

## Original Article

## Radiofrequency ablation for selective reduction in complex monochorionic multiple pregnancies: A case series



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## ABSTRACT

**Objective:** To determine the safety and efficacy of radiofrequency ablation (RFA) for selective fetal reduction in complex monochorionic multiple pregnancies.

**Materials and methods:** From July 2011 to January 2015, data on all cases treated with RFA were collected prospectively in our hospital. Indications, procedure details, cause of fetal demise and pregnancy outcomes were analyzed. Sonography and magnetic resonance imaging were performed to detect fetal brain damage. Information regarding development after birth was collected according to the Gesell Development Schedule<sup>®</sup>.

**Results:** There were 22 cases of twins (6 presenting with twin-twin transfusion syndrome, 10 with malformations, 4 with selective intrauterine growth restriction, and 2 with twin reversed arterial perfusion sequence); and 11 cases of triplets (9 dichorionic triamniotic, 2 monochorionic triamniotic). All surgeries were completed with one puncture. No maternal complications presented during RFA procedure, and the PPROM rate before 32 w was 9% (3/33). There were 3 cases of intrauterine fetal demise and 4 twin cases where pregnancy was terminated. The fetal survival rate was 77% (17/22) in twins, 91% (20/22) in triplets. Total fetal survival rate was 84% (37/44). The neurodevelopmental follow-up investigations showed no abnormalities in any of the survivors.

**Conclusion:** RFA for selective fetal reduction in complex monochorionic multiple pregnancies is effective, minimally invasive, and safe.

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## Introduction

In twin pregnancies, 20% are monochorionic (MC) [1]. Several complications can arise in MC pregnancies such as twin-to-twin transfusion syndrome (TTTS), twin reversed arterial perfusion sequence (TRAP), twin anemia-polycythemia sequence (TAPS) and selective intrauterine growth restriction (sIUGR), due to the vascular anastomosis on the placental surface. As a result, the perinatal morbidity and mortality in MC twins are significantly higher than in dichorionic (DC) twins [1]. In MC twins presenting

with complications, selective fetal reduction has been used as a method to reduce perinatal mortality [2,3].

Injection of potassium chloride (KCl) into the fetal heart is used as a method of feticide for termination of pregnancy. However, this method is not suitable for fetal reduction in MC twins due to the transplacental passage of KCl into the co-twin and potential hypotensive damage to the brain of the surviving fetus. Therefore, the preferred method of fetal reduction in MC twins is the immediate and complete occlusion of cord blood flow. Several methods have been clinically explored to occlude cord blood flow such as: laser cord coagulation [4], cord ligation [5], bipolar cord coagulation (BCC) [6], radiofrequency ablation (RFA) [7], and recently two new methods, microwave ablation [8], and high intensity focused ultrasound [9]. A systematic review analyzing different fetal reduction techniques reported that the overall survival rate was higher using RFA (86%) and BCC (82%) compared to laser cord coagulation

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(70%) and cord ligation (72%) [3]. While BCC potentially induces a faster and more complete occlusion of umbilical vessels by the compression of bipolar forceps, compared with RFA, the procedure is more technically complicated and requires the use of an instrument with a larger diameter, resulting in higher rates of preterm premature rupture of membranes (PPROM) in BCC (28.2%) compared to RFA (17.7%) [10].

