

OBSTETRICS

Outcome after fetoscopic selective laser ablation of placental anastomoses vs equatorial laser dichorionization for the treatment of twin-to-twin transfusion syndrome

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OBJECTIVE: The objective of the study was to compare the outcome in women with twin-twin transfusion syndrome (TTTS) who were managed by selective laser ablation of placental anastomoses (S-LASER) vs equatorial dichorionization of the anastomoses and chorionic plate (ED-LASER).

STUDY DESIGN: We conducted an analysis of 2 consecutive cohorts with TTTS treated with S-LASER and ED-LASER. Preoperative, procedural, delivery, and outcome details were compared between treatment groups.

RESULTS: A total of 147 twin pregnancies had laser (S-LASER, $n = 71$; ED-LASER, $n = 76$). Obstetric history, Quintero stage, placental location, individual arterial and venous Doppler parameters, and gestational age at laser and delivery did not differ. Use of lens fetoscope (96.1% vs 50.7%), coagulated anastomosis count (11 vs 15, $P < .001$), complete equatorial plate visualization (77.5% vs 92.1%, $P = .019$), and amniotic fluid transparency (80.3% vs 94.7%, $P = .011$) was greater during ED-LASER. Procedure-related

complications, gestational age at delivery, and perinatal details were comparable between groups. ED-LASER was associated with significantly lower recurrence of TTTS (3.9% vs 8.5%), twin anemia polycythemia sequence (2.6% vs 4.2%), and amniotic fluid abnormalities (0% vs 5.6%, $P < .05$ for all comparisons). Logistic regression identified complete visualization of the equator as the primary determinant for successful TTTS treatment and coagulation of the chorionic plate as an independent cofactor. Double survival at age 6 months was significantly higher after ED-LASER (68.4% vs 50.7%, $P < .05$), attributable to a lower postlaser and neonatal mortality rates.

CONCLUSION: In patients with TTTS, photocoagulation of causative anastomoses and the chorionic plate along the vascular equator decreases recurrence without increasing adverse outcome and improves survival compared with the selective technique.

Key words: equatorial dichorionization, fetoscopy, laser, twin-twin transfusion

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The vascular source of imbalance causing twin-to-twin transfusion syndrome (TTTS) in monochorionic placentation is at the vascular equator, the watershed of the vascular territories

of each twin.¹ Fetoscopic visualization and laser ablation of causative placental anastomoses (LASER) is the established first-line curative therapy.¹ When this is done by identifying each individual anastomosis along the equator (selective LASER [S-LASER]), closure of the causative connections and preservation of the placental territory offers the greatest survival benefit compared with amnioreduction and nonselective techniques.²⁻⁴ Unsuccessful LASER can result in treatment failure, recurrence of amniotic fluid discordance, twin anemia polycythemia sequence (TAPS), or decreased twin survival.

Evidence of incomplete treatment has been reported in up to 19% of patients and in those undergoing placental studies can be related to the presence of residual anastomoses.⁵⁻¹⁰ Residual anastomoses have been attributed to several causes including secondary enlargement

of small or collapsed vessels that were missed by S-LASER.

A laser technique that coagulates the surface of the chorionic plate between the main anastomotomic channels along the vascular equator has been described (Figure and personal communication, Professor K. H. Nicolaides). This equatorial dichorionization, or Solomon technique, has been suggested to decrease recurrence rate by targeting the placental territories left untreated by S-LASER (www.trialregister.nl; NTR1245). The aim of this study was to test the hypothesis that equatorial dichorionization and LASER photocoagulation of vessels (ED-LASER) decreases TTTS recurrence compared with S-LASER, without adverse effect on perinatal outcome.

MATERIALS AND METHODS

This was a retrospective analysis of patients referred for treatment of TTTS

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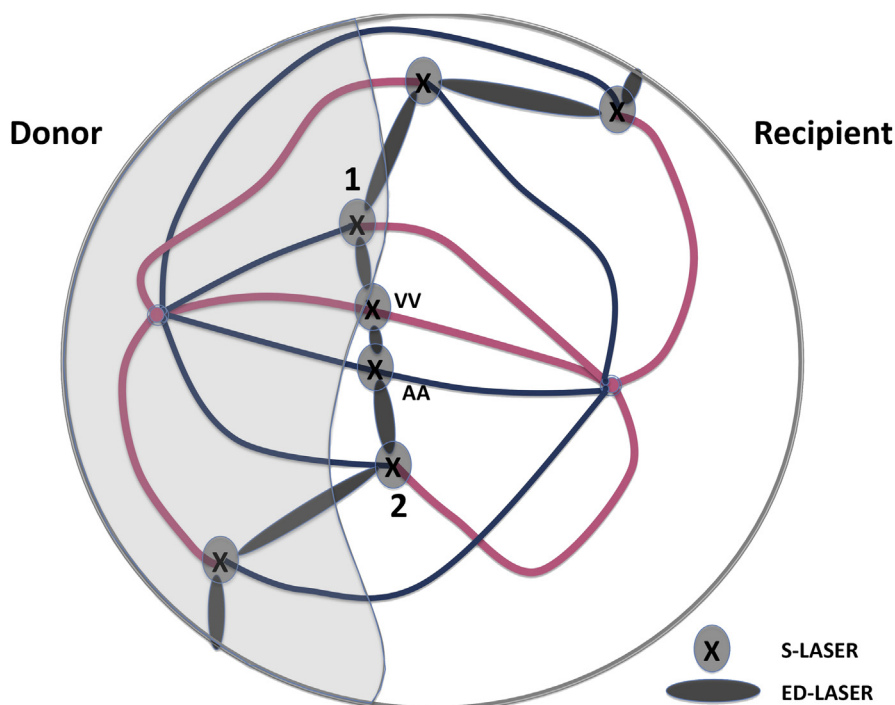
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FIGURE

