

Original Investigation

Selective fetal reduction in monochorionic twins: Preliminary experience

Selective fetal reduction in monochorionic twins

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INTRODUCTION

It is a well-accepted fact that multiple pregnancies have higher maternal complications (abortion, preterm labor, preterm pre-labor rupture of membranes, hypertension in pregnancy, anemia, ante and post partum hemorrhage, mal-presentation, cesarean section) and fetal complications (malformations, intrauterine fetal growth restriction, and complications of prematurity) [1]. Therefore, with triplet and higher order gestation, fetal reduction to achieve a total number of two live fetuses, is offered to couples with an aim to minimize these complications. Fetal reduction from twin to singleton in dichorionic twins is debatable, but selective termination in twin gestation discordant for malformations or genetic abnormality is acceptable [2].

In monochorionic twins, fetal reduction may be performed for indications other than twins discordant for anomalies. Mono-chorionic twins have a unique set of complications like twin to twin transfusion syndrome (TTTS), selective fetal growth restriction (sFGR), and twin reversed arterial perfusion sequence (TRAP). These complications are due to presence of inter-fetal vascular anastomosis, which may put one twin at risk of death and adversely affect health of the other twin. In the event of one twin dying, transfer of significant amount of blood from the normal to the dying fetus, through these placental vascular anastomosis, may occur leading to hypotension, hypo-perfusion of the brain leading to cerebral injury (20-30%) and fetal demise (upto 10%) [3,4,5]. In a situation where death in one twin is imminent but pregnancy is very preterm, resorting to fetal reduction can optimize outcome in the surviving twin. Unlike dichorionic pregnancy, fetal reduction using potassium chloride (KCL) instillation in fetal thorax/heart is not an option in mono-chorionic twins due to the presence of placental vascular anastomosis. KCL might get transferred to the other fetus and thus inadvertently cause demise of both the twins. Vaso-occlusive techniques like bipolar cord coagulation (BPCC), radiofrequency ablation (RFA), interstitial laser ablation (ILA) of cord and fetoscopy-guided cord coagulation with laser are the methods proposed for selective fetal reduction in complicated monochorionic twins [6].

We describe our experience of selective fetal reduction in complicated monochorionic twin pregnancies at Maternal Fetal Medicine unit in a tertiary care center in India.

Methods

This is a prospective data that included 31 patients with complicated mono-chorionic twin pregnancies who underwent selective fetal reduction from June 2013 to June 2017, in our unit. The pregnancies were very preterm and at risk of demise of one fetus, which could have adversely affected the other fetus. Informed written consent was obtained from each patient prior to the procedure. The analysis and publication of this data was approved by the institutional ethics committee.

Methods used for cord coagulation were interstitial laser, bipolar cord coagulation and radio-frequency ablation. In the first half of study period ILA was used for fetal reduction, whereas in the second half BPCC and RFA was used. The choice of method also depended on the period of gestation and the indication for reduction.

All the procedures were performed under ultrasound guidance, using aseptic precautions. Patients received intravenous sedation, injection cephazolin 1gm intravenous after sensitivity test and one dose of 100mg micronized progesterone intramuscularly prior to the procedure as per the unit protocol. Trocar/needle insertion site was infiltrated with 10 ml of 1% solution of Xylocaine.

Bipolar occlusion of cord (BPCC):

The procedure was carried out in pregnancies between 18-26 weeks period of gestation and only if the maximum diameter of the fetal cord was 15mm or less. Using ultrasound (USG) guidance, a 3mm port was inserted into a pocket of amniotic fluid of the affected fetus, preferably at a place away from the placenta. The cord was approached at the abdominal insertion, grasped with the prongs of bipolar insert and then pulled to ensure that it was held in its entire width and complete occlusion was confirmed by absence of flow on color Doppler. Coagulation of the cord was then performed using 20-40W energy in bursts of 10-15 sec. Echogenic bubbles could be seen and the area of the cord appeared echogenic following the procedure. Two areas of cord were coagulated. Procedure was successful if cardiac asystole and absence of flow in umbilical cord was observed.

Interstitial laser ablation of cord (IL)

The procedure was carried out in pregnancies between 18-26 weeks period of gestation (POG). A 400 micron diode laser was delivered through 18G spinal needle under USG guidance, targeting intraabdominal fetal umbilical vascular confluence. Laser was fired in short (6-10sec) pulses at 20-40W bursts till blood flow ceased.

Radiofrequency ablation of cord (RFA):

The procedure was carried out in pregnancies between 16-27 weeks POG. Under continuous ultrasound guidance, a 16 gauge RFA needle was inserted into the fetal abdomen, alongside the umbilical cord insertion. The prongs of the RFA needle were then deployed in the fetal abdomen and 40 W energy was delivered to build up the temperature to 100° C for 2-3 minute till cardiac asystole and cessation of blood flow in umbilical cord, in the absence of which the procedure was repeated again.

