

Complications Arising in Twin Pregnancy: Findings of Prenatal Ultrasonography

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Multifetal gestations are high-risk pregnancies involving higher perinatal morbidity and mortality, and are subject to unique complications including twin oligohydramnios-polyhydramnios sequence, twin-to-twin transfusion syndrome, acardiac twins, conjoined twins, co-twin demise, and heterotopic pregnancies. The purpose of this study is to describe the prenatal ultrasonographic and pathologic findings of these complications.

With rapid developments in assisted reproductive technology and an increasingly aging maternal population, the incidence of multiple births has increased. Multifetal gestations are high-risk pregnancies with higher perinatal morbidity and mortality, and involve a higher rate of perinatal complications including fetal anomalies, fetal demise, prematurity, intrauterine growth restriction, polyhydramnios and oligohydramnios (1). They are, in addition, subject to unique complications such as twin oligohydramnios-polyhydramnios sequence (TOPS), twin-to-twin transfusion syndrome (TTTS), acardiac twins, conjoined twins, co-twin demise, and heterotopic pregnancies. Precise prenatal ultrasonographic diagnosis of the type and complications of multifetal gestation, and any complications arising, is thus very important for antenatal care and the prediction of fetal outcome. The purpose of this study is to describe the prenatal ultrasonographic and pathologic findings of the unique complications arising in twin pregnancy.

Index terms :

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TWIN-TO-TWIN TRANSFUSION SYNDROME

TOPS is a complication of monochorionic twin pregnancy in which two fetuses share a single placenta. In as many as 35% of cases involving monochorionic twins, one will experience marked polyhydramnios and the other will be stuck in oligohydramnios (2). TOPS is a heterogeneous group of disorders with the following ultrasonographic criteria for antenatal diagnosis: marked growth discordance, with weight discordance of 20% or more: oligohydramnios of the growth-restricted (stuck) twin, with coexistent polyhydramnios of the larger one and a monochorionic placenta (3) (Fig. 1).

True TTTS is a subset of TOPS with interfetal blood transfusion (4). Vascular anastomoses occur in 90% of monochorionic pregnancies and do not usually harm the fetuses. In TTTS, however, which is responsible for as much as 17% of prenatal mortality, unbalanced shunting in deep arteriovenous anastomoses between the twins occurs within the placenta due to asymmetrical placental insufficiency or unequal placental sharing (1, 4-6). With increasing resistance to placental perfusion in an asymmetrically small placental portion, gradual transplacental interfetal transfusion develops between the umbilical artery of the restricted fetus (donor) and the umbilical vein of the larger twin (recipient) (4). Compared with recipients, a higher incidence of increased resis-

tance to placental perfusion, abnormal umbilical cord insertion and diminished placental microvasculature have been demonstrated in donors (4).

The donor is growth restricted, hypovolemic and anemic, and in the umbilical artery there is increased vascular resistance due to the lack of placental vasculature. The recipient, on the other hand, is hypervolemic and plethoric, and vascular resistance changes gradually.

Doppler sonography is useful for evaluating placental flow and the interfetal perfusion difference (6) (Fig. 2).

ACARDIAC TWINS (TWIN-REVERSED ARTERIAL PERFUSION SEQUENCE)

Acardiac twinning is a rare anomaly that occurs in 1% of

monozygotic twins. It is the extreme manifestation of the TTTS spectrum.

The acardiac twin (recipient) exists as a parasite, depending on the normal donor (pump) twin for its blood supply via transplacental anastomoses and retrograde perfusion of the acardiac umbilical cord. Perfusion of the malformed (acardiac) fetus occurs via artery-to-artery and vein-to-vein anastomoses between the fetuses. Umbilical arterial blood from the donor flows into the umbilical artery of the recipient, its direction reversed (7).

In an acardiac fetus, the malformation observed has characteristic features. Cardiac structures are absent or non-functioning, and the head, upper body and upper extremities are poorly developed. The lower body and lower extremities are, however, more or less normal (8) (Fig. 3).

