

Twin-to-twin transfusion syndrome: an obstetric catastrophe

Chowdhury TS^a, Mahtab NT^b, Mahmud SR^c, Chowdhury TA^d

Abstract

Twin-to-twin transfusion syndrome (TTTS) is an obstetric condition with high perinatal mortality, which develops when blood flows disproportionately from one fetus to another in a monochorionic twin pregnancy. Approximately 1 in 7 monochorionic pregnancies are affected with TTTS. The donor twin develops oligohydramnios and poor fetal growth, while the recipient twin develops polyhydramnios, heart failure and hydrops. Here we report two cases of severe TTTS in BIRDEM General Hospital 2 within a period of two years. It has been observed in different studies that, the mortality rate of both twins can be as high as 80% in TTTS depending on the stage of diagnosis and progression of the condition if untreated. In both our cases, the outcome was poor due to delayed diagnosis and lack of intrauterine therapies. So, there is an urgent need for timely diagnosis and appropriate management of this rare but complex condition which prompted us to report these two cases.

Key words: Twin pregnancy, stuck twin syndrome, monochorionic twin, twin-to-twin transfusion, laser ablation.

(BIRDEM Med J 2020; 10(3): 207-211)

Introduction

The incidence of multiple pregnancies is rising all over the world because of widespread use of ovulation inducing agents and availability of artificial reproductive technologies. Twin pregnancies are the commonest type of multiple pregnancies with monochorionic twins having an incidence of three to five per 1000 births.¹ Monochorionic diamniotic twins mostly result from late division of the inner cell mass about three to eight days after fertilization. Several complications may arise in pregnancies with monozygotic twins among which ‘twin-to-twin transfusion syndrome’ (TTTS) is the commonest leading to increased perinatal morbidity and mortality. This condition results from an unbalanced

blood supply through placental anastomoses of the blood vessels in monochorionic twins. It induces growth restriction, renal tubular dysgenesis and oliguria in the donor and visceromegaly and polyuria in the recipient.²

TTTS, a clinical entity, is often described as ‘stuck twin syndrome’ on ultrasonography. It is a condition where there is marked disparity between fluid volume and fetal weight in a monozygotic twin pregnancy. This catastrophic condition can affect approximately 35% of monozygotic twins.³ Here, we present two case reports of twin pregnancies who were admitted in BIRDEM General Hospital -2 diagnosed as a case of ‘stuck twin syndrome’ on ultrasonography.

Case report

Case 1

A 29-year-old homemaker was suffering from primary subfertility for 3 years. She took 2 doses of injectable gonadotropins for ovulation induction after which she conceived and ultrasound of lower abdomen confirmed twin pregnancy. Her pregnancy proceeded uneventfully till 20 weeks of gestation. On 13.04.18, she was diagnosed as a case of mild polyhydramnios. One month later, on 26.05.18, a repeat ultrasound revealed 26 weeks twin pregnancy with severe polyhydromnios. On 29.05.18, at her 26 weeks pregnancy, she developed per vaginal watery discharge for 6 hours and was

Author information

- Tanzeem S Chowdhury, Associate Professor, Ibrahim Medical College and BIRDEM General Hospital, Dhaka, Bangladesh.
- Naushaba Tarannum Mahtab, Registrar, Ibrahim Medical College and BIRDEM General Hospital, Dhaka, Bangladesh.
- Syeda Rifat Mahmud, Internee, BIRDEM General Hospital, Dhaka, Bangladesh.
- TA Chowdhury, Professor, Ibrahim Medical College and BIRDEM General Hospital, Dhaka, Bangladesh.

Address of correspondence: Tanzeem S Chowdhury, Associate Professor, Ibrahim Medical College BIRDEM General Hospital, 122, Kazi Nazrul Islam Avenue, Shahbag, Dhaka-1000, Bangladesh. Email: tanzeemsc@gmail.com

Received: April 16, 2020

Accepted: June 30, 2020

admitted in BIRDEM General Hospital -2 for further management. She was a known case of diabetes mellitus for two and a half years and was on insulin therapy.

On obstetric examination, her symphysis-fundal height was 36 cm. Fetal presentation and position could not be detected due to multiple pregnancy and polyhydramnios. Fetal heart sounds were present and regular. On vaginal examination, her membranes were intact and she was not in labor.

