



Diachorionic Triamniotic Triplets—Saline Cardiac Tamponade for Fetal Reduction: A Novel Approach

Ashutosh Gupta¹ · Arvind Vaid² · Rupam Arora³ · Sagarika Aggarwal² · Kshitiz Murdia²

Received: 12 April 2016 / Accepted: 1 August 2016 / Published online: 22 August 2016
© Society of Fetal Medicine 2016

Abstract Artificial reproductive techniques are helping the infertile couples to conceive but with an inherent risk of multifetal pregnancy. Multifetal pregnancies more so; multiple monochorionic pregnancies endanger both the fetus and the mother with an increased risk for morbidity and pregnancy loss. The reduction of multifetal pregnancy using Potassium chloride (KCl) is a usual procedure to reduce multiple pregnancies; but gets complicated in case of monochorionic multiple pregnancies like diachorionic trimniotic triplets in which KCl cannot be used. In this scenario, the usual procedure for fetal reduction might endanger both the fetuses with common placenta (monochorionic twins). Normal saline was used to create cardiac tamponade to achieve cardiac asystole, which is a novel way of reducing the multiple fetuses with common placentas without an adverse effect on the other co-twin and effect of maternal spillage of the drug commonly used.

Keywords Artificial · Multifetal · Monochorionic · Dichorionic diamniotic · Triplets · KCl · Saline

Introduction

Assisted reproductive technique has enabled many infertile couples to conceive, but with a price to pay, which is an increased risk of multifetal pregnancy.

The incidence of multifetal pregnancy ranges from 8 % (ovulation induction) to as high as 53 % (gonadotrophin usage). Overall, the rate of multifetal pregnancy increases to 30 % in in vitro fertilization [1, 2].

Multifetal pregnancy puts both the mother and the fetus at an increased risk, including anemia, diabetes, hyperemesis, hypertension, pre-eclampsia to increased risk of miscarriage, intrauterine growth restriction, intrauterine growth discrepancies, premature deliveries, malpresentations, and fetal complications [3]. These factors warrant consideration for fetal reduction in multifetal pregnancy to reduce the risk of associated complications.

This was first done by Aberg [4]. It has ranged from exsanguinations by aspiration [4] to hysterotomy (Beck et al. [5]) to transabdominal intracardiac instillation of formaldehyde and potassium chloride (KCl).

Techniques

1. Transvaginal: this route has been associated with complication rate as high as 10 % and moreover multifetal reduction prior to 10 weeks is associated with high incidence of miscarriage [6].
2. Transcervical: this method too has a high risk of chorioamnionitis and bleeding [1, 7]. Estimated total fetal loss following transcervical reduction is approximately 13 % [8, 9]. Underlying etiology could vary from contractions to chorioamnionitis, bleeding to preterm rupture of membranes.

✉ Ashutosh Gupta
dr_ashutosh75@rediffmail.com

¹ Department of Fetal Medicine and Clinical Geneticist, Max Super Speciality Hospital, West Block, 1 Press Enclave Road, Saket, New Delhi 110017, India

² Gynecologist and Laproscopic Surgeon, Indira Infertility Clinic and Test Tube Baby Centre, New Delhi, India

³ Department of Obstetrics and Gynecology, Max Balaji Hospital, Patparganj, New Delhi, India

3. Transabdominal: this approach has been identified to be the safest, with instillation of 2–3 milli-equivalent (mEq) of KCl under ultrasound guidance in fetal heart and is the standard procedure used for feticide worldwide. However, the adverse effect on the co-twin and maternal spillage of this technique have always been a concern.

Reduction from triplets to twins, in concordance with the literature leads to an appreciable decrease in fetal mortality from 21 % to 8.7 % with similar reduction in fetal morbidity, premature births and has helped in improving fetal growth [10, 11]. Survival rate after fetal reduction reaches to 94 % which is similar to that of natural conceived twin pregnancy [12, 13].

Reductions are usually 100 % successful in most of the cases; with transabdominal approach being the method of choice with intracardiac instillation of 2–3 mEq of KCl. To take the advantage of vanishing twin phenomenon, the optimal time of fetal reduction is in between 10 and 12 weeks [14, 15].

The benefits to both the mother and fetus cannot be overstated. This is ironical that a woman who is facing difficulty and failing to conceive is asking for fetal reduction. This puts her to a great psychological stress and the risk of adverse psychological outcome in event of post fetal reduction miscarriage of remaining fetuses is immense. She has an emotionally labile and vulnerable state, and in case of any adversity might lead to onset of depression. In Indian circumstances, socioeconomic and financial issues should be given due consideration due to associated high morbidity, physical, and great psychological stress to the pregnant women.