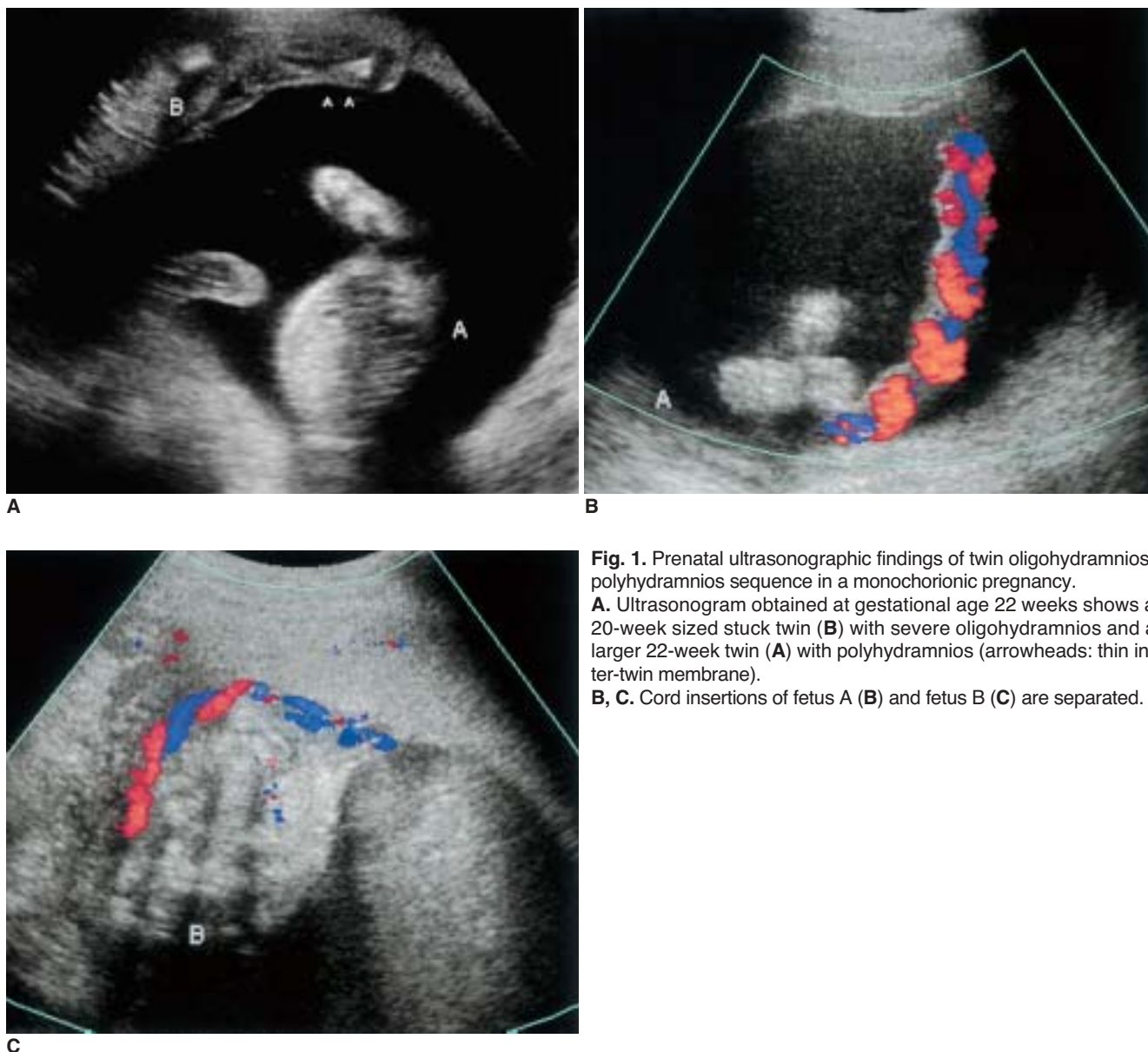


Fig. 1. Prenatal ultrasonographic findings of twin oligohydramnios-polyhydramnios sequence in a monozygotic pregnancy. **A.** Ultrasonogram obtained at gestational age 22 weeks shows a 20-week sized stuck twin (**B**) with severe oligohydramnios and a larger 22-week twin (**A**) with polyhydramnios (arrowheads: thin inter-twin membrane). **B, C.** Cord insertions of fetus A (**B**) and fetus B (**C**) are separated.

