The Medicine Forum

Volume 25 | Article 7

2024

Dissecting the Literature: A Systematic Review of Conservative Therapy Versus Revascularization in Spontaneous Coronary Artery Dissection

Avinash Saraiya, MS
Thomas Jefferson University, ars130@students.jefferson.edu

Brian Schonewald, MD
Thomas Jefferson University Hospital, brian.schonewald@jefferson.edu

Recommended Citation
Saraiya, MS, Avinash and Schonewald, MD, Brian (2024) "Dissecting the Literature: A Systematic Review of Conservative Therapy Versus Revascularization in Spontaneous Coronary Artery Dissection," *The Medicine Forum*: Vol. 25, Article 7.
DOI: https://doi.org/10.29046/TMF.025.1.006
Available at: https://jdc.jefferson.edu/tmf/vol25/iss1/7

Dissecting the Literature: A Systematic Review of Conservative Therapy Versus Revascularization in Spontaneous Coronary Artery Dissection

Avinash Saraiya, MS[1], Brian Schonewald, MD[2]

1. Sidney Kimmel Medical College, Thomas Jefferson University, Philadelphia, PA
2. Department of Internal Medicine, Thomas Jefferson University Hospital, Philadelphia, PA

INTRODUCTION

Spontaneous coronary artery dissection (SCAD) is a rare, but increasingly recognized cause of acute coronary syndrome (ACS). While previously only described in case series, the advent of advanced imaging techniques such as intravascular ultrasound (IVUS) and optical coherence tomography (OCT) has increased its prevalence dramatically. Anatomically, SCAD results from the formation of an intramural hematoma with or without intimal tear in a coronary artery, potentially leading to occlusion and ischemia. This phenomenon is especially common in women, accounting for 35% of ACS in women under the age of 50, and representing the leading cause of peripartum myocardial infarct.[1] There is a lack of consensus on whether to opt for a conservative approach or revascularization for these patients, but several small retrospective studies exist that compare the effect these management strategies have on cardiac outcomes. Consequently, treatment is usually chosen on a case basis rather than using a standard approach.[2] Conservative therapy is purely medical and typically includes antiplatelet therapy, beta-blockade, and antihypertensives, but optimal medical therapy is not well defined.[3] Revascularization options include percutaneous intervention (PCI) and coronary artery bypass grafting (CABG). The aim of this qualitative systematic review is to identify the literature involving the difference in cardiac outcomes (death, recurrent SCD, congestive heart failure, ACS) after conservative therapy versus revascularization in management of SCAD, analyze how these studies made their conclusions, and summarize the risk factors that the treatment team used to determine management strategy.

METHODS

A comprehensive electronic search of PubMed and Scopus databases were performed in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines using the following search terms: [Spontaneous Coronary Artery Dissection] AND ([DAPT] OR [SAPT] OR [Conservative Management]) AND [Revascularization]. The databases were searched from inception to March 2023, with no language or other restrictions imposed in the initial screening. A secondary search using the bibliographies of relevant articles was also performed to identify additional articles.

Study Selection Criteria

The PRISMA flow diagram (**Figure 1**) illustrates the study selection process. In this systematic literature review, studies were included if they explored the likelihood of major adverse cardiac events (MACE) of medical management versus revascularization in the management of spontaneous coronary artery dissection in all patients. Studies were excluded if they included the incorrect patient population, were case reports, had different outcomes of interest, or had no full text available. Two investigators (A.S. and B.S.) independently reviewed the full text of potentially eligible studies. Agreement between the two reviewers was required for the eligibility of studies for qualitative analysis.

Data Extraction

Data collection was performed independently and included general study characteristics such as study design, publication year, country where study was conducted, and sample size. In addition, detailed patient-level characteristics including age, sex, comorbidities (hypertension, diabetes mellitus, smoking, hyperlipidemia, postpartum), and some clinical presentation (ST, non ST-elevation myocardial infarction,

Published by Jefferson Digital Commons, 2024

and left ventricular ejection fraction) were abstracted. Study-specific thresholds for these categories stratified by medical management versus revascularization were tabulated. These thresholds included age, sex, ST-elevation, mean left ventricular ejection fraction (LVEF), involvement of the left anterior descending artery (LAD), involvement of the left main coronary artery, presence of proximal lesion, Thrombolysis in Myocardial Infarction (TIMI) flow, lesion length, and mean reference vessel diameter (RVD). Recorded outcomes included follow-up time, death, recurrent SCAD, heart failure, target vessel revascularization (TVR), LVEF, ACS, cerebrovascular accident (CVA), angina recurrence, and MACE.