On admission, ultrasound of pregnancy profile showed twin pregnancy with suggestion of stuck twin. Fetus 1 was corresponding to 26+ weeks weighing 927 gm and fetus 2 was corresponding to 20 weeks weighing 327 gm. There was also polyhydramnios (Amniotic fluid index : 37 cm) with grade I placental maturity. On 30.5.18, the patient went into spontaneous labor and after 6 hours; two female stillborn fetuses were expelled out vaginally. Baby 1 weighed 800 gm and baby 2 was weighing 300 gm only at birth (Figure 1). There was a single placenta and amniotic fluid was excessive (Figure 2).



Figure 1 Stillborn babies just after birth



Figure 2 Single placenta of monozygotic twin

Case 2

A 32-year-old housewife was admitted in BIRDEM General Hospital-2 on 03.03.2020 with the complaints of gradually increasing abdominal distension at her 25 weeks of twin pregnancy. She was married for 11 years and had a history of three caesarian sections. She was in regular antenatal check-up and her antenatal period was uneventful. After admission, on obstetric examination, her symphysis-fundal height was 36 cm. Fetal presentation and position could not be determined due to multiple pregnancy and polyhydramnios. Fetal heart sounds were audible and regular. Abdominal girth was 135 cm. On 7.3.2020, ultrasound revealed twin pregnancy of 24+ weeks with suggestive of stuck twin syndrome. There was polyhydroamnios (AFI: 44 cm) in one sac and amniotic fluid was almost absent in second sac. There was a single posterior placenta with restricted fetoplacental circulation of both foetuses. Over the next two days, she started to have uterine contraction and grew more restless. The patient and her attendants wanted termination of pregnancy due to mechanical discomfort. So, she underwent hysterotomy with bilateral tubal ligation (BLTL) on 8/3/2020. Both the babies were female, weighing 635 gm and 535 gm respectively. There was a single placenta. Both the babies expired on 2nd postnatal day due to prematurity.

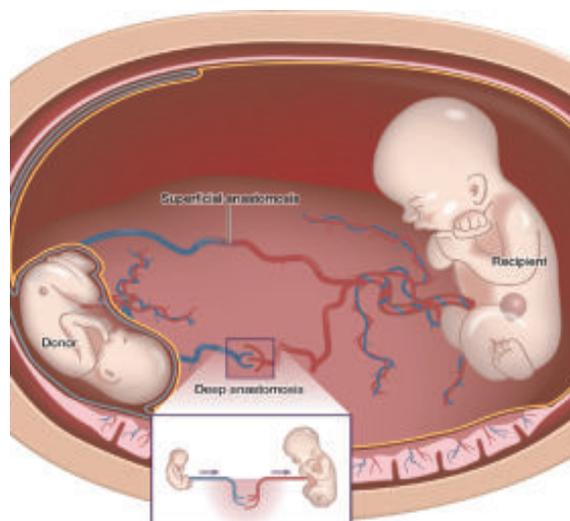


Figure 3 Diagram showing superficial and deep anastomoses in monozygotic twin (source: www.fetalhope.org)

Table I Quintero staging system for twin-twin transfusion syndrome⁸

Stage	Oligohydromnios/ polyhydromnios sequence	Absent bladder in donor	Abnormal dopplers*	Hydrops	Death
I	+	–	–	–	–
II	+	+	–	–	–
III	+	+	+	–	–
IV	+	+	+	+	–
V	+	+	+	+	+

*Absent or reversed flow in the umbilical artery, reversed flow in the ductus venosus, or pulsatile flow in the umbilical vein

Discussion

TTTS is defined as a sequence of oligo/polyhydramnios, with the deepest vertical pool of amniotic fluid in the donor measuring 2 cm or less and measuring 8 cm or more in the recipient.⁴ It occurs approximately in 15% of monochorionic diamniotic twins, affecting about 1 in 1600 pregnancies.⁴

The pathophysiological basis of developing TTTS in monochorionic diamniotic twin pregnancy is the presence of a common placental vascular anastomosis in 96% cases.⁵ Two types of anastomoses can occur (Figure 3). The first is a superficial anastomosis, which lie on the placental surface which may be either arterio-arterial anastomoses (AAAs) or veno-venous anastomoses (VVAs). These superficial anastomoses connect the twins' circulation directly and can result in net flow of blood in either direction. So, if there is an imbalance in blood flow between two twins: it leads to development of TTTS. In second type of anastomoses are deep arteriovenous anastomoses (AVAs) where a shared cotyledon receives its blood supply from one twin and drains its venous blood to the other. Color doppler ultrasound imaging has been used to diagnose AAAs in various studies and it has been seen that AAAs are actually protective against TTTS and the absence of AAAs is associated with an increased risk of developing TTTS during pregnancy (61% versus 15%, odds ratio 8.6).⁶