Depending on the state of disruption, acardiac anomalies are divided into four categories: acardius anceps, acardius acephalus, acardius acormus and acardius amorphus (9). For the pump twin, the prognosis is dismal, leading to a 50 to 70% mortality rate due to congestive heart failure, polyhydramnios or preterm delivery.

Doppler verification of reversed flow in the umbilical cord of the acardiac fetus confirms the diagnosis, and antenatal ultrasonography is important in early diagnosis and optimal prenatal management.

CONJOINED TWINS

Conjoined twins are the least common form of monozygotic twinning, which is always associated with monochorionic monoamniotic twins. They result from the incomplete division of an inner cell mass more than thirteen days after

fertilization. The nomenclature varies according to the fused anatomic region: craniopagus refers to head-to-head fusion; thoracopagus, to chest-to-chest fusion; and omphalopagus, to abdomen-to-abdomen fusion (10) (Fig. 4). The most common types are thoracoomphalopagus, thoracopagus, and omphalopagus. If a pregnancy is to be terminated, early prenatal diagnosis of conjoined twins is essential (11).

DEMISE OF CO-TWIN

Single fetal death during the first trimester is relatively common and the course of the pregnancy is usually not impaired. The incidence of spontaneous single fetal loss after the second trimester is 2.6–6.8% (12), while that of perinatal mortality and morbidity of the second twin varies. In monochorionic pregnancies the risk of these is greater (Fig.

