Successful Fetoscopic Laser Coagulation for Twin-to-Twin Transfusion Syndrome under Local Anaesthesia

S Cooley, J Walsh, R Mahony, S Carroll, S Higgins, P McParland, F McAuliffe
National Maternity Hospital, Holles St, Dublin 2

Abstract
A review of the efficacy and outcome of fifteen fetoscopic laser ablations under local anaesthesia for twin to twin transfusion syndrome (TTTS) in the National Maternity Hospital Dublin was undertaken. The mean gestation at laser was 19.7 weeks (range 16-25 weeks) with a mean gestation at delivery of 29.1 weeks (range 20-35 weeks). The overall liveborn birth rate was 79% (22 infants) and one pregnancy was still ongoing. There were four neonatal deaths secondary to complications of prematurity. The surviving eighteen infants (64%) underwent regular paediatric review. The procedure was performed successfully in all cases with local anaesthesia. In no case was there maternal discomfort that warranted the procedure to be abandoned and good visual access of the vascular anastamoses was obtained in all cases. Local anaesthesia therefore offers a safe effective anaesthetic option for fetoscopic laser coagulation in monochorionic pregnancies complicated by TTTS.

Introduction
The first laser coagulation of vascular anastamoses for twin-to-twin transfusion syndrome (TTTS) was undertaken by De Lia in 1990. Since then fetoscopic laser ablation of placental anastamoses has been proven to be the definitive treatment for severe TTTS between 16 and 26 weeks of gestation. This is based on the improved perinatal morbidity and mortality rates following fetoscopic laser ablation when compared with amnioreduction for TTTS in cases requiring urgent transfer to a tertiary hospital or regional or local anaesthesia. We report our experience in the National Maternity Hospital Dublin where oral analgesia premedication and local anaesthesia are successfully used for fetoscopic laser coagulation for the treatment of severe twin to twin transfusion syndrome.

Methods
This is a prospective study of all cases of monochorionic twin pregnancies affected with severe twin to twin transfusion syndrome (TTTS) at The National Maternity Hospital from January 1st 2007 to February 28th 2010. Fifteen cases of TTTS in monochorionic pregnancies were identified at a gestational age less than or equal to 25 weeks. In all cases written informed consent was obtained from the parents following extensive counselling. All cases had fetal growth, fetal anatomy, liquor volume, umbilical and middle cerebral artery measurements performed, and Quintero staging was determined.

Premedication using 10 mgs of oral diazepam, 100mgs of rectal diclofenac and pethidine 75-100mg intramuscularly was employed for all study participants 60 minutes preoperatively. All cases received co-amoxiclav 1.2 grams intravenously every eight hours for 24 hours following the procedure. Once the abdomen was prepped and draped 20 mls of 1% lignocaine was instilled to the skin. With continuous ultrasound guidance a single 3-mm trocar was inserted. Following trocar insertion a 2-mm rigid endoscope with a 60 degree field of vision was inserted into the amniotic cavity of the recipient twin. The fetoscope was connected to a light source and camera system and a 0.4 mm Nd:YAG laser fibre was passed via the channel of the sheath into the amniotic cavity. The intertwin membrane was systematically examined and the anastamoses vessels were successfully coagulated using repeated laser shots with an output of 50 to 60 W at a distance of 1 cm. Following laser coagulation of the anastamosis vessels amnioreduction was undertaken through the endoscope sheath following removal of the endoscope. All cases had repeat ultrasound in the following 24 hours and were subsequently discharged from hospital with arrangements for review one week later. Data on pregnancy outcome were collected prospectively, and none of the patients were excluded from analysis.

Results
The mean gestation at laser was 19.7 weeks (range 16-25 weeks). The average number of anastamotic vessels requiring laser ablation was 2 (range 2-10 vessels) with a median treatment to delivery interval of 8.9 weeks (range 1-16 weeks). Overall 78% of our cases had operative delivery with a mean gestation at delivery of 29.1 weeks (range 20-35 weeks). Table 1 illustrates the Quintero staging, gestation at intervention and outcome for our cohort. The median time of the procedure was 25 minutes (range 20-45 minutes).

Following fetoscopic laser ablation there were four second trimester losses of one or both of the monochorionic pair. Two cases of TTTS recurred, one patient opted for cord occlusion and the other patient had a repeat fetoscopic laser ablation. Both of these cases had their repeat procedures at another centre. The overall liveborn birth rate was 79% (22/28 infants) and one pregnancy is still ongoing. There were four neonatal deaths secondary to complications of prematurity. The surviving eighteen infants (64%, 18/28) underwent regular paediatric review. The procedure was performed successfully in all cases with local anaesthesia. In no case was there maternal discomfort that warranted the procedure to be abandoned. Good visual access of the vascular anastamoses was obtained in all cases.
The incidence of multiple pregnancy is increasing worldwide. Multiple pregnancy is associated with an increased risk of preterm delivery, pre-eclampsia and intrauterine growth restriction. Overall up to 1 in 5 of all admissions to neonatal intensive care are secondary to problems stemming from multiple pregnancy. Monochorionic (MC) twins account for about 20-30% of all twin births, and are by far the largest contributor to the increased perinatal morbidity and mortality associated with twin pregnancy. This is secondary to vascular anastomoses that have formed on the chorionic plate, resulting in communication between the two fetal circulations and an increased risk of TTTS.

