluated by dye-dilution techniques; the summed AFI identified 94% of twin pairs as having normal amniotic fluid volume when only 52% had normal volumes. In 20 of the 62 twin pairs with discordant amniotic fluid volume by dye-determination, the summed AFI identified the discordant volumes as normal in 90%. The summed AFI identified 8 of the 10 twin pregnancies with low volumes in both sacs by dye-determination as

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normal amniotic fluid volume. High and low volumes of amniotic fluid may well co-exist in twin pregnancies as summated AFI poorly detects discordant volumes by not taking membrane placement into consideration (Figure 4).

A number of other techniques have been used under the category of AFI to determine the amniotic fluid volume in twins.

Gerson et al. estimated the amniotic fluid volume by identifying the dividing membrane between the twins and, using the foetal diaphragm, divided the amniotic fluid sac into upper and lower halves measuring the largest pocket free of umbilical cord in centimetres and summed the measurement providing a two quadrant AFI (Figure 5).

Hill et al. detected each foetus and its surrounding amniotic sac and, using the foetus as the vertical axis in the sac, measured the largest vertical pocket in the 4 quadrants of the sac surrounding the foetus. The AFI was the summation of these 4 measurements (Figure 6). Neither of these techniques has been validated by a dye-determined amniotic fluid volume.

Magann et al. identified the separating membrane between the twins and measured the largest vertical pocket of fluid in each quadrant that the foetus and the sac occupied (Figure 7).

The foetus and sac occupied two quadrants and the summed measurement was the sum of the largest vertical pocket in those two quadrants. An AFI of ≤ 5 cm was regarded as oligohydramnios, 5-20 as normal, and ≥ 20 as hydramnios. The AFI was then compared with dye determined fluid volume, the AFI technique was able to correctly classify fluid volumes between 500 – 2000 ml in 47 of 48 cases (98%), but poorly identifies volume < 500 ml in 7 of 35 cases (20%) or > 2000 ml in 0 of 7 cases (0%).

In neither article were the issues of foetal small parts or umbilical cord in the pocket addressed. Chamberlain did not address how the amniotic fluid volume in twins should be estimated. Currently many clinicians measure the largest pocket without umbilical cord or foetal small parts or only if their
appearance is transient. In the estimation of amniotic fluid volume using the SDP in twins, the separating membrane is located and the largest vertical pocket of amniotic fluid volume in each sac is measured in centimetres (Figure 8).

A measurement of ≤ 2 cm is classified as oligohydramnios, 2-8 cm as normal, and > 8 cm as hydramnios, the same measurement thresholds that are used in singletons. A comparison of the SDP to a dye determined fluid volume revealed that the SDP was able to correctly classify fluid volumes between 500 – 2000 ml in 47 of 48 cases (98%), but poorly identifies volume < 500 ml in 1 of 35 cases (3%) or > 2000 ml in 0 of 7 cases (0%).10

**Diameter Pocket**

In singleton pregnancies, the 2-diameter pocket technique is the vertical measurement multiplied by the horizontal measurement of the largest identified pocket of amniotic fluid. A two-diameter pocket of ≤ 15 cm² was classified as oligohydramnios, 15 – 50 cm² as normal fluid volume and ≥ 50 cm² as polyhydramnios.13 In twin pregnancies, the separating membrane is identified and the largest pocket of fluid in each sac without foetal small parts or umbilical cord is identified and the horizontal measurement is multiplied by the vertical measurement (Figure 9).

The same values used for oligohydramnios, normal and polyhydramnios in singletons are also used for twins. A comparison of the 2DP to a dye-determined fluid volume revealed that the 2DP was able to correctly classify fluid volumes between 500 – 2000 ml in 39 of 48 cases (81%), identified volume < 500 ml in 20 of 35 cases (57%) and > 2000 ml in 1 of 7 cases (14%).10

**Subjective Assessment**

The subjective assessment of amniotic fluid volume is the visualization of the amniotic fluid volume by an experienced sonographer and estimating if the fluid volume is low, normal or high based on visualization alone, without measurements.10 In an investigation evaluating the subjective assessment of amniotic fluid volume in singleton pregnancies with multiple ultrasound estimates including the SDP, 2DP, and the AFI, the subjective assessments were similar in accuracy with the objective ultrasound measurements in classifying volumes of fluid as oligohydramnios, normal and polyhydramnios with those volumes validated by dye-determination techniques. A similar study was carried out in twin pregnancies and the subjective and objective evaluations were found to be similar in the identification of amniotic fluid volumes in each sac of a twin pregnancy, the volume validated by dye-dilution techniques. The recognition of low
volumes was poor, ranging from 7-29%.

Discussion
The assessment of amniotic fluid volume is important in singleton pregnancies as part of the foetal anatomic survey, and in at-risk pregnancies as a component of antenatal testing. In twin pregnancies with an increased risk for perinatal morbidity and mortality, that evaluation becomes even more important.

To recognize an abnormal fluid volume in a twin pregnancy, normal volumes must be identified. The difficulty of using the gold standard dye-dilution technique to accurately calculate the amniotic fluid volume in each sac of a twin pregnancy is exemplified by the fact that there is only a single study in the literature in which this has been done. This has led to the estimation of amniotic fluid volume using a variety of ultrasound measurements including the AFI, SDP, and 2DP techniques.

Additionally, the subjective assessment - visualization without measurement - has been shown by dye-dilution technique to be as accurate as the ultrasonic measurements. Regrettably the only way to validate which ultrasound measurements more accurately identify oligohydramnios, normal amniotic fluid volume and polyhydramnios is to correlate the ultrasound measurement with a calculated volume of fluid. In using the ultrasound estimate of amniotic fluid volume, it is clear that volumes must be measured in each individual sac.

The failure of the summated AFI, which did not take membrane placement into consideration, demonstrates that each amniotic sac must be measured or subjectively assessed. The determination of which techniques, measurement of the largest pocket of amniotic fluid above and below the diaphragm of the fetus in each sac (Figure 5) or using the foetus longitudinally to divide the sac into right and left halves and the foetal diaphragm to divide the sac into upper and lower halves and then measure the single deepest pocket in each of the 4 quadrants (Figure 6) or to measure the single deepest pocket in each quadrant that the foetus occupies (Figure 7) or the single deepest pocket in each amniotic sac (Figure 8) remains unknown.

The technique of measuring the single deepest pocket in each amniotic sac is in widespread use in the United States, perhaps because of its simplicity.

Conclusion
Amniotic fluid volume in normal diamniotic twin pregnancies in the third trimester of pregnancy is similar to the normal volumes in singleton pregnancies in the third trimester. The amniotic fluid volume can be measured accurately in each sac but the techniques to measure those fluid volumes are impractical for everyday use.

The summated AFI, by not considering membrane placement, is not able to recognize individual low or high sac volumes and shouldn't be used to estimate amniotic fluid volume. The other techniques evaluating individual sac volume; AFI, SDP, 2DP, and subjective assessment are all able to reasonably identify normal amniotic fluid volume, but poorly recognize oligohydramnios and polyhydramnios. Many health care providers currently measure the single deepest pocket of each sac in diamniotic twin pregnancies to estimate the amniotic fluid volume.

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References

Short communication

Figure 9: The two-diameter pocket method: the separating membrane is identified and the largest pocket of fluid in each sac without foetal small parts or umbilical cord is identified, and the horizontal measurement is multiplied by the vertical measurement.


