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Acute Myocardial Infarction in Pregnancy

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Acute myocardial infarction (AMI) during pregnancy or in the postpartum period is rare.

The risk of AMI is three to four times more in pregnancy relative to nonpregnant females of reproductive age group.

In the United States, the incidence of pregnancy-associated AMI is approximately 0.0062% (6.2/100,000) .

Age of patients ranged from 17 to 52 years old; 38-43% were older than 35 years. Multigravidas were found to have more PAMI.

The pathophysiological mechanism of PAMI is complex. Angiographically or on autopsy, pregnancy-related spontaneous coronary artery dissection (P-SCAD) was reported in 27–43% of patients.

However, the true incidence of P-SCAD may be underestimated for three reasons:

(1) initial presentation as sudden death,

(2) underuse or avoidance of coronary angiography in young women, and

(3) under-recognition of angiographic characteristics of the disease.

Pregnancy-related spontaneous coronary artery dissection (P-SCAD) is not typically associated with the traditional risk factors for coronary artery disease (diabetes, hypertension, smoking, family history, and hyperlipidemia).

Pregnancy-related spontaneous coronary artery dissection (P-SCAD) can occur at any time in pregnancy or after delivery and has been described in women 2 weeks post conception up to 6 weeks postpartum.

There are no controlled randomized trials, so there are no guidelines for optimal treatment of this challenging condition.

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Letter to the Editor

Treatment of acute myocardial infarction in pregnancy with coronary artery balloon angioplasty and stenting: Use of tirofiban and clopidogrel

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Abstract

Acute myocardial infarction (AMI) in pregnancy is rare and has a high mortality rate of 37–50%. The most important risk factors are

RESEARCH LETTER

ACUTE MYOCARDIAL INFARCTION DURING PREGNANCY

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Acute myocardial infarction (MI) is very uncommon … was localized in the retrosternal region, without radi-

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Case Report

Acute myocardial infarction during pregnancy: A clinical checkmate

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Case Report

A case of pregnancy-associated acute myocardial infarction with refractory ventricular fibrillation and heart failure

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ABSTRACT

Acute myocardial infarction (AMI) is rare among women of childbearing age. Spontaneous coronary artery dissection (SCAD), a rare cause of AMI, is the leading cause of pregnancy-associated acute

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PREGNANCY-RELATED SPONTANEOUS CORONARY ARTERY DISSECTION: A CASE SERIES AND LITERATURE REVIEW

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Case Series of Pregnancy-Related Spontaneous Coronary Artery Dissections

Case	Year	Age, y	Gravida/ Para	Days Postpartum	Symptoms	ECG	Diagnosis	Coronary Vessel Dissected	Management	Outcome
1	1983	27	G4P4	1	Mid-sternal chest pressure	Antero-lateral STE	Autopsy	LM, LAD, LCMX	Heparin (for presumed PE)	Death
2	1995	32	G1P1	75	Constant chest "heaviness" for 15 h	STE V3–5, TWI V1–V2	Cardiac cath	Proximal LAD	Bare-metal stent	Asymptomatic with 43% LV function at 3 y
3	2003	34	G4P4	14	Mid-sternal chest pain, RUE, LUE, and jaw pain	STE V4–V6	Cardiac cath	LM	Medical management	Asymptomatic with normal LV function at 3 y
4	2003	33	G5P5	14	Mid-sternal chest pain (rated 7/10)	STE antero-lateral leads	Cardiac cath	LAD, LM, LCMX, distal RCA	Thrombolytics (at outside ED), Then: medical management	Mild CHF, EF 35% in 2006, AICD placed in 2010
5	2006	33	G1P1	8	Substernal chest pain with radiation to RUE	Anterior peaked TW, biphasic III, aVF	Cardiac cath	LAD, CMX	Stents ×6 (2 initial and 4 additional); CABG	Mild SOB, EF 55%
6	2012	39	G8P8	7	Anterior "heaviness" with radiation to LUE	Anterior STE	Cardiac cath	LM	CABG	EF 50%–55% in 2013

AICD = automatic internal cardioverter defibrillator; CABG = coronary artery bypass graft surgery; CHF = congestive heart failure; ECG = electrocardiogram; ED = emergency department; EF = ejection fraction; LAD = left anterior descending; LCMX = left circumflex; LM = left main; LUE = left upper extremity; LV = left ventricular; PE = pulmonary embolism; RCA = right coronary artery; RUE = right upper extremity; SOB = shortness of breath; STE = ST segment elevation; TWI = T-wave inversion.

Hemodynamics During Pregnancy

Peripheral resistance ↓
↑ uterine blood flow

Blood volume ↑ 40–45%

Heart rate ↑ 10–20%

} Cardiac output ↑ 30%

Blood pressure → or ↓

Pulmonary vascular resistance ↓

Venous pressure in lower extremities ↑

During pregnancy, maternal blood is highly thrombogenic because it contains an increased concentration of clotting factors with increased platelets adhesiveness and decreased fibrinolysis.

