

# Number of yolk sacs does not predict amnionicity in early first-trimester monochorionic multiple gestations

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**KEYWORDS:** amnionicity; chorionicity; first trimester; multiple gestation; twins; ultrasound; yolk sac

## ABSTRACT

**Objective** To determine the relationship between amnionicity and number of yolk sacs before 11 weeks of gestation.

**Methods** Twenty-two cases of monochorionic multiple pregnancy were scanned before 11 weeks of gestation. There were 21 sets of twins and one of triplets. Amnionicity was determined by visualization of a dividing amniotic membrane between the gestational sacs. The number of yolk sacs was recorded and compared with the presence or absence of a dividing membrane for all fetuses.

**Results** In 17/20 (85%) cases of monochorionic diamniotic twins, two yolk sacs were seen. In 3/20 (15%) cases of monochorionic diamniotic twins, a single yolk sac was seen. In the one case of monochorionic diamniotic triplets, two yolk sacs were visualized. In one case of monoamniotic twins, a single yolk sac was observed.

**Conclusions** In monochorionic pregnancies, the presence of two yolk sacs predicts diamnionicity. However, the use of the number of yolk sacs as a predictor of amnionicity may not be accurate in a small proportion of patients. The diagnosis of monoamnionicity can be made only following a careful search for a dividing amniotic membrane. Copyright © 2005 ISUOG. Published by John Wiley & Sons, Ltd.

## INTRODUCTION

Sonography can accurately determine chorionicity in the first trimester. This can be done by determination of the number of chorionic sacs separated by a thick dividing membrane<sup>1</sup>. Determination of amnionicity is typically

done after 8–10 weeks when the amniotic dividing membrane becomes visible. It has been suggested<sup>2,3</sup> that amnionicity can be predicted indirectly even earlier, by counting the number of yolk sacs; this is, allegedly, equal to amnionicity order, both in monoamniotic and diamniotic pregnancies.

In this study, we present our observation on the relationship between the number of visible yolk sacs and amnionicity in early first-trimester monochorionic pregnancies.

## METHODS

We identified 22 cases of monochorionic multiple gestation initially scanned between 6 and 10 weeks at Shaare Zedek Medical Center between 2002 and 2005. Scans were performed transvaginally and/or transabdominally using an ATL HDI 5000 or ATL HDI 3000 device (Advanced Technology Laboratories, Bothell, WA, USA). All scans were performed by operators with over 10 years of experience in first-trimester prenatal sonography. When the number of yolk sacs was smaller than the number of amniotic sacs, two senior sonographers (O.S. and R.R.) examined the patient and confirmed the observation in three cases, and one senior sonographer did so in one case.

Monochorionicity was determined by identifying the fetuses in a single chorionic sac. In each scan, crown–rump lengths, fetal pulses, the presence or absence of dividing amniotic membranes, and the number and size of yolk sacs were documented. The demonstration of a dividing amniotic membrane or membranes was considered adequate evidence of diamnionicity. In the case of monoamniotic twins and triplets, membrane status was confirmed by gross evaluation of the membranes postpartum. When the number of observed dividing

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amniotic membranes or the number of yolk sacs was smaller than the order of gestation, a repeat scan was scheduled within 2 weeks, up to 12 weeks. In all these cases a combined transabdominal and transvaginal approach was used. Gestational age was calculated from earliest crown–rump length.

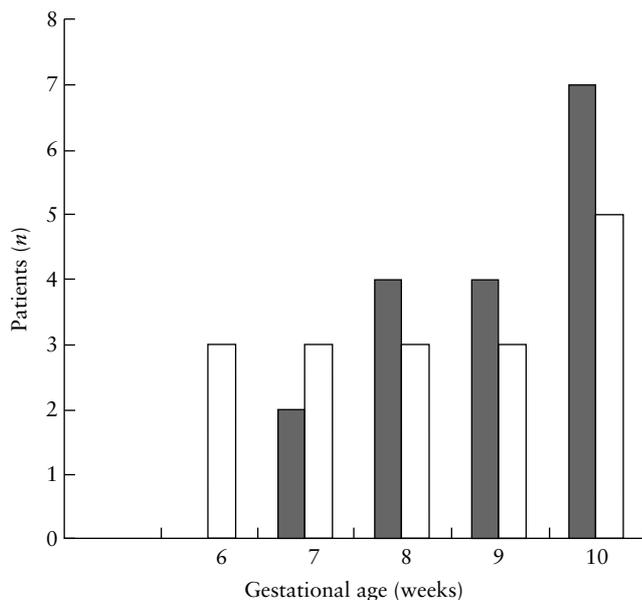
## RESULTS

There were 20 cases of monochorionic diamniotic twins, one case of monochorionic triplets and one case of monochorionic monoamniotic twins.

