

EDITORIAL COMMENT

# Insights Into Spontaneous Coronary Artery Dissection

## Can Recurrence Be Prevented?\*

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Within the past 5 years, recognition of spontaneous coronary artery dissection (SCAD) as a cause of acute coronary syndrome (ACS) and sudden cardiac death (SCD) has improved (1). Formerly depicted in case reports or small case series and considered a rare entity, contemporary series have demonstrated SCAD in as many as 34% of women <50 years of age presenting with ACS (2), and SCAD is an important etiology of pregnancy-associated myocardial infarction (3,4). Despite enhanced awareness and diagnostic strategies, evidence regarding the natural history, outcomes, and optimal treatment strategies of SCAD remains inadequate. ACS secondary to atherosclerosis differs from SCAD in that patients are often young women without typical atherosclerotic risk factors (5,6), and percutaneous coronary interventions (PCIs) for acute SCAD are less often successful and may lead to increased complications (6,7). Importantly, SCAD recurrence has been reported to be between 12.7% to 29.0% (2,5,6,8,9), during which patients present with another ACS or SCD. In 1 case series, 14 of 102 (13.7%) of patients with SCAD presented with sudden death, and all were successfully resuscitated (10). It is not known how many patients experience SCD from SCAD and do not survive. There is active research into risk factors and strategies for prevention of recurrent SCAD (5,6).

In this issue of the *Journal*, Saw et al. (11) report the clinical characteristics and outcomes in 327 patients

evaluated at Vancouver General Hospital with a history of SCAD. Most were Caucasian women with a mean age of 52.5 years. Consistent with prior observations (12), associated conditions included fibromuscular dysplasia (FMD) (62.7%, of whom 14.1% had intracranial aneurysm), emotional and physical stressors, connective tissue disorders, and systemic inflammatory disease.

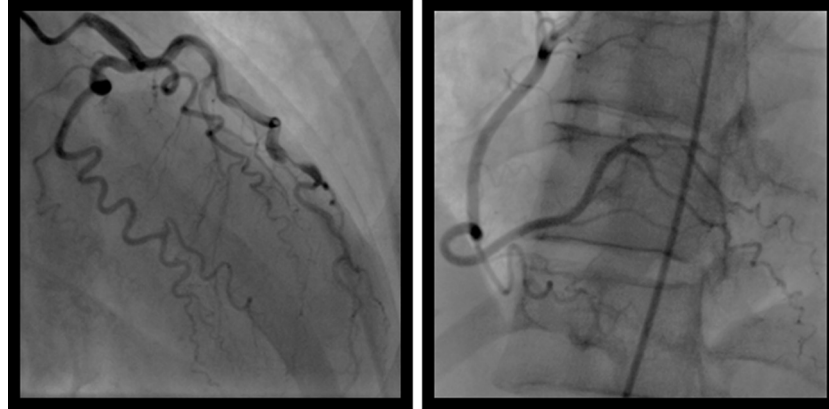
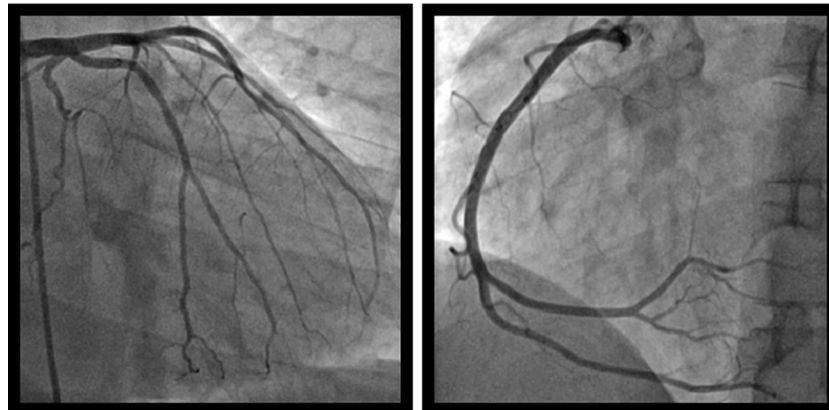
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Nearly three-quarters of patients presented with non-ST-segment myocardial infarction, and coronary flow was TIMI (Thrombolysis In Myocardial Infarction) flow grade 2 or 3 in 78.8% of patients. More than 80% of acute SCAD patients were treated medically, with only 3.3% experiencing dissection extension requiring revascularization. There were no in-hospital deaths. Similar to other observations (6,7), less than one-half of PCI procedures were successful. These findings, along with the knowledge that vessels affected by spontaneous dissection tend to heal, help confirm that a conservative strategy is appropriate in patients who are stable and have suitable coronary blood flow. However, in patients who are clinically unstable or have lack of adequate coronary blood flow (TIMI flow grade 0 to 1), revascularization is indicated to salvage the acutely ischemic myocardium. The poor PCI success rate motivates investigation of novel technical approaches (e.g., using intravascular ultrasound and optical coherence tomography to guide stent placement) and early consideration of coronary artery bypass grafting in surgical candidates.

