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Expectative Management of a Late-Diagnosis Twin Reversed Arterial Perfusion Sequences (TRAPS) - A Rare Case Report

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ABSTRACT

Twin Reversed Arterial Perfusion Sequence (TRAPS) is a rare and severe complication unique to monochorionic twin pregnancies, characterized by retrograde perfusion of a nonviable acardiac twin by a structurally normal pump twin. Management of TRAPS diagnosed in late gestation remains controversial due to limited interventional options and an unpredictable clinical course. While early fetal intervention is generally recommended, evidence supporting expectant management in late-diagnosed cases, particularly in resource-limited settings, remains scarce. We report a 31-year-old gravida 2, para 1 woman with a monochorionic diamniotic twin pregnancy complicated by TRAPS, who was referred to a maternal–fetal medicine clinic at 29–30 weeks of gestation. Given stable pump twin hemodynamics, late gestational age, and unavailability of fetal therapy, expectant management with intensive ultrasound surveillance was pursued. At 32 weeks, signs of evolving cardiac compromise prompted delivery by cesarean section. The pump twin survived with prematurity-related complications and was discharged in stable condition. This case highlights that expectant management may be a reasonable option in carefully selected late-diagnosed TRAPS cases when fetal therapy is unavailable, provided that close surveillance and timely delivery are ensured.

1. INTRODUCTION

Twin Reversed Arterial Perfusion Sequence (TRAPS), or acardiac twin, is a rare and serious complication unique to monochorionic multiple gestations. It occurs in 1: 9500–11000 pregnancies and in nearly 2.6% of monochorionic twin pregnancies, with approximately 75% in diamniotic and 25% in monoamniotic twin pairs, making it one of the rarest forms of twin complications (Dejene et al., 2025; Micheletti et al., 2021). The condition results from abnormal arterioarterial and venovenous anastomoses within the shared placenta, allowing retrograde perfusion of one twin (the acardiac twin) by the structurally normal co-twin (the pump twin) (Dhanju and Breddam, 2022). The acardiac twin lacks a functional heart and typically demonstrates profound malformations such as acrania, acardia, absent thoracic structures, and limb reduction defects (Vitucci et al., 2020; Dubey et al., 2017). This twin is not viable, but its survival depends entirely on the pump twin's circulation (Khalil et al., 2025). The pump twin faces a significant hemodynamic burden from this continuous reversed perfusion, which can lead to high-output cardiac failure, polyhydramnios, fetal hydrops, preterm delivery, and intrauterine demise with reported mortality rates of 50-75% if left untreated (Thirupathi and Meganathan, 2025).

Management of TRAPS diagnosed in late gestation remains controversial due to the narrowing of therapeutic windows and unpredictable disease progression. Late-diagnosed TRAPS cases pose a particularly high risk of sudden pump twin deterioration, as opportunities for fetal intervention may have passed. Despite growing evidence supporting early fetal therapy, most available data focus on second-trimester interventions, leaving limited guidance for clinicians managing cases diagnosed in the third trimester (Pagani et al., 2013). Fetal therapies include minimally invasive procedures such as radiofrequency ablation (RFA), bipolar cord coagulation,

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laser photocoagulation of placental anastomoses, and intrafetal alcohol or thrombogenic injections (Alshanafey et al., 2023; Ye et al., 2022). Among these, RFA and bipolar cord coagulation are widely used and demonstrate a survival rate of 80-90% for the pump twin when performed before 24 weeks of gestation (Ye et al., 2022). Nevertheless, these procedures carry risks, including preterm premature rupture of membranes, preterm labor, and fetal demise (Rao and Rao, 2020).

Here we present a late-diagnosed TRAPS case managed expectantly, illustrating clinical decision-making challenges and highlighting the role of intensive ultrasound surveillance. We report a case of TRAPS diagnosed at 29-30 weeks of gestation in a monochorionic diamniotic twin pregnancy, for which management in late gestation remains controversial due to limited interventional options and an unpredictable clinical course. Despite the limited resources of settings where RFA is unavailable, expectant management with intensive surveillance may be a reasonable option, but this approach remains controversial due to its carrying a 50–75% risk of adverse outcomes, including preterm birth, heart failure, or death of the pump twin caused by the high-output demands of nourishing the acardiac twin (Micheletti et al., 2021; Alshanafey et al., 2023; Pepe et al., 2015). This case presents a unique challenge in managing TRAPS in late gestation to achieve optimal fetal outcomes where the evidence regarding expectant management in late-diagnosed TRAPS, which meant the ideal time for intervention had already passed, is particularly limited in resource-limited settings. This case was managed expectatively with intensive surveillance, leading to the successful delivery of the pump twin at 32-33 weeks, thereby contributing to the evidence supporting expectative management in select cases of late-diagnosis TRAPS and highlighting the importance of vigilant ultrasound surveillance in monochorionic pregnancies for suitable timing of delivery.