The severity of TTTS is classified according to the five stages described by Quintero. These range from Stage I disease where there is evidence of oligohydramnios in the donor twin and polyhydramnios in the recipient twin with a visible bladder in the donor and normal Dopplers to Stage V disease where one or both of the fetuses have died. Untreated TTTS is associated with a perinatal mortality rate of 80-90% with significant neurological sequelae in a majority of survivors. Prior to 1990 serial amnioreduction was the mainstay of treatment for TTTS. This increased survival rates for one fetus to 50% when compared to the untreated population. Survival rates for TTTS requiring fetoscopic laser ablation has been reported as high as 80%, with a 10% incidence of neurological sequelae and an overall favourable prognosis after 6 years of follow-up.

A Cochrane review of the treatments available for TTTS in 2008 evaluated the data available on randomised and quasi-randomised studies of amnioreduction, laser coagulation and septostomy and compared their outcomes. The results showed that fetoscopic laser coagulation resulted in less overall death (48% vs. 59%), less perinatal death (26% vs. 44%) less neonatal death (8% vs. 26%) and less neurological sequelae at 6 months of age (31% vs. 52%) when compared with amnioreduction. This establishes fetoscopic laser ablation as the treatment of choice for all stages of TTTS. The survival rates on our work compares favourably to international standards and other studies where a similar practice involving local rather than regional anaesthesia is employed. In the study by Hecher et al in 2000 the overall survival rate was 61% with a median gestation to delivery interval of 12.9 weeks. Our overall survival rate was 83% with a median gestation to delivery interval of 12.3 weeks compares favourably with this. The focus in TTTS has been on overall treatment success and fetal morbidity and mortality. To date there is a paucity of data available on effective analgesia for the procedure.

The initial work on laser ablation in TTTS employed regional or general anaesthesia, with a purse-string polyglycolic suture to minimise amniotic fluid leakage and uterine blood loss from the operative site. The risks associated with laparotomy include increased blood loss, preterm birth and chorioamnionitis. Advances in laparoscopic equipment and surgery has meant that laser can now be more safely undertaken via a minimal access technique, the laparoscopic approach is now standard of care. Many units use a combination of regional anaesthesia and intravenous opiate sedation for fetoscopic surgery.

Regional anaesthesia can affect the fetus directly or indirectly. All local anaesthetic agents used in regional blockade can cross the placenta. The combination of fentanyl with local anaesthetic results in better analgesia for the patient. The indirect effect of regional anaesthesia results from sympathetic blockade with resulting peripheral vasodilatation and a drop in maternal blood pressure which may precipitate a decrease in uteroplacental blood flow and fetal bradycardia. This responds quickly to immediate treatment with intravenous fluids, relief of aortocaval compression and vasopressor use.

Retrospective studies have implicated regional anaesthesia in fetal acidemia but this has not been proven in prospective trials. Intravenous sedation involves the use of midazolam and an analgesic for example fentanyl or morphine. Midazolam is a short acting water-soluble benzodiazepine that has a minimal impact on maternal haemodynamics and induces amnesia. It rapidly crosses the placenta and impacts negatively on fetal breathing, fetal tone and fetal body temperature. Work on the impact of midazolam on fetal wellbeing relates to the midazolam use of midazolam at 0.2 mg/kg for rapid sequence intravenous anaesthetic induction.
There is no data on the impact of midazolam on fetal wellbeing when the lower dosage of midazolam (1-2 mgs preoperatively) is used but caution must be exercised.

Fentanyl is a synthetic opioid that is protein bound in the circulation and is highly lipid soluble. It is irregularly used in obstetric analgesia as it has a rapid onset of action and a short half-life when used in small doses. Its potency is in excess of seventy five times that of morphine and also rapidly crosses the placenta being detectable in fetal blood after one minute of maternal transfusion. Fetal levels of fentanyl are approximately one third maternal levels and at the dosages used in intraamnionic transfusion (50g) has minimal impact on maternal or fetal haemodynamics in animal models but may reduce the biophysical profile score in later pregnancy. Morphine crosses the placenta with the fetomaternal blood concentration ratio reaching 0.96 after five minutes and equilibrating over time. The clearance of morphine is also delayed when the fetal liver is immature. Morphine may also more readily cross the blood-brain barrier in the immature fetus and impact negatively on fetal heart rate variability.

The use of intraamnionic sedation has therefore implications on maternal and fetal wellbeing and should be used with caution and only when necessary. In our study the use of oral analgesia and local anaesthesia allowed for safe identification of anastamotic vessels. The successful use of local anaesthesia for TTTS was first reported in 1995.

Correspondence: S Cooley
Fetal Medicine Unit, National Maternity Hospital, Holles St, Dublin 2
Email: s.cooley@hotmail.com

References