In the current study with a median follow-up of 3.1 years, major adverse cardiac events occurred in 19.9% of patients (death 1.2%, recurrent myocardial infarction 16.8%, stroke/transient ischemic attack 1.2%, and revascularization 5.8%). Recurrent SCAD occurred in 10.4% of total patients. Using multivariate modeling, the authors

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**FIGURE 1** Comparison of Coronary Arteries With and Without Tortuosity**Coronary Arteries with Tortuosity****Coronary Arteries without Tortuosity**

The **top row** demonstrates severe coronary artery tortuosity in a patient with spontaneous coronary artery dissection of the left anterior descending coronary artery. The **bottom row** demonstrates coronary arteries without tortuosity.

identified 2 important findings: 1) the presence of hypertension increased the risk of recurrence (hazard ratio: 2.46;  $p = 0.011$ ); and 2) the use of beta-blockers decreased the risk of recurrence (hazard ratio: 0.36;  $p = 0.004$ ). Beta-blockers reduce heart rate, blood pressure, contractility, and myocardial oxygen demand, and limit adverse effects of catecholamines to the myocardium (13). One may hypothesize that beta-blockers also decrease intracoronary shear stress, thereby potentially reducing risk of another coronary dissection; however, much remains to be understood regarding the complex intracoronary hemodynamics, effects of shear stress, and subsequent remodeling (14,15).

Even though these findings are novel and important, there are several aspects of this report that should be emphasized. This was a prospective observational study, not a randomized prospective

trial. It is not known why 248 of 327 patients (76%) were treated with beta-blockers and the remainder was not. The dosage and type of beta-blocker was not specified. Also of importance, by the time the curves began to separate at 3 years (Figure 5 in Saw et al. [9]), the numbers at risk had substantially decreased. Thus, the “take home” point from this study is that beta-blockers may decrease recurrence, but these results are hypothesis generating and will require confirmation through a randomized trial.

The other important and interesting finding from this report is that the presence of hypertension is associated with a risk of recurrent SCAD. However, there is no information about whether the patients' blood pressure was under optimal control, the types of medications each patient was taking, or the duration of hypertension. Without knowledge of these

details, it is not possible to assess exactly what role hypertension played in the rate of recurrence.

Other factors have been implicated in recurrent SCAD. In a series of 246 patients, SCAD coronary tortuosity (**Figure 1**) was 4× more common among SCAD patients compared with control subjects, and severe tortuosity was associated with recurrent SCAD and FMD (8). Although coronary tortuosity may be an indicator of arteriopathy and/or FMD, recurrent dissections most often occurred in tortuous segments and hinge points of the coronaries. Flow disturbances due to tortuosity with changes to laminar flow and heterogeneity of wall shear stress may hypothetically contribute to coronary dissection susceptibility. Coronary tortuosity was not included as a variable in the present study, and requires further exploration.

This series introduces 2 important factors for SCAD recurrence, thus helping to direct future research in patients with SCAD. Before these factors can be accepted as absolute fact, a multicenter randomized clinical trial to test these hypothesis-generating findings is needed. In the meantime, this series helps to guide medical treatment and enables patients to participate in a possible preventative strategy along with other measures considered beneficial among SCAD patients, including cardiac rehabilitation, stress modification, limitation of extreme activities, and anxiety/depression treatment (16). Furthermore,

factors not associated with recurrence were identified in this study. Specifically, neither FMD nor statin therapy were associated with increased recurrence. Because statins were not found to be harmful or helpful, the present data suggest that statin therapy is appropriate for those with dyslipidemia, but may otherwise be unnecessary. Certainly, additional investigation is warranted, particularly as some SCAD patients also have concurrent coronary vasospasm, in which case statin drugs are considered beneficial (17).