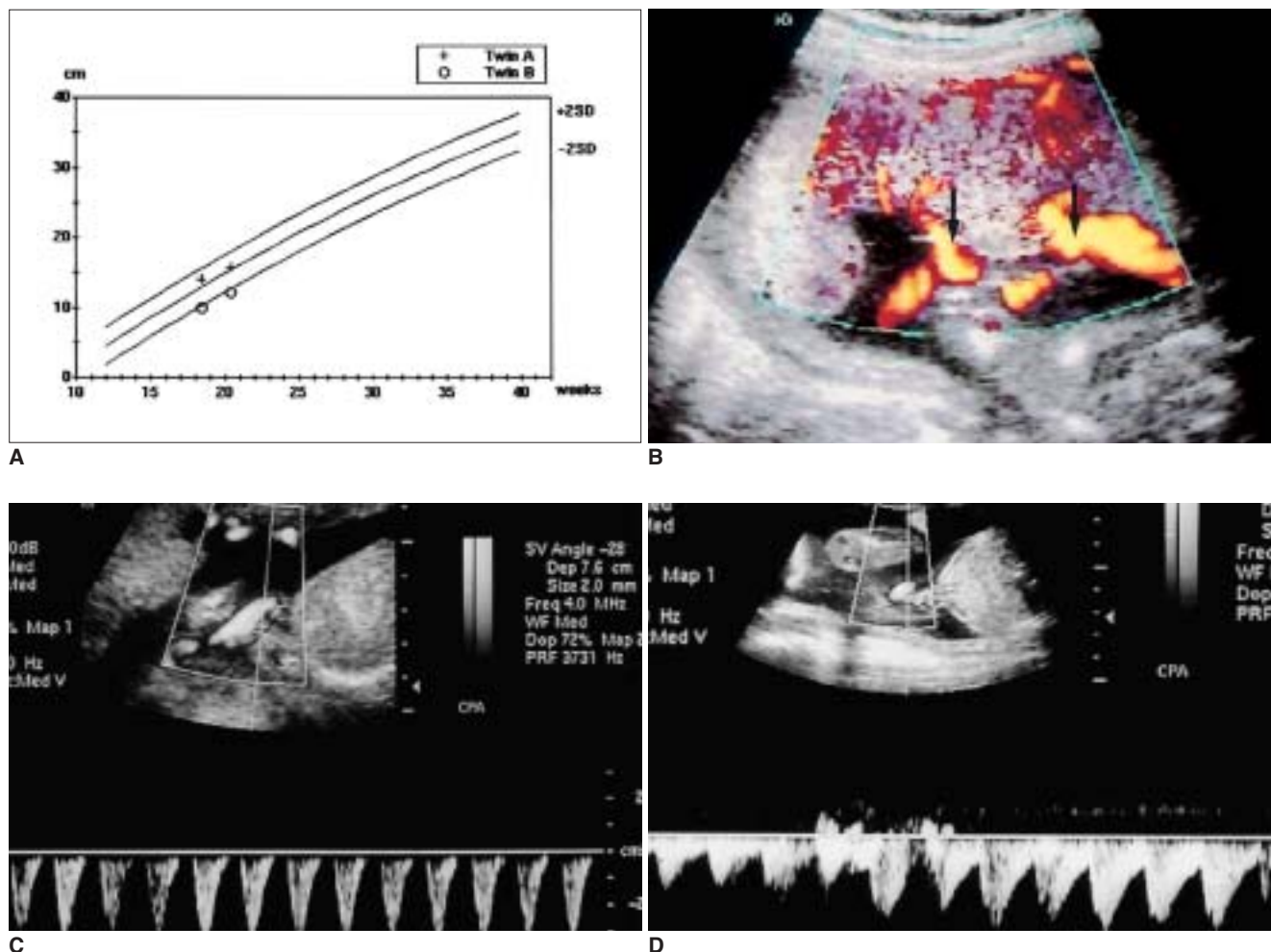


Fig. 2. Doppler sonographic findings of twin-to-twin transfusion syndrome in a monochorionic diamniotic twin pregnancy. **A.** Ultrasonogram obtained at gestational age 21 weeks shows significant discrepancy in fetal sizes. Fetus A is larger than fetus B by more than 2 SD. **B.** Color Doppler sonogram demonstrates approximate insertions (arrows) of two umbilical cords in a single placenta. **C, D.** Umbilical arterial Doppler sonogram of the smaller fetus (**C**) depicts increased vascular resistance and absent diastolic flow, while that of the larger fetus (**D**) shows normal diastolic flow.

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5), and reports have described increased risk of neurologic injury including cerebral necrotic lesion due to thromboembolic material, hemodynamic change such as anemia or hypotension in TTTS, and premature delivery (13).

HETEROTOPIC PREGNANCY

A heterotopic multiple pregnancy is one in which an in-

trauterine pregnancy and ectopic gestation coexist, and due to the dramatic increase in fertility treatments such as ovulation induction and assisted reproductive technology, the incidence of the condition has increased dramatically, during ovulation induction, for example it is now about 1%. In an intrauterine pregnancy, sonographic detection of an extrauterine gestational sac, with or without a fetal pole, confirms the diagnosis (Fig. 6). The most frequent location

