Curr Treat Options Cardio Med (2020) 22: 56
DOI 10.1007/s11936-020-00858-2

Pregnancy and Cardiovascular Disease (N Scott, Section Editor)

Pregnancy After Spontaneous Coronary Artery Dissection (SCAD): a 2020 Update

Esther Davis, MBBS, DPhil[1,2]
Malissa J. Wood, MD[1,2,*]

Address
[*,1]Cardiology Division, Massachusetts General Hospital, 55 Fruit Street, Boston, MA, 02114, USA
Email: mjwood@mgh.harvard.edu
[2]Harvard Medical School, Boston, MA, USA

Published online: 28 October 2020

This article is part of the Topical Collection on *Pregnancy and Cardiovascular Disease*

Keywords Spontaneous coronary artery dissection · SCAD · Pregnancy · Pregnancy-associated spontaneous coronary artery dissection · Recurrence risk · Pregnancy-associated myocardial infarction

Abstract

Purpose of review Spontaneous coronary artery dissection (SCAD) is a disease which affects a predominantly female and relatively young population, some of whom have not yet completed their reproductive lives. SCAD has traditionally been considered a contraindication to future pregnancy due to concerns about the risk of recurrence and the high-risk phenotype associated with pregnancy-associated SCAD (P-SCAD). This review summarizes recent advancements in the understanding of pregnancy and reproductive health after SCAD.

Recent findings Although traditionally under-recognized and underdiagnosed, the importance of SCAD as a unique clinical entity is now recognized in a growing number of expert guidelines and consensus documents which provide advice on the management of pregnancy. Recent data, although insufficient to alter current management recommendations, offers hope that the recurrence rate in subsequent pregnancies may be lower than previously believed.

Summary Pregnancy and reproductive health for women after SCAD is a complex area with relatively limited data to guide management decisions. At present, there is insufficient data to challenge the traditional assumption that subsequent pregnancy should be avoided. Where pregnancy is pursued, thoughtful multidisciplinary management in expert women's heart health centres is vital. Going forward, increased experience in the management of all aspects of reproductive health in these women will hopefully provide data to allow more accurate understanding of risks and optimal management in this population.

Case-introduction

A 34-year-old woman presents for routine cardiology follow-up. Her history is significant for a spontaneous coronary artery dissection at age 32 and episodic migraines. The SCAD occurred 2 weeks following a first trimester miscarriage when she presented to a local hospital emergency department with a 1-hour history of retrosternal chest pain which radiated to the jaw and both arms. ECG showed anterior T wave inversions and troponin-T peaked at 0.99 ng/mL (normal < 0.03 ng/mL). Subsequent coronary angiogram revealed multivessel SCAD involving the LAD, first diagonal and third obtuse marginal. She was managed conservatively and ultimately discharged from hospital on medical therapy with a preserved ejection fraction. Investigations did not reveal any evidence of underlying rheumatological condition or vasculopathy. She has been stable since this time and has returned to normal activity. Current medications are aspirin 81 mg and metoprolol succinate 25 mg. She is now keen to pursue another pregnancy. What are the risks of recurrent SCAD in this woman with previous pregnancy-associated SCAD and how should she be counselled going forward.

Back to the clinical case

The patient is counselled that the risks of recurrence associated with further pregnancy in women with a history of spontaneous coronary artery dissection is not clearly understood but has been estimated at between 3 and 12.5%. In addition, she is advised that there is evidence that pregnancy-associated SCAD presents with a more severe phenotype than non-pregnancy-associated SCAD. Although understanding of the reasons that pregnancy is generally advised against for those with a history of SCAD, she decides to pursue further pregnancy.

Clinical case conclusions

The patient is referred for preconception review at a tertiary centre with access to high-risk obstetrics and cardiology. She subsequently conceives a singleton pregnancy and undergoes close monitoring by both cardiology and obstetrics throughout gestation. She underwent uncomplicated delivery of a healthy infant by caesarean section (CS) at 39-week gestation. Her post-natal course was uncomplicated and she has had no further SCAD events over 3 years of post-partum follow-up.