The pathogenesis of P-SCAD remains unclear, especially in the peripartum period. Increased levels of estrogen and progesterone, enhanced vascular reactivity, or thrombophilia due to pregnancy related hypercoagulability may be potential underlying causes.

Moreover, estrogen and progesterone are thought to produce biochemical and structural changes in arterial walls, such as loss of normal elastic fibers, fragmentation of reticular fibers, and decreases in volume of acid mucopolysaccharides.

Moreover, accumulation of released eosinophils and proteases may further lead to cystic medial necrosis. Elevated cardiac output during pregnancy may enhance wall stress, particularly during labor, accompanying cystic medial necrosis and resulting in greater intramural hematoma and subsequent coronary dissection.

Other contributing factors include intense exercise, oral contraceptives, cocaine use, and strain of labor aggravate the shear stress on vulnerable blood vessels.

In P-SCAD, these factors lead to the hemorrhagic segregation of the epicardial coronary artery media, with or without intimal disruption, and creation of a false lumen within the vessel wall.

In contrast to the localized vessel wall involvement associated with coronary artery disease, P-SCAD frequently affects multiple coronary arteries with a higher incidence of anterior myocardial wall territories.

Higgins GL 3rd, Borofsky JS, Irish CB, Cochran TS, Strout TD. Spontaneous peripartum coronary artery dissection presentation and outcome. J Am Board Fam Med 2013;26:82–9.

Clinicians may not consider AMI and might be distracted by more common differential diagnoses in young pregnant female , without significant cardiac risk factors, mimicking an acute pulmonary embolism.

The diagnostic modality of P-SCAD also poses a significant challenge. Coronary angiography is a widely used clinical tool in diagnosing SCAD. However, careful application of angiography in the coronary catheterization laboratory is necessary to preclude the iatrogenic extension of the dissection.

Optical coherence tomography (OCT) or intravascular ultrasound (IVUS) can be used to enhance diagnostic capability and assist with guided percutaneous coronary intervention (PCI).

Although coronary CT angiography (CCTA) recognizes the SCAD, but the sensitivity of detection for this modality is unclear. Furthermore, CCTA has potential significant teratogenic and carcinogenic effects on the fetus due to the large dose of radiation.

There is no established consensus on management of spontaneous coronary artery dissection.

Appleby CE, Barolet A, Ing D, et al. Contemporary management of pregnancy-related coronary artery dissection: a single-centre experience and literature review. Exp Clin Cardiol 2009;14:e8–16.

Adlam D, Cuculi F, Lim C, Banning A. Management of spontaneous coronary artery dissection in the primary percutaneous coronary intervention era. J Invasive Cardiol 2010;22:549–53.

Treatment options for P-SCAD include conservative medical therapy, PCI, coronary artery bypass graft surgery (CABG), or heart transplantation. Thrombolytic therapy may be indicated for an AMI not due to a SCAD.

Thrombolytic therapy is not recommended, as it may propagate the dissection and exacerbate coronary vasospasm. Heparin and glycoprotein IIb/IIIa inhibitors are also contraindicated due to the potential of worsening the intramural hematoma.

Conservative therapy may be reasonable management in hemodynamically stable patients with P-SCAD. This management may be preferred in some cases, as intervention has associated risks, and many dissections resolve spontaneously within 4 weeks up to 1 year documented by follow-up coronary angiogram.

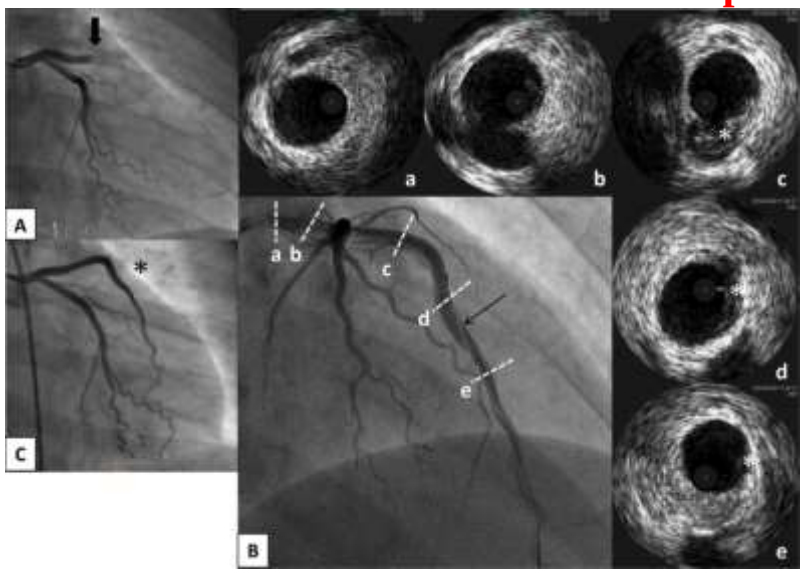
Intracoronary stent placement is favored for a distinct localized lesion of a single coronary artery without the involvement of left main coronary artery (LMCA).

