

Percutaneous debulking of tricuspid vegetations due to infectious endocarditis in pregnancy: a case report



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Infective endocarditis is a rare but serious disease with increasing prevalence in women of childbearing age because of the opioid epidemic. Therefore, it is an increasingly frequent pregnancy complication. The gold standard of treatment is intravenous antibiotics with surgery reserved for refractory cases. However, pregnancy complicates decisions about the risk and timing of surgery. AngioVac represents a percutaneous alternative to surgical intervention. Here, we present a case of a 22-year-old G2P1001 woman with a history of intravenous drug use and infective endocarditis who continued to show signs and symptoms of septic pulmonary emboli despite management with intravenous antibiotics. The patient was deemed not to be a surgical candidate while pregnant and had an AngioVac procedure at 30 2/7 weeks of gestation with the removal of tricuspid vegetations. The patient was delivered via cesarean delivery at 32 5/7 weeks of gestation because of a nonreassuring fetal heart tracing. The patient's tricuspid valve was replaced on postpartum day 16. This case demonstrates that AngioVac can be safely used in the third trimester of pregnancy and may be considered in consultation with a multidisciplinary team for the management of infective endocarditis refractory to antibiotic treatment as an interim measure until surgery can be safely performed.

Key words: AngioVac, case report, infective endocarditis, pregnancy, tricuspid valve

Introduction

Because of the opioid epidemic, intravenous (IV) drug use (IVDU) and its sequelae, including infective endocarditis (IE), are increasing.^{1–3} IE rates are increasing greatly in women of childbearing age with subsequent increases in the rates in pregnancy.^{1,3–5} IE can involve any valve, but it most commonly involves the tricuspid valve (TV) when secondary to IVDU.⁶ Despite being rare, IE has significant morbidity

and mortality rates. Pregnancy further exacerbates the risk of heart failure. The maternal mortality rate of peripartum IE is estimated at 11% to 33%.^{5,7,8} Right-sided lesions have a lower, although still clinically significant, mortality rate of 6.1%⁵ with a TV-specific mortality rate of 9.5% reported in 1 systematic review.⁹ Mortality is similarly elevated for the fetus with an overall rate of 14.6% to 29.0%^{5,7} and a TV-specific rate of 9.5%.⁹ Over half of these pregnancies result in preterm delivery. The average gestational age (GA) at delivery is 32 to 34 weeks, with consequent neonatal morbidity and mortality.^{5,8,10}

IV antibiotics are the gold standard of treatment for IE, with cardiac surgery typically reserved for cases of acute heart failure or cases refractory to medical management.^{6,7,11–13} Pregnancy complicates the surgical decision-making process. During pregnancy, there are anatomic and physiological changes to the cardiovascular system, which can exacerbate the stresses of heart failure because of IE.

Cardiac surgery in pregnancy has a 33.1% fetal mortality rate and an 11.2% maternal mortality rate, although this may overestimate the mortality rate for

valve replacement.¹⁴ Determinations have to be made about whether to operate in the antepartum, intrapartum, or postpartum period. If the surgical procedure is to be performed in the postpartum period, delivery timing needs to be optimized, weighing the risks to the mother of continuing the pregnancy against the benefits to the fetus of further gestation.

AngioVac is a Food and Drug Administration–approved, noninvasive treatment option for patients who are poor surgical candidates.¹⁵ The system is composed of venous drainage and return cannulae and an extracorporeal circuit with a pump and filter. Blood and thrombotic material are aspirated and filtered, and blood is returned to the patient. In a meta-analysis of vegetation debulking using the AngioVac system, the pooled events rate of successful removal was 74.5%, whereas the operative mortality pooled events rate was 14.6%.¹⁶ In a retrospective study of right-sided IE, the use of the AngioVac showed a significant improvement in surgical candidacy based on National Surgical Quality Improvement Program scores.¹⁷

Here, we describe the successful performance of an AngioVac procedure for the removal of TV vegetations during the third trimester of pregnancy in a

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This study has obtained a signed consent form from the patient in this case report, which is filed with our records and available for review on request.

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woman with septic emboli from IE who had failed IV antibiotics and was not deemed to be a surgical candidate while pregnant.