Spontaneous coronary artery dissection (SCAD) is defined as a non-atherosclerotic, non-traumatic and non-iatrogenic dissection of an epicardial coronary artery [1••]. Traditionally SCAD was both under recognized and underdiagnosed; however, there is now increasing understanding of the importance of SCAD as an important pathophysiological entity that affects a unique and otherwise largely healthy population and has specific treatment requirements which may differ from those of atherosclerotic coronary artery disease. This increased appreciation has culminated in the recent publication of the 2018 AHA scientific statement on SCAD providing expert management recommendations for these patients [1••].

SCAD is primarily a disease of relatively young women. Some registries report that up to 90% of those affected are female with an average age of 45–53 [2]. SCAD causes of up to 35% of myocardial infarction in women under 50 and 43% of infarction around the time of pregnancy [1, 3]. Although the aetiology of SCAD is unknown, there is a substantial association with arteriopathies particularly fibromuscular dysplasia which is reported to co-exist in up to 86% of patients [4]. The pathophysiology

underlying the association between pregnancy and SCAD is also incompletely understood; however, it is speculated that exposure to excess estrogen and progesterone may alter vascular wall structure in a manner that increases the likelihood of SCAD and that these changes may accumulate across pregnancies [1, 3].

Because SCAD predominantly affects a young female population, a not insignificant percentage of patients impacted will be of reproductive age. Traditionally, SCAD has been considered a contraindication to subsequent pregnancy and patients continue to be advised to avoid future pregnancy regardless of whether their SCAD event was pregnancy associated or not. This is clearly a life-changing recommendation for women who may not have started or completed their families. We review the current literature in regard to the risks of pregnancy following SCAD, how the phenotype of pregnancy-associated SCAD (P-SCAD) influences recommendations in regards to future pregnancy, recommendations of management of women who do become pregnant post-SCAD and other reproductive health issues in this population (Fig. 1).

Recommendations with regard to pregnancy after spontaneous coronary artery disease

The overall risk of recurrent SCAD is as high as 30% during medium- to long-term follow-up of 1 up to 10 years, although this estimate may be inflated by referral bias seen in quaternary centre registries [1••]. There is limited data as to

