

Brief Report

THERMOCOAGULATION FOR THE EARLY TREATMENT OF PREGNANCY WITH AN ACARDIAC TWIN

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IN twin pregnancy with acardia, which occurs in about 1 in 35,000 deliveries, the heart and usually other organs fail to develop in one twin.¹ The acardiac ("recipient") twin receives blood from the normal ("pump") twin, and the blood is then returned to the normal twin.² The natural history is variable, and some pregnancies proceed to term. Commonly, the acardiac twin becomes grossly edematous, and its size may exceed that of the pump twin. Hydramnios may occur in either sac. The perinatal mortality rate for pump twins is around 55 percent, with death due mainly to congestive cardiac failure or prematurity.³ Acardia is discovered by routine ultrasonography in early pregnancy or when a clinical finding later in pregnancy, such as polyhydramnios, leads to ultrasonography.

Various therapeutic options have been proposed, including control of amniotic-fluid volume by repeated amniocentesis or indomethacin therapy in the mother,⁴ administration of digoxin to the mother to treat heart failure in the pump twin, and selective preterm delivery of the acardiac twin by hysterotomy.⁵⁻⁷ These interventions are usually feasible only after 24 weeks of gestation, and they are hazardous for both the mother and the normal fetus. Another approach is to stop the perfusion of the acardiac twin by the pump twin, which has been done with varying degrees of success by percutaneous injection of thrombogenic coils⁸ or sclerosing agents to occlude the umbilical cord of the acardiac twin⁹; by cord ligation performed at hysterotomy¹⁰ or with endoscopic^{11,12} or ultrasound¹³ guidance; and by fetoscopic laser coagulation.^{14,15}

We report here on a new technique of thermocoagulation used in four women with pregnancies in which there was one acardiac twin. The technique was used to stop the perfusion of the acardiac twin, with the subsequent delivery of the healthy twin.

METHODS

Thermocoagulation was performed with a wire electrode, 1 mm in diameter, that could be passed through an 18-gauge needle and that was insulated with polytetrafluoroethylene along most of its length, with 3 mm of the wire left bare at the tip. The electrode, which was made in the medical-physics workshop at our institution, was connected to a standard monopolar diathermy machine and activated by a foot switch.

After deciding on the basis of color-flow mapping which vessel was to be coagulated, an 18-gauge needle was introduced transabdominally with the use of local anesthesia and with ultrasound guidance (128XP/10 system, Acuson, Mountain View, Calif.). The tip of the needle was guided into the lumen of the fetal aorta if the vessel was of sufficient size; if it was too small, the tip was placed near the vessel. The wire electrode was inserted so that its bare tip lay in or just outside the vessel wall, with care taken to ensure that the tip was beyond the needle and no longer in contact with it (Fig. 1). Power was delivered for periods of 5 to 15 seconds, with 10 W delivered initially and the amount increased in increments of 5 to 10 W, until a white echodense area of thermocoagulation surrounded the electrode tip and the vessel. The procedure was judged to be successful when the cessation of blood flow to the acardiac twin was confirmed by color Doppler ultrasonogra-

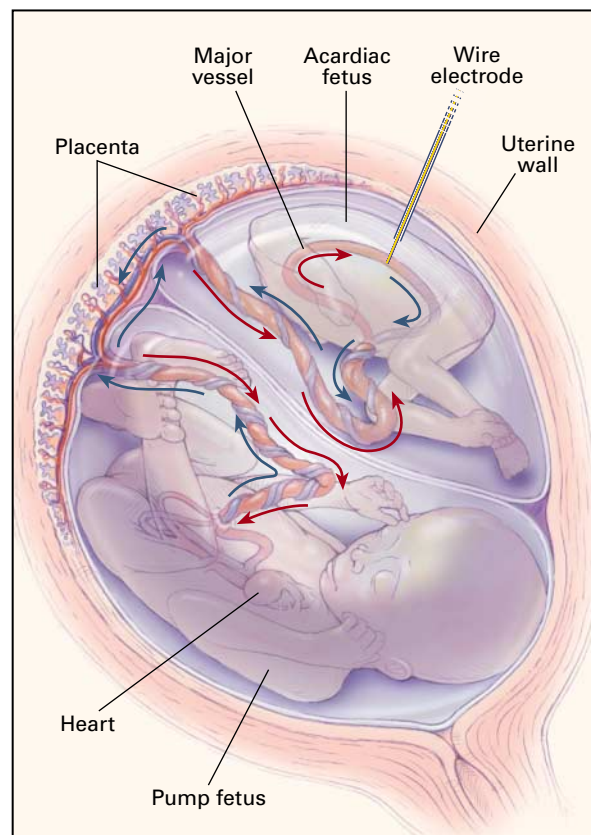


Figure 1. Placement of 18-Gauge Needle and Monopolar Insulated Wire Electrode for Thermocoagulation of a Major Vessel in the Body of an Acardiac Acephalic Fetus.

The arrows show the direction of circulation from and to the normal (pump) twin.

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phy. Before 20 weeks of gestation, the maximal power required for thermocoagulation was 20 to 35 W. Ultrasound imaging and Doppler ultrasonography were also used to demonstrate that the circulation of the pump twin remained normal during and after thermocoagulation. The procedure took 5 to 10 minutes, and the women were allowed to go home 1 hour afterward.

RESULTS

The four cases presented here were consecutive and unselected. Use of the procedure was approved by the institutional review committee at our hospital, and all the women gave written informed consent.

