

Elective Laparoscopic Fetal Laser Photocoagulation in Twin-Twin Transfusion Syndrome: A Case Report

Morgan A. Ward, CRNA

Twin-twin transfusion syndrome (TTTS) is a complication of multiple gestation in which arteriovenous vascular communications occur in a shared placenta. Due to these communications, there is an imbalance of blood flow between the developing fetuses. This results in 1 twin becoming the donor and the other becoming the recipient. In severe cases, the recipient may experience polycythemia, polyhydramnios, and hydrops fetalis, while in the donor oligohydramnios and severe anemia may develop. It has been reported that fetal mortality can reach as high as 60% to 80% if TTTS develops before 26 weeks' gestation and goes untreated. Therapeutic options available include decompression amniocentesis, amniotic septostomy, interruption of the

placental vessel communications, and selective fetal reduction. Selective fetoscopic laser photocoagulation of abnormal vascular communications has shown to result in increasing survival rates and has become a definitive treatment option for severe TTTS. The case report presented involves a 32-year-old, gravida 5, para 2 patient at 19 weeks' estimated gestational age with a monochorionic diamniotic twin gestation with TTTS diagnosed using ultrasonography presenting for an elective laparoscopic fetal laser photocoagulation.

Keywords: Epidural anesthesia, fetal laser photocoagulation, monochorionic placenta, twin-twin transfusion syndrome (TTTS).

Twin-twin transfusion syndrome (TTTS) is a complication of multiple gestation in which arteriovenous vascular communications in a monochorionic placenta occur.¹ This results in an uneven balance of blood flow between the developing fetuses, with 1 fetus becoming the donor and the other becoming the recipient. In severe TTTS, the recipient can experience polycythemia, polyhydramnios, and hydrops fetalis, while in the donor oligohydramnios and severe anemia may develop. It has been reported that fetal mortality reaches 60% to 80% if TTTS develops before 26 weeks of gestation and goes untreated.

Current therapeutic options include decompression amniocentesis, amniotic septostomy, interruption of the placental vessel communications, and selective feticide.^{1,2} Medical therapy with indomethacin and digoxin has had limited success.¹ Vessel occlusion addresses the cause of the problem, whereas other interventions aim to lessen the adverse effects of TTTS.² Serial amniocentesis is a minimally invasive procedure with a 50% to 60% survival rate for both fetuses but shows a 25% incidence of abnormalities on neonatal cranial scans.¹ Selective fetoscopic laser photocoagulation of abnormal placental vascular communications is a more invasive procedure but carries a better neurologic outcome than does serial amniocentesis. Both procedures were shown to have similar survival rates in the older literature; however, recent studies have shown that selective fetoscopic laser photocoagulation has increasing survival rates and has

become a definitive treatment option for severe TTTS.³

Case Report

The patient was a 32-year-old woman, gravida 5, para 2, at 19 weeks' estimated gestational age. She presented with a monochorionic, diamniotic twin gestation with TTTS diagnosed on an ultrasonogram, and she was scheduled for an elective laparoscopic fetal laser photocoagulation. An ultrasound examination obtained on February 29, 2012, showed the donor fetus having oligohydramnios with a maximum vertical pocket of 1.8 cm and the recipient fetus having polyhydramnios with a maximal vertical pocket of 10.2 cm.

Results of the preanesthetic assessment were remarkable for current tobacco use, with a 5-year pack history now decreased to 3 to 5 cigarettes per day. The patient had no known drug or environmental allergies and no reported problems with anesthesia. Her surgical history included ventricular septal defect closure and bilateral myringotomy tube placement as a child. Medications included docusate sodium (Colace), folic acid, iron, and prenatal vitamins. Preoperatively, the patient was counseled extensively about the risks, benefits, and alternatives of this procedure, as well as various treatment options. The patient elected to proceed with the laparoscopic fetoscopic ablation of the vessels via laser photocoagulation.

On the morning of March 1, 2012, the patient arrived to the obstetric preoperative area and was prepared for

surgery. Baseline vital signs were obtained, nothing-by-mouth status was confirmed, indomethacin was given via the rectal route, and a 16-gauge intravenous catheter was inserted in the left hand with 1 L lactated Ringer's solution infusing. An ultrasonogram showed the presence of 2 fetuses and 2 normal heart tones. The patient was transported to the operating room and was placed in the sitting position for epidural placement. Standard monitors were applied, and blood pressure was measured. The patient's lower back was prepared and draped, and epidural placement was achieved on the first attempt. The patient then was placed in a left uterine displacement position. A combination of 20 mL of 2% lidocaine, 2 mL of sodium bicarbonate, 100 µg of fentanyl, and 0.15 mL of epinephrine at a concentration of 1:100,000 was injected into the epidural catheter to achieve a sensory block at T4. Once the level was achieved, a propofol infusion was initiated to maintain sedation throughout the procedure. A dose of 5 mg of ephedrine was given at this time to raise blood pressure from 87/54 mm Hg. A phenylephrine infusion was also started to maintain adequate blood pressure. Ultrasonography was performed, and results confirmed the previous findings. The abdomen was prepared and draped to obtain a sterile field, and the procedure began.