In case of dichorionic triamniotic triplets, reduction of one of the diachorionic fetuses, which is technically feasible, will leave monochorionic twins with a high background risk of unequal placental share and growth discrepancy and twin-to-twin transfusion syndrome (TTTS).

As the monochorionic twins share a common vascular channel, so the routine and standard use of KCl for multifetal reduction might put the other monochorionic co-twin at risk of demise and thus contraindicated. Mechanical disruption of cardiac conduction leads to hypotension in one of the fetuses with other surviving fetuses becoming a donor and might lead to hypotension in the surviving fetus too, and might endanger both. Toxic substances can circulate between monochorionic twins through the placental vascular connection. Even, once one monochorionic twin has demised after TTTS, risks of major morbidity in survivors are increased [16].

Ideal situation would be to convert dichorionic triamniotic triplets to diachorionic diamniotic twin pregnancy by getting one of the monochorionic twins reduced.

Report of Cases

Chorionicity in multiple pregnancies is a key factor to the prognosis [17], which can be sonographically determined by “twin-peak” or lambda sign [18] seen only in dichorionic twinning as a result of the placenta fusion process. This sign facilitates in identifying chorionicity with 99–100 % accuracy in twins between 10 and 14 weeks of gestation [19] and therefore, can be used in differentiating zygosity in the dichorionic triplets.

The purpose of this fetal intervention is to preserve diachorionic twins by attempting to sacrifice one of the monochorionic twins in dichorionic triamniotic triplets. Detailed counseling regarding the risks of multifetal gestation (triplets), especially, monochorionic fetuses (growth discrepancy and TTTS) and those of fetal reduction were very well explained. We attempted cardiac tamponade by instilling normal saline in the pericardial space and achieving cardiac asystole by creating cardiac tamponade. Early dating ultrasound for fetal viability and chorionicity clearly identified and established dichorionic triamniotic triplets (Fig. 1). After identifying and marking the said fetus, 25 G (gauge) spinal needle was introduced under ultrasound guidance into the pericardial space in one the monochorionic fetuses and cardiac tamponade was created by instilling, approximately 10 mL of normal saline (Fig. 2).

In the first case, pericardial tamponade was created; cardiac asystole was achieved but cardiac activity resumed spontaneously after 45 min of waiting period and thus, the procedure was considered a failure. The patient was asked to come again after one week for the same procedure. The same procedure was attempted again and complete cardiac asystole was achieved.

In the second case of monochorionic triamniotic triplets, cardiac tamponade was attempted at 11 weeks and was successful in achieving cardiac asystole in one attempt. In follow-up ultrasounds, the twin pregnancies which were left behind, were separated from a thick intertwine membrane with lambda sign suggestive of dichorionicity with the monochorionic fetus getting reduced (Fig. 3).

Discussion

It is reported that about 30 % of dizygotic triplets are complicated by loss of viability and TTTS, which can lead to neurological damage or other major morbidity in about half of the survivors after one monochorionic fetus had demised [20].

Triplets have an increased incidence of prematurity and associated retinopathy in comparison to twins and therefore,

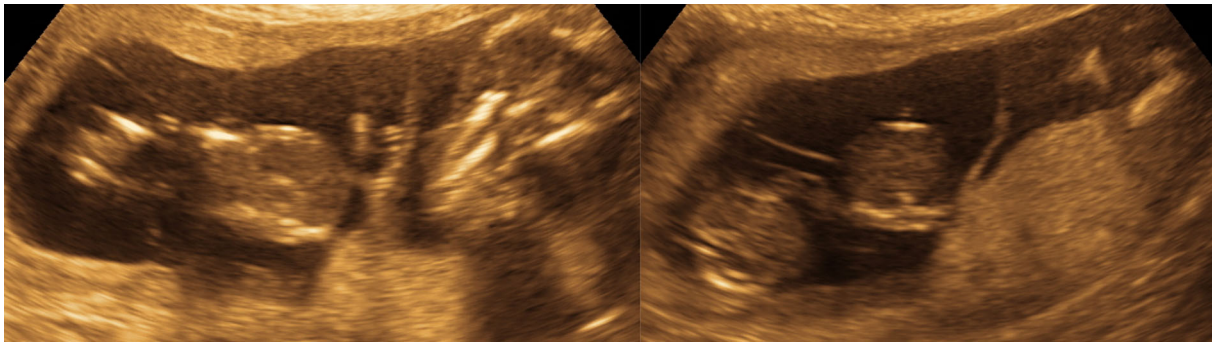


Fig. 1 Diachorionic triamniotic (DCTA) triplets—thin membrane with one common placenta and thick membrane with lambda sign suggestive of DCTA triplets



Fig. 2 25 G spinal needle in the thoracic cavity during the process of attempting and creating cardiac tamponade; last image showing no cardiac signal on *color* Doppler suggestive of cardiac asystole

