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Treatment of twin reversed arterial perfusion sequence with radiofrequency ablation and expectant management: A single center study in China

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ABSTRACT

Objective: To evaluate the treatment of pregnancies in different stages complicated by TRAP sequence at a single medical center in China.

Study design: A retrospective study evaluating 25 pregnancies with TRAP sequence was performed at Shengjing Hospital in Shenyang, Liaoning between 2012 and 2016. Patients were diagnosed by ultrasound and categorized into three groups (Ia, IIa and IIb) and were expectantly managed or performed RFA (radiofrequency ablation) according to their stage of TRAP sequence. Perinatal outcomes and survival rates were analyzed.

Results: There were four cases in stage Ia, 19 cases in stage IIa, and two cases in stage IIb. Cases in stage Ia were expectantly managed. Among cases in stage IIa, we performed RFA (radiofrequency ablation) in 10 cases and expectant management in 6 cases, with the remainder of the patients refusing intrauterine treatment. We applied RFA to treat one case in stage IIb and the other was managed expectantly. For expectant management group and the RFA group, the survival rates were both 64%(7/11). All pump twins in stage Ia survived and the average gestational age at delivery was 37.9 weeks. In stage IIa, the overall survival rate of the pump twin was 70%(7/10) and the average gestational age at delivery was 35.8 weeks in cases treated by RFA. The survival rate was 50%(3/6) and the average gestational age at delivery was 32.8 weeks in expectantly managed cases in stage IIa. No pump twin survived in stage IIa without treatment (3 cases refused any therapy who were excluded) or in stage IIb.

Conclusion: Expectant management is effective for treatment of TRAP sequence in stage Ia. In stage IIa, RFA improves the prognosis of pump twins.

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Introduction

Twin reversed arterial perfusion (TRAP) sequence, also known as acardius, is a rare condition thought to occur in 1 per 35000 pregnancies and in 1 per 100 monozygotic twin pregnancies [1]. However, van Gemert [2] and his colleagues believe that with the development of diagnostic techniques and the use of assisted reproductive technology in recent years, the incidence is actually higher, occurring in 2.6% of monozygotic twins, and in 1 per 9500 to 11,000 pregnancies. The acardiac twin receives all of its blood supply from the pump twin through direct arterio-arterial and veno-venous anastomoses. If TRAP is not treated properly, the mortality rate of the pump twin is up to 55% [3]. In the past decade, increasing numbers of intrauterine interventions have been developed to minimize complications to the pump twin and to improve perinatal outcomes by eliminating flow to the acardiac twin, including alcohol ablation, bipolar cord coagulation, intra-fetal laser, radiofrequency ablation, microwave ablation, and high-intensity focused ultrasound [4–8].

Several studies have shown that RFA is a preferred procedure for TRAP sequence [6,9–11]. Wang [12] thought RFA is a minimally invasive, safe, and reliable technique for selective fetal reduction in complex MC multiple pregnancies. Cabassa [6] and Sugibayashi [11] thought that the indications of RFA included a monochorionic placentation, the presence of an acardiac twin with blood flow (both in the umbilical cord and in the fetal) at Doppler examination, demonstration of continued growth of the acardiac fetus over at least 1 week and a structurally normal "pump" twin. But Chaveeva [13] preferred to use it in early gestation, severe oligohydramnios and small acardiac twin. Whereas, The

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Table 1
Clinical characteristics of the four cases in stage I a.

Case No.	GA at diagnosis, wks	GA at delivery, wks	Stage	Intervention	Outcomes	Complications
1	25	34 + 5	Ia	Expectant management	Live birth	PROM
2	13	38 + 5	Ia	Expectant management	Live birth	PDA
3	25	39 + 6	Ia	Expectant management	Live birth	–
4	14	38 + 4	Ia	Expectant management	Live birth	–

GA, gestational age; PROM, premature rupture of membranes; PDA, patent ductus arteriosus; TRAP, twin reversed arterial perfusion.

experience of RFA treatment for TRAP sequence remains limited, which thus renders the need for larger studies to find the optimal timing and indications for TRAP.

The aim of our study is to describe the perinatal outcomes of 25 patients with pregnancies complicated by different stages of TRAP treated in a single center with various therapies, predominantly RFA and expectant management.

Material and methods

We performed a retrospective study of 25 pregnancies affected by TRAP sequence at Shengjing Hospital, China Medical University, Shenyang, Liaoning between August 2012 and December 2016. Patients were diagnosed by ultrasound and categorized into three groups (Ia, IIa and IIb) according to the degree to which the pump twin was affected and the abdominal circumference ratio between the acardiac and pump twin [3].