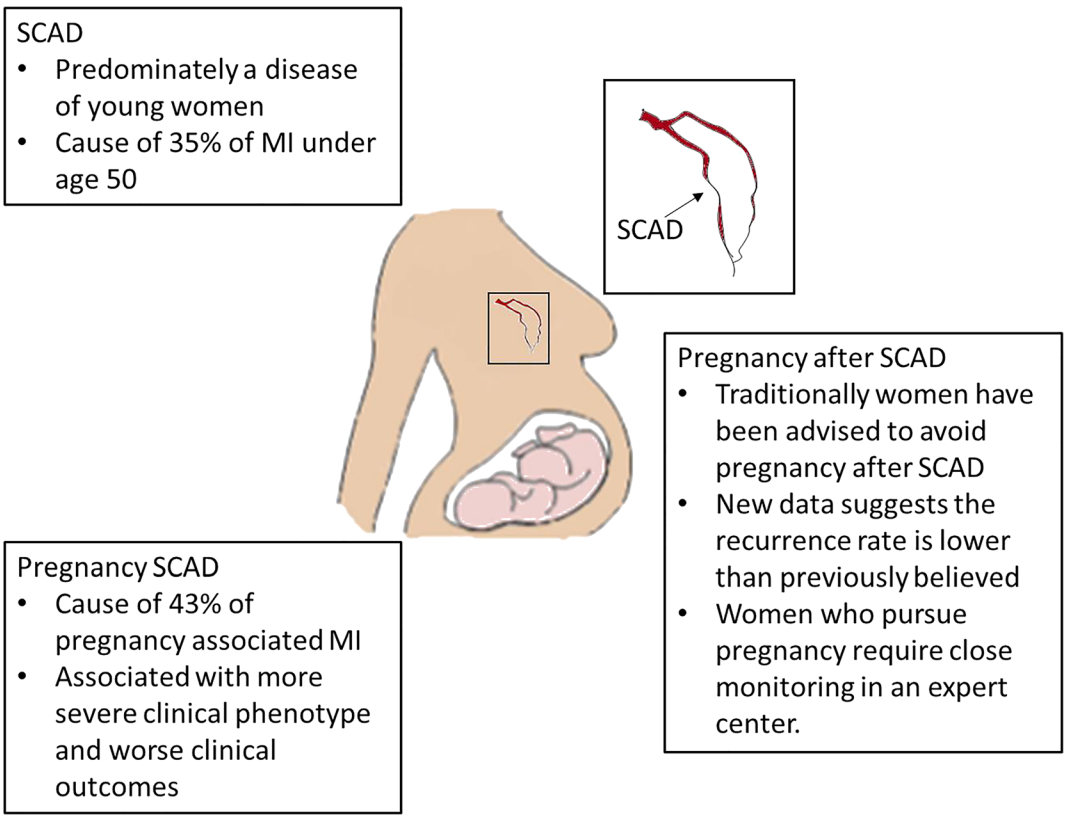

Fig. 1. SCAD and pregnancy.

whether subsequent pregnancy accelerates or has no influences on this risk of recurrence (see below). However, due to the underlying association of SCAD with pregnancy and the tendency of P-SCAD to associate with more severe clinical presentation and outcome, women have generally been advised to avoid pregnancy after SCAD regardless of whether the initial event was pregnancy associated or not.

Pregnancy-associated spontaneous coronary artery disease and differences from non-pregnancy-associated SCAD

One of the major concerns with regard to recurrent events during subsequent pregnancies relates to the seeming increase in severity of pregnancy-associated SCAD events compared with those not associated with pregnancy. Pregnancy-associated SCAD (P-SCAD) is not formally defined although it is generally taken to mean a SCAD event that occurs during pregnancy or following delivery. For research purposes, the post-partum period for P-SCAD has been limited to 12 weeks [5] although it has been suggested that cases up to a year may be considered pregnancy-related in association with breastfeeding [1••]. While SCAD was initially believed to be predominantly a condition of pregnancy, more modern data suggests that only the minority of cases are pregnancy associated [6]. Despite that this P-SCAD remains a dominant cause of pregnancy-associated myocardial infraction, there appear to be some distinct phenotypic differences between P-SCAD and non-pregnancy associated SCAD events. These differences were examined in a series of 323 women participating in a Mayo clinic registry, of whom 54 experienced pregnancy-associated SCAD. The vast majority of these women experienced SCAD in the early post-partum period or immediately following pregnancy loss and only 4 women (7.4%) were pregnant at the time of their SCAD event. In this group, P-SCAD was more likely to present with ST segment elevation MI, to affect multiple vessels or have left main involvement. It was also associated with higher rates of coronary artery bypass grafting and lower ejection fraction when compared with non-pregnancy-associated SCAD events [5]. A prior, smaller study of 23 women showed that patients with P-SCAD experienced larger, more commonly anterior infarcts and lower left ventricular ejection fractions compared with those whose events were not pregnancy related [7]. Overall, across the published P-SCAD literature, there are high rates of LAD or anterior infarction, evidence of moderate to severe LV impairment in as many as 44% of women and relatively high rates of cardiogenic shock and/or need for mechanical circulatory support [8]. Together, these data suggest that pregnancy-associated SCAD, for unclear reasons, tends to manifest a more severe phenotype than non-pregnancy-associated SCAD. The fear that a recurrent SCAD event associated with a subsequent pregnancy may be more serious in nature has contributed to the belief that pregnancy should be avoided after SCAD.

Risk of recurrent SCAD during subsequent pregnancy

Very little data exists to guide us in understanding the risk of recurrent SCAD events for women who have a subsequent pregnancy. In 2015, the Mayo clinic

published a case series detailing eight women who experienced post-SCAD pregnancies followed up for a median of 26 months. In this group, four of the initial SCAD events occurred in the peripartum period. In this cohort, one woman had recurrent SCAD 9 weeks after delivery ultimately requiring surgical revascularization. Interestingly, this individual's initial SCAD event had not been associated with pregnancy [9]. This presumptive 12.5% recurrence rate formed part of the basis on which subsequent pregnancy was advised against.