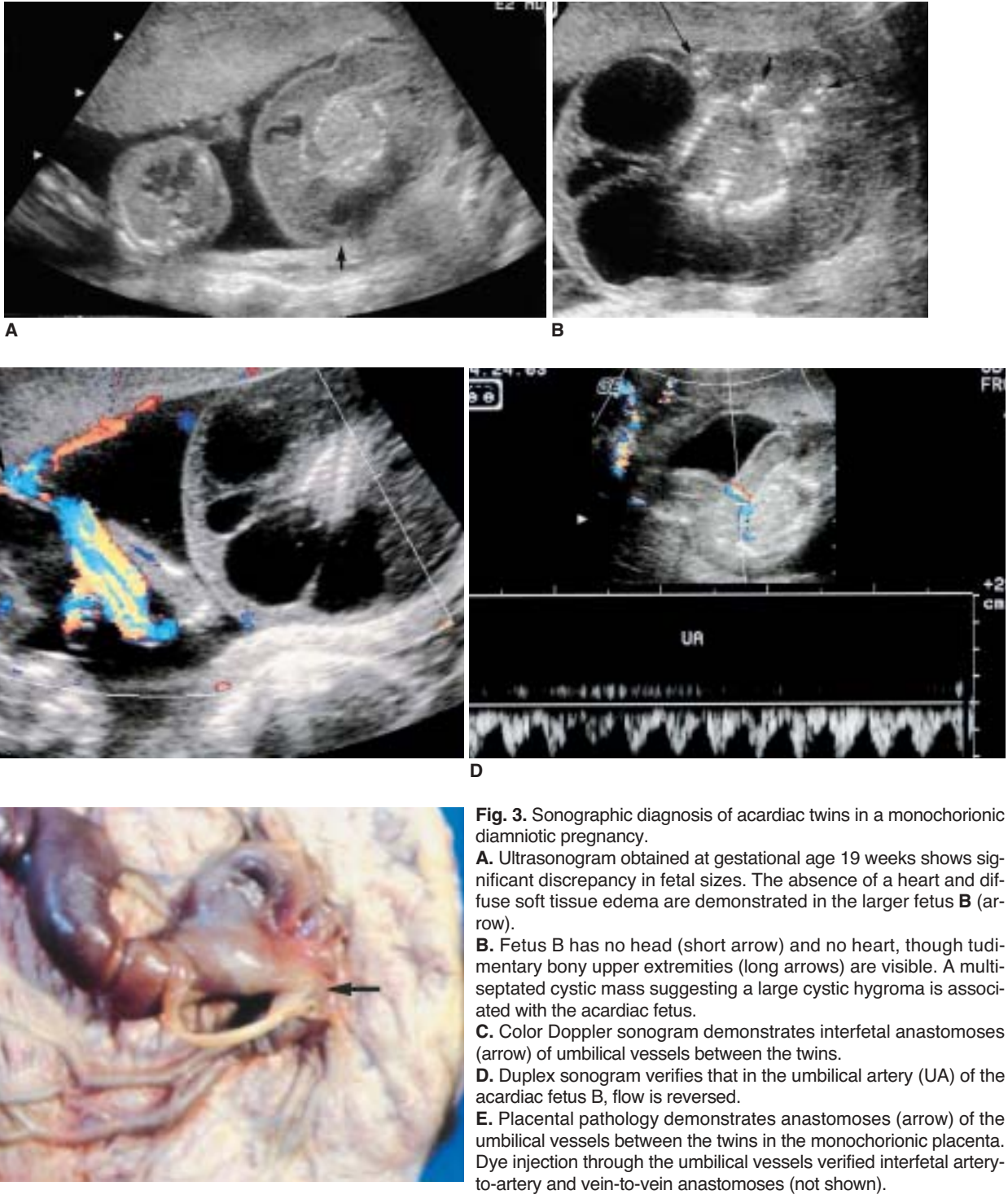


Fig. 3. Sonographic diagnosis of acardiac twins in a monozygotic diamniotic pregnancy.

- A.** Ultrasonogram obtained at gestational age 19 weeks shows significant discrepancy in fetal sizes. The absence of a heart and diffuse soft tissue edema are demonstrated in the larger fetus **B** (arrow).
- B.** Fetus **B** has no head (short arrow) and no heart, though rudimentary bony upper extremities (long arrows) are visible. A multi-septated cystic mass suggesting a large cystic hygroma is associated with the acardiac fetus.
- C.** Color Doppler sonogram demonstrates inter-fetal anastomoses (arrow) of umbilical vessels between the twins.
- D.** Duplex sonogram verifies that in the umbilical artery (UA) of the acardiac fetus **B**, flow is reversed.
- E.** Placental pathology demonstrates anastomoses (arrow) of the umbilical vessels between the twins in the monozygotic placenta. Dye injection through the umbilical vessels verified inter-fetal artery-to-artery and vein-to-vein anastomoses (not shown).

is the ampulla of the fallopian tube, followed by the isthmus and fimbria. The prognosis of an intrauterine pregnancy is similar to one without heterotopia (14).

CONCLUSION

We have described the prenatal ultrasonographic and pathologic findings of the complications arising in twin pregnancy. Prenatal ultrasonography can provide accurate

