Case Report

Pregnancy in a Woman with a History of Acute Myocarditis Following Ovulation Induction: A Case Report and Narrative Review

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Highlights

- Acute myocarditis occurred shortly after controlled ovarian stimulation for IVF in a previously healthy woman.
- Multimodality cardiac imaging, including CMR and dobutamine stress echocardiography, provided complementary information for preconception risk stratification.
- Pregnancy was successfully completed in a woman with persistent mild LV systolic dysfunction and residual myocardial scar following individualized multidisciplinary counseling.
- Pregnancy after myocarditis may be feasible in selected women with careful preconception assessment, shared decision-making, and close cardio-obstetric surveillance.

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ABSTRACT

Background: Myocarditis in women of reproductive age poses unique challenges for pregnancy planning, particularly when assisted reproductive technology (ART) is considered. Current guidelines lack specific recommendations for pregnancy after myocarditis, especially in the presence of residual ventricular dysfunction or myocardial fibrosis.

Case Presentation: We describe a 43-year-old woman who developed acute myocarditis shortly after controlled ovarian stimulation for in vitro fertilization. Cardiac magnetic resonance imaging confirmed myocardial inflammation with a markedly reduced left ventricular ejection fraction. She was treated with guideline-directed medical therapy and showed progressive improvement on follow-up imaging, including recovery of contractile reserve on dobutamine stress echocardiography. After a comprehensive prepregnancy evaluation and multidisciplinary consultation, she proceeded with frozen embryo transfer, with close surveillance during gestation.

Discussion: This case highlights the importance of individualized, multimodal risk assessment before pregnancy in women with prior myocarditis. Cardiac magnetic resonance imaging and stress echocardiography can provide valuable prognostic information beyond conventional echocardiographic measures. In addition, we review the potential temporal association between ART and myocarditis, outline proposed mechanisms, and summarize current recommendations for reproductive planning in this population.

Conclusion: With careful risk stratification and coordinated care, pregnancy may be considered in selected women with a history of myocarditis.

Keywords: Myocarditis; Pregnancy; Assisted Reproductive Technology (ART); Cardiac Magnetic Resonance; Dobutamine Stress Echocardiography; Cardio-Obstetrics

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RHYTHM
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Introduction

Acute myocarditis is an inflammatory condition of the myocardium with diverse clinical presentations, ranging from mild, self-limiting symptoms to fulminant heart failure (HF) or sudden cardiac death. The cornerstone of treatment is supportive care.[1] In cases with left ventricular (LV) systolic dysfunction, guideline-directed medical therapy (GDMT) for HF with reduced ejection fraction (HFrEF)-including beta-blockers, angiotensin-converting enzyme (ACE) inhibitors, angiotensin receptor–neprilysin inhibitors (ARNIs), mineralocorticoid receptor antagonists (MRAs), and sodium-glucose cotransporter 2 inhibitors (SGLT2is)-is indicated.[2] Expert consensus recommends continuing these therapies for several months after complete LV function recovery, with withdrawal considered only after comprehensive reassessment, resolution of arrhythmias, and absence of ongoing myocardial inflammation on cardiac magnetic resonance (CMR) imaging.[3,4]

The question of whether or not pregnancy is safe after recovery from acute myocarditis presents a complex clinical challenge. Neither the American Heart Association (AHA) nor the European Society of Cardiology (ESC) provides disease-specific guidance regarding pregnancy after myocarditis. In clinical practice, nonetheless, pregnancy in these patients is approached with caution. A thorough preconception cardiovascular evaluation is strongly recommended and generally includes echocardiography to assess ventricular function and CMR to evaluate residual myocardial inflammation or fibrosis. In selected patients, additional testing such as low-dose dobutamine stress echocardiography may be considered to assess myocardial contractile reserve and aid individualized risk stratification before pregnancy.[5-7] In women with normal or recovered left ventricular ejection fraction (LVEF), absence of active myocardial inflammation, and no significant arrhythmic risk, pregnancy may be considered with close clinical surveillance. Such decisions should be based on a multidisciplinary approach involving cardiology, maternal–fetal medicine, and reproductive medicine (assisted reproductive technology [ART]) teams. Shared decision-making and individualized risk assessment remain essential given the limited prospective data in this population.