RESULTS

Literature Search Results

Our initial search yielded 104 articles, and after removing duplicates, 64 articles remained to be screened. A total of 20 articles were excluded based on study title. Out of the 44 remaining articles, 7 were removed for having the incorrect patient population, 18 were removed because they were case reports, 13 were removed because they had an irrelevant outcome of interest, and 1 was removed because there was no full text available (**Figure 1**). Overall, 5 articles satisfied the inclusion criteria for qualitative analysis.

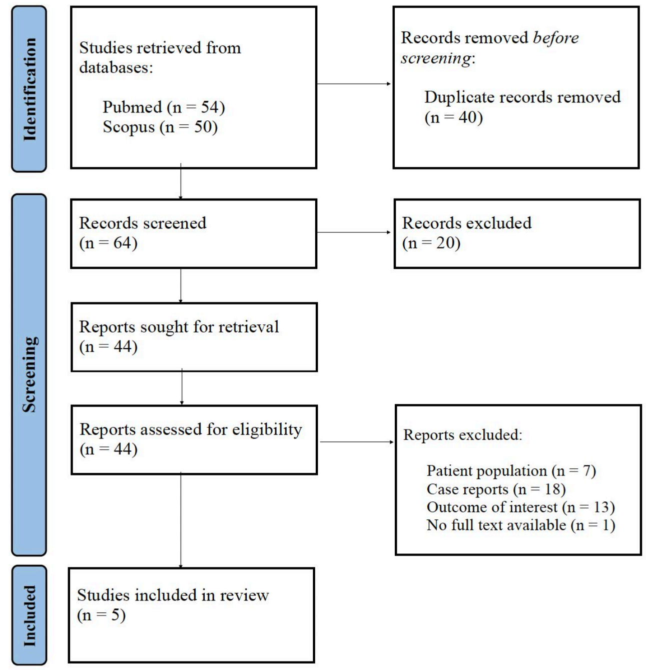

Figure 1

Study Characteristics

A total of 665 patients from 5 studies were included. From 2013 to 2023, there were 4 retrospective cohort studies, and 1 cohort study that contained both retrospective and prospective components. 2 studies were conducted in the United States, 2 in Italy, and 1 in China. Most studies were single center (80%). Liu et al. had the highest mean age and lowest percent of women (57 years and 14%, respectively). Study details, patient characteristics, and clinical presentation are summarized in **Table I**.

Table I: Baseline Characteristics of the Included Studies

ID	Author (Year)	Study Type	Country	Sample Size	Mean Age (yrs±SD)	Women (%)	HTN (%)	DM (%)	Smoking (%)	HLD (%)	Post-partum (%)	Clinical Presentation	STEMI (%)	NSTEMI (%)	Mean LVEF (%±SD)
5	Tweet (2014)	SC, R	United States	189	44±9	92	22	2	15	31	15		37	–	52±12
6	Buja (2013)	SC, R	Italy	38	51±12	84	53	5	–	–	5		50	29	56±10
2	Lettieri (2015)	MC, R/P	Italy	134	52±11	81	51	2	34	33	–		49	40	52±10
3	Jensen (2023)	SC, R	United States	186	44	80	52	8	29	43	17		48	–	51
7	Liu (2019)	SC, R	China	118	57±10	14	63	37	70	43	–		24	24	50±9

SC, Single-center; MC, Multi-center; R, Retrospective; P, Prospective; HTN, Hypertension; DM, Diabetes Mellitus; HLD, Hyperlipidemia; STEMI, ST-Elevation Myocardial Infarction; NSTEMI, Non ST-Elevation Myocardial Infarction; LVEF, Left Ventricular Ejection Fraction; –, not included in study