Case

A 22-year-old White G2P1001 woman presented to a county hospital at 28 1/7 weeks of gestation for cerebrovascular accident tenderness and malaise. The patient's past medical history indicated polysubstance abuse, methicillin-sensitive *Staphylococcus aureus* bacteremia (MSSA), hepatitis C virus with an undetectable viral load, and endocarditis, for which the patient had been admitted a year ago, treated with 6 weeks of IV antibiotics, and planned for surgical management but was lost to follow-up. On admission, the patient was found to have COVID-19 pneumonia, pyelonephritis, MSSA bacteremia, and thrombocytopenia and was admitted to the intensive care unit (ICU) for respiratory failure. The patient was intubated, and treatment was started. The patient had a transesophageal echocardiogram, which showed severe TV regurgitation, large TV vegetations (2 × 1 cm), and

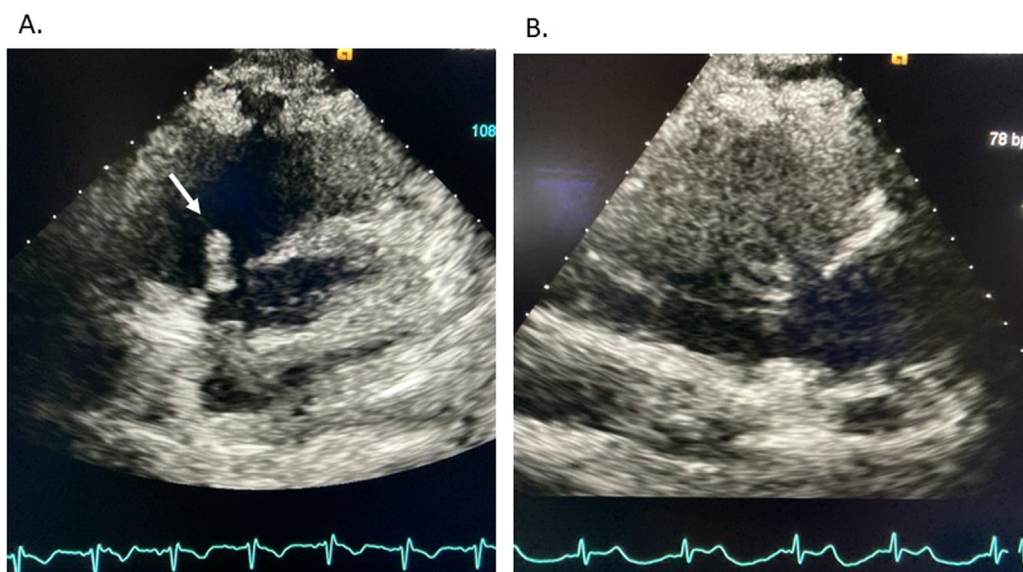
flail TV leaflets with severe valve malcoaptation.

The patient received betamethasone for fetal lung maturation and was transferred to a tertiary care hospital. The cardiothoracic surgery team recommended medical management with IV antibiotics, with a plan to consider valve surgery after delivery. The patient's condition improved with the antibiotic treatment. Moreover, the patient was extubated and was transferred to the maternal-fetal medicine (MFM) unit at 29 3/7 weeks of gestation for fetal monitoring, Subutex initiation, and continuation of IV antibiotics. The infectious diseases (ID) team was consulted, and they recommended the continuation of IV cefazolin.

At 29 6/7 weeks of gestation, the patient became tachypneic and tachycardic and required increasing oxygen supplementation. A computed tomography angiogram showed several new septic emboli throughout the lungs bilaterally and a small pericardial effusion. In a multidisciplinary discussion with members of the MFM, anesthesia, interventional radiology (IR), cardiology, critical care, and ID units, an

AngioVac procedure was recommended. At our institution, AngioVac is used as a stand-alone treatment for TV vegetations in nonsurgical candidates (competent valves not requiring replacement, prosthetic valves, or those not offered surgery because of IVDU recidivism) or as a means of stabilizing patients (clearing blood cultures, halting septic emboli, and improving clinical status and surgical risk factors) before surgery, especially when a delay in surgery is desired (as in this patient because of the patient's GA).¹⁷ The patient was counseled on the risks of the AngioVac procedure, including exposure to radiation from fluoroscopy. Afterward, the patient signed an informed consent. A preprocedure echocardiogram showed an ejection fraction of 60%, moderate TV regurgitation, and continued presence of a mobile vegetation on the TV (Figure 1, A). The AngioVac procedure was performed at 30 2/7 weeks of gestation under general anesthesia with continuous fetal monitoring. An obstetrician was present, and the neonatal ICU (NICU) was on standby for emergency cesarean delivery (CD) if needed. The

