Perioperative characteristics associated with preterm birth in twin-twin transfusion syndrome treated by laser surgery

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OBJECTIVE: To identify perioperative risk factors for preterm delivery (PTD) in laser-treated patients with twin-twin transfusion syndrome (TTTS).

STUDY DESIGN: Twin-twin transfusion syndrome patients who underwent laser surgery were followed prospectively. Univariate and multivariate analyses were performed to identify gestational and surgical characteristics associated with preterm delivery.

RESULTS: Of 318 eligible patients, the mean (SD) gestational age of delivery was 32.8 (4.2) weeks. The number of days from laser surgery to delivery had a bimodal distribution; group I delivered within 21 days and group II delivered after 21 days of surgery. Eighteen patients (5.7%) were in group I and demonstrated the following risk factors for delivery within 21 days: incomplete laser surgery suspected (odds ratio [OR], 11.14; $P = .0106$), preoperative subchorionic hematoma (OR, 7.92, $P = .0361$), preoperative cervical length <2.0 cm (OR, 4.71; $P = .0117$), and recipient's maximum vertical pocket ≥14 cm (OR, 3.23; $P = .0335$). In group II, 92 of 300 patients (30.7%) delivered <32 weeks, and 25 (8.3%) delivered <28 weeks; multivariate logistic regression analyses identified 5 risk factors for delivery <32 weeks: incomplete laser surgery suspected (OR, 10.0; $P = .0506$); incidental septostomy (OR, 4.4; $P = .0009$); triplet gestation (OR, 2.6; $P = .0689$); postoperative membrane detachment (OR, 2.4; $P = .0393$); and nonposterior placental location (OR, 1.8; $P = .0282$).

CONCLUSION: Timing of delivery after laser for twin-twin transfusion syndrome has a bimodal distribution with distinct gestational and surgical risk factors. This information may be useful in counseling patients and in directing future avenues of research.

Key words: laser surgery, prematurity, preterm birth, twin-twin transfusion syndrome, TTTS

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Selective laser photocoagulation of communicating vessels via operative fetoscopy has been shown to be the optimal treatment for twin-twin transfusion syndrome (TTTS),[1,2] with survival rates of over 90% for at least 1 twin and approximately 70% for dual survival.[3] However, counseling of prospective TTTS patients contemplating laser surgery must take into account both survival statistics and potential morbidity. For example, recent metaanalyses have shown that the prevalence of long-term neurodevelopmental impairment after laser surgery for TTTS is 11-13%, with rates of cerebral palsy in the range of 4–7%.[4,5] The etiology for neurologic morbidity is multifactorial,[6] but preterm delivery is 1 important and potentially modifiable risk factor.[7,8]

Laser surgery for TTTS is associated with approximately 17-22% risk of birth before 28 weeks' and 29-54% risk of birth before 32-34 weeks' gestation.[1,9,10] Research findings have suggested that both gestational and surgical factors are important predictors for prematurity in these patients. For example, some studies have implicated a shortened cervical length as a risk factor for preterm birth after laser.[9,11,12] In a study by Cobo et al,[9] preoperative cervical length and earlier gestational age at time of laser surgery were weakly associated with prematurity. A study by Stirnemann et al[13] showed that perioperative clinical parameters may predict, in part, postoperative outcomes. An improved understanding of the perioperative risk factors for preterm birth may facilitate counseling of patients before and shortly after laser surgery, and may guide improvement of surgical techniques.

The aim of this study was to identify gestational and surgical risk factors for preterm birth before 32 weeks in laser-treated TTTS patients.

Materials and Methods

We analyzed data collected prospectively from consecutive patients undergoing laser surgery for the treatment of TTTS at our center from March 2006 to March 2012. The diagnosis of TTTS was established in monochorionic diamniotic multiple gestations if the maximum vertical pocket of amniotic fluid measured ≤2 cm in the donor's sac and ≥8 cm in the recipient's sac at the time of the preoperative ultrasound, performed 1 day before surgery. Patients were classified according to the Quintero Staging System.[14] No patients were upstaged based on echocardiographic findings. Patients categorized as Quintero Stage I through IV were offered laser surgery if they were diagnosed with TTTS between 16 and 26 weeks' gestation. All patients underwent

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an endovaginal ultrasound assessment to measure the cervical length at the pre- and postoperative ultrasound examinations. Patients with a cervical length less than 2.0 cm underwent cervical cerclage placement.[12] Patients were informed that umbilical cord occlusion is not a treatment option for TTTS at our center. Patients with clinical evidence of ongoing abruption, active labor, chorioamnionitis, or ruptured membranes were not offered laser surgery.