In cases with cervical length less than 25mm cerclage was performed at same sitting

An ultrasound was performed after 24hrs to re-document absent cardiac activity in reduced twin and to check cardiac activity in other twin. Middle cerebral artery (MCA) peak systolic velocity (PSV) was measured in surviving twin to detect fetal anemia, following which the patients were discharged and kept on 2 weekly follow up. Fetal MRI was performed for some patients after 28 weeks (or 3-4 weeks after procedure) to look for intracranial hemorrhage and cerebral injury.

Outcome measures included overall co-twin survival after selective fetocide, survival rates with each method, miscarriage (defined as all fetal loss before 24 weeks), early fetal death (<24 hours after procedure) and late fetal death (>24hrs after the procedure) of co-twin.

Results

Of 31 patients undergoing procedure, technical success was obtained in 30/31 (96.77%), one patient with failed procedure was excluded from the analysis. This patient was at 26 weeks with TTTS stage III and gross polyhydramnios, BPCC was unsuccessful. The indications for selective fetal reduction and methods used in the other 30 patients are shown in Table No 1.

The mean POG at fetal reduction was 23 weeks and 2 days (range, 16-26⁺ weeks). Early intrauterine fetal death (IUFD) occurred in 5/30 (16.67%) patients and late IUFD occurred in 1/30 (3.33%), there were 2

spontaneous abortions (6.66%). Both early and late fetal deaths happened in fetuses less than 24 weeks POG. Thus there were 8 (26.67%) miscarriages (defined as pregnancy loss at or less than 24 weeks POG)

The mean POG at delivery was 35 weeks (26-39 weeks): 13/30 (43.33%) women delivered at or beyond 36 weeks of POG, 2/30 (20%) delivered between ≥ 32 -36 weeks, 3/30 (30%) delivered at ≥ 28 -32 weeks gestation. Out of the 4 patients who delivered between 24 and 28 weeks, 3 had stillbirths.

Overall live birth rate was 19/30 (63.3%). There were 3 stillbirths (10 %). These three patients had delivered between 26-28 weeks POG.

Vaginal birth was achieved in 18/30 (60%) patients. Four babies (21%) required care in the neonatal intensive care unit. Perinatal outcome with the three procedures is shown in Table 2.

Follow up after procedure

We detected raised middle cerebral artery peak systolic velocity after the procedure in 3 cases, one of which aborted subsequently. The other two pregnancies had a normal fetal MRI, the values decreased on follow up and they delivered a healthy baby at term.

MRI of fetal brain was done in 14 cases and was found to be normal.

Patients were followed up bi-weekly for growth scans, and monitored for fetal well being. There was no evidence of infection (clinical) in the patients following the procedures.

Discussion

We evaluated perinatal outcome after selective feticide in complicated MC twins. The overall survival rate of co-twin was 62.5%. The survival rate was lower with ILA (50%), whereas survival after RFA and BPCC was similar (71.4 and 75%). A systematic review of selective fetal reduction in 345 complicated mono-chorionic twin pregnancies had an overall fetal survival rate of 79% (65-90%) [2]. The systematic review [2] observed that fetal survival rates were maximum with RFA (86%) followed by BPCC (82%), laser cord coagulation (72%) and least with cord ligation (70%). The overall survival of co-twin in our cohort was lower than that reported in this systematic review, though comparable to the study published by van Bos Den et al (67.2%) [6]. In their series of 131 cases, the survival was lowest with ILA at 46.7%. In our series the mean gestational age at procedure was higher, this is because of late referrals. Also, TTTS was the indication for reduction in 30% of cases, with most associated with polyhydramnios and short cervix and higher risk of preterm delivery. Doing the procedure at an advanced gestation with bigger diameter of cord may require longer time and multiple cycles of coagulation leading to inter twin transfusion during the procedure, increasing risk of demise of normal twin.

Studies have shown that fetal loss is higher when procedure is performed before 18 weeks gestation [6]. As also shown in the systematic review [2], survival rates were better if the procedures were performed after 18 weeks (89% vs 69%). Yinon et al [7] compared RFA and BPCC with a similar overall survival rates (88.9 vs 76.5%). Selective IUGR as primary indication for feticide, compared to TTTS, showed a trend towards higher gestational age at delivery and longer procedure to delivery interval. Though overall survival was similar, the interval between procedure and delivery was shorter in group > 24 weeks gestation at the time of procedure compared to that at < 24 weeks. Bebbington et al [8] compared RFA with BPCC and reported similar success rates. They also reported lower survival if indication for reduction was TTTS compared to other indications. Sun et al [9] reported fetal death rate of 23% after RFA. Variables associated with fetal death were indications for RFA , gestation age > 20 weeks , > 2 cycles of RFA coagulation and maximal power setting. In multivariate analysis > 2 cycles of RFA coagulation was the only factor independently associated with fetal death (OR 3.46).

