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REVIEW ARTICLE

Ultrasonography in Multiple Pregnancies

Masahiko Nakata

Department of Obstetrics and Gynecology and Perinatal Care Center, Tokuyama Central Hospital
Shunan, Japan

Correspondence: Masahiko Nakata, Department of Obstetrics and Gynecology and Perinatal Care Center, Tokuyama Central Hospital, 1-1 Kouda-cho, Shunan, 745-8522, Japan, Phone: +81-834-28-4411, Fax: +81-834-29-2579, e-mail: masahiko.nakata@tokuchuhp.jp

ABSTRACT

Multiple pregnancies have a higher risk of both maternal and fetal prognosis. Accurate diagnosis of chorionicity and amnionicity plays an important role for optical perinatal management. In monochorionic pregnancies, there may be several unique pathological complications derived from vascular anastomoses on monochorionic placentation. Twin-twin transfusion, twin-reversed arterial perfusion sequence and single fetal demise have several issues on both perinatal prognosis and management. Recent investments of medical instruments have allowed intervention during prenatal period, such as fetoscopic laser photocoagulation of communicating vessels. These interventions provide more favorable perinatal prognosis. Another risk in multiple pregnancies is congenital anomaly, which is apparently higher than in singleton pregnancy. Therefore, detailed ultrasound examination is necessary for optical management.

Keywords: Multiple pregnancies, Chorionicity, Twin-twin transfusion syndrome, Fetal therapy.

DETERMINATION OF CHORIONICITY AND AMNIONICITY

Accurate determination of chorionicity is essential for optimal management of multiple pregnancies. Monochorionic (MC) twin pregnancies have a significant higher risk of either perinatal death or neurologic disability because of specific complications, such as twin-twin transfusion syndrome (TTTS) or intrauterine death of a co-twin compared to dichorionic (DC) twin pregnancies. It has been reported that MC twins have an approximately three- to five-fold increased perinatal morbidity[1,2] and a five-fold increased fetal or prenatal loss.[3,4]

Most reliable time to determine chorionicity is earlier in the first trimester, between 6 and 9 weeks of gestation.[5] Thick dividing membrane, generally 2 mm or greater, supports a presumed diagnosis of dichorionicity (Fig. 1A). In contrast, a dividing membrane is so thin that it may not be seen in MC pregnancies (Fig. 1B). In the second and third trimesters, however, measurement of membrane thickness has poor intraobserver and interobserver variability in determining chorionicity,[6] because the chorion regress as the pregnancy progresses. If later in the first trimester, the lambda or twin peak sign is useful to determine DC placentation (Fig. 2), which represents the triangular portion of placenta insinuating between two amniotic layers in DC placentation. On the other hand, thin dividing membrane perpendicular to placenta is seen in MC placentation, which is called 'T' sign. In the second trimester, discordant gender confirms dizygosity and DC placentation except in rare cases.[7]

Determination of amnionicity is more complicated. A single amniotic cavity, a single placenta and two umbilical cord insertions are a characteristic sign in monoaminiotic twin, but detection of clear dividing membrane is nothing unusual in the

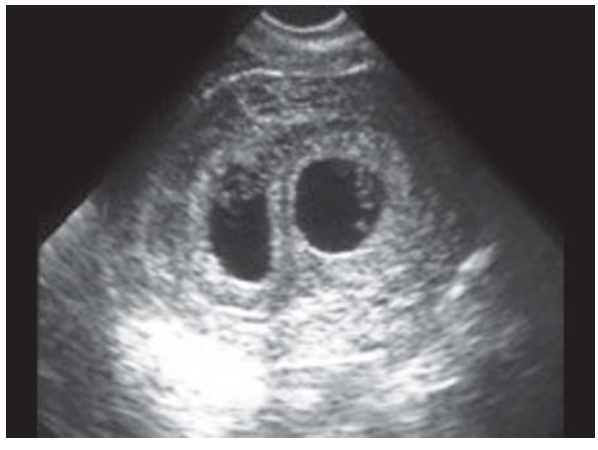

Fig. 1A: Early stage of dichorionic pregnancies. Thick dividing membrane is visible