2. METHOD

Case Report

G2P1A0, a 31-year-old woman with an estimated gestational age of 29–30 weeks (from her last menstrual period on December 30th, 2024), came to Margono Soekarjo General Hospital with a referral from a maternal-fetal specialist with a diagnosis of monochorionic diamniotic twin gestation complicated by TRAPS for expectant management. This pregnancy was conceived with ovulation induction using clomiphene citrate. The patient and her husband had no family history of multiple pregnancies or exposure to teratogenic substances before and during pregnancy. Antenatal care had been performed regularly at a primary health care and obstetrician. At 18 weeks of gestation, ultrasonography at the obstetrician revealed that the patient had a monochorionic diamniotic twin pregnancy with the absence of cranial and heart structures in one fetus. Then she came to a maternal-fetal specialist for confirmation at 22 weeks of pregnancy and was told the same. Due to patient preferences for another hospital, the patient went for another ultrasound at 29-30 weeks of gestation to a maternal-fetal specialist and was diagnosed with monochorionic diamniotic twin gestation complicated by TRAPS. The patient was advised to undergo hospitalization for fetal lung maturation admission.

On admission, maternal vital signs were stable (blood pressure 110/80 mmHg, pulse 84 bpm). Body mass index was 35 kg/m^2. Fundal height was 38 cm. There were no uterine contractions or vaginal bleeding. Ultrasonography demonstrated:

- **Twin pump:** cephalic presentation; biometry consistent with 29+4 weeks; estimated fetal weight 1479 g; normal umbilical artery and middle cerebral artery Doppler; no hydrops.
- **Acardiac twin**: transverse lie with acrania, absent cardiac structures, and meromelia.
- **Amniotic fluid**: polyhydramnios in both sacs (SDP 8.6 cm and 9.1 cm).
- **Placenta**: fundal, monochorionic diamniotic. Color Doppler confirmed reversed arterial perfusion from the pump twin to the acardiac twin.
- The Doppler study, illustrated in Figure 1 (5 and 6), demonstrated the reversed arterial sequence connecting the first twin to the second twin**.**

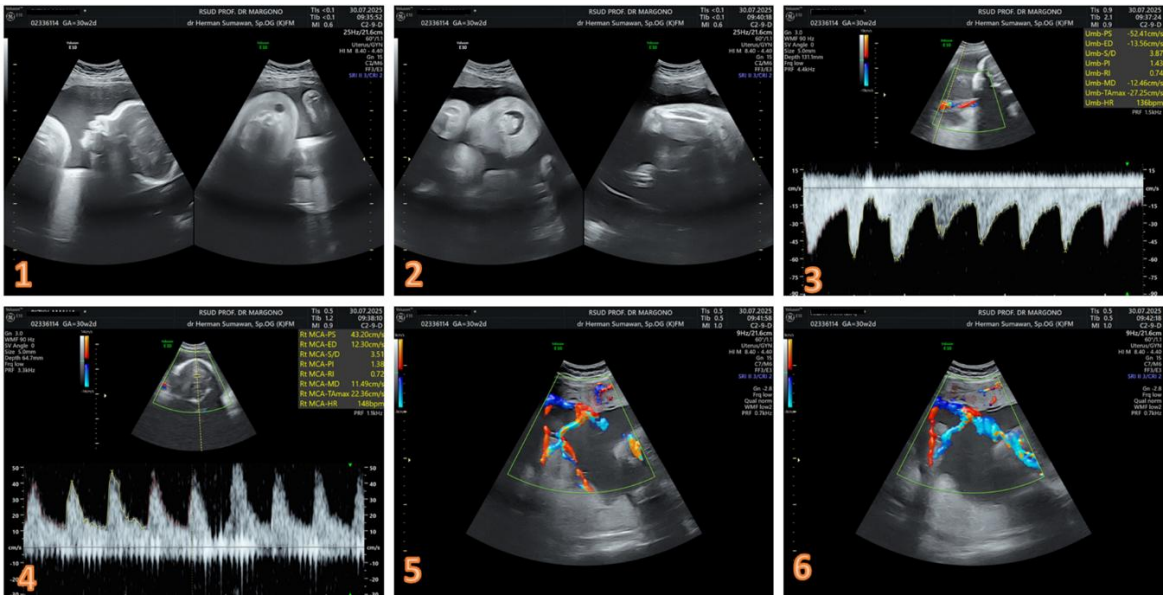

Figure 1. Ultrasonography at 30 weeks of pregnancy
(1) figure of 1st twin, (2) figure of 2nd twin, (3) umbilical doppler from 1st twin,
(4) middle cerebral artery doppler from 1st twin, (5) and (6) revered arterial sequence from 1st to 2nd twin

