

# Fetoscopic Laser Coagulation in Twin-Twin Transfusion Syndrome: Case Series

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## ABSTRACT

Twin-to-twin transfusion syndrome is a fatal complication and twins with monochorionic/diamniotic placentas are affected due to placental vascular anastomoses, producing volume transfer of blood from one twin to the other. The donor twin becomes hypovolemic with oligohydramnios and the recipient becomes hypervolemic with polyhydramnios. Twin-to-twin transfusion syndrome is associated with increased perinatal morbidity and mortality and expresses longstanding health hazards. Serial amnioreduction and fetoscopic laser photocoagulation of the vascular anastomoses are the main therapeutic approaches for twin-to-twin transfusion syndrome. Higher survival rates after fetoscopic laser ablation of the anastomotic vessels in comparison to serial amnioreduction have been reported in multicenter randomized clinical trials. We report the fetoscopic laser coagulation of three twin-to-twin transfusion syndrome cases at Ankara Dr. Zekai Tahir Burak Health Practice Research Center, Perinatology Clinics.

**Keywords:** Twin - Twin transfusion syndrome, Fetoscopic laser coagulation, Monochorionic pregnancy  
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## Introduction

Monochorionic pregnancies have a prevalence of 2–3/1000 births and Twin-to-twin transfusion syndrome (TTTS) will evolve in about 10-20% of monochorionic twin gestations (1). The prevalence of TTTS in monochorionic pregnancies is 1-3:10.000 (1). TTTS is a fatal complication and twins with monochorionic/diamniotic placentas are mainly affected. TTTS is associated with increased perinatal morbidity and mortality and expresses long-term health hazards for the progeny (2).

Main complications are secondary to monochorionic / diamniotic pregnancies and TTTS; selective intrauterine growth restriction (sIUGR), twin anemia-polycythemia sequence (TAPS), cardiomyopathy, polyhydramnios, preterm birth, preterm premature rupture of membranes, preeclampsia, and lifelong complications such as neurodevelopmental delay (2).

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TTTS cases have a published amount of 55% mortality in the Euro twin study (3). The explanation for the undesirable outcome depends on placental vascular anastomoses in the monochorionic placentas, producing volume transfer of blood from one twin to the other. The donor twin becomes hypovolemic with oligohydramnios and the recipient becomes hypervolemic with polyhydramnios. TTTS was classified by Quintero in 1999 (4). Quintero standardized ultrasound criteria for the staging of TTTS classification to predict prognosis by stage (Table 1).

Table 1. Quintero staging system for TTTS(4)

Stage	Sonographic findings
I	Polyhydramnios in recipient and oligohydramnios in donor
II	Nonvisualization of bladder in donor fetus
III	Abnormal Doppler findings; absent or reversed flow in the umbilical arteries, reversed flow in the ductus venosus, or pulsatile umbilical vein
IV	Hydrops fetalis in either fetus
V	Death of one or both fetuses

In monochorionic / diamniotic pregnancies, neurodevelopmental deterioration may appear nearly 10% in general and 14% secondary to laser ablation therapy for TTTS (2). If single fetal death occurs, the co-twin has a risk of intrauterine death (IUD) of 15% and a risk of neurologic impairment of 26% (5).

Serial amnioreduction and fetoscopic laser photocoagulation of the vascular anastomoses are the main therapeutic approaches for TTTS. Eurofetus multicenter randomized clinical trial study revealed higher survival rates after fetoscopic laser ablation of the anastomotic vessels in comparison to serial am-

nioreduction (6). Consequently, fetoscopic laser coagulation (FLC) of the anastomotic vessels has become the preferred treatment.

### Material Method

Twin-to-twin transfusion syndrome was diagnosed and staged according to Quintero's system (4). All examinations were performed using Voluson 730 Expert, GE Medical Systems, Milwaukee, Wisconsin, U.S.A. Patients were counseled about the outcome of FLS, and informed consent was obtained. Fetoscopic Laser Coagulation was performed between 16 and 26 gestational weeks. All the patients were under general anesthesia. Indomethacin suppository 100 mg and antibiotic prophylaxis with 2 g cefazolin i.v. were given 1 hour before the operation. A 3.0-mm Karl Storz 26161 U trocar (Karl Storz GmbH & Co. KG, Tuttlingen, Germany) was inserted percutaneously into the sac of the recipient twin by the help of ultrasonographic visualization. A 2.0-mm Karl Storz 26008AA Hopkins II Telescope with 0 degrees was passed through the trocar. A 600- $\mu$ m diameter diode laser fiber, with a maximum power of 40 W (Diode laser, Dornier MedTech) was passed through the 3.0-mm trocar sheath. Vessels were coagulated by using Solomon technique in which the full vascular equator is coagulated (7). All the visible anastomoses are coagulated and a line from one edge of the placenta to the other was coagulated with a maximum power of 40 W. At the end of the operation, amniodrainage was performed in order to reduce the largest deepest vertical pocket in the recipient to 5-6 cm.