FIGURE 1
Echocardiogram before and after the AngioVac procedure

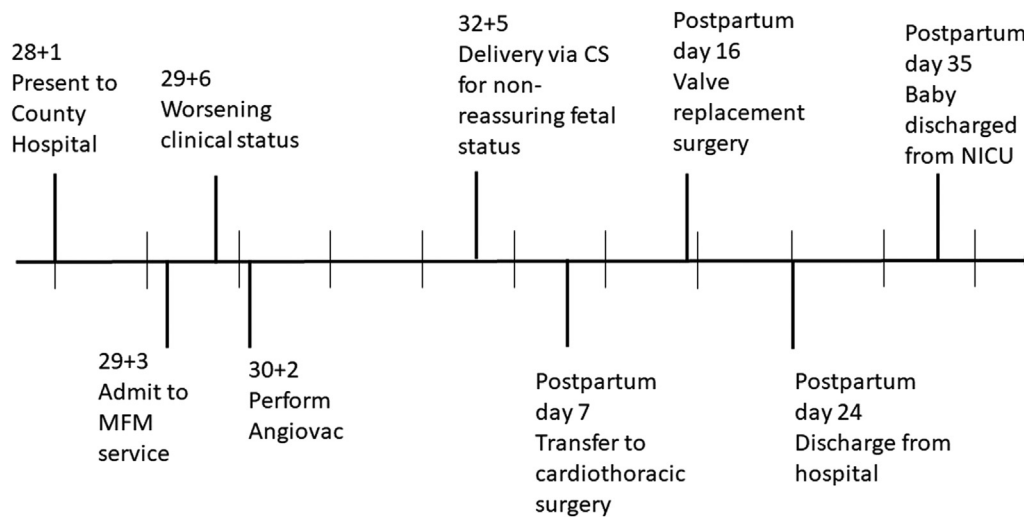


Transthoracic echocardiogram before (A) and after (B) the AngioVac procedure. The arrow indicates the vegetation.

CD, cesarean delivery; NICU, neonatal intensive care unit.

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FIGURE 2
Timeline of hospital course



The *small hatch marks* indicates weeks since admission. The *large hatch marks* are labeled with timing of major events.

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patient was placed in the supine position with a leftward tilt. A Foley catheter and external fetal heart monitor were placed. The patient was prepped and draped. Access was obtained to both the femoral veins and the right internal jugular vein. An 8 French intracardiac echocardiogram was directed to the right atrium. Intracardiac echocardiography identified the vegetations on both the posterior and anterior leaflets of the TV and along the eustachian valve at the confluence of the inferior vena cava and the right atrium (Video). An AngioVac cannula was introduced through the right internal jugular vein and directed to the right atrium under fluoroscopic guidance. Using ultrasound guidance, the AngioVac cannula was directed toward the vegetations while the venous bypass circuit was activated. Multiple passes were made until most vegetations (80%) were debulked. The vegetations grew *S aureus*. The procedure was uncomplicated and well tolerated by the patient and fetus. The postoperative echocardiogram showed an ejection fraction of 57%, continued presence of mobile vegetations on the TV, flail TV, and severe TV regurgitation (Figure 1, B).

Postoperatively, the patient's clinical status improved. Blood cultures were

negative when repeated 1 week after the procedure. At 32 5/7 weeks of gestation, there was a nonreassuring fetal heart tracing of uncertain etiology, and the patient was delivered via an uncomplicated primary low transverse CD for fetal malpresentation and a biophysical profile of 4/8. The patient gave birth to a live-born male infant weighing 1803 g with Apgar scores of 9 and 9 at 1 and 5 minutes, respectively. Placental pathology showed a 3-vessel cord with no evidence of funisitis or chorioamnionitis. The placental disk had scattered perivillous fibrin deposition and calcification. The neonate was admitted to the NICU for respiratory distress syndrome and prematurity. The neonate had a prolonged course because of ongoing nutritional needs. The neonate was discharged on day 35 of life. The patient's postpartum course was complicated by preeclampsia with severe features. The patient received magnesium and was started on long-acting nifedipine with improvement.