Operative fetoscopy and selective laser photocoagulation of communication vessels was performed using previously described surgical techniques.[3] Briefly, maternal anesthesia was provided via local anesthesia with intravenous conscious sedation, except in the rare case that regional anesthesia was used. All cases were performed percutaneously through a single port, with insertion of 3.8 mm diameter trocar. The patients then spent 1 night in the hospital, and were placed on tocolysis only if clinically significant contractions developed. Postoperative ultrasound was performed the day after surgery. Patients then returned to their referring physicians to be subsequently managed and delivered.

Data regarding preoperative gestational and surgical characteristics were collected. These data were prospectively collected and entered in a database in an ongoing fashion. Variables studied were selected because they had a potential association with the occurrence of preterm birth. Risk factors for preterm birth were tested for the outcome of preterm birth at <32 gestational weeks. History of preterm birth was defined as a prior pregnancy that resulted in delivery before 37 gestational weeks. Preoperative uterine contractions were defined as symptomatic contractions that required hospitalized evaluation and/or tocolysis before laser surgery. The moon sign was defined as chorioamniotic membrane separation from the decidua over the internal cervical os and lower uterine segment.[15] Membrane detachment was an ultrasound finding in which the fetal membranes could be identified a measureable distance from the uterine wall. The cocoon sign described an ultrasound finding of a donor twin with severe oligohydramnios enveloped by dividing membranes and connected to the uterine wall by a laminar stalk of these membranes.[16] Incidental septostomy was the unintentional piercing of the dividing membranes at the time of operative fetoscopy; this finding may be recognized at the time of laser surgery or at the time of the postoperative ultrasound. Finally, suspected incomplete laser surgery was defined as the technical inability to assure that all vessels were occluded successfully.

Data were first analyzed univariately to test the statistical significance of their association with preterm birth using 2-sample t tests and χ^2 tests for continuous and categorical covariates, respectively. Means are expressed $\pm$ the standard deviation (SD). Next, logistic regression was used to examine the relationship between the binary preterm birth outcomes and the gestational and surgical characteristics, adjusted for other significant covariates. Covariates associated with the outcome ($P < .20$) were included in a multiple logistic regression using forward, backward and stepwise techniques to select a subset of simultaneously significant covariates that were associated with the preterm birth outcomes. As this was an exploratory study to identify risk factors for preterm birth, variables were selected for the final model if statistically significant ($P < .05$), or they had a strong odds ratio and contributed significantly to the model even if P was not less than .05.

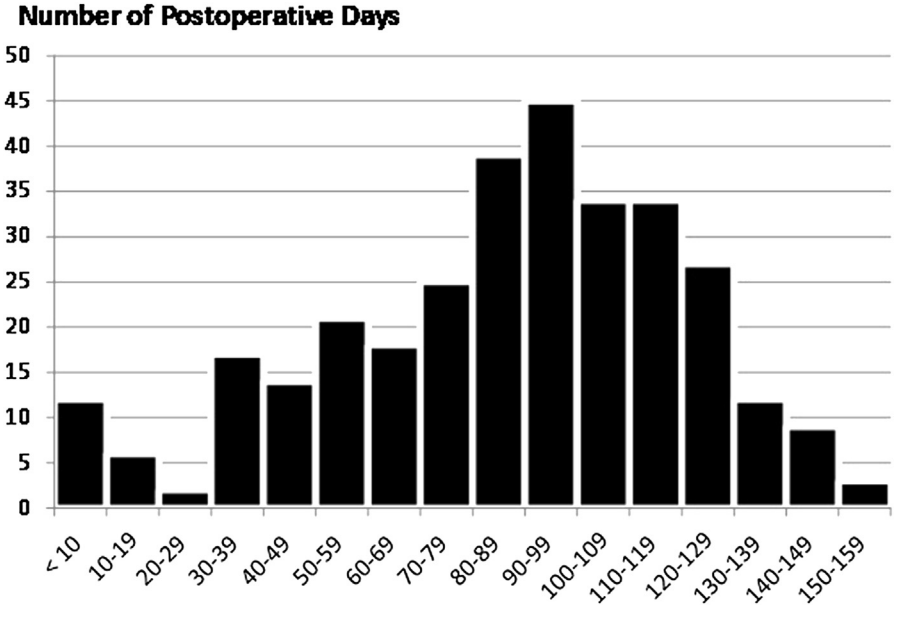
Data were analyzed using SAS statistical software (version 9.2; SAS Institute, Inc, Cary, NC). Survival outcomes of the first 210 of the 321 patients considered in this study have been published previously.[3] This study was approved by the Health Sciences Institutional Review Board of the University of Southern California (USC), Los Angeles, California, and complied with all patient protection criteria stipulated therein.

Results

During the study period, a total of 321 patients underwent TTTS laser surgery. Three patients (0.9%) had a postoperative elective pregnancy termination, resulting in a final study population of 318 patients with a mean (SD) gestational age of 32.8 (4.2) weeks at delivery.

The number of days from laser surgery to delivery had a bimodal distribution (Figure 1). Eighteen of the patients

FIGURE
Distribution of number of days from laser surgery to delivery (n = 318)



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