Conservative management was performed, including intramuscular injection of 6 mg dexamethasone every 12 hours for four doses, nifedipine 10 mg orally if uterine contraction occurred, and closed maternal and fetal monitoring. During hospitalization, the patient remained hemodynamically stable with no contractions or vaginal bleeding. Laboratory investigations in Table 1 showed hemoglobin 12.3 g/dL, leukocyte 11700/mm^3, platelet 313000/µL, normal renal function, and no proteinuria. Mild asymptomatic bacteriuria was noted. The patient was then discharged from the hospital after completion of dexamethasone in good condition and advised for weekly monitoring of her pregnancy.

Table 1. Laboratory findings on Admission

Items	**Laboratory Result**			**Unit**	**Normal value**
	27/07/2025	**15/08/2025 (pre operative)**	**16/08/2025 (post operative)**		
Hb	12.3	13	12.1	g/dl	10,9-14,9
Ht	37.4	38.7	36.7	%	34-45
Leukocyte	11.700	**13.220**	**19.870**	/mm3	4790-11340
Thrombocyte	313000	293000	273000	/uL	216.000-451.000
MCV	94.6	94.3	95.2		80-96
MCH	31	31.7	31.3		27.5-35.5
MCHC	32.8	33.6	32.9		33.4-35.5
Seg. Neutrophile	**71.6**	**76.1**	**89.1**	%	50-70
Lymphocyte	17.1	14.8	5.4	%	20.4-44.6
Monocyte	6.5	5.8	4.1	%	3.6-9.9
PT	11.8	**12.2**		second	9,9-11,8
APTT	30	29.7		second	22.5-40.1
LDH	210	202		U/L	< 223
Albumin	3.52	3.63		g/dl	3,5-5,2
RBG	90.1	80.2		mg/dl	80-139
Ureum	11.5	9.86		mg/dl	15-40
Creatinin	0.48	0.48		mg/dl	0,5-1
SGOT	19	16		U/L	<35
SGPT	12	9		U/L	<33
Natrium	**129**	**133**		mEq/L	134-145

Kalium	3.76	3.76	mEq/L	3,4-4,5
Calcium	9.6	9.2	mEq/L	8,6-10,3
Chloride	99	99	mEq/L	96-108
HbsAg	NR		-	NR
Anti HIV	NR		-	NR
Urinalysis				
Bacteria	20-30	**>30**	/HPF	Negative
Epitel	10-15	10-15	/SPF	Negative
Keton	3+/50	Negative		
Leukocyte	**+3/500**	**3+/500**	/HPF	Negative
Protein urin	**1+/25**	**1+/25**	mg/dl	Negative

At 32 weeks of gestation, a decision was made to proceed with elective cesarean delivery due to findings suggestive of fetal heart failure on ultrasound in the 1st twin, as seen in Figure 2, which shows thickening of both ventricle walls with pericardial effusion and progression of cardiomegaly (CTAR 0.32 (31 weeks gestation) to 0.38 (32–33 weeks gestation)). A live female infant (1st twin) weighing 1650 gr was delivered with APGAR scores of 6/6/6 and admitted to the neonatal intensive care unit with respiratory distress syndrome requiring noninvasive positive pressure ventilation. The second twin was delivered stillborn, 900 gr with acrania, acardiac, and meromelia, confirming TRAPS (Figure 3). The placenta demonstrated monochorionic diamniotic placentation. Post-delivery recovery of the mother was uneventful. She received antibiotics, analgesics, and uterotonics. The infant required intensive neonatal care due to prematurity, low birth weight, respiratory distress, and congenital heart defect (moderate secundum atrial septal defect/MsASD and patent ductus arteriosus/PDA) and was managed with oxygen therapy, antibiotics, diuretics, and supportive care.