The rate of successful PCI in SCAD is only 65% due to wire migration into the false lumen, as well as propagation of dissection or hematoma from stent implantation. As such, once PCI is performed, the use of intracoronary imaging to detect extent of dissection, coupled with direct stent techniques, may be the best choice.

Tweet MS, Hayes SN, Pitta SR, Simari RD, Lerman A, Lennon RJ, Gersh BJ, Khambatta S, Best PJ, Rihal CS, Gulati R. Clinical features, management, and prognosis of spontaneous coronary artery dissection. Circulation 2012;126: 579–88.

CABG is the treatment of choice in patients with multivessel involvement or LMCA or ostial LAD dissection.

Despite these modalities, it remains difficult to achieve successful revascularization without complication.



(A) Coronary angiographic imaging shows the obstructed proximal left anterior descending artery (LAD) (black arrow). (B) Coronary angiography after guide wire passage through the LAD reveals the spiral dissection (thin black arrow). Intravascular ultrasonography imaging demonstrates intramural hematoma from proximal to middle sections of the LAD (a–e, white asterisks). (C) Angiographic imaging after stent implantation shows normal flow of the LAD without dissections (black asterisk).

Though the actual mortality rate is unknown, patients who survive the initial episode of P-SCAD tend to have a favorable prognosis. In some patients, unremitting severe LV systolic dysfunction despite optimal medical management can occur.

Recurrence rate in P-SCAD is unknown. Due to potential risk and high associated morbidity and potential mortality, subsequent pregnancy is discouraged after a patient develops P-SCAD.

Although there are some controversies concerning the preferred mode of delivery, vaginal delivery is thought to be superior to cesarean section in pregnant women with acute MI because vaginal delivery avoids surgical morbidity, decreases hemodynamic fluctuations, and usually results in less blood loss. Most authors recommend epidural analgesia during labor.

Cesarean section is only recommended based on obstetric indications and in patients with unstable ischemic or hemodynamic conditions.

Effects of Cardiovascular Drugs on Fetus During Pregnancy

DRUG	POTENTIAL FETAL SIDE EFFECTS
Adenosine	Likely safe; no known teratogenic effect
Amiodarone	Contraindicated; goiter, hypothyroidism and hyperthyroidism, bradycardia, intrauterine growth restriction
Aldosterone antagonists	Contraindicated; antiandrogenic effects; oral clefts
Angiotensin-converting enzyme inhibitors	Contraindicated; IUGR, oligohydramnios, renal failure, abnormal bone ossification
Angiotensin II receptor blockers	Contraindicated; renal malformations, oligohydramnios, abnormal bone ossification
Aspirin	Safe; low-dose aspirin not harmful; high-dose aspirin associated with premature fetal duct closure
Antiplatelet drugs; Clopidogrel	Safe
Beta blockers	Relatively safe; IUGR, neonatal bradycardia, neonatal hypoglycemia Labetalol frequently used to treat hypertension Atenolol may be associated with lower-birth-weight babies when compared with other beta blockers
Calcium channel blockers	Relatively safe; few data; concern regarding uterine tone at time of delivery Nifedipine frequently used to treat hypertension Diltiazem has been reported to have possible teratogenic effects
Digoxin	Safe; no adverse effects
Flecainide	Relatively safe; limited data; used to treat fetal arrhythmias
Heparin	Safe; does not cross placenta, increased risk of subplacental bleeding
Hydralazine	Safe; no major adverse effects, maternal lupus-like syndrome reported
Furosemide	Safe; caution regarding maternal hypovolemia and reduced placental blood flow
Lidocaine	Safe; high doses may cause neonatal central nervous system depression
Methyldopa	Safe; often used to treat hypertension in pregnancy
Procainamide	Relatively safe; limited data; has been used to treat fetal arrhythmias, no major fetal side effects
Propafenone	Limited data
Sotalol	Safe; often used to treat fetal arrhythmias
Statins	Contraindicated; congenital anomalies
Warfarin	Warfarin embryopathy when used between 6 and 12 weeks' gestation, placental and fetal hemorrhage, central nervous system abnormalities

Take Home Message

AMI during pregnancy has high maternal as well as fetal mortality and morbidity and therefore highly relevant for physicians taking care of the primary assessment and resuscitation of pregnant women.

Take Home Message

Thrombolytics should be avoided during AMI in pregnancy without knowledge of coronary anatomy, as it may potentially complicate coronary dissection cases by increasing the risk of hemorrhage and further progression of the dissection.

Take Home Message

Coronary angiography is underutilized for this patient population due to radiation safety concerns. This not only helps in differentiating coronary spasm and coronary artery dissection from atherosclerotic disease but also provides a therapeutic tool.

Take Home Message

In an urgent or emergent clinical setting, the interventionalist must make decisions and recommendations that include the knowledge that the life of the conceptus depends upon the life of the mother and that speed may be a crucial factor in decision-making.

Take Home Message

Each case must be evaluated individually, based on the aforementioned factors, to determine whether to perform revascularization through percutaneous or surgical approach.

Thank You