Preterm birth and preterm premature rupture of membranes(PPROM) has been reported as an important cause of perinatal morbidity and mortality in other series also. [6,8]. Van Den Bos reported an overall PPROM rate of 19.8% with 43.5% babies born between 28 and 37 weeks period of gestation [6]. Bebbington et al reported an overall PPROM rate of 21.9% after RFA and BCC with preterm delivery (< 34 weeks) in 59% of RFA and 44 % of the BCC procedures [8]. In our series, 30% women delivered before 32 weeks.

The procedure is done to avoid neurological sequelae in co-twin when one twin is at risk of death and too premature to deliver. But we need to understand that survivors after selective feticide in MC twins are at increased risk of neurodevelopmental delay. Van Klink et al [10] reported neurodevelopmental impairment in 6.8% of surviving twins at a minimum follow up of 2 years. This is very important and should be part of pre-procedure counseling. We could do antenatal MRI after procedure in a small number of cases.

Fetal reduction procedures in monochorionic twins are considered to be considerably complex and challenging. They require expertise with hand – eye –needle coordination and a great deal of patience, as needed for most of the fetal medicine procedures done under ultrasound guidance. Anterior placenta poses technical difficulty as introducing the trocar/ needle might result in hemorrhage into the amniotic cavity which could limit visibility and may also compromise the fetuses. Position of the fetus is also crucial to the success of the procedure. With the fetal spine up towards the maternal abdomen, gaining access to the umbilical cord insertion during IL ablation / RFA might be difficult. During bipolar cord coagulation, the cord may slip from between the prongs resulting in exsanguination from an incompletely coagulated cord. Presence of poly-hydramnios and short cervical length may contribute to increased incidences of preterm premature rupture of membranes (PPROM) and preterm delivery/abortion.

This is probably one of the few studies from developing countries which deals with selective fetal reduction in complicated monochorionic twin pregnancies. The only other studies from our country include a retrospective series of 15 cases of complicated monochorionic twin pregnancies managed by RFA [11] and a single case of complicated TRAP sequence managed by interstitial laser [12].

Even though we have performed the procedure in a small number of patients, this study highlights the feasibility of selective fetal reduction in complicated monochorionic twins in low resource settings. The drawbacks are that we could not retrieve from our data number of women having preterm premature rupture of membranes and also the follow up of babies after discharge is not available. We did not record the cervical length and time/ number of cycles required for successful reduction factors known to be risk factors for perinatal outcome. The number of cases of BPCC are small.

Conclusion

Data from initial cases of selective fetal reduction in complicated mono-chorionic twins suggests that these procedures are feasible but are associated with high adverse perinatal outcome.

Conflict of Interest: - The authors report no conflict of interest

Financial Disclosure - None

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Table 1: Indications and methods used for fetal reduction

Total No of patients	31
Successful Procedures	30/31 (96.8%)
Indications for Selective Fetal Reduction	TRAP 4/30 (13.33%) TTTS 9/30 (30%) sFGR 3/30 (10%) Discordancy for Malformations/ NIH 14/30 (46.67%)
Methods used for selective fetal reduction in the 30 patients included in analysis	IL 12/30 (40%) BPCC 4/30 (13.33%) RFA 14/30 (46.67%)

TRAP-twin reversed arterial perfusion; TTTS –twin to twin transfusion syndrome; sFGR- selective fetal growth restriction; NIH – Non immune hydrops, IL-interstitial laser; BPCC-bipolar cord coagulation; RFA-radio frequency ablation

Table No 2: Perinatal outcome according to technique for selective fetal reduction

	IL N=12	BPCC N=4	RFA N=14	Total N = 30
Mean POG at procedure (in weeks)	23 ⁺⁴	22 ⁺⁵	24 ⁺³	23 ⁺²
Range (in weeks)	(18-26 ⁺⁴)	(20-26)	(16-26 ⁺⁴)	(16-26 ⁺⁴)
Early IUFD	3	1	1	5(16.67%)
Late IUFD	0	0	1	1(3.33%)
Spontaneous abortion	1	0	1	2 (6.67%)
Still Birth	2	0	1	3(10%)
Mean POG at delivery (in weeks)	34	36	36	35
Range (in weeks)	26-39	28-37	28-38	26-39
Live birth rate	6/12 = 50%	3/4=75%	10/14 = 71.4%	19/30 (63.3%)