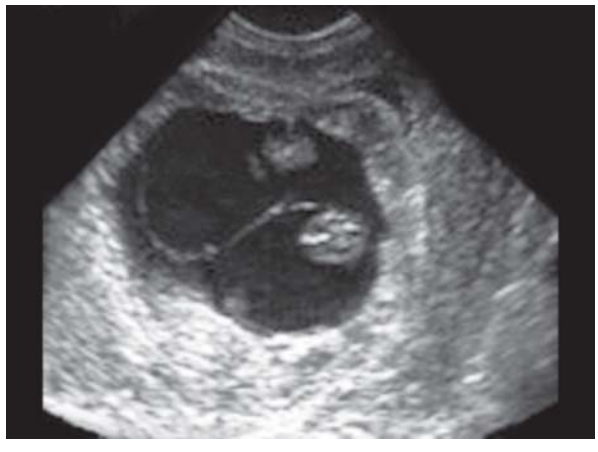

Fig. 1B: Early stage of monochorionic pregnancies. Only thin amniotic membranes are visible

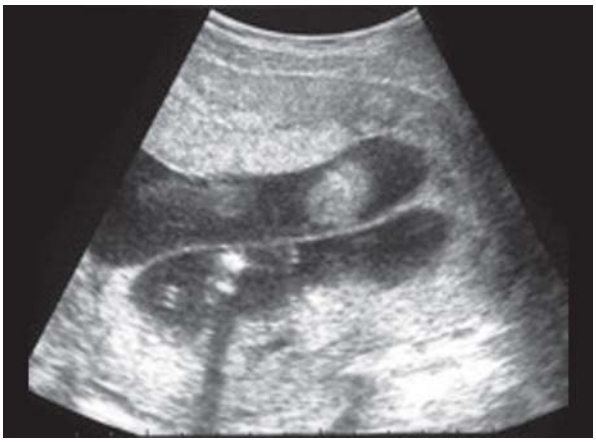

Fig. 2: Twin peak sign, typical feature of dichorionic pregnancies, at 14 weeks of gestation

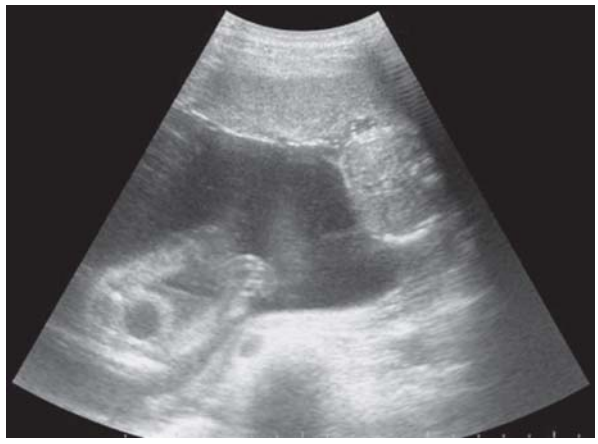

Fig. 3: Typical feature of twin-twin transfusion syndrome. Donor twin is present just below placenta due to oligohydramnios. Recipient sac is enlarged by polyhydramnios. Dividing amniotic membrane is unclear because of collapsed donor sac

early first trimester. Although number of yolk sac was once considered as certain evidence for amnionicity,[8] it has been recognized that the presence of two yolk sacs does not confirm diamniotic twins.[9,10] The diagnosis of amnionicity should be made only following a careful search for a dividing amniotic membrane.

Unique Complications of Monochorionicity

In nearly all of MC twins, vascular anastomoses between two placental teritories are present. Although most of these vascular communications are hemodynamically balanced, some develop significant pathological patterns. One is TTTS and the other is twin reversed-arterial perfusion (TRAP) sequence.