More recently, this case series was expanded to include 22 women with a combined total of 31 post-SCAD pregnancies and median follow-up of 4.6 years. In this expanded cohort, there was only one additional patient who experienced recurrent SCAD; however, this was not associated with the subsequent pregnancy and occurred more than 10 years after delivery [10••]. There is an additional reported case of an uncomplicated subsequent pregnancy in a 37-year old who had experienced a pregnancy-associated SCAD 9 weeks after the delivery of her first child [11]. In its most optimistic light, these data suggest a risk of recurrent SCAD as low as 3%. It is, however, important to note that the majority of pregnancy-associated SCAD events occur in the third trimester or early post-partum period [1••]. Published data includes a substantial number of patients with first trimester pregnancy loss (29%) and it is possible that the risk is higher in women whose pregnancies continue to term. The authors themselves noted that this data was insufficient to change current advice to avoid pregnancy [10••].

The only data available on the characteristics and pregnancy outcomes of women after SCAD are also derived from this group. These women had an average age a subsequent pregnancy of 37 years, and similar to many SCAD registries, the participants were majority white (86%). A total of 41% ($n = 9$) of women had experienced P-SCAD previously while the others had experienced a non-pregnancy-associated SCAD event. A total of 61% of the pregnancies resulted in live births of which all but one were at term [10••]. As larger SCAD registries are prospectively formed, it can be expected that case series will become available to allow a more complete understanding of the natural history of pregnancy following SCAD and what if any factors are associated with recurrence.

Risk stratification for subsequent pregnancy

Beyond traditional markers of risk for pregnancy in pregnancy with cardiovascular disease such as reduced ventricular function and the presence of connective tissue disease at this time, there is no data to guide risk stratification of pregnancy in women with a history of SCAD [12, 13].

Management of subsequent pregnancy in women with a history of spontaneous coronary artery dissection

Although women are generally advised to avoid pregnancy after SCAD, expert management is important for women who choose to pursue further pregnancies. Care of these women is based on expert consensus and general guidelines for the management of pregnancy in women with cardiovascular disease.

Optimally, these women should be managed in a tertiary centre with capacity for multidisciplinary input by high-risk obstetrics, cardiology and obstetric anaesthesia with referral prior to pregnancy to allow for timely pre-conception counselling. From a cardiac perspective, such counselling should include discussion of the risk of recurrence during pregnancy, review of baseline cardiac function with echocardiography and review of cardiac medications with particular reference to those that are contraindicated in pregnancy [1••]. It may also be necessary to consider genetic counselling in women in whom an underlying connective tissue disorder has been diagnosed [14]. Women who have persistently depressed ventricular function require particularly careful consideration. Although there is no data suggesting a higher rate of SCAD recurrence in such women, depressed ejection fraction is a risk factor for poor maternal outcomes and the risk of pregnancy in such women must be carefully and individually considered and patients counselled appropriately [12, 13, 15–19]. It has been recommended that if a women does decide to pursue pregnancy, it should be delayed at least 1 year following the SCAD event and that there may be benefit in pre-pregnancy CT coronary angiogram to confirm vessel healing [20].

The management of labour and delivery must be individualized and carefully considered. The AHA scientific statement notes that most specialists recommend vaginal delivery with passive descent and delayed Valsalva effort [1, 14]. In women with underlying connective tissue diseases, disease-specific advice is normally followed, notably for patients with an aortic root diameter of > 45 mm or vascular Ehlers-Danlos, caesarean delivery is recommended [12, 13, 16]. Post-partum management for women who experience an uncomplicated pregnancy is generally by standard guidelines. Women who experience recurrent SCAD in pregnancy or the post-partum period are managed in the same manner as women who experience a primary pregnancy-associated SCAD event as detailed below.

Management of recurrent SCAD during subsequent pregnancy

For women who experience recurrent SCAD during a subsequent pregnancy, management is by standard recommendations for P-SCAD. Management must be undertaken by a multidisciplinary team including high-risk obstetricians who can assist in advising on how to maximize fetal well-being while caring for the mother [1••]. Concerns about missed diagnosis due to the failure to consider SCAD in pregnant women are unlikely to be relevant in a population of women who have a history of the condition. Diagnosis and treatment generally follow the same pathway as in non-pregnancy-associated SCAD with cardiac catheterization with or without intracoronary imaging being standard and conservative management being preferred where possible. Both angiography and percutaneous coronary intervention where needed can be performed during pregnancy with relatively low foetal radiation dose [1, 14]. When percutaneous coronary intervention is performed in pregnancy, the necessitated dual antiplatelet therapy is associated with increased bleeding at delivery and prohibits the use of epidural anaesthesia [21]. This represents a challenge in the context of the desire to reduce Valsalva manoeuvres and maternal hemodynamic fluctuations that could

increase cardiac demand during delivery. Cardiac surgery requiring cardiopulmonary bypass during pregnancy is associated with significant maternal (7.3%) and fetal (25.9%) mortality and is therefore avoided where possible [22]. In a literature review of primary P-SCAD cases, CABG was undertaken immediately after emergency CS in six women and during pregnancy in four women. On those undertaken during pregnancy, there were two cases of foetal loss, one emergency CS and one case of premature delivery [8].