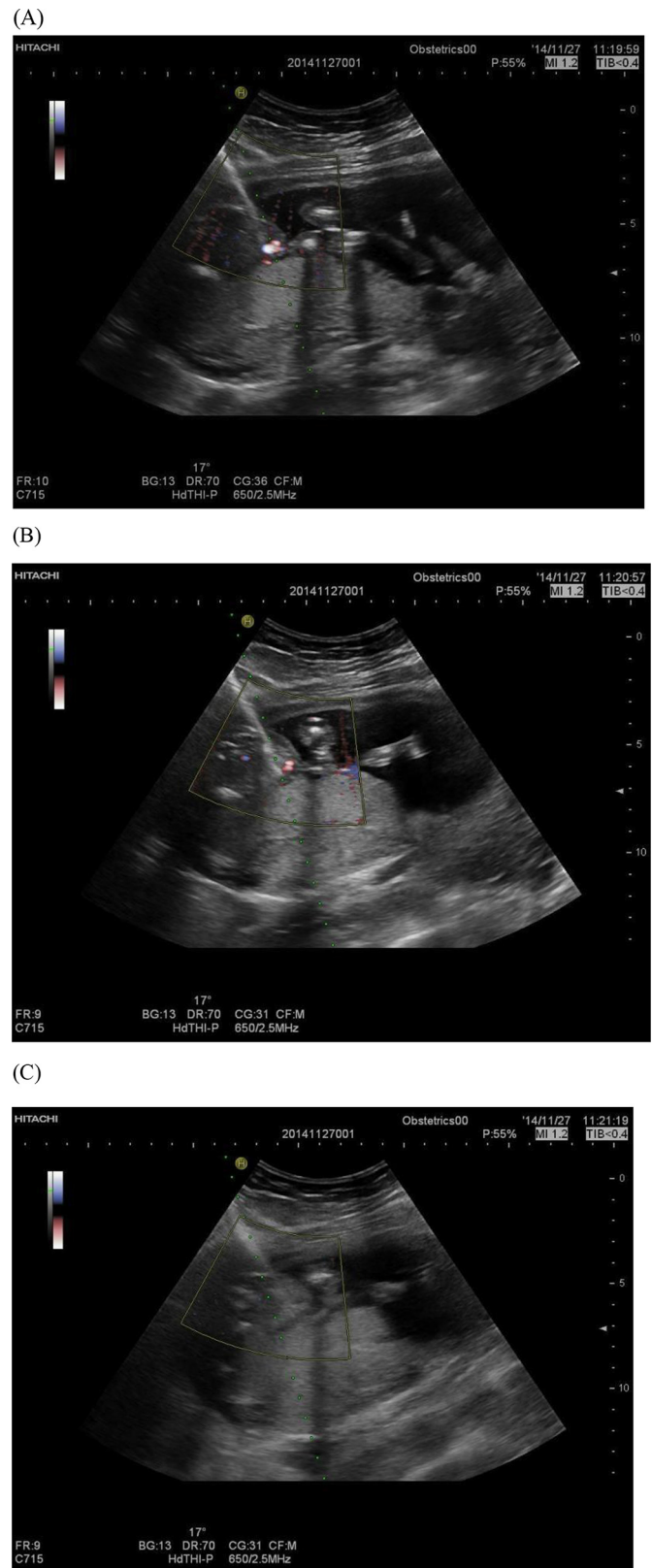
RFA works with alternating current at very high frequencies (200–1200 kHz) between the electrodes, resulting in high tissue temperatures that cause tissue coagulation and necrosis inside the targeted area. In fetal reduction, RFA can be performed using a 17 gauge (1.4 mm) needle to ablate tissue within a diameter of 2 cm, and is reported to be a safe and effective procedure with lower procedure-related risks such as PPRM and preterm delivery [11–13].

Herein we report a prospective analysis of 33 consecutive cases of RFA performed in our center on complicated MC pregnancies. We analyze indications, procedure details, and pregnancy outcomes to determine the safety and efficacy of RFA as fetal reduction technique.

## Methods

Between July 2011 and January 2015 at our hospital, 33 consecutive MC multiple pregnancy cases were treated with RFA. A detailed ultrasound examination was performed to determine the status of chorionicity, placental position, malformations or abnormal growth, amniotic fluid volume, cervical length, as well as the umbilical artery and middle cerebral artery blood flow. Indications for RFA included complicated twin pregnancies such as TTTS (stage III and IV) [14], malformations, sIUGR (type II and III) [15], and TRAP (exceeding 50% of the abdominal circumference of the donor). RFA was also performed in one of the MC twins in DCTA and MCTA triplet pregnancies to reduce potential risk of preterm labor and TTTS. Patients and their families underwent detailed counseling regarding the risks of the RFA procedure, including miscarriage, preterm labor, co-twin demise and neurological or thermal injury to the surviving fetus, fetal brain MRI and the Gesell Development Schedule® [16,17] would be used for follow-up and a signed consent before RFA was obtained. The research was proved by the Hospital Ethics Committee.

To minimize the risk of procedure-related loss, oral indomethacin (25 mg) [18] and dydrogesterone (10 mg) [19] were administered prior to the RFA procedure. All RFAs were performed by the same operator and sonographer under local anesthesia. The Starburst Radiofrequency Ablation System (Angiodynamics, Latham NY) with the 1500X RF generator and 17G Starburst SDE RFA needle were used for all procedures. Under ultrasound guidance, a 17G RFA needle (12 cm in length) was used to puncture to get near to the abdominal segment of the fetal umbilical cord, avoiding placenta and amniotic sac of other fetus(es). Once the needle tip was positioned, the three electrodes were ejected to surround the abdominal segment of the cord vessels. Thermal energy with a diameter range of 2 cm was applied using the RF generator (target temperature = 110 °C, power = 30–50 W). In each 3 min long ablation cycle, all three electrode lines reached an average temperature of 100–110 °C for the duration of the cycle. If the temperature in all three electrode tines did not increase synchronously, they were retracted and the position was adjusted. During the ablation, color Doppler was used to confirm cessation of blood flow in the cord vessel (Fig. 1). In the case where multiple ablations were required, there was a cool-down interval of 1 min between ablation cycles. Ultrasonography was performed to confirm cardiac asystole in the targeted fetus.



**Fig. 1.** Color Doppler flow change of the umbilical vessels showing at the beginning (A), during (B), and after (C) RFA procedure.

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