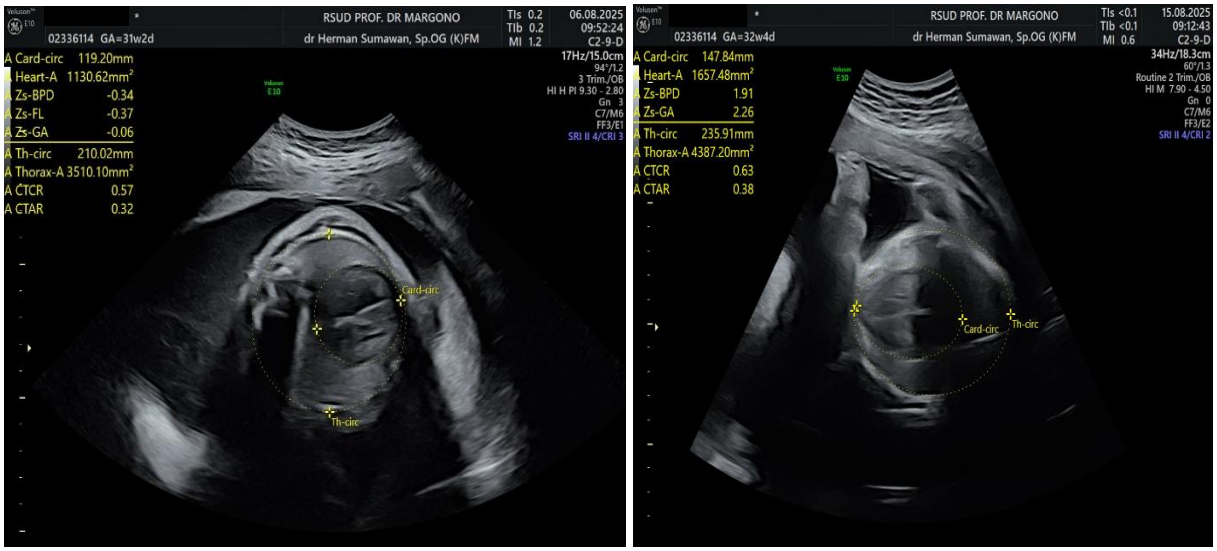

Figure 2. 1st twin cardiac progression from 31 to 32 weeks of pregnancy
Progression of 1st twin fetal heart from 31 to 32 weeks of pregnancy showing thickening of left and right ventricle wall with pericardial effusion

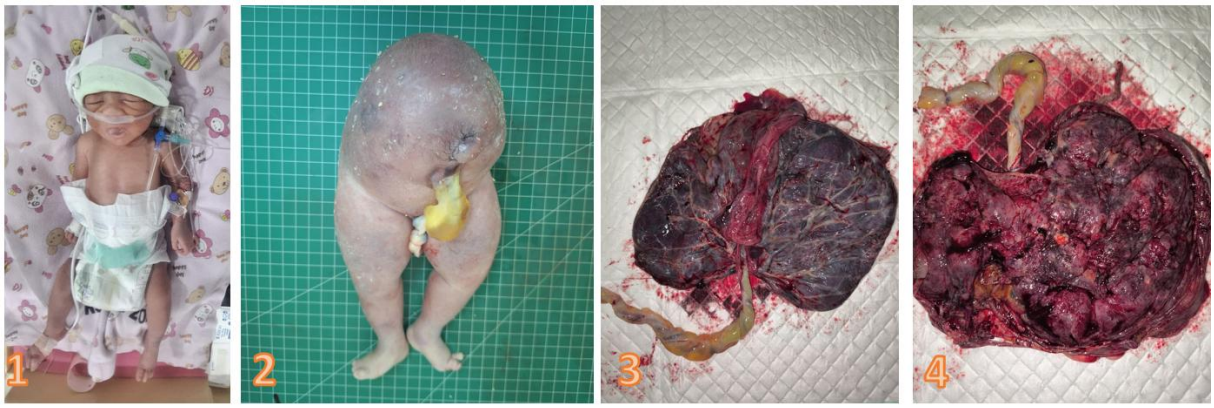

Figure 3. Fetal outcome and placenta

The mother was discharged in good condition after routine post operative care with standard uterotonic infusion, antibiotic prophylaxis, analgesia and progressive mobilization this align with enhanced recovery principles after caesarean in high risk pregnancies, although no TRAPS specific postnatal maternal risks are expected. The pump neonate required escalating non invasive respiratory support for respiratory distress syndrome (RDS) consistent with preterm physiology at 32-33 weeks gestation. Empiric ampicillin gentamicin was started for early onset sepsis risk and later escalated to vancomycin/amikacin with positive staphylococcus haemolyticus blood culture, reflecting standard pathogen directed practice. Echocardiography demonstrated hemodynamically significant patent ductus arteriosus (HsPDA) and moderate secundum atrial septal defect (MsASD), managed medically with diuretics and supportive care, consistent with contemporary PDA guidance emphasizing individualized treatment. The infant experienced IVH grade II on cranial ultrasound and required prolonged ventilation with periods of SIMV, in keeping with known morbidities among very preterm infants and were managed perconsensus guidance.