With the increasing use of ART-including ovulation induction and embryo transfer-among women with cardiovascular comorbidities, attention must also be paid to the potential cardiovascular complications associated with fertility treatment. The 2025 AHA Scientific Statement by Mauricio et al[8] emphasized that ovarian stimulation protocols, particularly those involving exogenous gonadotropins and human chorionic gonadotropin (hCG), lead to supraphysiologic levels of vascular endothelial growth factor (VEGF), increasing vascular permeability and predisposing patients to ovarian hyperstimulation syndrome (OHSS). OHSS is characterized by third-spacing, hypovolemia, and thromboembolic risk, all of which may exacerbate underlying or latent cardiovascular dysfunction.

Although myocarditis is not a well-established complication of ART, a few case reports have described acute perimyocarditis following ovulation induction. Proposed mechanisms include immune-mediated hypersensitivity reactions, hormonal modulation of inflammatory pathways, or vascular injury secondary to ovarian hyperstimulation.[9,10] The AHA acknowledges that, although robust data are lacking, ART may unmask or trigger cardiovascular complications, particularly in individuals with predisposing risk factors or exaggerated inflammatory responses.[8]

The present case underscores the need for a tailored, comprehensive preconception evaluation in women with prior myocarditis, especially when ART is being considered. Greater awareness of the cardiovascular risks associated with ovarian stimulation, along with interdisciplinary risk stratification, is essential to optimize maternal and fetal outcomes. Further research is needed to clarify the pathophysiologic links and inform management strategies at this clinical intersection.

Case Presentation

A 43-year-old woman with a history of endometriosis and infertility, and no known cardiac disease, was undergoing evaluation and treatment for in vitro fertilization (IVF).

In 2023, she underwent controlled ovarian hyperstimulation using letrozole and human

menopausal gonadotropin (HMG; 75 IU of follicle-stimulating hormone/luteinizing hormone [FSH/LH] daily), starting on day 3 of her menstrual cycle. A gonadotropin-releasing hormone antagonist (GnRH) antagonist was added later in the cycle, and final oocyte maturation was triggered with a GnRH agonist. Oocyte retrieval was performed under anesthesia without complications, and she was discharged on the same day. Because of poor oocyte quality, embryo formation was not achieved, even after intracytoplasmic sperm injection (ICSI).

Three months later, a second cycle was initiated using letrozole and recombinant FSH/LH (150 IU daily), followed by a GnRH antagonist and a GnRH agonist trigger. During oocyte retrieval under anesthesia, frequent premature ventricular contractions (PVCs) were noted on cardiac monitoring. The procedure was otherwise uneventful, and 7 oocytes were obtained. Five embryos were successfully created via ICSI. Nevertheless, because of new-onset symptoms, fresh embryo transfer was postponed, and the embryos were cryopreserved.

Approximately 1 week after oocyte retrieval, the patient presented with fever, dyspnea, palpitations, and pleuritic chest pain. Given the temporal relationship to controlled ovarian stimulation and oocyte retrieval, OHSS was initially considered by the gynecology team. Still, clinical evaluation revealed no abdominal distension or tenderness. Pelvic ultrasonography showed no significant ovarian enlargement or ascites, and laboratory investigations demonstrated no hemoconcentration or electrolyte abnormalities. Because the patient lacked the typical clinical and imaging features of moderate-to-severe OHSS, further evaluation was undertaken to identify alternative causes of her symptoms. Frequent PVCs, first noted during oocyte retrieval, were again observed on the admission electrocardiogram (ECG), prompting cardiology consultation and further cardiovascular evaluation.

Transthoracic echocardiography revealed an LVEF of 20% to 25% with global hypokinesia. Laboratory evaluation showed markedly elevated troponin levels (23 000 ng/L), and Holter monitoring confirmed frequent PVCs, including short-couplet patterns. Coronary computed tomography angiography (CCTA) ruled out coronary artery stenosis.

Based on the clinical presentation, markedly elevated cardiac biomarker levels, and the absence of obstructive coronary artery disease on CCTA, acute myocarditis was suspected. CMR demonstrated an LVEF of 30% with global hypokinesia, increased myocardial T2 signal intensity consistent with myocardial edema, and nonischemic late gadolinium enhancement (LGE) involving the midwall and subepicardial layers of the basal-to-mid inferoseptal segments. These findings fulfilled the revised Lake Louise criteria for acute myocarditis. No pericardial effusion or intracardiac thrombus was identified. Viral serologic and autoimmune evaluations performed during the acute presentation were negative.

The patient was treated with beta-blockers, ARNI, MRA, and SGLT2i, with gradual symptomatic improvement. A follow-up echocardiogram 3 months later showed improvement in LVEF to 40% with persistent inferoseptal hypokinesia. She reported New York Heart Association (NYHA) class I–II symptoms, with no recurrence of chest pain or dyspnea.