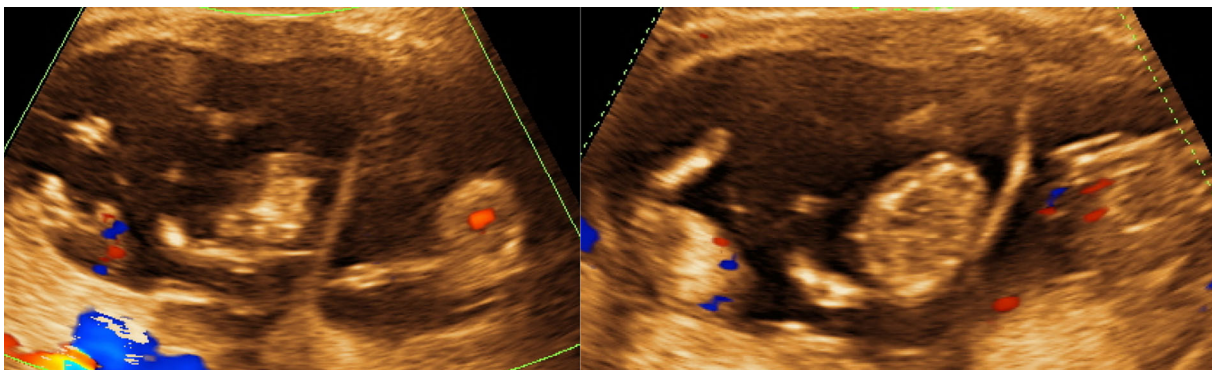


Fig. 3 Three fetuses (DCTA triplets) separated by thin and thick membrane; 40 min after the procedure showing *color* signal in two fetuses suggestive of cardiac activity

the need of more expensive perinatal care [20, 21]. The reduction of multifetal pregnancy has improved the outcomes for both early losses and prematurity. Reduction from triplets to twins has been proven to produce outcomes as good as those of unreduced twin gestations [22, 23].

Compared with dichorionic twin pregnancies, higher rates of fetal loss, perinatal mortality, preterm delivery, and birth weight below the 5th percentile are reported in monochorionic twin pregnancies.

Shang-Gwo et al. [24] has demonstrated that, a small amount of amniotic fluid is sufficient to create a tamponade without affecting the co-twin. The usage of KCl can be

replaced by autologous amniotic fluid injection to create a tamponade for successful fetal reduction.

Horng et al. [25] have also demonstrated that intrathoracic autologous amniotic fluid injection may be used successfully for reduction of multifetal pregnancy in the first trimester.

As the fetal gestational age advances, its cardiac conduction system becomes resistant to lidocaine and KCl, thus leading to failures of reductions at advanced gestational age. In these circumstances, cardiac tamponade achieved either by autologous amniotic fluid or normal saline may be effective or at least supplementary, in fetocide performed at late gestation [26].

Conclusion

In circumstances where conventional KCI cannot be used or in cases of failure of KCI for reduction of multifetal pregnancy, normal saline can be used safely for creating cardiac tamponade and asystole, and mitigating the potential adverse effect on the other co-twin and in case of maternal spillage.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Informed Consent Informed consent was obtained from all individual participants included in the study.

