

Perspective

# With the Use of Color Doppler, Should We Lower Our Thresholds to Estimate Oligohydramnios?

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The assessment of amniotic fluid volume is usually carried out when an ultrasound is done in pregnancy. Even if the amniotic fluid volume is not specifically measured, the sonographer will take note if the amniotic fluid volume is subjectively low, normal or high. The estimate of the amniotic fluid volume by ultrasound is part of the fetal, uterine, and adnexal survey at the time of the targeted second trimester ultrasound and is an integral part of the appraisal of pregnancies at risk for an adverse outcome as either part of the biophysical profile (fetal tone, fetal movement, fetal breathing, non-stress test, single deepest pocket) or the modified biophysical profile (non-stress test, amniotic fluid index or single deepest pocket (SDP)).

At the time of a targeted ultrasound, the recognition of an abnormal amniotic fluid volume should alert the sonographer to look for fetal structural anomalies. The detection of oligohydramnios alerts the health care provider to search for the presence of renal arteries and kidneys, bladder outlet obstructions and rupture of the fetal membranes. Polyhydramnios informs the provider to look for open neural tube defects, intracranial abnormalities that might interfere with fetal swallowing, evidence of a gastrointestinal obstruction, fetal hydrops, fetal macrosomia, and/or maternal diabetes. When at-risk pregnancies are identified, their surveillance is often done using the biophysical profile (BPP). Manning first proposed and validated the use of the BPP for assessing at-risk pregnancies [1]. Phelan published follow up work suggesting the use of a four quadrant evaluation or amniotic fluid index (AFI), be used along with other testing (non-stress test) in the assessment of the at-risk pregnancy [2]. The studies in which the use of color Doppler has been advocated are typically high-risk pregnancies including those with intrauterine growth restriction, hypertensive disorders of pregnancy, diabetes, chronic maternal medical conditions, fetal conditions and placental conditions.

Color Doppler has been recently used in studies of high risk pregnancies to determine if pregnancies with low amniotic fluid volume can more be more easily recognized.

Recent articles assessing the estimated amniotic fluid volume are mixed in the use of color Doppler. Some studies continue to use gray scale alone, some use color Doppler's and others do not specify

if gray scale alone or if color Doppler is used. In the original articles describing methods to estimate amniotic fluid volume, fluid pockets are only measured if they are free of fetal small parts or umbilical cord. If cord or small parts are transiently present then the pocket is measured. If fetal small parts or cord persist, the pocket of fluid should not be measured or measurements should only be of the largest pocket to the cord and not through the cord. Color Doppler was not available when the original studies were undertaken and measurements were done with gray scale alone. These studies validated that an estimated low fluid volume was linked with adverse pregnancy outcomes.

The use of color Doppler has been advocated because it will identify umbilical cord in an amniotic fluid pocket that may not be seen by gray scale alone. Since the original investigators did not measure a pocket of amniotic fluid that persistently contained cord, those investigators who support the use of color Doppler assert that it should be part of the routine to use color Doppler to identify those pockets of fluid with cord present that may not be seen by gray scale.

A literature search was undertaken to evaluate the impact of color Doppler compared with gray scale in the assessment of amniotic fluid volume. The search was undertaken using the search engines PubMed and Web of Science and the search terms "amniotic fluid" AND "color Doppler" OR "colour Doppler", AND "ultrasonography" AND "prenatal" AND amniotic fluid/ultrasonography AND "doppler and volume". The search was limited to the last 20 years and articles in English. There were 100 abstracts identified. All of the abstracts were read and 4 of the abstracts were found that compared color Doppler and gray scale in the estimation of amniotic fluid volume. In a study by Bianco et al., measurements of the AFI with and without color Doppler were compared, and the use of color Doppler was found to significantly decrease the AFI and increase the incidence of oligohydramnios [3]. In a second study the investigators found that the AFI was always lower with the use of color Doppler compared to the AFI and in the group with an AFI between 5 and 10 by gray scale assessment, 16% of those patients would have an AFI < 5 when color Doppler was used [4]. The finding of the first two studies was confirmed in another study where both AFI and SDP were measured with and without color Doppler [5]. Both values were decreased by approximately 20% when color Doppler was used, as opposed to gray scale alone. In that same study, the use of color Doppler was analyzed to determine if its use increased the detection rate of actual oligohydramnios (dye-determined oligohydramnios). The investigators found that not only did the use of color Doppler not improve the diagnostic accuracy of oligohydramnios, but it overestimated oligohydramnios by labelling 9/42 (21%) pregnancies with normal amniotic fluid as having oligohydramnios. The other abstract "Amniotic fluid index measurements are unaltered by the addition of color flow Doppler" was presented at the 25<sup>th</sup> annual meeting of the Society for Maternal Fetal Medicine in February of 2005. The authors concluded that although color Doppler reduced

the measurement of the AFI in normal volumes of fluid that alteration was not significant. In ultrasound estimated low fluid volumes the addition of color Doppler identified more volumes as low compared to gray scale but the difference was not statistically significant. This study has appeared only as an abstract and we find no evidence that it has been published. In summary the 3 published studies [3-5] and the abstract all revealed that the use of color Doppler compared with gray scale decreased either the AFI or the SDP and labelled more pregnancies with oligohydramnios.

Since oligohydramnios is associated with adverse pregnancy outcomes, the addition of any techniques or measurements that will assist in identifying more women with actual oligohydramnios will be very helpful. However, additional assessments that misclassify normal fluid volumes as oligohydramnios may lead to more interventions including inductions of labor that do not result in improved perinatal outcomes but do result in increased morbidity secondary to failed inductions or inductions of preterm fetuses even with other reassuring assessments of fetal well-being and resulting in increased neonatal morbidity from prematurity.

There are currently problems with the use of color Doppler. First, all of the initial studies that validated the association of ultrasound estimated oligohydramnios with adverse pregnancy outcomes were done with gray scale alone, and not color Doppler. Can we reliably say that this association is the same as with ultrasound studies utilizing color Doppler, since we know that color Doppler will label more pregnancies as having oligohydramnios? The published studies to date [3-5] and the unpublished abstract all show a reduction in the ultrasound estimate of amniotic fluid volume when color Doppler is used compared to gray scale alone. Should investigators re do the old studies done with gray scale alone to re-validate new estimated amniotic fluid volume thresholds using color Doppler and associate those thresholds with adverse intrapartum and perinatal outcomes. If

new authentication studies are not undertaken or until new studies are undertaken should we set new thresholds based on our current knowledge about the use of color Doppler. Since both the AFI and SDP are reduced by approximately 20% in the published studies by the use of color Doppler then shouldn't we reduce our threshold to label amniotic fluid volume by 20%. Then instead of using an AFI of  $< 5$  as a threshold for oligohydramnios we would then use  $< 4$  and rather than using a single deepest pocket of  $< 2$  we should use 1.6. The answers to the questions are unclear but until the questions are addressed the addition of a new technology (color Doppler) to older validated studies (gray scale) may lead to more interventions and more maternal morbidity without any improvement in perinatal morbidity and mortality.

Future investigations will need to compare pregnancy outcomes between gray scale and color Doppler techniques to determine if the classification of more amniotic fluid volumes as oligohydramnios with color Doppler will lead to an improvement in perinatal outcomes.

## References

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