Although much remains to be discovered, this series demonstrates that recurrence rates among SCAD patients are higher in patients with hypertension and lower in those receiving beta-blockers. Further research is necessary to risk-stratify patients, including identification of anatomical (8) and genetic markers (18) that may confer risk. Moving ahead, prospective data collection, continued patient engagement to facilitate large database clinical research, and development of basic science studies to further understand mechanisms and genetic predisposition are critical for understanding SCAD.

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## REFERENCES

- Hayes SN. Spontaneous coronary artery dissection (SCAD): new insights into this not-so-rare condition. *Tex Heart Inst J* 2014;41:295-8.
- Nakashima T, Noguchi T, Haruta S, et al. Prognostic impact of spontaneous coronary artery dissection in young female patients with acute myocardial infarction: a report from the Angina Pectoris-Myocardial Infarction Multicenter Investigators in Japan. *Int J Cardiol* 2016;207:341-8.
- Elkayam U, Jalnapurkar S, Barakkat MN, et al. Pregnancy-associated acute myocardial infarction: a review of contemporary experience in 150 cases between 2006 and 2011. *Circulation* 2014;129:1695-702.
- Tweet MS, Hayes SN, Codsí E, Gulati R, Rose CH, Best PJM. Spontaneous coronary artery dissection associated with pregnancy. *J Am Coll Cardiol* 2017;70:426-35.
- Tweet MS, Hayes SN, Pitta SR, et al. Clinical features, management, and prognosis of spontaneous coronary artery dissection. *Circulation* 2012;126:579-88.
- Saw J, Aymong E, Sedlak T, et al. Spontaneous coronary artery dissection: association with predisposing arteriopathies and precipitating stressors and cardiovascular outcomes. *Circ Cardiovasc Interv* 2014;7:645-55.
- Tweet MS, Eleid MF, Best PJM, et al. Spontaneous coronary artery dissection: revascularization versus conservative therapy. *Circ Cardiovasc Interv* 2014;7:777-86.
- Eleid MF, Guddeti RR, Tweet MS, et al. Coronary artery tortuosity in spontaneous coronary artery dissection: angiographic characteristics and clinical implications. *Circ Cardiovasc Interv* 2014;7:656-62.
- Saw J, Prakash R, Starovoytov A, et al. Cardiovascular outcomes in a large prospectively followed single-center cohort of spontaneous coronary artery dissection patients (abstr). *J Am Coll Cardiol* 2016;67 Suppl:457.
- Sharma S, Rozen G, Duran J, Mela T, Wood M. Sudden cardiac death in patients with spontaneous coronary artery dissection. *J Am Coll Cardiol* 2017;70:114-5.
- Saw J, Humphries K, Aymong E, et al. Spontaneous coronary artery dissection: clinical outcomes and risk of recurrence. *J Am Coll Cardiol* 2017;70:1148-58.
- Saw J, Mancini GBJ, Humphries KH. Contemporary review on spontaneous coronary artery dissection. *J Am Coll Cardiol* 2016;68:297-312.
- Amsterdam EA, Wenger NK, Brindis RG, et al. 2014 AHA/ACC guideline for the management of patients with non-ST-elevation acute coronary syndromes: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol* 2014;64:e139-228.
- Meng H, Tutino VM, Xiang J, Siddiqui A. High WSS or low WSS? Complex interactions of hemodynamics with intracranial aneurysm initiation, growth, and rupture: toward a unifying hypothesis. *AJNR Am J Neuroradiol* 2014;35-62.
- Hung OY, Molony D, Corban MT, et al. Comprehensive assessment of coronary plaque progression with advanced intravascular imaging, physiological measures, and wall shear stress: a pilot double-blinded randomized controlled clinical trial of nebivolol versus atenolol in nonobstructive coronary artery disease. *J Am Heart Assoc* 2016;5:e002764.
- Liang J, Tweet M, Hayes S, Gulati R, Hayes S. Prevalence and predictors of depression and anxiety among survivors of myocardial infarction due to spontaneous coronary artery dissection. *J Cardiopulm Rehabil Prev* 2014;34:138-42.
- Ishii M, Kaikita K, Sato K, et al. Impact of statin therapy on clinical outcome in patients with coronary spasm. *J Am Heart Assoc* 2016;5:e003426.
- Goel K, Tweet M, Olson TM, Maleszewski JJ, Gulati R, Hayes SN. Familial spontaneous coronary artery dissection: evidence for genetic susceptibility. *JAMA Intern Med* 2015;175:821-6.

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