Twin-twin Transfusion Syndrome (TTTS)

TTTS occurs in approximately 10% of MC twin pregnancies, and carries a high risk of perinatal morbidity and mortality.[11,12] The precise etiology of TTTS remains uncertain, although unbalanced blood flow between two fetuses via placental vascular anastomoses, resulting from a net transfusion of blood flow from the donor twin to the recipient twin, attributes the pathophysiology of TTTS. If left untreated, perinatal mortality rates reach 90%.[13] As fetoscopic laser photocoagulation of placental vascular communicating vessels has evoked as the best therapeutic option in TTTS with significant perinatal outcomes,[14-17] appropriate diagnosis and management is important.

Diagnosis of TTTS is based on standard criteria by Quintero et al[18]: MC twin pregnancy and presence of a polyhydramnios in the recipient's sac (maximum vertical pocket (MVP) > 8 cm) and oligohydramnios in the donor's sac (< 2 cm) (Fig. 3). If diagnosed as TTTS by both MVPs, additional Doppler studies in the umbilical artery, ductus venosus and umbilical vein are necessary for staging (Figs 4A and B). Absence or presence of hydrops fetalis in the recipient should also be assessed (Fig. 5).

- Stage 1: Oligo/polyhydramnios sequence only with bladder visualized in the donor twin
- Stage 2: Bladder not visualized in the donor twin

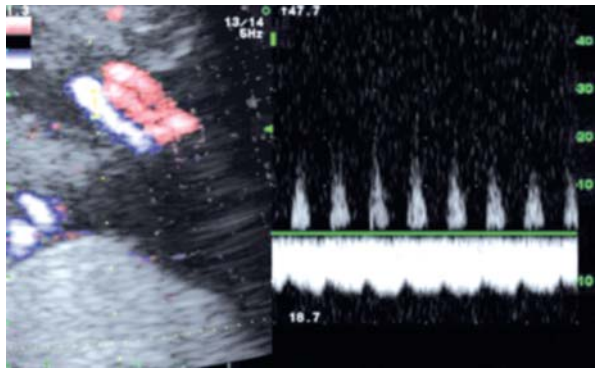

Fig. 4A: Doppler waveforms in the donor fetus complicated with twin-twin transfusion syndrome stage 3. Absent end-diastolic flow in the umbilical artery and pulsatile waveform in the umbilical vein

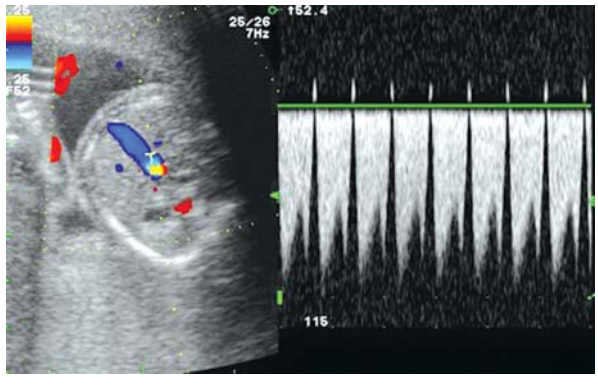

Fig. 4B: Doppler waveforms in the recipient fetus complicated with twin-twin transfusion syndrome stage 3. Reversed flow in the ductus venosus

- Stage 3: Critically abnormal Dopplers—absent or reversed diastolic flow in the donor umbilical artery, pulsatile venous or reverse flow in the ductus venosus
- Stage 4: Hydrops in either twin
- Stage 5: Demise of one or both twins.