Before incision, another ultrasonogram was obtained, which reconfirmed twin positioning of the posterior placenta and placenta cord insertion. A 5-mm incision was made inferior and to the right of the patient's umbilicus. A 2.5-mm trocar was inserted using direct ultrasound guidance. The fetoscope was inserted into the trocar with intra-amniotic placement and confirmed an excellent view of the root, the recipient fetus, and posterior placenta. Using a combination of ultrasound guidance and direct fetoscopic visualization, the surgeons identified the vascular equator and all the vascular anastomoses were identified by tracing all the vessels from the donor to the recipient as well from the recipient to the donor. Four anastomoses were noted. Two donor-to-recipient arteriovenous communications and 2 donor-to-recipient venous to arterial communications were seen. The donor arteriovenous anastomoses were approached first, and the vessels were ablated using several laser pulses. Attention was then turned to the third and fourth anastomosed vessels, which were ablated as well. Throughout the entire procedure, heart rates for both the donor and recipient remained normal.

At the completion of the procedure, the fetoscope was removed, and 2,320 mL of amniotic fluid in the recipient was slowly drained until the maximum vertical pocket was 5 cm for the recipient. The skin incision was closed with glue, and a sterile strip of tape (Steri-Strip, 3M) was placed for added reinforcement. After closure of the incision, the propofol and phenylephrine infusions were discontinued. The epidural catheter was removed with the

tip intact. At the conclusion of the procedure, a total of 2 L of crystalloids had been infused, urine output totaled 250 mL, and there was an estimated blood loss of 5 mL. The patient was transported to the labor and delivery recovery area. Vital signs were stable at arrival, and no complaints of pain or discomfort were reported.

Discussion

Multiple pregnancy is associated with an increased risk of preterm labor and delivery, preeclampsia, and intrauterine growth restriction.³ Multiple pregnancy accounts for up to 1 in 5 of all neonatal intensive care unit admissions due to pregnancy complications. Monochorionic twins account for approximately 20% to 30% of all twin births. This type of development is the largest contributor to the increased perinatal morbidity and mortality related to twin pregnancy.

The severity of TTTS is classified based on 5 stages.³ These range from stage 1 disease, in which oligohydramnios is present in the donor and polyhydramnios in the recipient, each with a visible bladder and normal Doppler ultrasonogram, to stage 5 disease, in which one or both fetuses have died. In this case report, the patient's disease was classified as stage 1. There is an 80% to 90% perinatal mortality rate if TTTS is left untreated, and most survivors experience substantial neurologic dysfunction. Before 1990, serial amnioreduction was the mainstay treatment and increased survival rates for 1 fetus to 50%. The use of fetoscopic laser ablation in the treatment of TTTS demonstrates survival rates as high as 80%, with a 10% incidence of neurologic sequelae.

Anesthesia for fetal surgery involves extensive coordination and communication between surgical and anesthetic teams.⁴ In severe TTTS, umbilical cord coagulation is often an indication when heart failure is present in the recipient twin and laser photocoagulation would not be beneficial. As a result, a preoperative fetal echocardiogram is required before surgery to screen for cardiac failure. Cardiac failure may present as hydrops fetalis, in which polyhydramnios, ascites, skin edema, and an effusion of the pericardial or pleural space is noted. If severe cardiac failure is present, a deep inhaled anesthetic would cause further cardiac depression. It is imperative that the anesthesia provider is aware of TTTS risks and proceeds with a balanced inhaled-opioid anesthetic or regional technique to decrease the risk of myocardial depression and perioperative risk.

Epidural anesthetic techniques are often recommended in this patient population.¹ Studies have shown that epidural and general anesthetic techniques have both been successful for the treatment of TTTS. There are multiple factors that influence the choice of anesthetic, which include the planned surgical approach and probability of converting to open fetal surgery, maternal preoperative medical history and physical examination,

and history of previous uterine activity. The surgical approach is based on location of the placenta, position of the fetuses, and trocar insertion placement. For a successful surgery, constant communication between the patient, anesthesia team, and surgical team is vital—from planning the anesthetic technique to the procedure itself. The ultimate goal is the safety of the mother and twins.

REFERENCES

1. Myers LB, Watcha MF. Epidural versus general anesthesia for twin-twin transfusion syndrome requiring fetal surgery. *Fetal Diagn Ther.* 2004;19(3):286-291.
2. Koffel BL. Abnormal presentation and multiple gestation. In: Chestnut DH, Polley LS, Wong CA, Tsen LC, eds. *Obstetric Anesthesia: Principles and Practice.* 3rd ed. Philadelphia PA: Elsevier Mosby; 2004:779-794.
3. Cooley A, Walsh J, Mahony R, et al. Successful fetoscopic laser coagulation for twin-to-twin transfusion syndrome under local anaesthesia. *Ir Med J.* 2011;104(6):187-190.
4. Galinkin JL, Gaiser RR, Cohen DE, Crombleholme TM, Johnson M, Kurth CD. Anesthesia for fetoscopic surgery: twin reverse arterial perfusion sequence and twin-twin transfusions syndrome. *Anesth Analg.* 2000;91(6):1394-1397.

AUTHOR

Morgan A. Ward, CRNA, is employed by C.S. Mott Children's Hospital, Ann Arbor, Michigan. Email: mthursto@umflint.edu.

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