Georgina Smart

University of St Andrews

Year 2

Foetoscopic Guided Laser Occlusion in Twin-to-Twin Transfusion Syndrome

Twin-to-twin Transfusion Syndrome (TTTS) is a comparatively rare syndrome that only is experienced by monozygotic, dichorionic twins - also referred to as Foetal Transfusion Syndrome. It is estimated to affect 5-10% of twin pregnancies (1). TTTS is effectively when one twin acts as a 'donor' by losing blood for the other twins (the recipients) gain. This, most commonly, causes a drawback for the donor twin but in some cases can create bad effects for both, including multisystem organ impairment (2). It may be that the donor has insufficient blood and thus would benefit from a transfusion, whilst the other may need the volume of blood in its body reduced.

If both twins survive, the donor is characteristically dehydrated, anaemic and pale – aside from being smaller than the recipient. The recipient is classically red in colour and exacerbating hypertension. As the recipient has much more blood, it urinates more frequently and consequently has additional amniotic fluid. As the donor twin has decreased amniotic fluid, it can occasionally appear, under ultrasound scanning, to be 'stuck' to one region of the uterine wall – denoted as 'stuck twin phenomenon' (1). Because of the fact that the recipient has excessive blood, the heart may be struggling to manage the workload and therefore the recipient may progress to heart failure and requisite medical intervention so as to fortify heart function. Unequal sizing of monozygotic twins is referred to as discordant twins (3).

TTTS is detected during pregnancy via ultrasound examining. However, after parturition, further diagnostic tests are obligatory, including blood tests: prothrombin time; partial thromboplastin time; complete metabolic panel; full blood count; liver function tests; urea and electrolytes (3). The twins would also compel a chest x-ray. Interestingly, in extremely rare cases, it emerges that on cutting one umbilical cord, the unborn twin may obtain an abrupt blast of blood and this may be the instigating element of TTTS, even without impediments throughout gestation. If TTTS arises afore 26 weeks of pregnancy and no treatment is endeavoured, there is an 80% mortality rate for the twins.

Management can initiate before the twins are even fully developed or born. During pregnancy, they may need to endure recurrent amniocentesis or have, in addition or solely, foetal laser surgery in order to suspend the blood flow from the donor to the recipient. Amniocentesis is fundamentally repeated drainage of superfluous amniotic fluid; it can also work by generating a hole amid the two amniotic sacs, which allows a fluid equilibrium between the two. The laser surgery works by extricating the circulation amongst the two foetuses and effectively putting a termination to the TTTS. To carry out surgery on foetuses in the womb conveys numerous dangers and medical professionals may delay using this method if repetition amniocentesis seems to have a favourable outcome. Some mothers may select to voluntarily terminate their pregnancy if the prognosis does not materialise to be good. Following birth, the treatment is unambiguous to the patients symptoms and habitually carried out in a neonatal intensive care unit. In most cases the donor twin would need a blood transfusion in order to treat the anaemia. It may be that an exchange transfusion (3) is performed whereby blood is acquired from one twin, the recipient, and transfused into the donor. Medication could be prescribed for the heart failure in the recipient.

If TTTS is moderately minor, it is most likely that both twins will make a complete recovery. However, selected cases can be so severe that mortality of one or both twins, either preceding to and post birth may result. Symptoms can be perceived in the expectant mother, and either twin throughout pregnancy. The mother may exacerbate a hastily enlarging abdomen over a period of just a few weeks due to the accrual of amniotic fluid around the recipient twin. The focal symptom in the twins will be size, the donor twin being 10-20% smaller than the recipient (1). A further complication can arise called hydrops fetalis, and this may develop in one or both twins. Hydrops fetalis is simply fluid accumulation in a body segment of the foetus – i.e. fluid may just accumulate in the abdomen.

Laser treatment was first introduced in 1995 and the core procedure involves both visualisation and separation of the adjoining blood vessels on the placenta using laser therapy – foetoscopic guided laser occlusion, also known as foetoscopic selective laser photocoagulation (2). The visualisation part of the procedure comprises an endoscope of 1.0-1.2mm diameter being passed into the womb through a minor incision of 3 to 5mm laterally (usually, although this depends on the position of the foetuses) in the maternal abdomen so that a laser beam can be applied to the vessels to generate a coagulation effect. The laser and endoscope are both passed through a distinctive, watertight cannula in order for the technique to be carried out using only the one incision. Following the laser application, a concluding amniocentesis procedure will be performed until the balance in amniotic fluid in both amniotic sacs are the same. The final amniocentesis appears to have a 95% success rate following the laser treatment, meaning that amniotic fluid will persist as stable throughout the rest of the pregnancy in 95% of cases. This suggests that laser therapy does not target the amniotic fluid and moreover may have a focus on the cause of TTTS, with the following amniocentesis allowing the regulation of fluid.