3. RESULT AND DISCUSSION

TRAPS results from abnormal placental vascular connections, particularly arterio-arterial anastomoses leading to reversed perfusion of the acardiac twin by the pump twin (Vitucci et al., 2020; Dubey et al., 2017; Dejene et al., 2025). The acardiac twin typically exhibits absent cranial and thoracic structures, while the pump twin faces significant risks, including hydramnios, cardiac overload, and intrauterine demise (Thirupathi and Meganathan, 2025). Diagnosis is based on ultrasonography showing an anomalous twin without cardiac activity, retrograde blood flow in umbilical arteries on Doppler, and features such as acrania and acardia. Diagnosis of TRAPS in this case rested on the presence of a monochorionic diamniotic placenta, a severely malformed (acardiac/ancephalic) cotwin without cardiac activity, and a normally formed pump twin, which fulfills diagnostic criteria described in reviews and guidelines. We employed serial biometry, amniotic fluid index, and Doppler studies (middle cerebral artery and umbilical artery) of the pump twin to surveil for high-output compromise, consistent with ISUOG recommendations for monochorionic pregnancies with complications. Hydramnios observed in the pump sac likely reflected increased fetal urine output from high-output physiology and contributed to preterm delivery risk as commonly reported in TRAPS.

The primary consideration in this case was twin reversed arterial perfusion sequence (TRAPS), which presents as an acardiac twin supplied by retrograde blood flow from the pump twin through placental arterioarterial anastomoses (Dejene et al., 2025). TRAPS should be differentiated from other conditions that can mimic a malformed twin with absent cardiac activity. One important differential is vanishing twin syndrome, where one twin ceases to develop in early pregnancy, resulting in resorption or compression of fetal tissue. Unlike TRAPS, vanishing twin usually occurs in the first trimester and does not demonstrate Doppler evidence of reversed perfusion (Dejene et al., 2025; Thirupathi and Meganathan, 2025). Another differential is fetus

papyraceus, which describes the demise and mummification of one twin in a multiple pregnancy, typically after the first trimester. In this condition, the demise twin is compressed and flattened against the uterine wall, showing no signs of continued growth or vascular flow. This is different from the acardiac twin in TRAPS, which has blood vessels but is misshapen (Khalil et al., 2025; Aldiansyah et al., 2022; Seo et al., 2019). Anencephaly with cardiac activity can also mimic TRAPS. In anencephaly, the fetus lacks a calvarium and cerebral structures, but cardiac activity is present, and the fetus has an organized body axis. In contrast, TRAPS presents with absent functional heart tissue and frequently severe truncal and limb malformations, as in our case with acrania, acardiac, and meromelia (Tavares de Sousa et al., 2020). A further consideration is conjoined twins with severe anomalies, particularly if one twin has lethal malformations. However, conjoined twins demonstrate shared anatomical structures and are not perfused exclusively by reversed arterial flow. Careful ultrasonographic evaluation, including Doppler studies, allows differentiation between conjoined malformations and TRAPS (Tavares de Sousa et al., 2020; Buyukkaya, Tekbas, and Buyukkaya, 2015; Dubey et al., 2017). Finally, placental chorioangioma may mimic a second abnormal twin mass. Chorioangiomas are benign vascular tumors of the placenta that can appear as avascular or hypovascular echogenic masses adjacent to the fetus. Unlike TRAPS, these lesions lack a fetal pole and skeletal structures, and Doppler usually shows a single feeding vessel rather than arterio-arterial perfusion.

When risk is elevated, such as with a large acardiac pump weight ratio, cardiac compromise, or hydramnios, options include intrafetal laser or radiofrequency ablation of the acardiac perfusion, both associated with improved pump twin survival compared with expectant management in contemporary series and meta-analyses (Aldiansyah et al., 2022). Antenatal corticosteroids for threatened preterm birth reduce neonatal respiratory morbidity and are recommended by major obstetric guidelines, informing timing in TRAPS when preterm delivery is likely (Micheletti et al., 2021; Ye et al., 2022). Neonatal care commonly addresses respiratory distress syndrome (RDS), apnea of prematurity, and patent ductus arteriosus (PDA), following evidence-based consensus statements (Micheletti et al., 2021; Rao and Rao, 2020). The use of clomiphene citrate is associated with an increased risk of multiple gestation, a consideration relevant to this patient's conception history.