On postpartum day 7, the patient was transferred back to cardiothoracic surgery. A repeat echocardiogram showed severe TV regurgitation, TV vegetations, flail leaflet, Chiari network in the right atrium, a dilated right atrium, normal ventricular function, and a patent

foramen ovale. Blood cultures showed no growth. The patient underwent an uncomplicated TV replacement with a porcine valve and had a primary closure of the patent foramen ovale on postpartum day 16. The patient completed her antibiotics course and was discharged on postpartum day 24. Figure 2 shows the timeline of the patient's hospital course.

Comment

This case demonstrates a typical presentation and disease course of IE in pregnancy. Most patients are White, are uninsured, and have a history of IVDU with multiple comorbidities.^{4,8,10,18} Patients often present antenatally with cardiopulmonary symptoms or symptoms related to the infectious sequelae of IVDU.^{4,8,10} The most common pathogen is *S aureus*.^{4,6,8,10,18} Pulmonary septic emboli are a frequent comorbidity.^{4,5,10}

Because of the medical complexity of this patient, we employed a multidisciplinary team composed of members of the anesthesia, IR, ID, critical care, cardiology, cardiothoracic surgery, and neonatology teams. Although our team was created ad hoc, there is evidence that established multidisciplinary teams reduce mortality in patients with IE and

have been employed in the setting of pregnancy.¹⁰

To the best of our knowledge, this is the third reported case of the use of AngioVac in pregnancy. Moreover, this study reports the use of AngioVac after periviability. Ayzenbart et al¹⁹ reported the use of AngioVac for debulking TV vegetations in a woman with endocarditis at 22 weeks of gestation. The patient had a recurrence of the vegetations, and the procedure was repeated at 26 weeks of gestation. Similar to our case, the patient had IVDU with severe tricuspid regurgitation and developed septic pulmonary emboli despite appropriate treatment with IV antibiotics. The patient tolerated the procedure and delivered several weeks later. Torok et al²⁰ reported the use of AngioVac for the removal of a saddle pulmonary embolism in a postpartum woman with Fontan circulation who had failed thrombolytic therapy.

In this case, our patient delivered 2 weeks after the AngioVac procedure. The cause of the nonreassuring fetal status was unknown. Despite maternal clinical improvement after the AngioVac procedure, the case was a high-risk pregnancy with multiple comorbidities that may have contributed to the deteriorating fetal status. We believe that it is highly unlikely to have been precipitated by the procedure, given that it occurred weeks later. However, it is impossible to know when the delivery would have occurred if the AngioVac procedure had not been performed. Similarly, there was no way to know if her cardiac status would have remained constant or declined more precipitously if the AngioVac procedure had not been performed.

Data on IE in pregnancy and the use of AngioVac in pregnancy are limited and prone to reporting bias. Further research is needed on the safety and efficacy of AngioVac in pregnancy, including the ideal timing of the procedure and characteristics of patients who would most benefit.

Conclusion

Our study demonstrates the use of the AngioVac system for the removal of TV bacterial vegetations of a pregnant patient with IE at 30 2/7 weeks of gestation. The use of the procedure was successful and well tolerated. The patient delivered at 32 5/7 weeks of gestation because of fetal distress. ■

Supplementary materials

Supplementary material associated with this article can be found in the online version at [doi:10.1016/j.xagr.2023.100204](https://doi.org/10.1016/j.xagr.2023.100204).