Schematic representation of laser techniques



Selective photocoagulation (X only, selective laser ablation of placental anastomoses) coagulates anastomoses where they occur. The position of these anastomoses defines the vascular equator and therefore the placental territories of each twin. With equatorial dichorionization (*shaded areas*, equatorial dichorionization of the anastomoses and chorionic plate) the chorionic plate is also coagulated along the line defining the vascular equator. For vessels with bidirectional shunting (AA, VV), the line of the chorionic plate coagulation was determined by the position of the nearest 2 bidirectional anastomoses (1 and 2).

AA, artery to artery; VV, vein to vein.

Baschat. Equatorial laser dichorionization for TTTS. *Am J Obstet Gynecol* 2013.

between 2005 and 2011. Patients who met the following criteria were eligible for inclusion: (1) monochorionic twin gestation; (2) diagnosis of TTTS established before 26 weeks' gestation; and (3) polyhydramnios in the recipient twin's amniotic sac (maximum vertical pool greater than 8 cm at less than 20 weeks' gestation and greater than 10 cm at 21-25 weeks' gestation) and oligohydramnios in the donor (stuck) twin's amniotic sac less than 2 cm. Exclusion criteria were fetal death, ruptured membranes, and preterm labor.

Following a detailed ultrasound evaluation of fetal anatomy, amniotic fluid volume, bladder filling, and cardiovascular parameters, the severity of TTTS was assigned according to the Quintero staging system.¹¹ We analyzed cases that

were referred after the primary surgeon (A.A.B.) completed 1 year of training at a center with an average case load of 2 fetoscopic LASER procedures per week and personally performed 30 of these procedures. The choice of analgesia, intraoperative recording of procedure details, postdelivery follow-up, and acquisition of source documentation by the fetal therapy team was identical throughout the entire study period. The following approach was utilized for the LASER treatment.

After local or regional anesthesia, the trocar was inserted percutaneously under ultrasound guidance into the recipient sac. For a posterior placenta, a 2 mm 0° fetoscope and an insertion sheath with a working channel (outer diameter 3.2 mm, 11603AA or 26008AA,

and 26161 U; Karl Storz GmbH, Tuttlingen, Germany) were used. For anterior placenta, a 2 mm 30° fetoscope and double sheath with Albaran mechanism (outer diameter of 3.8 mm, 26008 BUA, 26161 UH and 26161 UF; Karl Storz GmbH) were used.

Photocoagulation was carried out using KTP laser energy, adjusting the delivery watts as required to achieve vessel coagulation (600 μ m bare fiber; Endostat, Laserscope, San Jose, CA). This is a neodymium:YAG laser that is directed through a potassium titanyl phosphate crystal reducing the output wavelength to 532 nm. During S-LASER all visible intertwin anastomoses and vessels with uncertain course were coagulated if they crossed the equator. During ED-LASER the same approach was chosen for the coagulation of the anastomoses. However, in addition, the chorionic plate was coagulated along the line that connected the anastomoses until visual blanching was observed (Figure). For bidirectional vessels the nearest arteriovenous anastomoses were chosen as reference points for the equator.

Intraoperatively, anastomosis type and size, location of intertwin membrane, equator visualization, and amniotic fluid transparency (categorized as clear or cloudy) were recorded. Complete anastomosis visualization indicated that vessel origins and connection could be verified. Complete visualization of the vascular equator indicates that the line connecting all anastomoses could be visually inspected from 1 placental edge to the other. Coagulation was noted as being satisfactory if complete blanching of the vessel or chorionic plate was achieved. At the end of the procedure, amniodrainage was performed to reduce the fluid in the recipient sac to a maximum vertical pocket of 6 cm or less. The procedure time, maximum watts, minutes and joules of laser energy, and intraoperative complications were recorded. Ultrasound follow-up was performed for 2 days postoperatively and then was tailored in frequency as clinically indicated.

For patients returning to their referring providers, contact was maintained

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