References

- Hutch A. Multifetal pregnancy and selective fetal reduction. In: Kurjak A, editor. *Textbook of perinatal medicine*. London: Parthenon Publishing; 1998. p. 1532–5.
- Evans MI, Hume RF Jr, Polak S, et al. The geriatric gravida: multifetal pregnancy reduction, donor eggs, and aggressive infertility treatments. *Am J Obstet Gynecol*. 1997;177(4):875–8.
- Geva E, Fait G, Yovel I, Lerner—Geva L, Yaron Y, Daniel Y, et al. Second-trimester multifetal pregnancy reduction facilitates prenatal diagnosis before the procedure. *Fertil Steril*. 2000;73:505–8.
- Aberg A, Mitelman F, Cantz M, Gehler J. Cardiac puncture of fetus with Hurler's disease avoiding abortion of unaffected co-twin. *Lancet*. 1978;2(8097):990–1.
- Beck L, Terende R, Dolff M. Zwillingschwän Gershaft mit freier Trisomie 21 eines Kindes: Sectio parva mit Entfernung des Dranden und spätere Geburt des gesunden Kindes. *Geburtshilfe Frauenheild*. 1980;40:397–400.
- Depp R, Macones G, Rosenn M, Turso E, Wapner R, Weinblatt V. Multifetal pregnancy reduction: evaluation of fetal growth in the remaining twins. *Am J Obstet Gynecol*. 1996;174:1233–40.
- Fasouliotis S, Schenker J. Multifetal pregnancy reduction: a review of the world results for the period 1993–1996. *Eur J Obstet Gynecol Reprod Biol*. 1997;75:183–90.
- Wapner R, Davis GH, Johnson A, Weinblatt V, Fischer RL, Jackson LG, et al. Selective reduction of multifetal pregnancies. *Lancet*. 1990;335:90–3.
- Timor-Tritsch IE, Peisner DB, Monteagudo A, Lerner JP, Sharma S. Multifetal pregnancy reduction by transvaginal puncture: evaluation of the technique used in 134 cases. *Am J Obstet Gynecol*. 1993;168:799–804.
- Lipit ZS, Reichman B, Uval J, Shalev J, Achiron R, Barkai G, et al. A prospective comparison of the outcome of triplet pregnancies managed expectantly or by multifetal reduction to twins. *Am J Obstet Gynecol*. 1994;170:874–9.
- Check JH, Nowrozzi K, Vetter B, Rankin A, Dietterich C, Shubert B. The effect of multiple gestation and reduction on fetal outcome. *J Perinat Med*. 1993;21:299–302.
- Mulcahy MT, Roberman B, Reid SE. Chorion biopsy, cytogenetic diagnosis, and selective termination in a twin pregnancy at risk of haemophilia. *Lancet*. 1984;13:866–7.
- Iberico G, Navarro J, Blasco L, Simon C. Embryo reduction of multifetal pregnancies following assisted reproduction treatment: a modification of the transvaginal ultrasound-guided technique. *Hum Reprod*. 2000;15:2228–33.
- Evans M, Goldberg J, Dommergues M, Wapner R, Lynch L, Dock B, et al. Efficacy of second-trimester selective termination for fetal abnormalities: international collaborative experience among the world's largest centers. *Am J Obstet Gynecol*. 1994;171:90–4.
- Blumenfeld Z, Dirnfeld M, Abramovici H. Spontaneous fetal reduction in multiple gestations assessed by transvaginal ultrasound. *Br J Obstet Gynaecol*. 1992;99:333–7.
- Van Heteren CF, Nijhuis JG, Semmekrot BA, Mulders LG, van den Berg PP. Risk for surviving twin after fetal death of co-twin in twin–twin transfusion syndrome. *Obstet Gynecol*. 1998;92:215–9.
- Dube J, Dodds L, Armson BA. Does chorionicity or zygosity predict adverse perinatal outcomes in twins? *Am J Obstet Gynecol*. 2002;186:579–83.
- Monteagudo A, Timor-Tritsch IE, Sharma S. Early and simple determination of chorionic and amniotic type in multifetal gestations in the first fourteen weeks by high-frequency transvaginal ultrasonography. *Am J Obstet Gynecol*. 1994;170:824–9.
- Sepulveda W, Sebire NJ, Hughes K, Odibo A, Nicolaides KH. The lambda sign at 10–14 weeks of gestation as a predictor of chorionicity in twin pregnancies. *Ultrasound Obstet Gynecol*. 1996;7:421–3.
- Chasen ST, Al-Kouatly HB, Ballabh P, Skupski DW, Chervenak FA. Outcomes of dichorionic triplet pregnancies. *Am J Obstet Gynecol*. 2002;186:765–7.
- Kaufman GE, Malone FD, Harvey-Wilkes KB, Chelmow D, Penzias AS, D'Alton ME. Neonatal morbidity and mortality associated with triplet pregnancy. *Obstet Gynecol*. 1998;91:342–8.
- Evans MI, Berkowitz RL, Wapner RJ, Carpenter RJ, Goldberg JD, Ayoub MA, Horenstein J, Dommergues M, Brambati B, Nicolaides KH, Holzgreve W, Timor-Tritsch IE. Improvement in outcomes of multifetal pregnancy reduction with increased experience. *Am J Obstet Gynecol*. 2001;184:97–103.
- Sebire NJ, Snijders RJ, Hughes K, Sepulveda W, Nicolaides KH. The hidden mortality of monochorionic twin pregnancy. *Br J Obstet Gynaecol*. 1997;104:1203–7.
- Shang-Gwo H, Chia-Woei W, Hong-Yuan H, et al. Short communication: successful outcome of intrathoracic injection of autologous amniotic fluid in fetal reduction: report of two cases. *J Assist Reprod Genet*. 2004;21(9):343–5.
- Hornig SG, Wang CW, Huang HY, et al. Successful outcome of intrathoracic injection of autologous amniotic fluid in fetal reduction: report of two cases. *J Assist Reprod Genet*. 2004;29:343–5.
- Chen Chia-Hsiang, Chen Tze-Ho, Kuo Shou-Jen, et al. Late termination of pregnancy: experience from an east asian population and report of a novel technique for fetocide. *J Med Ultrasound*. 2009;17(4):193–9.