Two yolk sacs were visualized in 85% (17/20) of the monochorionic diamniotic twins. In all of these cases visualization was achieved on the first examination; Figure 1 shows the gestational age at which the first sonogram was performed, and the gestational age at which the dividing amniotic membrane was initially demonstrated. Figure 2 is an image of diamniotic twins with two yolk sacs. In the remaining 15% (3/20) of the monochorionic diamniotic twin pregnancies, one yolk sac was observed (Figure 3).

Of the three cases of diamniotic twins with a single yolk sac, two presented at 7 weeks and the third at 8 weeks. The follow-up studies performed at 2-week intervals up to 12 weeks failed to demonstrate a second yolk sac. In all three cases the dividing membrane was first seen with certainty at 9 weeks.

In the single case of monoamniotic twins, a single yolk sac was identified. This case presented at 10 weeks' gestation. In the triplets, two yolk sacs were identified. This case presented initially at 9 weeks, at which point one dividing amniotic membrane was seen. At 11 and 13 weeks an amniotic membrane was considered to surround each of the fetuses separately and the pregnancy



**Figure 1** Gestational age at first sonogram for all monochorionic diamniotic pregnancies (□) and at first visualization of dividing amniotic membrane (■).



**Figure 2** Ultrasound image showing monochorionic diamniotic pregnancy with two yolk sacs.



**Figure 3** Ultrasound image showing monochorionic diamniotic pregnancy with a single yolk sac. Arrow, amnion.

was considered to be monochorionic triamniotic. The two yolk sacs were identified on these follow-up examinations also. Examination of the placenta and membranes in this case established that this was a monochorionic diamniotic triplet pregnancy.

## DISCUSSION

First-trimester sonographic diagnosis of chorionicity, by counting the number of sacs separated by a thick membrane, is accurate and easy to perform<sup>1,4–6</sup>. As we found, the relatively thin amniotic membrane is visible after 8 weeks<sup>1,2</sup>.

In monoamniotic twins, a single yolk sac is present<sup>2,7</sup>. Between 5 and 8 weeks the amniotic membrane cannot be imaged reliably, and determining amnionicity may be difficult. Bromley and Benacerraf<sup>2,3</sup> suggested that

the diagnosis of amnionicity in twins can be made at this early stage, by counting the number of yolk sacs. They explained this by the close temporal proximity between yolk sac and amniotic differentiation. Our results confirm that demonstration of two yolk sacs can predict diamniotic pregnancy. However, unlike in their report, in three of our cases, the number of yolk sacs was smaller than the order of amnionicity. This observation of a single yolk sac with a monochorionic diamniotic twin gestation was also apparently made by Monteagudo *et al.*<sup>1</sup>, who commented that this was seen 'occasionally' but did not provide a detailed description. Having a yolk sac 'short', signifies the presence possibly, but not necessarily, of a monoamniotic pair. In our case of diamniotic triplets, and in the case of monoamniotic twins, this was indeed the case, as found on postpartum examination of the placenta.

These results are not surprising from an embryological perspective. Yolk sac and amnion differentiation occur very close to each other in time. The exact temporal relation between them is still not entirely clear<sup>8</sup>. The amnion differentiates 6–8 days after conception and the primary yolk sac probably appears within hours of this differentiation. The early studies<sup>8</sup> on human embryos do not depict clearly whether the yolk sac develops prior to or following the appearance of the amnion. Our results suggest that yolk sac differentiation occurs after that of the chorion and before that of the amnion. We might speculate that when splitting occurs after yolk sac and before amnion differentiation, the result is a single yolk sac and two amniotic sacs, while when splitting occurs after chorion and before yolk sac differentiation, the result is two yolk sacs and two amniotic sacs. As in the majority of cases of monochorionic, diamniotic twins there are two yolk sacs, and it is only in a small minority of these cases that there is a single yolk sac, it would be reasonable to speculate that yolk sac differentiation occurs shortly before that of the amnion. This is compatible with the studies on early embryos.

The ability to predict amnionicity at an early stage is of value. The prognosis of a monoamniotic pregnancy is worse<sup>9</sup> than that of a monochorionic diamniotic pregnancy. For some, monoamniotic twins may be an indication to consider pregnancy termination due to the excessive risk of fetal mortality. According to our

observation, the diagnosis of monoamnionicity can be ruled out when two yolk sacs are observed, but cannot be made based on the presence of a single yolk sac. The diagnosis of monoamnionicity is best deferred to a later stage, probably no earlier than 8–9 weeks of gestation, when the amniotic membrane's presence or absence can be determined directly and with certainty.

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