Expectant management was preferred for patients in stage Ia without obvious blood flow to the acardiac twin. We reevaluated these patients every two weeks to reassess the stage of the TRAP.

For stage IIa and IIb cases, we performed RFA (radiofrequency ablation) or expectant management according to the condition of the TRAP. Expectant management was performed for patients meeting the following criteria: 1.the abdominal circumference ratio between the acardiac and pump twin was less than 70%; 2. The gestational age at diagnosis was in the third trimester. For cases not corresponding to above criteria, RFA was performed.

We used a X1500 radiofrequency generator and a 15 cm-long, 17-gauge, internal electrode with a 1 cm-long exposed tine (produced by Med Sphere International company, USA). Patients received local anesthesia for the procedure. An electrode was introduced transabdominally and inserted under continuous ultrasonographic guidance into the fetal abdomen adjacent to the area of the umbilical cord insertion of the acardiac twin. Coagulation was initiated at 20W of energy and increased in intervals of 10W per minute according to the temperature. The energy was continuously applied until cessation of umbilical cord

blood flow in the acardiac twin occurred. This was confirmed by ultrasonography with color Doppler at the end of the procedure in all cases.

The primary outcome was perinatal outcome: live birth, IUFD (intrauterine fetal demise) or labor induction. Secondary outcomes included gestational age at delivery and complications.

The clinical data were analyzed by the SPSS 22.0 software. The categorical data were expressed as number/proportion and analyzed by X2-test or Fisher's exact test. $p < 0.05$ was considered statistically significant.

Ethics approval was obtained from the Shengjing Hospital Research Ethics Board for this study.

Results

In our study, there were four cases in stage Ia, 19 cases in stage IIa and two cases in stage IIb. For stage IIa cases, we performed RFA (radiofrequency ablation) in 10 cases, we performed expectant management in 6 cases, and the remaining 3 cases refused any therapy, who were induced for termination of the pregnancy and were excluded from analysis. We also applied RFA to treat one case in stage IIb; the other was expectantly managed.

The total survival rate when the pump twin received treatment was 64% (14/22). For expectant management group and the RFA group, the survival rates were both 64%(7/11). The average gestational age at delivery was 35.8 weeks (range: 28.8 weeks–39.8 weeks).

Table 1 shows the clinical characteristics of the four cases in stage Ia. All stage Ia cases resulted in a live birth and the average gestational age at delivery was 37.9 weeks (range: 34.4 weeks–39.9 weeks). The pump twin in case 1 was delivered vaginally at 34.4 weeks of gestation due to PROM. In the other three cases, the pump twin was born live at term. There was one severe fetal complication, a PDA, in case 2.

Clinical characteristics of the cases in stage IIa are summarized in Table 2. Among the six cases in stage IIa treated with expectant management, the survival rate of the pump twins was 50% (3/6)

Table 2
Clinical characteristics of the 16 cases with intervention in stage II a.

Case No.	GA at diagnosis, wks	GA at surgery, wks	GA at delivery wks	Stage	Intervention	Outcomes	Complications
5	26 + 1	27	38 + 3	IIa	RFA	Live birth	–
6	19		34 + 5	IIa	Expectant management	Live birth	PROM
7	20 + 3		23 + 5	IIa	Expectant management	IUFD	–
8	21 + 3	21 + 5	31 + 5	IIa	RFA	Live birth	PROM
9	20	20 + 2	20 + 5	IIa	RFA	IUFD	–
10	27		34 + 5	IIa	Expectant management	Live birth	Progressed Into IIb
11	11	21 + 6	34 + 6	IIa	RFA	Live birth	PROM
12	12 + 5	23 + 6	39 + 4	IIa	RFA	Live birth	–
13	26		28 + 6	IIa	Expectant management	Live birth	Preterm birth
14	19	21 + 2	34	IIa	RFA	Live birth	Triplet
15	14	14 + 2	22	IIa	RFA	Labor induction	PROM
16	17 + 3	18 + 4	25	IIa	RFA	Labor induction	PROM
17	11	21 + 2	37	IIa	RFA	Live birth	–
18	12		13	IIa	Expectant management	IUFD	–
19	12 + 5		13 + 5	IIa	Expectant management	Labor induction	–
20	16 + 5	16 + 6	35	IIa	RFA	Live birth	PROM

GA, gestational age; RFA, radiofrequency ablation; IUFD, intrauterine fetal demise; PROM, premature rupture of membranes; TRAP, twin reversed arterial perfusion.