

# Characteristic ultrasound findings of resolving twin-twin transfusion syndrome after Solomon laser treatment



## OBJECTIVE

Fetoscopic laser occlusion (FLOC) of placental anastomoses with the Solomon technique has the highest likelihood of achieving complete resolution of twin-twin transfusions syndrome (TTTS). We aimed to evaluate the sequence of ultrasound findings as TTTS resolves after Solomon laser.

## BACKGROUND

Fetoscopic surgery for Twin-to-twin transfusion syndrome (TTTS) has evolved from nonselective to selective Laser occlusion (FLOC) of placental anastomoses. After the recent Solomon RCT confirmed that additional coagulation of the chorionic plate along the vascular equator produces the most complete separation of the twin circulations, we adopted this technique for all FLOC surgeries.

Simultaneously, assessment of TTTS has evolved from the original Quintero staging to also incorporate middle cerebral artery Doppler (MCA) leading to the recognition of twin anemia polycythemia sequence (TAPS) as a distinct manifestation of TTTS. TAPS can occur pre FLOC or following incomplete surgical ablation of placental anastomoses (postlaser TAPS). With these significant changes in management and surveillance, characterization of the expected pattern of disease resolution is critical to accurately assess the impact of surgery and plan management.

## METHODS

Patients with TTTS resolution after Solomon FLOC had Quintero staging and MCA peak systolic velocity (PSV) measurement pre-FLOC, on day 1, day 2, week 1 and week 2 after laser surgery. The following ultrasound findings were categorized as abnormal: vertical amniotic pocket (MVP, <2 cm or >8 cm), absent or distended bladder filling, absent umbilical artery end-diastolic velocity (UA-AEDV), absent ductus venosus a-wave (DV-RAV), umbilical vein pulsations (UVP) and an MCA PSV of >1.7 or <0.8 multiples of the median (MoM) were recorded for each twin. Significant difference of proportional distribution of these variables was determined using SPSS.

## RESULTS

Of 139 patients meeting inclusion criteria 24 (17.3%) had stage I, 47 (33.8%) stage II, 61 (43.9%) stage III and 7 (5%) stage IV at presentation. 119 (85.6%) had double twin survival at week 2. Of 27 single twin demises 9 (33.3%) were recipients and 18 (66.6%) donors. Within 2 days of FLOC 109 / 139 (82.5%) of recipients normalized their fluid MVP ( $p < 0.00001$ ). In contrast, only 55/139 (45.3%) donors had normal MVP (ns) but had more bladder filling than observed at staging [65, (45.3%) vs. 112/125 (89.6%); ( $p < 0.00001$ )].

## Jena Miller, MD

Johns Hopkins Center for Fetal Therapy  
Assistant Professor of Gynecology and  
Obstetrics, and Surgery

## Majed Faden, MD

Johns Hopkins Center for Fetal Therapy

## Ahmet Baschat, MD

Director, Johns Hopkins Center for Fetal  
Therapy

Professor of Gynecology and Obstetrics, and  
Surgery

Among the critical Doppler abnormalities, venous Doppler improved for the recipient and placental Doppler for the donor. At 48 hours, recipient DV-RAV decreased from 19.4% to 9.8% (27 vs. 13) and donor UA AEDV resolved tenfold [36 (25.8%) vs. 4 (3.2%) (all  $p < 0.05$ ).

Postlaser, recipients were more likely to have high MCA PSV [5, (3.6%) vs. 19 (12.2%);  $p = 0.0087$ ].

Donor twins had low MCA PSV MoM which improved within 1 week [20 (16%) vs. 6 (6.7%);  $p = 0.04$ ]. Critical Doppler abnormalities resolved faster in recipients while MCA Doppler resolved similarly in both twins (Figure 1).