Given appropriate growth and absence of pump twin hydrops or decompensation, we pursued conservative antenatal optimization with corticosteroids, symptom-driven tocolysis, and close surveillance, an approach supported for selected TRAPS cases when fetal therapy is unavailable or deferred (Alshanafey et al., 2023). When intervention is indicated, radiofrequency ablation (RFA) or intrafetal laser (IFL) targets the acardiac twin's blood supply and improves pump twin survival versus expectant management in pooled analyses. Published case series report pump twin survival rate after RFA around 80-90% and after IFL in a similar range, with risk profiles influenced by gestational age and acardiac/pump size ratio (Ye et al., 2022). Besides the limited availability of RFA resources, this method was not performed due to late gestational age at diagnosis and limited availability of fetal therapy. Evidence suggests that intrafetal laser or radiofrequency ablation is most beneficial when performed in mid-gestation, whereas data supporting intervention in late-diagnosed TRAPS are limited and procedural risks increase with advancing gestation (Hecher et al., 2006; Pagani et al., 2013; Cabassa et al., 2013).

Several factors likely contributed to the survival of the pump twin despite the late diagnosis: (1) the relatively smaller acardiac twin size compared with the pump twin, as the prognosis largely depends on the relative size of the acardiac twin; if the weight ratio exceeds 50%, the pump twin is at higher risk of complications (Thirupathi and Meganathan, 2025). (2) absence of hydrops fetalis, (3) initially normal Doppler parameters, and (4) intensive ultrasound surveillance allowing timely delivery at early signs of cardiac decompensation. However, expectative management with close monitoring is appropriate when the pump twin remains stable and the acardiac twin is smaller, as in this case. *The Sullivan et al.* study showed that TRAP that was diagnosed antenatally had less neonatal mortality of the pump twin, with a 90% survival rate, so that expectant management with close antepartum surveillance can be considered. *Kumar et al.* performed conservative management and an antepartum surveillance approach on a TRAP case and showed an excellent outcome of the pump twin (Sullivan et al., 2003; Kumar et al., 2015).

In our case, the rationale for expectant management was that a risk–benefit analysis favored conservative management due to advanced gestational age, stable hemodynamics, and lack of access to fetal therapy. Immediate delivery at diagnosis would have exposed the neonate to severe prematurity-related morbidity, while delayed fetal intervention carried procedural risks without clear benefit at this gestational age.

Weekly evaluations were continued, and ultimately termination was decided because of suspected signs of heart failure, such as cardiomegaly, ventricular wall thickening, and pericardial effusion (Rao and Rao, 2020). This reflects the challenges encountered in resource-limited settings, where interventional therapy may not be available despite guideline recommendations. Our decision to manage expectantly allowed prolongation of pregnancy to 32 weeks, optimizing neonatal outcomes while avoiding risks associated with invasive procedures and optimizing fetal maturity (Vitucci et al., 2020). The clinical implication is that expectant management remains a valid option in stable TRAP cases when the pump twin shows normal growth, Doppler findings, and no early markers of decompensation or sign of hydrops (Micheletti et al., 2021; Dhanju and Breddam, 2022; Thirupathi and Meganathan, 2025; Alshanafey et al., 2023). The surviving pump twin in this case had respiratory distress and congenital heart defects consistent with a prior report that cardiac strain in utero may predispose to postnatal complications, likely reflecting the earlier cardiovascular load endured by the pump twin, but the baby made improvement daily and was discharged in good condition (Rao and Rao, 2020; Seo et al., 2019).

Late-diagnosed TRAPS successfully managed expectantly without access to fetal therapy is rarely reported, especially from resource-limited settings. Ultimately, close surveillance and timely delivery remain the cornerstones of care in the TRAP sequence. Nevertheless, survival was achieved with multidisciplinary management involving obstetricians, neonatologists, and pediatric cardiologists.

4. CONCLUSION

Late-diagnosed TRAPS presents a complex clinical dilemma. Expectant management with intensive surveillance may be a viable option in carefully selected cases when fetal intervention is unavailable and the pump twin remains stable. Early recognition of decompensation and timely delivery are critical to optimize outcomes.

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