The first step in diagnosis of TTTS is determination of chorionicity in first trimester of pregnancy. Single placenta, same fetal sex and a "T-sign" in which the dividing membrane inserts perpendicular to the placenta

on ultrasound are helpful in diagnosing a monochorionic twin gestation. If a twin pregnancy is diagnosed as a case of monochorionic twin, ultrasound assessment every two weeks is recommended from the second trimester onwards, usually between 15 and 25 weeks, to exclude TTTS.⁷ If TTTS develops, the donor (i.e. the twin with net volume loss) shows signs of intrauterine growth restriction (IUGR) with oliguria (small or non-visible bladder), oligohydramnios and abnormal umbilical artery dopplers. On the other hand, the recipient (i.e. the twin with net volume gain) shows signs of overload with polyuric polyhydramnios; cardiomegaly and abnormal venous dopplers (for example, reverse flow in the ductus venosus or pulsatile flow within the umbilical vein). In late cases, hydrops and right sided heart failure with tricuspid regurgitation may occur.⁷

Till date, the most unique staging system for TTTS was developed by Quintero et al in 1999 who suggested that prognosis of TTTS was dependent on stage at initial presentation of TTTS (Table I).⁸ But this staging system became outdated as Taylor in 2002 showed that unpredicted disease progression can occur in about 45% of cases.⁹ Later on, Tan and Taylor in 2004 developed a new staging system which incorporated AAAs in its classification and according to that, overall survival rates based on stage at treatment are: Ia 100%, Ib 63%, IIa 100%, IIb 59%, IIIa 83%, IIIb 44%, IVa 25% and IVb 50%.¹⁰

TTTS is a condition of significant perinatal mortality, which can be as high as 80% if no intervention is done. The donor is in more risk than the recipient. Doppler

ultrasound may play a significant role in prediction of outcome. Absent or reversed end diastolic flow in the umbilical artery, reverse flow in the ductus venosus or pulsatile flow in the umbilical vein have the highest risk of fetal death. Taylor and Denbow in 2000 showed that the probability of at least one twin surviving is only 33% if there is absent or reversed end diastolic flow in the donor umbilical artery and 37% when abnormal venous recordings are seen in the recipient.¹¹ Haverkamp et al in 2001 showed that even in survivors, there is a 20% chance of severe neurological impairment with cerebral palsy and a further 30% chance of minor neurological impairment and/or language delay.¹²

The treatment options of TTTS may include non-intervention and termination of pregnancy before the age of viability after proper counselling to the parents as the prognosis is often very poor. The treatment options are amnioreduction, septostomy, laser ablation and occlusive feticide.

Amnioreduction is a simple treatment for reducing polyhydramnios but it does not treat the underlying cause of TTTS. It has been beneficial to prevent preterm labor and increase blood flow to the uterus but there are risks of premature rupture of membranes leading to chorioamnionitis and abruptio placentae.¹³ Septostomy, either by needle or laser, allows excess fluid to pass from the recipient's sac into the donor's sac. A randomized trial by Saade et al in 2002 showed that there was no difference in overall survival (70%), but a decrease in the need for repeat procedures with septostomy compared to amnioreduction (40% versus 70%).¹⁴ Laser ablation of anastomotic vessels, performed between 18 and 26 weeks of gestation, is the only method that addresses the underlying pathology. The method includes introduction of a fetoscope in the amniotic cavity of the recipient and ablation of suspected anastomoses. In 2003, Quintero et al conducted selective laser ablation of 95 cases and showed that 83% of cases had at least one survivor but with a neurological morbidity of 4%.¹⁵ In a randomized trial in 2004 (Eurofetus study), serial amnioreduction versus laser therapy and single amnioreduction was compared in 142 women presenting with TTTS before 26 weeks of gestation. But this study was halted early after interim analysis showed laser therapy to be associated with improved perinatal outcome.¹⁶ Lastly; selective feticide can be offered where one fetus is deemed to be

preterminal, or where there is stage III/IV TTTS as an alternative to laser ablation. Cord occlusion using bipolar diathermy can be performed up until approximately 26 weeks of gestation. In one study by Taylor and Shalev of 14 cases, survival rates for the remaining twin were 80–90% with no neurological abnormalities evident prior to discharge, despite an incidence of up to 20% of ruptured membranes.¹⁷

Conclusion

TTS is considered as one of the most dangerous complications of monochorionic twin pregnancies with a catastrophic outcome if not treated early. The most important aspect of management of TTS is timely diagnosis of chorionicity and follow up of monochorionic twins closely for early diagnosis of TTTS. Till now laser ablation of placental anastomosis is the procedure of choice but there are multiple risks associated with it. So, further research for newer and safer procedures is required in order to allow clinicians and patients to make informed choice about this serious condition.