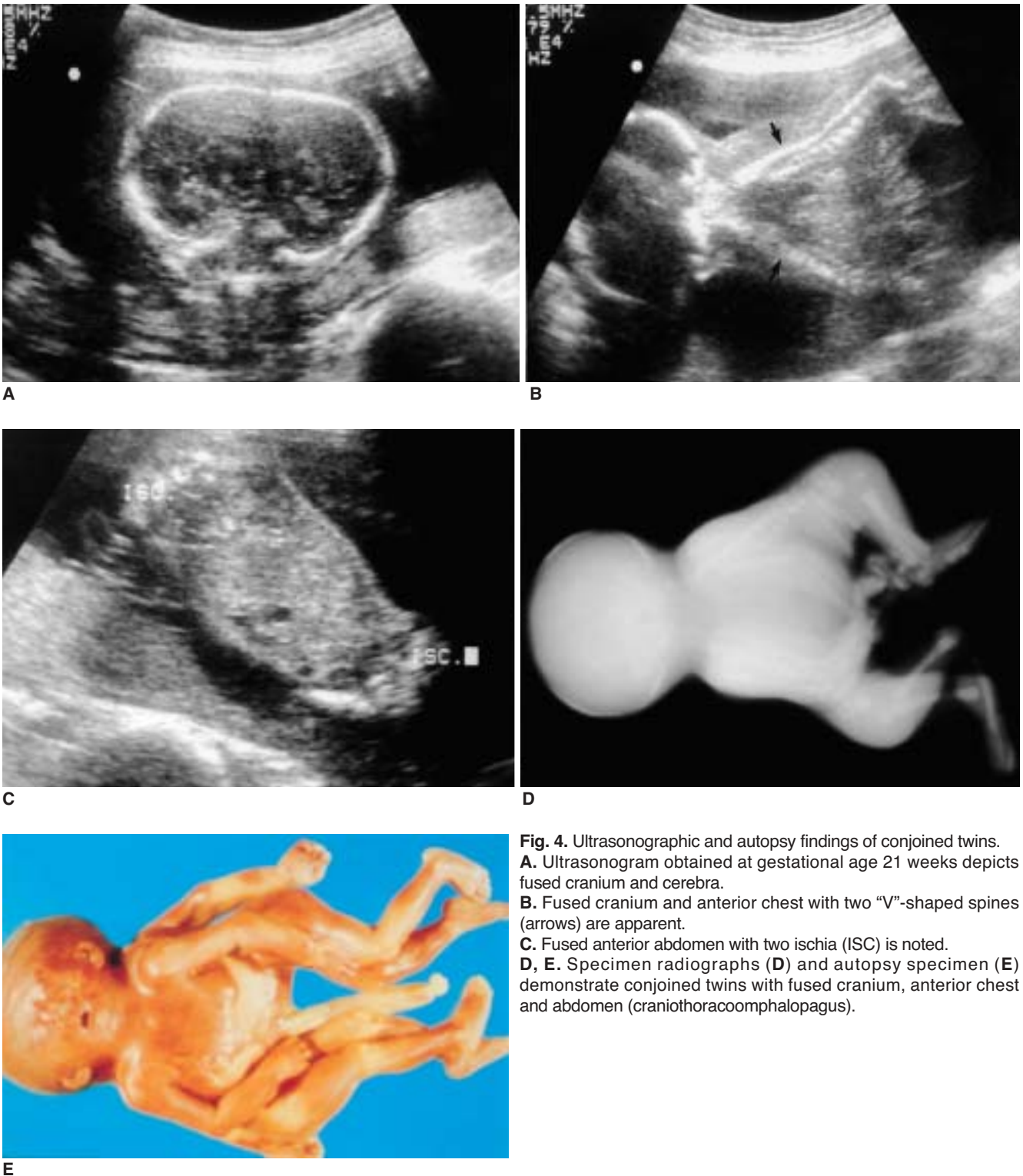


Fig. 4. Ultrasonographic and autopsy findings of conjoined twins. **A.** Ultrasonogram obtained at gestational age 21 weeks depicts fused cranium and cerebra. **B.** Fused cranium and anterior chest with two "V"-shaped spines (arrows) are apparent. **C.** Fused anterior abdomen with two ischia (ISC) is noted. **D, E.** Specimen radiographs (**D**) and autopsy specimen (**E**) demonstrate conjoined twins with fused cranium, anterior chest and abdomen (craniothoracomphalopagus).

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A



B



C

Fig. 5. Sonographic findings of monochorionic diamniotic twins with co-twin demise.