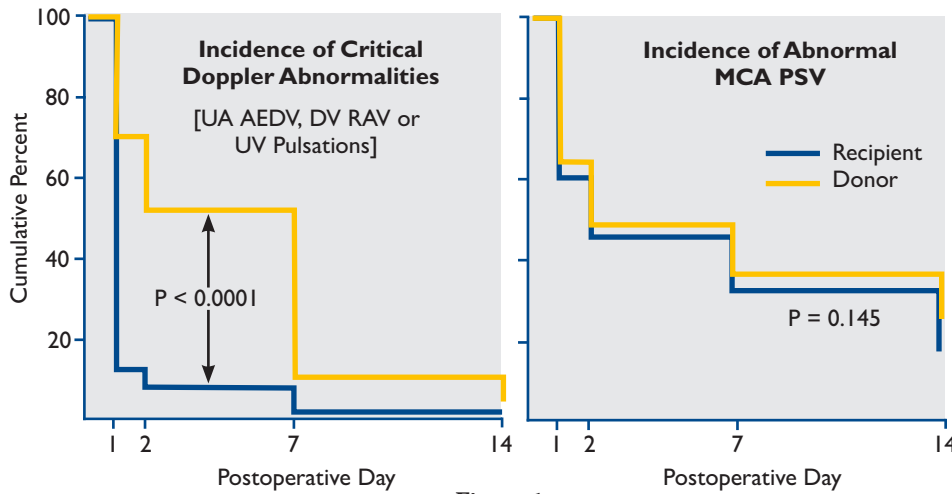


Figure 1

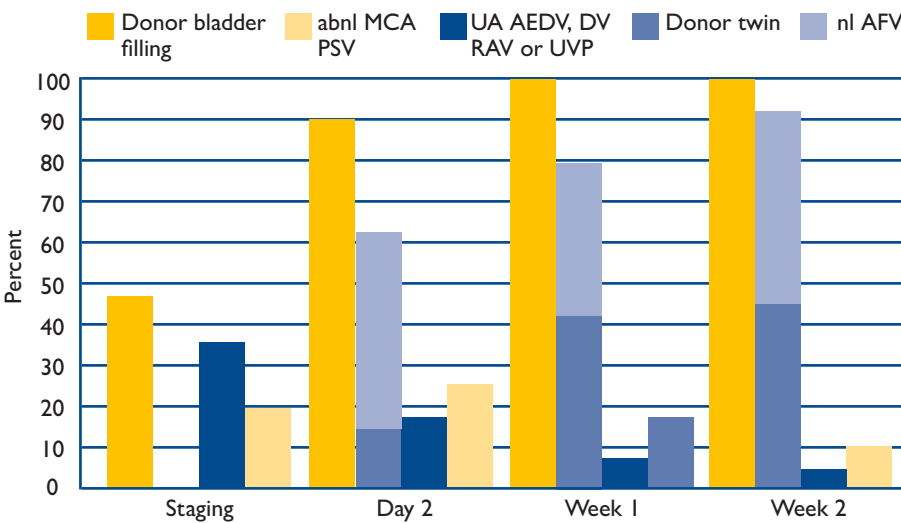


Figure 2

Stage	TAPS - Slaghekke, et. al.	TTTS - Quintero, et. al.	Interpretation
I	Recipient MCA PSV <1.0 MoM Donor MCA >1.5 MoM	Recipient AF MVP > 8 cm, Donor AF MVP < 2 cm & bladder seen	TAPS = mild HgB discordance TTTS = mild volume imbalance
II	Recipient MCA PSV <1.0 MoM Donor MCA >1.5 MoM	AF as above, absent donor bladder filling	TAPS/TTTS = increasing HgB or volume discordance
III	Critically abnormal Doppler: UA AREDV, DV RAV, UVP	Critically abnormal Doppler: UA AREDV, DV RAV, UVP	Superimposed cardiovascular dysfunction
IV	Hydrops	Hydrops	Overt heart failure
V	Single*/ Dual Demise	Single*/ Dual Demise	*Organ damage risk in co-twin

**Legend:** DV RAV = absent/reversed ductus venosus a-wave; HgB = hemoglobin, MCA PSV = middle cerebral artery peak systolic velocity, UA AREDV = absent or reversed umbilical artery end diastolic velocity, UVP = umbilical vein pulsations.

Despite normalized fluid or bladder filling in almost all twins by 2 weeks, 13% of examinations still showed abnormal Doppler findings (Figure 2).

## CONCLUSIONS

After successful laser immediate improvement is characterized by normalization of fetal fluid balance and improvement of critical Doppler abnormalities that are related to recipient preload and donor placental function.

As these trends continue evidence of donor polycythemia resolves by week one. While most significant resolution changes are achieved by week 2 a significant number of patients have abnormal ultrasound findings that do not meet criteria for TTTS but require follow up.