Conflicts of interest: Nothing to declare.

References

1. Chiswick M. Assessing outcomes in twin-twin transfusion syndrome Arch Dis Child Fetal Neonatal Ed 2000;83:F165–F167
2. Pettern RM, Mack LA, Harvey D. Disparity of amniotic fluid volume and fetal size- problem of the stuck twin-US studies. *Radiology* 1989;172:153-57.
3. Mahieu-Caputo D, Dommergues M, Delezoide A. Twin-to-Twin Transfusion Syndrome Role of the Fetal Renin-Angiotensin System. *Et American Journal of Pathology* 2000;156:2.
4. Jain V, Fisk NM. The twin-twin transfusion syndrome. *Clin Obstet Gynecol* 2004;47:181-202.
5. Denbow ML, Cox P, Taylor M, Hammal DM, Fisk NM. Placental angioarchitecture in monochorionic twin pregnancies: relationship to fetal growth, fetofetal transfusion syndrome, and pregnancy outcome. *Am J Obstet Gynecol* 2000; 182:417-26.
6. Taylor MJ, Denbow ML, Tanawattanacharoen S, Gannon C, Cox PM, Fisk NM. Doppler detection of arterio-arterial anastomoses in monochorionic twins: feasibility and clinical application. *Hum Reprod* 2000; 15:1632-36.
7. Denbow ML, Smith RP. Review- Twin-To- Transfusion syndrome. *The Obstetrician & Gynaecologist* 2006;8:1-6.
8. Quintero RA, Morales WJ, Allen MH, Bornick PW, Johnson PK, Kruger M. Staging of twin-twin transfusion syndrome. *J Perinatol* 1999; 19:550-55.

9. Taylor MJ, Govender L, Jolly M, Wee L, Fisk NM. Validation of the Quintero staging system for twin-twin transfusion syndrome. *Obstet Gynecol* 2002; 100:1257-65.
10. Tan TY, Taylor MJ, Wee LY, Vanderheyden T, Wimalasundera R, Fisk NM. Doppler for artery-artery anastomosis and stage-independent survival in twin-twin transfusion. *Obstet Gynecol* 2004; 103:1174-180.
11. Taylor MJ, Denbow ML, Duncan KR, Overton TG, Fisk NM. Antenatal factors at diagnosis that predict outcome in twin-twin transfusion syndrome. *Am J Obstet Gynecol* 2000; 183:1023-28.
12. Haverkamp F, Lex C, Hanisch C, Fahnenstich H, Zerres K. Neurodevelopmental risks in twin-to-twin transfusion syndrome: preliminary findings. *Eur J Paediatr Neurol* 2001; 5:21-27.
13. Bower SJ, Flack NJ, Sepulveda W, Talbert DG, Fisk NM. Uterine artery blood flow response to correction of amniotic fluid volume. *Am J Obstet Gynecol* 1995; 173:502-07.
14. Saade G, Moise K, Dorman K, Fisk N, Dickenson JE, Wilson RD, et al. A randomized trial of septostomy versus amnioreduction in the treatment of twin oligohydramnios polyhydramnios sequence (TOPS). *Am J Obstet Gynecol* 2002;187:S54.
15. Quintero RA, Dickinson JE, Morales WJ, Bornick PW, Bermudez C, Cincotta R, et al. Stage-based treatment of twin-twin transfusion syndrome. *Am J Obstet Gynecol* 2003; 188:1333-40.
16. Senat MV, Deprest J, Boulvain M, Paupe A, Winer N, Ville Y. Endoscopic laser surgery versus serial amnio reduction for severe twin-to-twin transfusion Syndrome. *N Engl J Med* 2004; 351:136-44.
17. Taylor MJ, Shalev E, Tanawattanacharoen S, Jolly M, Kumar S, Weiner E, et al. Ultrasound-guided umbilical cord occlusion using bipolar diathermy for Stage III/IV twin-twin transfusion syndrome. *Prenat Diagn* 2002; 22:70-76.