Repeat Holter monitoring showed a reduced PVC burden. Serial echocardiograms confirmed a stable LVEF of approximately 40%.

Two years later, she expressed a desire to proceed with frozen embryo transfer (FET) and was referred to the Multidisciplinary Cardio-Obstetrics Clinic at Al-Zahra University Hospital for preconception cardiovascular evaluation and counseling.

Discussion

Pregnancy in women with a history of myocarditis presents a complex clinical scenario because of the absence of disease-specific guidelines and the potential for residual myocardial vulnerability. Myocarditis, especially when associated with LV systolic dysfunction, has been linked to increased arrhythmic risk, persistent myocardial fibrosis, and an unpredictable response to the hemodynamic stress of pregnancy.[9,10] Although most patients improve with GDMT, residual myocardial injury, particularly in the form of LGE on CMR, may confer ongoing risk even when LVEF normalizes.[11]

Pregnancy After Myocarditis: What Do We Know?

There are no specific recommendations from the ESC or AHA regarding pregnancy after recovery from myocarditis. However, because myocarditis often leads to nonischemic cardiomyopathy, current pregnancy risk-stratification models for cardiomyopathy are typically extrapolated to these patients.[12,13]

The 2025 ESC guidelines on cardiovascular disease in pregnancy classify pregnancy as contraindicated (World Health Organization [WHO] class IV) in women with symptomatic HF, LVEF less than 30%, or NYHA class III–IV symptoms. In contrast, for women with an LVEF greater than 45% and no symptoms, pregnancy may be considered (WHO class II–III) with careful monitoring and thorough preconception assessment.[5] Importantly, LVEF alone is insufficient for risk stratification. The presence of nonischemic LGE on CMR has been associated with adverse long-term outcomes-including ventricular arrhythmias, HF events, and mortality—even in patients with partially or completely recovered LV function.[11,14] Therefore, CMR and functional testing (eg, dobutamine stress echocardiography) should be incorporated into the preconception evaluation. Arrhythmia burden should also be taken into consideration, particularly because pregnancy-related changes in autonomic tone and plasma volume can exacerbate latent arrhythmogenic substrates. Holter monitoring or extended rhythm surveillance may be indicated in selected cases.[15,16]

In summary, pregnancy may be possible for selected women with recovered LVEF and no residual myocardial fibrosis or arrhythmias. Be that as it may, risk stratification should be individualized and guided by a multidisciplinary cardio-obstetrics team.

2. Risk Stratification: Role of CMR, EF, and Dobutamine Stress Echocardiography

Advanced imaging and functional testing provide important complementary information for risk stratification in women with previous myocarditis who are considering pregnancy. CMR remains the reference standard for noninvasive myocardial tissue characterization. According to the updated 2018 Lake Louise criteria, persistent nonischemic LGE may reflect residual myocardial scar or fibrosis, even in the absence of active myocardial inflammation.[12] Several studies, including the cohort reported by Gräni et al,[11] have demonstrated that the presence and extent of nonischemic LGE are associated with adverse long-term outcomes and may provide prognostic information beyond LVEF alone.

Although ventricular systolic function remains a key determinant of maternal cardiovascular risk, LVEF alone may not fully capture the risk associated with residual myocardial injury. In women with previous myocarditis, an LVEF above 45% to 50% is generally considered more reassuring, whereas borderline ventricular function (40%-45%) warrants further evaluation. In such cases, dobutamine stress echocardiography can be used to assess myocardial contractile reserve. Demonstration of contractile reserve, reflected by improvement in LV systolic function or regional wall motion during low-dose dobutamine infusion, suggests preserved inotropic capacity and has been associated with more favorable outcomes in patients with nonischemic cardiomyopathy.[14] Conversely, the absence of contractile reserve may suggest persistent myocardial dysfunction and should prompt more cautious preconception counseling and closer surveillance during pregnancy.

Given the reduced LVEF of 40% on transthoracic echocardiography, repeat CMR was performed before pregnancy to assess residual myocardial inflammation and scar burden. CMR demonstrated a mildly reduced LVEF of 45% and persistent nonischemic LGE involving the previously affected inferoseptal segments, consistent with residual myocardial scar, without evidence of ongoing myocardial inflammation. Quantitative assessment of fibrosis burden was not available in the original CMR report.

During the subsequent follow-up period, no clinical manifestations suggestive of an underlying systemic autoimmune or rheumatologic disease were identified.