Medical management of P-SCAD requires particular attention to medication recommendations for pregnancy and lactation.

- Aspirin (81 mg or 100 mg): Aspirin is considered safe during pregnancy and lactation and does not need to be stopped prior to delivery including where epidural anaesthesia is planned [23, 24]
- Clopidogrel 75 mg: The usefulness of a second antiplatelet agent in SCAD is questioned due to the risk of extension of dissection, bleeding risk and lack of evidence of benefit [1••]. Case reports exist of successful use of clopidogrel in pregnancy; however, data is generally lacking. Should generally only be used in patients who have undergone PCI. Recommended to be discontinued 7 days before delivery based on the risk of anaesthesia complications and increased maternal bleeding risk extrapolated from major surgical data. Transition to eptifibatide infusion has been suggested as a possible approach where dual antiplatelet therapy is needed; however, data is lacking to support the safety of this approach [21, 25, 26]. No data exists on the safety of clopidogrel during lactation and it is generally avoided.
- Beta-blockers: Are associated with fetal growth restriction, however are widely used for the treatment of hypertension in pregnancy. The greatest experience in pregnancy is with labetalol and is the preferred agent. Atenolol is generally avoided during pregnancy and lactation due to greater associations with growth restriction and fetal bradycardia [1, 12, 13].
- Statins: Not generally indicated for SCAD patients due to a potential although not universally reported increased risk of recurrence [5, 27]. Statins are contraindicated during pregnancy and lactation [12, 13].
- ACE/ ARBs: Used in SCAD patients with decreased ejection fraction as part of routine heart failure therapy, however contraindicated in pregnancy due to fetotoxic effects. Captopril and enalapril have been used in lactation [12, 13].
- Anticoagulation: Heparin anticoagulation is generally stopped in SCAD patients due to risk of propagation of intramural haematoma. Where required, heparin products are safe during pregnancy and lactation [1, 12, 13].
- Anti-anginal therapy: can be indicated in post-SCAD chest pain syndrome. Non-dihydropyridine calcium channel blockers are generally avoided in pregnancy but are compatible with breastfeeding. There is limited experience with nitrates in pregnancy or lactation. [12, 13]

Timing of delivery following a SCAD event during pregnancy is controversial with some experts recommending where feasible delaying delivery for 2–3 weeks [14], which clearly will not be possible in all circumstances. Delivery decisions need to be individualized, particularly in regards to anaesthesia planning for women who have undergone coronary intervention and consideration of cardiac reserve. Beyond this, general recommendations are similar to those women with a history of SCAD who have not experienced recurrence.

Contraception after spontaneous coronary artery dissection

Although there is not at this time sufficient data to provide a clear understanding of the relationship between SCAD and female sex hormones, there is a generally held belief that such a relationship exists based on the increased prevalence in young female populations and around the time of pregnancy. Authors have speculated that exposure to excess estrogen and progesterone may alter vascular wall structure in a manner that increases the likelihood of SCAD [3]. This relationship means that while there is limited evidence to guide advice, the 2018 AHA scientific statement on SCAD recommended the avoidance of exposure to systemically absorbed hormones where possible [1••]. This presents a challenge in a subgroup of SCAD patients who desire to avoid the potential risks of future pregnancy but are advised away from hormonal contraceptives. The US CDC recommendations for medical eligibility for contraceptive use do not make specific recommendations for SCAD patients but does advise against the use of combined hormonal contraceptives and depot medroxyprogesterone acetate in women with a history of ischemic heart disease. Recommendations for progesterone-only contraceptives and levonorgestrel-releasing intrauterine device are less clear in this population with the recommendation that the benefits of initiation likely out-weigh the risks; however, there are theoretical disadvantages in continuation for women who have an event while on therapy [28]. The 2018 AHA scientific statement on SCAD recommends vasectomy for male partners, tubal ligation, and levonorgestrel-releasing intrauterine device as preferred forms of contraception [1••]. At our institution, levonorgestrel-releasing intrauterine device is used as the contraceptive of choice in women with a history of SCAD due to its efficacy and positive effects in reduction of menorrhagia in women who may require antiplatelet therapy.