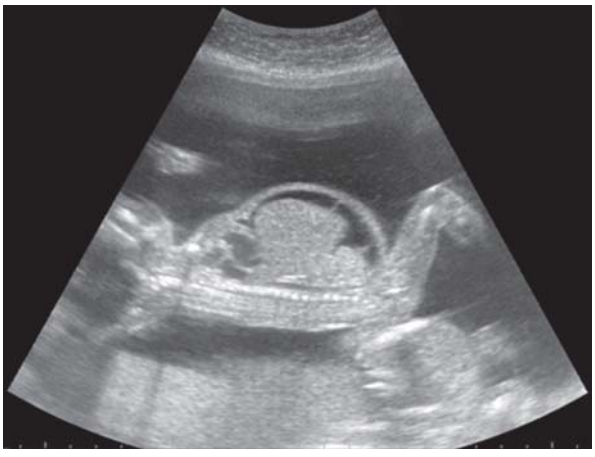

Fig. 5: Longitudinal view of hydropic recipient twin

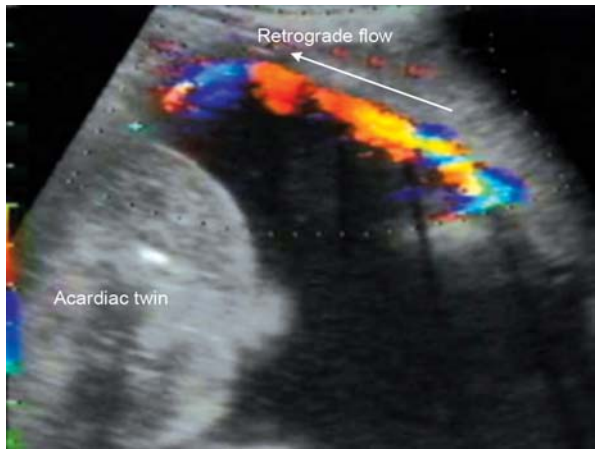

Fig. 6: Retrograde blood flow through an artery-to-artery anastomosis from a pump twin to an acardiac twin

Abnormal Doppler findings are associated with adverse outcome in TTTS. In particular, the donor fetus with preoperative absent or reversed end-diastolic flow in the umbilical artery has been considered to be a significant risk factor for intrauterine fetal demise in donors after laser surgery, in which the rate is up to 75%.[19-22]

Twin Reversed-Arterial Perfusion (TRAP) Sequence

TRAP sequence is a rare and compromised complication in MC pregnancies, which affects about one in 35,000 births.[23] Retrograde blood flow through an artery-to-artery anastomosis from a pump twin to an acardiac twin, returning through a venous-to-venous anastomosis into the pump twin, is mainly involved to develop the syndrome[24] (Fig. 6). Increased cardiac output in the pump twin caused by extraperfusion into the acardiac twin can lead to severe clinical manifestations, such as hydrops fetalis or progressive polyhydramnios, resulting in poor perinatal outcomes.

Intrauterine Death of One Twin

Intrauterine death of one twin in MC twin pregnancies is associated with an increased mortality and morbidity of the co-twin.[25] Perimortem feto-fetal blood transfusion and subsequent severe anemia in a surviving fetus around the time of single intrauterine death of co-twin have been considered to be a possible mechanism for the undesirable prognosis of the surviving fetus, which is called feto-fetal hemorrhage.[3] Mari et al[26] reported that middle cerebral artery peak systolic velocity (MCA-PSV) is reliable for predicting the severity of fetal anemia. Several investigators also have shown that MCA-PSV is useful to predict levels of fetal hemoglobin or hematocrit in cases of fetal anemia caused by exsanguinations of surviving fetus, such as fetomaternal hemorrhage[27] or single fetal demise in MC pregnancy.[28] It is, therefore, suggested that serial monitoring of MCA-PSV is useful to evaluate the anemic status of the surviving fetus in MC twin pregnancy complicated with single fetal demise. If survivig fetus suffers from severe anemia, ultrasound-guided intrauterine rescue transfusion can be a useful intervention to improve surviving co-twin.[29]

Congenital Malformations

As multiple pregnancies have a significant higher rate of congenital malformations compared with singleton pregnancy, detailed ultrasound examination is necessary. About 2% of major or 4% of minor malformations was reported in twin pregnancies.[30,31] Monozygotic twin is associated with midline defects[32] and cardiovascular defects.[33,34] Antenatal ultrasound is useful to detect congenital anomaly.[35,36]

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