Considering the persistent mild LV systolic dysfunction on follow-up echocardiography and residual nonischemic myocardial scar on repeat CMR, the patient was considered to be at intermediate-to-high maternal cardiovascular risk

(modified WHO class III). Multidisciplinary preconception counseling involving cardiology, maternal–fetal medicine, and reproductive medicine was conducted. It comprehensively covered potential adverse fetal outcomes and maternal risks, including worsening HF, deterioration in LV systolic function, ventricular arrhythmias, hospitalization for cardiovascular complications, and the uncertain prognostic implications of residual myocardial fibrosis. Despite these risks and the limited evidence regarding pregnancy after myocarditis, the patient expressed a strong desire to proceed with FET.

Accordingly, potentially teratogenic HF medications-including sacubitril/valsartan, spironolactone, and SGLT2i-were discontinued before conception in accordance with contemporary HF and cardio-obstetrics recommendations. Hydralazine and isosorbide dinitrate were introduced as pregnancy-compatible alternatives, while beta-blocker therapy was continued. For accurate assessment of myocardial contractile reserve, beta-blocker therapy was withheld for 48 to 72 hours before low-dose dobutamine stress echocardiography and was resumed thereafter. Comprehensive preconception risk stratification also included repeat CMR, 48-hour Holter monitoring, and low-dose dobutamine stress echocardiography. The demonstration of preserved myocardial contractile reserve on low-dose dobutamine stress echocardiography provided additional reassurance regarding the patient's ability to tolerate the hemodynamic stress of pregnancy and informed multidisciplinary counseling.

3. Pregnancy Outcomes in Women with Prior Myocarditis or LV Dysfunction

Data on pregnancy outcomes in women with prior myocarditis are limited. Most available studies address dilated or peripartum cardiomyopathies, which share pathophysiologic features with myocarditis-related cardiomyopathy.[18,19] In women with recovered function (LVEF >50%) and no fibrosis, pregnancy is usually well tolerated. Still, even in these cases, residual LGE has been associated with increased arrhythmic risk and long-term deterioration.[11,20]

In women with a persistent LVEF less than 45%, the risks include HF exacerbation, ventricular arrhythmias, thromboembolic events, and adverse obstetric outcomes such as preterm birth and fetal growth restriction.[17] The ROPAC registry found that women with an LVEF less than 45% had a 20% risk of HF during pregnancy, with higher risk in those with an LVEF less than 30% or NYHA class III–IV symptoms.[17,21]

Our patient, classified as modified WHO class III based on persistent mild LV dysfunction and residual myocardial scar, experienced an uneventful pregnancy under close multidisciplinary monitoring. During pregnancy, beta-blocker therapy was continued, whereas sacubitril/valsartan, spironolactone, and SGLT2i had been discontinued during preconception counseling because of their contraindication in pregnancy. Hydralazine and isosorbide dinitrate were prescribed as pregnancy-compatible alternatives throughout gestation. Maternal cardiovascular status was monitored with serial clinical assessments, periodic measurement of N-terminal pro–B-type natriuretic peptide (NT-proBNP) levels, and follow-up echocardiography throughout pregnancy. She remained clinically stable throughout gestation without HF hospitalization, sustained ventricular arrhythmias, thromboembolic complications, or clinically significant deterioration in LV systolic function. Delivery occurred at 37 weeks with favorable maternal and neonatal outcomes.

At the 6-month postpartum follow-up, the patient remained clinically stable without evidence of HF progression, deterioration in functional status, sustained ventricular arrhythmias, or thromboembolic complications. Follow-up echocardiography demonstrated no clinically meaningful deterioration in LV systolic function compared with the preconception assessment. GDMT was reintroduced after delivery and continued in accordance with contemporary HF guidelines.

This case supports existing evidence that carefully selected women with prior myocarditis and borderline ventricular function may tolerate pregnancy successfully when comprehensive preconception risk stratification, appropriate optimization of HF therapy before conception, and close cardio-obstetrics surveillance are provided.

4. ART and Cardiovascular Complications: An Emerging Link

The use of ART-including ovulation induction, IVF, and embryo transfer-has increased substantially in recent years. Nonetheless, the cardiovascular safety of these procedures, particularly in women with predisposing conditions, requires elucidation.

Ovarian stimulation protocols elevate estrogen and VEGF levels, increasing vascular permeability and predisposing patients to third-spacing, hypovolemia, and thrombosis. These effects may aggravate underlying cardiac dysfunction or unmask subclinical disease.[8,22]

Although myocarditis is not a commonly recognized complication of ART, a few case reports have described its onset shortly after ovulation induction. Nappi et al[23] reported a case of acute perimyocarditis following controlled ovarian stimulation with gonadotropins and hCG in a previously healthy woman. Proposed mechanisms include immune-mediated hypersensitivity reactions, cytokine release, VEGF-induced endothelial inflammation, and estrogen-mediated immune modulation.