Conclusions

Spontaneous coronary artery dissection is predominately a disease of young women a portion of whom will not have finished their reproductive life. The management of reproductive health after a SCAD event is complex and limited data exists to guide decision. Although SCAD events are generally considered a contra-indication to further pregnancy, recent small case series suggest that the risk of recurrence may be lower than previously believed [10••]. Despite this, there is at present insufficient evidence to challenge current recommendations against pregnancy after SCAD. Where women with a history of SCAD do conceive multidisciplinary expert management of pregnancy, delivery, and

cardiac health is paramount. Further experience in the care of these women who do choose to pursue pregnancy will provide a better understanding of the natural history of pregnancy after SCAD and may in time allow better risk stratification of these women.

Compliance with Ethical Standards

Human and Animal Rights and Informed Consent Statement

This article does not contain any studies with human or animal subjects performed by any of the authors.

Conflict of interest

Esther Davis and Malissa Wood declare that they have no conflict of interest.

References and Recommended Reading

Papers of particular interest, published recently, have been highlighted as:

•• Of major importance

1.•• Hayes SN, Kim ESH, Saw J, Adlam D, Arslanian-Engoren C, Economy KE, et al. Spontaneous coronary artery dissection: current state of the science: a scientific statement from the American Heart Association. Circulation. 2018;137(19):e523–e57.

This article summarizes current understanding of spontaneous coronary artery dissection including pathophysiology, epidimology, associated conditions and treatment recommendations.

2. Saw J, Aymong E, Sedlak T, Buller CE, Starovoytov A, Ricci D, et al. Spontaneous coronary artery dissection. Circ: Cardiovasc Interv. 2014;7(5):645–55.
3. Elkayam U, Jalnapurkar S, Barakkat MN, Khatri N, Kealey AJ, Mehra A, et al. Pregnancy-associated acute myocardial infarction. Circulation. 2014;129(16):1695–702.
4. Saw J, Ricci D, Starovoytov A, Fox R, Buller CE. Spontaneous coronary artery dissection: prevalence of predisposing conditions including fibromuscular dysplasia in a tertiary center cohort. J Am Coll Cardiol Intv. 2013;6(1):44–52.
5. Tweet MS, Hayes SN, Codsi E, Gulati R, Rose CH, Best PJM. Spontaneous coronary artery dissection associated with pregnancy. J Am Coll Cardiol. 2017;70(4):426–35.
6. Rogowski S, Maeder MT, Weilenmann D, Haager PK, Ammann P, Rohner F, et al. Spontaneous coronary artery dissection. Catheter Cardiovasc Interv. 2017;89(1):59–68.
7. Ito H, Taylor L, Bowman M, Fry ETA, Hermiller JB, Van Tassel JW. Presentation and therapy of spontaneous coronary artery dissection and comparisons of postpartum versus nonpostpartum cases. Am J Cardiol. 2011;107(11):1590–6.
8. Havakuk O, Goland S, Mehra A, Elkayam U. Pregnancy and the risk of spontaneous coronary artery dissection. Circ: Cardiovasc Interv. 2017;10(3):e004941.
9. Tweet MS, Hayes SN, Gulati R, Rose CH, Best PJM. Pregnancy after spontaneous coronary artery dissection: a case series. Ann Intern Med. 2015;162(8):598–600.
10.•• Tweet MS, Young KA, Rose CH, Best PJ, Gulati R, Hayes SN. Abstract 13043: pregnancy after spontaneous coronary artery dissection: a case series of 22 women and 31 pregnancies. Circulation. 2019;140(Suppl_1):A13043-A.

This expanded case series provides the only currently available evidence on the risks of subsequent pregnancy in women with a history of SCAD.