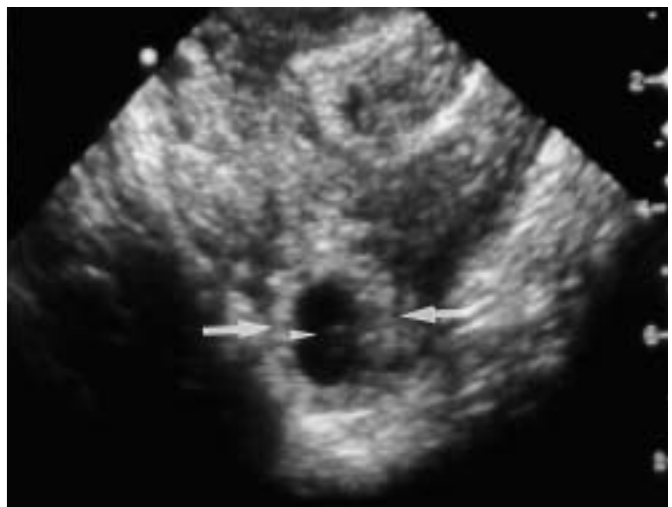
A. Ultrasonogram obtained at gestational age 14 weeks shows a fairly-well visualized (short arrow) but preserved (arrowheads) thin intertwin membrane with a single placenta, and intrauterine fetal death of one fetus with diffuse soft tissue edema (arrows).

B. Ultrasonogram obtained at gestational age 23 weeks depicts an enlarged umbilical cord (arrow) in the surviving fetus.

C. Cardiomegaly with thickened biventricular walls (arrows) developed in the surviving fetus.



A



B

Fig. 6. Ultrasonographic findings of a cornual heterotopic pregnancy.

A. Ultrasonogram obtained at gestational age 7 weeks shows a gestational sac (black arrow) with an embryo (arrowhead) within the uterine cavity.

B. In the cornual portion of the uterus, a coexisting gestational sac (arrows) with an embryo (arrowhead) is visible.

diagnosis of these conditions and assist in their proper management.

References

1. Divon MY, Weiner Z. Ultrasound in twin pregnancy. *Semin Perinatol* 1995;19:404-412
2. Mahony BS, Petty CN, Nyberg DA, Luthy DA, Hickok DE, Hirsch JH. The "stuck twin" phenomenon: ultrasonographic findings, pregnancy outcome, and management with serial amniocenteses. *Am J Obstet Gynecol* 1990;163:1513-1522
3. Bruner JP, Rosemond RL. Twin-to-twin transfusion syndrome: a subset of the twin oligohydramnios-polyhydramnios sequence. *Am J Obstet Gynecol* 1993;169:925-930
4. Bruner JP, Anderson TL, Rosemond RL. Placental pathophysiology of the twin oligohydramnios-polyhydramnios sequence and the twin-twin transfusion syndrome. *Placenta* 1998;19:81-86
5. Farley CL, Cox LA, Long BW. Ultrasound and twin-twin transfusion syndrome. *Radiol Technol* 2000;72:95-100
6. Hecher K, Ville Y, Nicolaides KH. Fetal arterial Doppler studies in twin-twin transfusion syndrome. *J Ultrasound Med* 1995;14:101-108
7. Van Allen MI, Smith DW, Shepard TH. Twin reversed arterial perfusion (TRAP) sequence: a study of 14 twin pregnancies with acardius. *Semin Perinatol* 1983;7:285-293
8. Chen CP, Shih SL, Liu FF, Jan SW, Lin YN, Lan CC. Skeletal deformities of acardius anceps: the gross and imaging features. *Pediatr Radiol* 1997;27:221-225
9. Mohanty C, Mishra OP, Singh CP, Das BK, Singla PN. Acardiac anomaly spectrum. *Teratology* 2000;62:356-359
10. Guttmacher AF, Nichols BC. Teratology of conjoined twins. *Birth Defects* 1967;3:3-9
11. Lam YH, Sin SY, Lam C, Lee CP, Tang MH, Tse HY. Prenatal sonographic diagnosis of conjoined twins in the first trimester: two case reports. *Ultrasound Obstet Gynecol* 1998;11:289-291
12. Kilby MD, Govind A, O'Brien PM. Outcome of twin pregnancies complicated by a single intrauterine death: a comparison with viable twin pregnancies. *Obstet Gynecol* 1994;84:107-109
13. Petersen IR, Nyholm HC. Multiple pregnancies with single intrauterine demise: Description of twenty-eight pregnancies. *Acta Obstet Gynecol Scand* 1999;78:202-206
14. Tal J, Haddad S, Gordon N, Timor-Tritsch I. Heterotopic pregnancy after ovulation induction and assisted reproductive technologies: a literature review from 1971 to 1993. *Fertil Steril* 1996;66:1-12