These findings suggest that ART may serve as a trigger for myocarditis in susceptible individuals. The present case supports this hypothesis because myocarditis occurred shortly after controlled ovarian stimulation in a previously healthy woman. Although causality cannot be definitively established, the temporal association and the absence of other identifiable triggers raise concern.

The 2025 AHA Scientific Statement underscored the significance of pre-ART cardiovascular screening and individualized treatment protocols in women with known or suspected cardiac disease.[8] Cardio-obstetrics involvement is critical for monitoring patients during stimulation cycles and early pregnancy.

Although ovarian stimulation appears to be the primary immunologic and hemodynamic trigger in most ART-related cardiac complications, the safety of subsequent FET in women with prior ART-induced myocarditis remains undefined. FET protocols typically avoid high-dose gonadotropins and hCG, resulting in substantially lower systemic inflammatory and vascular effects than controlled ovarian stimulation cycles. In particular, natural or minimally stimulated FET cycles may minimize re-exposure to potential immunologic triggers implicated in ART-associated myocarditis. According to contemporary expert opinion and available cardio-obstetrics guidance, pregnancy after myocarditis should be individualized and based on a comprehensive assessment of LV function, residual myocardial scar burden, arrhythmic risk, functional capacity, and clinical stability. In selected women with recovered or stable ventricular function and no evidence of active myocardial inflammation, pregnancy may be considered following multidisciplinary counseling and careful risk stratification.[2,6,13] In such cases, FET, especially in a natural cycle, may represent a safer alternative to repeated ovarian stimulation. Nevertheless, given the uncertain risk of recurrent myocarditis, particularly if immune-mediated mechanisms are suspected, preimplantation cardiac reassessment and multidisciplinary planning remain essential.[9,21]

5. Clinical Implications and Recommendations

Based on available evidence, we propose a framework for preconception planning in women with a history of myocarditis. First, standard echocardiography should be performed to assess LVEF, regional wall motion abnormalities, and pulmonary pressures. Second, CMR should be performed to evaluate residual myocardial inflammation and scar burden, including the presence and distribution of LGE. Third, stress echocardiography may be considered in selected patients with borderline ventricular function to assess myocardial contractile reserve. Fourth, rhythm evaluation should be performed using ECG and ambulatory rhythm monitoring when clinically indicated. Fifth, ventricular function, symptoms, arrhythmic burden, functional capacity, and CMR findings should be integrated to estimate maternal cardiovascular risk, with final risk categorization based on the modified WHO classification and multidisciplinary cardio-obstetrics assessment. Sixth, for patients undergoing ART, clinicians should consider strategies to minimize hemodynamic and inflammatory stress while closely monitoring for arrhythmias, HF symptoms, and thromboembolic complications. Finally, individualized follow-up should be implemented

during pregnancy, including serial clinical assessments and echocardiographic surveillance, with delivery planning coordinated at an experienced tertiary care center.

This case reinforces the need for structured, multidisciplinary evaluation and highlights the importance of integrating cardiac imaging and functional testing into preconception assessment for women with prior myocarditis, especially in the context of ART.

Conclusions

This case adds to the limited literature describing acute myocarditis occurring shortly after controlled ovarian stimulation for ART. Although a causal relationship cannot be established, the close temporal association raises awareness of a possible link between ART-related hormonal and inflammatory changes and myocardial injury in susceptible individuals.

Importantly, this report demonstrates that pregnancy may be feasible in carefully selected women with a history of myocarditis following comprehensive preconception cardiovascular evaluation, optimization of HF therapy, and multidisciplinary cardio-obstetrics counseling. In our patient, repeat CMR, rhythm surveillance, and assessment of myocardial contractile reserve with low-dose dobutamine stress echocardiography were central to individualized risk stratification and informed clinical decision-making before embryo transfer.

For women with prior myocarditis pursuing pregnancy after ART-associated cardiac complications, management should be individualized according to LV function, residual myocardial scar, arrhythmic burden, and overall maternal cardiovascular risk. Although evidence remains limited, this case highlights the value of structured preconception assessment, shared decision-making, and close maternal cardiovascular surveillance in optimizing maternal and fetal outcomes.

Declarations:

Ethical Approval

This study was approved by the Institutional Review Board and the Ethics Committee of Isfahan University of Medical Sciences (Ethics code: IR.ARI.MUI.REC.1404.203)

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Conflict of Interest

The authors report no conflict of interest.

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