### Case 1

A 27-year-old multiparous woman was referred to our hospital for perinatal care of a monochorionic diamniotic twin pregnancy at 20 weeks and 2 days of gestation. Ultrasound examination revealed no structural abnormalities in two fetuses. The donor fetus had oligohydramnios while the recipient had polyhydramnios. Two-week discordance was detected in terms of abdominal circumference measurement between the fetuses. The donor fetus had an abdominal circumference of two weeks smaller than the recipient (Figure 1) did. The donor fetal bladder could not have been visualized while the recipient had a visualized bladder. Both fetuses had normal Doppler findings and no hydrops existed in either. The pregnancy was diagnosed as TTTS with Quintero stage II. The patient was counseled about TTTS and fetoscopic laser coagulation of the anastomotic placental vessels was offered. FLC was performed at 22 weeks and 3 days. FLC was performed by using Solomon technique (Figure 2). Amniodrainage was performed at the end of the operation in order to reduce the largest deepest vertical pocket in the recipient to 5-6 cm. One week later the donor fetus had an increase of amniotic fluid and the bladder could have been visualized. The Doppler findings were normal. The pregnancy was weekly followed up with sonographic evaluation. Cesarean section was performed at 33

weeks and 3 days due to uncontrollable labor pain. The recipient twin was a 1725 g female with an Apgar score of 8 and 8 at 1 and 5 minutes, respectively. The donor fetus was a 1255 g female with an Apgar score of 7 and 8 at 1 and 5 minutes, respectively. The donor and the recipient babies were discharged from neonatal intensive care unit (NICU) on postnatal 25<sup>th</sup> and 15<sup>th</sup> days with no neurological abnormality and with average growth, respectively.



Figure 1: Pre-laser sonography of the TTTS with 22 gestational weeks



Figure 2: Fetoscopic photocoagulation of the anastomotic vessels

### Case 2

A 23-year-old nulliparous woman was referred to our hospital for perinatal care of a monochorionic diamniotic twin pregnancy at 20 weeks and 2 days of gestation. Ultrasound ex-

amination revealed no structural abnormalities in two fetuses. The donor fetus had oligohydramnios while the recipient had polyhydramnios. The donor fetus had an abdominal circumference of four weeks smaller than the recipient did. The donor fetal bladder could not have been visualized while the recipient had a visualized bladder. Both fetuses had normal Doppler findings and no hydrops existed in either. The pregnancy was diagnosed as TTTS with Quintero stage II. The patient was counseled about TTTS and fetoscopic laser coagulation of the anastomotic placental vessels was offered. FLC was performed at 23 weeks and 2 days. FLC was performed by using Solomon technique. Amniodrainage was performed in order to reduce the largest deepest vertical pocket in the recipient to 5-6 cm. Five days later the donor fetus had an increase of amniotic fluid and the bladder could have been visualized. The Doppler findings were normal. The pregnancy was weekly followed up with sonographic evaluation. The patient delivered the babies by cesarean section at 31 weeks and 4 days due to preterm labor pain. The recipient twin was a 2165 g male with an Apgar score of 7 and 9 at 1 and 5 minutes, respectively. The donor fetus was a 1375 g male with an Apgar score of 6 and 8 at 1 and 5 minutes, respectively. Karyotype analysis for both babies was done due to atypical face shape and the results revealed as normal. The donor and the recipient babies were discharged from NICU on postnatal 51th days with no neurological abnormality and with average growth, respectively.