11. Elshatanoufy S, Kozlowski J, Dubey E, Sakr S, Gonik B. Subsequent pregnancy in a patient with spontaneous coronary artery Dissection. 2015.
12. Elkayam U, Goland S, Pieper PG, Silverside CK. High-risk cardiac disease in pregnancy: part I. J Am Coll Cardiol. 2016;68(4):396–410.
13. Elkayam U, Goland S, Pieper PG, Silversides CK. High-risk cardiac disease in pregnancy: part II. J Am Coll Cardiol. 2016;68(5):502–16.
14. Codsi E, Tweet MS, Rose CH, Arendt KW, Best PJ, Hayes SN. Spontaneous coronary artery dissection in pregnancy: what every obstetrician should know. Obstet Gynecol. 2016;128(4):731–8.
15. Regitz-Zagrosek V, Blomstrom Lundqvist C, Borghi C, Cifkova R, Ferreira R, Foidart JM, et al. ESC guidelines

on the management of cardiovascular diseases during pregnancy: the Task Force on the Management of Cardiovascular Diseases during pregnancy of the European Society of Cardiology (ESC). Eur Heart J. 2011;32(24):3147–97.
16. Regitz-Zagrosek V, Roos-Hesselink JW, Bauersachs J, Blomstrom-Lundqvist C, Cifkova R, De Bonis M, et al. 2018 ESC guidelines for the management of cardiovascular diseases during pregnancy. Kardiol Pol. 2019;77(3):245–326.
17. Siu SC, Sermer M, Colman JM, Alvarez AN, Mercier LA, Morton BC, et al. Prospective multicenter study of pregnancy outcomes in women with heart disease. Circulation. 2001;104(5):515–21.
18. Drenthen W, Boersma E, Balci A, Moons P, Roos-Hesselink JW, Mulder BJM, et al. Predictors of pregnancy complications in women with congenital heart disease. Eur Heart J. 2010;31(17):2124–32.
19. Roos-Hesselink J, Baris L, Johnson M, De Backer J, Otto C, Marelli A, et al. Pregnancy outcomes in women with cardiovascular disease: evolving trends over 10 years in the ESC Registry Of Pregnancy And Cardiac disease (ROPAC). Eur Heart J. 2019;40(47):3848–55.
20. Naderi S. Spontaneous coronary artery dissection and pregnancy. Curr Treat Options Cardiovasc Med. 2017;19(9):69.
21. Horlocker TT, Vandermeuelen E, Kopp SL, Gogarten W, Leffert LR, Benzon HT. Regional anesthesia in the patient receiving antithrombotic or thrombolytic therapy: American Society of Regional Anesthesia and Pain Medicine Evidence-Based Guidelines (Fourth Edition). Reg Anesth Pain Med. 2018;43(3):263–309.
22. Gupta A, Umapathi KK, Gupta M. Fetal outcomes after cardiac surgery during pregnancy: a meta-analysis. J Am Coll Cardiol. 2020;75(11 Supplement 1):2123.
23. Datta P, Rewers-Felkins K, Kallem RR, Baker T, Hale TW. Transfer of low dose aspirin into human milk. J Hum Lact. 2017;33(2):296–9.
24. CLASP: a randomised trial of low-dose aspirin for the prevention and treatment of pre-eclampsia among 9364 pregnant women. CLASP (Collaborative Low-dose Aspirin Study in Pregnancy) Collaborative Group. Lancet. 1994;343(8898):619–29.
25. Chernoguz A, Telem DA, Chu E, Ozao-Choy J, Tammaro Y, Divino CM. Cessation of clopidogrel before major abdominal procedures. Arch Surg. 2011;146(3):334–9.
26. Yarrington CD, Valente AM, Economy KE. Cardiovascular management in pregnancy. Circulation. 2015;132(14):1354–64.
27. Tweet MS, Hayes SN, Pitta SR, Simari RD, Lerman A, Lennon RJ, et al. Clinical features, management, and prognosis of spontaneous coronary artery dissection. Circulation. 2012;126(5):579–88.
28. Curtis KMTN, Jatlaoui TC, et al. U.S. Medical eligibility criteria for contraceptive use, 2016. MMWR Recomm Rep 2016;65(No. RR-3):1–104. https://doi.org/10.15585/mmwr.rr6503a1.

Publisher's Note