Patient 1 was first seen when she was 24 weeks pregnant. The acardiac twin was enormously edematous with no amniotic fluid, and it compressed the pump twin and its amniotic sac (Table 1). The pump twin had cardiac failure, with an enlarged heart, reversed flow in the ductus venosus, and oligohydramnios. The target of first choice for thermocoagulation in the acardiac twin was the point of insertion of the umbilical cord into the placenta, but this site was obscured. The needle and electrode tip were therefore inserted into the fetal end of the umbilical cord. The cord was so large and edematous that thermocoagulation with up to 60 W of power did not cause an immediate cessation of flow. Color Doppler ultrasonography did demonstrate a reduction of flow, however, and in the next two weeks, the acardiac twin stopped growing, and the hydrops decreased. The pump twin continued to grow, the volume of amniotic fluid became normal, and no abnormalities of the brain or cerebral ventricles were seen with ultrasonography.

At 32 weeks, severe preeclampsia developed, and the pump twin was delivered by emergency cesarean section. The twin weighed 1265 g and had hyaline membrane disease and intraventricular hemorrhage, resulting in developmental delay. The acardiac twin

was mummified, and an autopsy confirmed the absence of the heart and other viscera.

Patient 2 underwent the procedure at 18 weeks' gestation because the acardiac twin had gross hydrops and was bigger than the pump twin (Table 1).

Patient 3 was referred at 16 weeks' gestation; the acardiac twin was edematous but smaller than the pump twin. Ultrasonography was performed weekly; by 19 weeks, the acardiac twin was larger than the pump twin, which had some myocardial hypertrophy and polyhydramnios. The procedure was therefore performed at this time.

Patient 4 was referred at 12 weeks' gestation, at which time the acardiac twin did not have hydrops and was smaller than the pump twin. Serial ultrasonography showed a dramatic increase in hydrops and oligohydramnios in the acardiac twin and mild polyhydramnios around the pump twin by 16 weeks, when the procedure was performed.

Acardiac fetuses have small, often short umbilical cords, usually with two vessels. Before 20 weeks' gestation, it is difficult to place an 18-gauge needle in an umbilical vessel. Therefore, in Patients 2, 3, and 4, we positioned the needle near the major vessel in the acardiac twin under color Doppler ultrasonographic guidance, and the electrode tip was then advanced into the vessel or placed next to it. The exact placement was not critical in the small fetuses, since the zone of thermocoagulation was large enough to include the vessel and hence to occlude it (Fig. 1).

In Patients 2, 3, and 4, perfusion of the acardiac twin stopped immediately, as demonstrated by color flow mapping. Growth ceased and hydrops disappeared in the three acardiac fetuses. All three pregnancies continued without further complications, and in each case, a healthy baby was delivered vaginally at term, together with a mummified acardiac fetus.

TABLE 1. CHARACTERISTICS AND OUTCOMES OF FOUR PREGNANCIES WITH AN ACARDIAC TWIN THAT WERE TREATED BY THERMOCOAGULATION.

PATIENT No.	REFERRAL wk of gestation	TREATMENT wk of gestation	CONDITION OF TWINS AT TREATMENT		ENERGY REQUIRED watts	OUTCOME	
			PUMP TWIN	ACARDIAC TWIN		PUMP TWIN	ACARDIAC TWIN
1	24	24	Enlarged heart, reversed flow in ductus venosus, oligohydramnios	Massive edema, oligohydramnios	60	Emergency cesarean section at 32 wk for severe preeclampsia; birth weight, 1265 g	Mummified
2	18	18	Normal	Gross edema	30	Vaginal delivery at 39 wk; birth weight, 3360 g	Mummified
3	16	19	Myocardial hypertrophy, polyhydramnios	Gross edema	35	Vaginal delivery at 37 wk; birth weight, 3510 g	Mummified, acephalic
4	12	16	Polyhydramnios	Gross edema, oligohydramnios	20	Vaginal delivery at 37 wk; birth weight, 2300 g	Mummified

DISCUSSION

In pregnancies involving an acardiac twin, conservative management results in a high rate of loss of the normal twin. In the largest reported series, involving 49 cases, congestive cardiac failure, polyhydramnios, and preterm delivery were strongly related to the ratio of the weight of the acardiac twin to that of the pump twin, with a ratio above 70 percent correlated with an adverse outcome. Some acardiac twins become smaller in the absence of intervention; nonetheless, when ultrasonography reveals features of cardiac compromise in the pump twin, edema in the acardiac twin, or polyhydramnios in either sac, vascular occlusion should be performed in the acardiac twin to correct the excessive cardiovascular demands on the normal twin. In our series, cardiac compromise in the pump twin was apparent as early as 16 weeks' gestation.

Thermocoagulation has several advantages over alternative therapies for this condition. It is simple and quick and does not require expensive equipment. Thermocoagulation is guided by ultrasonography in a manner similar to that of fetal-blood sampling and does not require the instruments and skills necessary for intrauterine surgery under endoscopic guidance. Whereas thermocoagulation is performed with the use of local anesthesia, other methods of selective occlusion of the umbilical cord are more invasive and carry greater risks of fetal and maternal morbidity and of fetal mortality.

The cord of the acardiac twin is often very short and thin, and it may be difficult to identify clearly, even when visualized directly, or it may be markedly edematous, in which case endoscopic ligation or laser coagulation may be hazardous. Occlusion of the cord is also difficult in the presence of polyhydramnios or oligohydramnios. These problems are avoided by identifying the main intraabdominal vessel in the body of the acardiac twin and ablating it by thermocoagulation, thus arresting the circulation of the acardiac twin. Finally, thermocoagulation can be used earlier in pregnancy than most of the alternative procedures.

We conclude that thermocoagulation offers a safe and effective method to occlude the circulation of the acardiac twin and should become the treatment of choice for pregnancy with an acardiac twin.

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