### Case 3

A 33-year-old nulliparous woman was referred to our hospital for perinatal care of a monochorionic diamniotic twin pregnancy at 20 weeks and 1 days of gestation. Ultrasound examination revealed no structural abnormalities in two fetuses. The donor fetus had oligohydramnios while the recipient had polyhydramnios. The donor fetus had an abdominal circumference of three weeks smaller than the recipient did. Both fetal bladders were visualized. Donor fetus had reversed flow in the ductus venosus Doppler. The pregnancy was diagnosed as TTTS with Quintero stage III. Amniodrainage was performed at 20 weeks and 1 days of gestation for maternal symptoms due to polyhydramnios. The sonographic findings persisted one week later. The patient was counseled about TTTS and fetoscopic laser coagulation of the anastomotic placental vessels was offered. FLC was performed at 21 weeks and 2 days by using Solomon technique. Amniodrainage was performed in order to reduce the largest deepest vertical pocket in the recipient to 5-6 cm. Eight days later membrane rupture occurred and a 560 g female with 0 Apgar and a 400 g female with 0 Apgar were born vaginally.

### Discussion

Twin to twin transfusion syndrome is a condition that affects monochorionic twin pregnancies. Placental vascular

anastomoses exist between the fetuses and the blood passes from the donor twin to the recipient. The donor twin becomes hypovolemic with oligohydramnios and the recipient becomes hypervolemic with polyhydramnios. The separating membrane may be visualized as totally covering the donor fetus. Discordance is usually detected between the twins and the recipient is appropriate for gestational age with a distended bladder and may show tricuspid regurgitation, if markedly compromised. Additionally, the donor is growth restricted and may have abnormal Doppler findings. TTTS can be classified according to Quintero's staging (4).

Twin to twin transfusion syndrome is associated with the demise of one or both fetuses in more than 80% of pregnancies, if left untreated. The risk is higher if TTTS develops before 28 gestational weeks (8,9). The demise of one twin can occur suddenly in TTTS and this may lead to the demise of the co-twin or result in neurological impairment (10,11).

Serial amnioreduction of the amniotic fluid and fetoscopic laser coagulation of the vascular anastomoses are the two essential treatment choices in TTTS. Serial amnioreduction is reported to be associated with increased perinatal mortality in comparison with fetoscopic laser coagulation (12).

De Lia et al. reported the first fetoscopic laser treatment as an alternative for amnioreduction for the treatment of TTTS in 1990 (13). TTTS therapy improved significantly in the two decades. Today, perinatal survival chance of at least one twin after laser coagulation is 81-88% of pregnancies, survival of both twins is 52-54% of pregnancies, and the preferred treatment for TTTS is fetoscopic laser coagulation of the vascular anastomoses. The median gestational age at delivery is 32.4 weeks (14).

4-16% of the surviving babies have signs of cerebral injury, and 13-17% have neurodevelopmental morbidity (15). The objective of fetoscopic laser surgery is to coagulate all of the placental vascular anastomoses. However, up to 33% of laser treated patients have been reported to have remaining vascular anastomoses (15). Severe complications due to these residual anastomoses are twin anemia polycythemia sequence (TAPS) (13%) and recurrent TTTS (21%) (16). A modified fetoscopic laser surgery technique called the "Solomon technique" has been developed to prevent the remaining residual anastomoses and secondary complications. The principle of the Solomon technique is the coagulation of the entire vascular equator (16). Ruano et al. have found that fetoscopic laser coagulation with Solomon technique significantly reduces the incidence of twin anemia polycythemia sequence and recurrent twin-to-twin transfusion syndrome (7,17).

We used Solomon fetoscopic laser coagulation technique in all three cases. In two cases, both twins survived and were born at 33 weeks 3 days and 31 weeks 4 days, respectively.

Iatrogenic preterm premature rupture of membranes (PPROM) is usually the most significant causes of premature birth after laser therapy (18). In our third case, 8 days after the laser therapy the pregnancy terminated due to PPRM.

In terms of longstanding outcome, more babies were reported to be alive without neurological abnormality at the age of six years in the laser group in comparison with the amnioreduction groups in a meta-analysis concluding of 182 pregnancies and 364 fetuses (12). Roberts et al compared laser surgery and amnioreduction and found no significant differences for death of at least one infant per pregnancy or death of both infants per pregnancy (12).

Amnioreduction may only be accepted as a therapeutic option if fetoscopic laser coagulation cannot be done due to technical problems and lack of expertise, and if TTTS pregnancy is beyond 26 weeks. In comparison with amnioreduction, fetoscopic laser coagulation of placental anastomotic vessels is a significant consideration for TTTS for the neurodevelopmental improvement.

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