REFERENCES

1. Wurcel AG, Anderson JE, Chui KK, et al. Increasing infectious endocarditis admissions among young people who inject drugs. *Open Forum Infect Dis* 2016;3:ofw157.
2. Correa de Sa DD, Tleyjeh IM, Anavekar NS, et al. Epidemiological trends of infective endocarditis: a population-based study in Olmsted County, Minnesota. *Mayo Clin Proc* 2010;85:422–6.
3. Fleischauer AT, Ruhl L, Rhea S, Barnes E. Hospitalizations for endocarditis and associated health care costs among persons with diagnosed drug dependence - North Carolina, 2010–2015. *MMWR Morb Mortal Wkly Rep* 2017;66:569–73.
4. Adesomo A, Gonzalez-Brown V, Rood KM. Infective endocarditis as a complication of intravenous drug use in pregnancy: a retrospective case series and literature review. *AJP Rep* 2020;10:e288–93.
5. Kebed KY, Bishu K, Al Adham RI, et al. Pregnancy and postpartum infective endocarditis: a systematic review. *Mayo Clin Proc* 2014;89:1143–52.
6. Moreillon P, Que YA. Infective endocarditis. *Lancet* 2004;363:139–49.
7. Habib G, Lancellotti P, Antunes MJ, et al. 2015 ESC Guidelines for the management of infective endocarditis: the Task Force for the Management of Infective Endocarditis of the European Society of Cardiology (ESC). Endorsed by: European Association for Cardio-Thoracic Surgery (EACTS), the European association of nuclear medicine (EANM). *Eur Heart J* 2015;36:3075–128.
8. Dagher MM, Eichenberger EM, Addae-Konadu KL, et al. Maternal and fetal outcomes associated with infective endocarditis in pregnancy. *Clin Infect Dis* 2021;73:1571–9.
9. Campuzano K, Roqué H, Bolnick A, Leo MV, Campbell WA. Bacterial endocarditis

complicating pregnancy: case report and systematic review of the literature. *Arch Gynecol Obstet* 2003;268:251–5.

10. Shapero KS, Nauriyal V, Megli C, Berlacher K, El-Dalati S. Management of infective endocarditis in pregnancy by a multidisciplinary team: a case series. *Ther Adv Infect Dis* 2022;9:20499361221080644.

11. Thuny F, Grisoli D, Collart F, Habib G, Raoult D. Management of infective endocarditis: challenges and perspectives. *Lancet* 2012;379:965–75.

12. Baddour LM, Wilson WR, Bayer AS, et al. Infective endocarditis: diagnosis, antimicrobial therapy, and management of complications: a statement for healthcare professionals from the Committee on Rheumatic Fever, Endocarditis, and Kawasaki Disease, Council on Cardiovascular Disease in the Young, and the Councils on Clinical Cardiology, Stroke, and Cardiovascular Surgery and Anesthesia, American Heart Association: endorsed by the Infectious Diseases Society of America. *Circulation* 2005;111:e394–434.

13. Prasad M, Jones M. Medical complications of opioid use disorder in pregnancy. *Semin Perinatol* 2019;43:162–7.

14. Jha N, Jha AK, Chand Chauhan R, Chauhan NS. Maternal and fetal outcome after cardiac operations during pregnancy: a meta-analysis. *Ann Thorac Surg* 2018;106:618–26.

15. Divekar AA, Scholz T, Fernandez JD. Novel percutaneous transcatheter intervention for refractory active endocarditis as a bridge to surgery-angiovac aspiration system. *Catheter Cardiovasc Interv* 2013;81:1008–12.

16. Hameed I, Lau C, Khan FM, et al. AngioVac for extraction of venous thromboses and endocardial vegetations: a meta-analysis. *J Card Surg* 2019;34:170–80.

17. Scantland J, Hendrix J, Schmitz A, Casciani T, Butty S. Clinical efficacy of percutaneous Vegetectomy in tricuspid and right-heart indwelling device infective endocarditis. *Angiology* 2022;33197221121009.

18. Sinner GJ, Annabathula R, Viquez K, Alnabetsi TS, Leung SW. Infective endocarditis in pregnancy from 2009 to 2019: the consequences of injection drug use. *Infect Dis (Lond)* 2021;53:633–9.

19. Ayzenbart V, Fuentes H, Fuentes F, Aziz S, Joseph M. AngioVac use in endocarditis during pregnancy: a novel approach for recurrent debulking of tricuspid infective vegetations in a 27-year-old woman in her 22nd and 26th weeks of pregnancy. *Chest* 2021;160:A786.

20. Torok RD, Fleming GA, Hill KD. Transcatheter pulmonary embolectomy after Fontan. *Catheter Cardiovasc Interv* 2016;87:939–44.