There are some downfalls to foetoscopic guided laser occlusion (FGLO), and some links have been made to brain defects. However, it seems that brain damage only seems to occur in 6% of babies after FGLO, compared to a much larger 20% following repeated amniocentesis (4). Using laser treatment, it is estimated that both babies survive in 54% of cases, at least one baby survives in 80% of cases, but 20% will experience a loss of both babies (4). In about 15% of cases, the donor will decease very shortly after the FLGO and this is assumed to be due to the newly separated placenta being too small for the donor baby to survive. From the latest and numerous publications, it seems that survival rate following FGLO is healthier than for repeated amniocentesis, however there is not yet abundant data for this variance to be deemed statistically meaningful.

Many reports have observed associations between FGLO and subsequent cerebral injury. A study conducted in 2012 suggested that FGLO caused no modification in incidence of cerebral injury and that the solitary strong association was concerning early gestational age at birth and cerebral injury. It seems, due to current research, that the early gestational age at birth expected in TTTS caused speculation that it may be the treatment used caused cerebral injury rather that premature birth itself when this is in fact not yet proven to be the case (5).

Another potential converse effect of FGLO is that it seems to have a high occurrence of chorioamniotic membrane separation following the procedure, approximately in 20% of cases, as found by Egawa et Al (2012) (6). Chorioamniotic membrane separation has an extremely elevated correlation with preterm premature rupture of membranes, ostensibly with the sturdiest relationship being afore 28 weeks gestation. Egawa's study did not discover any robust evidence, however, that the chorioamniotic membrane separation was caused by FGLO and had any effect on gestational age at parturition, or survival of the twins.

A final possible complication is that of pre-eclampsia-like conditions. Hayashi (2006) reported a case whereby FGLO had a subsequent complication known as 'Mirror syndrome'. This is a syndrome extremely similar to preeclampsia and was only before described in severe hydrops fetalis following rhesus isoimmunisation, and later found also in nonimmunological fetal hydrops. Hayashi's report merely included one patient, however, so there is not yet nearly substantial confirmation suggestive of any link between FGLO and the possibly fatal complication that is mirror syndrome (7).

In addition to complications, a few studies have been conducted considering laser surgery alongside another complementary therapy, one of which being the arabian cervical ring pessary. Carreras (2012) found that inserting a cervical pessary immediately after FLGO seemed to prolong gestational age at birth by approximately four weeks, suggesting that it provided extra support for the twins following laser treatment. It also seemed to severely reduce neonatal morbidity, with a decrease in rates of 52% (8).

As FGLO is a relatively new procedure, there may be other complications associated that have not yet been proven through research. At the present time, the benefits of the procedure definitely seem to outweigh the complications and it is proving to be a popular choice among pregnant mothers expectant of twins that are exacerbating TTTS. In order to gain more data about amniocentesis vs. FLGO, a trial has been put in place by the European Commission to assign patients to either one treatment or the other. It is hoped that over time, more data will be able to prove the advantages that foetoscopic guided laser occlusion has over repeated amniocentesis.

Georgina Smart

University of St Andrews

Year 2

References:

(1) Zach T, Ford S. Twin-to-twin Transfusion Syndrome. 2005; Available at: http://rarediseases.about.com/od/rarediseasest/a/031905.htm. Accessed February 22, 2013.

(2) Khalek N, Johnson MP, Bebbington MW. Fetoscopic laser therapy for twin-to-twin transfusion syndrome. Semin Pediatr Surg 2013 Feb;22(1):18-23.

(3) Vorvick L. Twin-to-twin transfusion Syndrome. 2013; Available at: http://www.nlm.nih.gov/medlineplus/ency/article/001595.htm. Accessed February/22, 2013.

(4) Eurofoetus. Twin-Twin Transfusion Syndrome (TTTS): a complication of identical twins. Available at: http://www.eurofoetus.org/eurotwin2twin/public/ttts.php. Accessed February 22, 2013.

(5) Spruijt M, Steggerda S, Rath M, van Zwet E, Oepkes D, Walther F, et al. Cerebral injury in twin-twin transfusion syndrome treated with fetoscopic laser surgery. Obstet Gynecol 2012 Jul;120(1):15-20.

(6) Egawa M, Hayashi S, Yang L, Sakamoto N, Sago H. Chorioamniotic membrane separation after fetoscopic laser surgery for twin-twin transfusion syndrome. Prenat Diagn 2013 Jan;33(1):89-94.

(7) Hayashi S. · Sago H. · Hayashi R. · Nakagawa S. · Kitagawa M. · Miyasaka K. · Chiba T. · Natori M. Manifestation of Mirror Syndrome after Fetoscopic Laser Photocoagulation in Severe Twin-Twin Transfusion Syndrome. Fetal diagnosis and therapy 2006;21:51-44.

(8) Carreras E, Arevalo S, Bello-Munoz JC, Goya M, Rodo C, Sanchez-Duran MA, et al. Arabin cervical pessary to prevent preterm birth in severe twin-to-twin transfusion syndrome treated by laser surgery. Prenat Diagn 2012 Dec;32(12):1181-1185.