Intra-study Mean Characteristics: Conservative vs. Revascularization

The patient characteristics in the conservatively managed groups (C-SCAD) and the revascularization group (R-SCAD) differed within each study (**Table II**). Compared to C-SCAD, Tweet et al. had a significantly higher portion of R-SCAD patients originally present with ST-elevation (51% vs. 23%), lower mean LVEF (50% vs. 54%), TIMI flow 0-1 (48% vs 17%), and larger RVD (2.8 vs. 2.6mm).[5] **Buja et al. had a higher portion of R-SCAD patients originally present with ST-elevation (70% vs. 28%), lower mean LVEF (52% vs. 61%), more proximal vessel involvement (55% vs. 17%), shorter lesion length (67% vs. 89% length $\geq$ 30mm), and RVD $\geq$ 2.5 mm (80% vs. 56%).**[6] Lettieri et al. had a higher portion of R-SCAD patients originally present with proximal involvement (52% vs. 27%) and TIMI flow 0-1 (53% vs. 31%).[2] Jensen et al. had a higher portion of R-SCAD patients originally present with younger age (39 vs. 48 yrs), ST-elevation (67% vs. 34%), lower mean LVEF (45% vs. 55%), more LAD involvement (75% vs. 51%), and more proximal vessel involvement (35% vs. 19%).[3] Liu et al. had a higher portion of R-SCAD patients originally present with LAD involvement (72% vs. 64%) and shorter lesion length (82% vs. 68% length < 20mm).[7]

Table II: Selected Mean Characteristics by Study Group: Conservative (C) vs. Revascularization (R)

ID	Author (Year)	Mean Age (yrs)		Women (%)		Clinical Presentation	ST-Elevation (%)		Mean LVEF (%)		LAD (%)		Left Main (%)		Proximal	TIMI	Length	Mean RVD
		C R	p-value	C R	p-value		C R	p-value	C R	p-value	C R	p-value	C R	p-value	p-value	p-value	p-value	p-value
5	Tweet (2014)	44 44	0.99	92 92	0.53		23 51	**< 0.001**	54 50	**< 0.05**	57 65	0.25	1 6	0.56	0.79	**< 0.001**	0.99	**< 0.05**
6	Buja (2013)	54 49	0.27	83 85	0.89		28 70	**< 0.01**	61 52	**< 0.05**	89 75	0.79	6 20	0.18	**< 0.05**	0.06	**< 0.05**	**< 0.05**
2	Lettieri (2015)	53 52	0.58	86 75	0.12		40 63	–	53 52	0.42	32 42	–	2 3	–	**< 0.001**	**< 0.01**	0.23	–
3	Jensen (2023)	48 39	**< 0.01**	81 79	0.95		34 67	**< 0.001**	55 45	**< 0.01**	51 75	**< 0.01**	–	–	**< 0.001**	–	–	–
7	Liu (2019)	–	–	–	–		–	–	–	–	64 72	**< 0.05**	9 7	0.90	0.46	0.90	**< 0.05**	–

LVEF, Left Ventricular Ejection Fraction; LAD, Left Anterior Descending Artery; TIMI, Thrombolysis in Myocardial Infarction; RVD, Reference Vessel Diameter; –, data not included in source article; bolded if statistically significanct, determined by p < 0.05

Outcomes

Tweet at al. found no difference in death, recurrent SCAD, CHF, TVR, or follow-up LVEF (median follow-up of 28 months) between C-SCAD and R-SCAD. Between these two groups, Buja et al. found no difference in death, CHF, TVR, ACS, CVA, or angina recurrence (median follow-up of 17 months). Lettieri did have more TVR in R-SCAD (9.4% vs 1.3%), but found no difference in death, CHF, TVR, ACS, or CVA (mean follow-up of 31 months). Jensen et al. found no difference in death or freedom from MACE at 10 years (by Kaplan-Meier analysis), defined in that study as composite outcome of cardiac death, recurrent/progressive SCAD, TVR, and new CHF. Also using Kaplan-Meier analysis, but at 12 years, Liu et al. found higher freedom from death in R-SCAD (77.6% vs. 56.8%) and higher freedom from ACS in R-SCAD (47.8% vs. 24.7%). Liu et al. found no difference between C-SCAD and R-SCAD in freedom from TVR (**Table III**).

Table III: Outcomes by Study Group: Conservative (C) vs. Revascularization (R)

ID	Author (Year)	Follow-Up Time	Death (%)		Recurrent SCAD (%)		Heart Failure (%)		Target Vessel Revascularization (%)		Mean F/U LVEF (%)		ACS (%)		CVA (%)		Angina Recurrence (%)		MACE (%)	
			C R	p-value	C R	p-value	C R	p-value	C R	p-value	C R	p-value	C R	p-value	C R	p-value	C R	p-value	C R	p-value
5	Tweet (2014)	Median 2.3 years, IQR 0.7-5.6	1.1 1.1	0.92	16.0 14.7	0.70	6.4 7.4	0.47	14.9 25.3	0.06	58 55	0.09	–	–	–	–	–	–	–	–
6	Buja (2013)	Median 17.4 months, IQR 2-8	5.6 5.0	0.94	–	–	5.6 5.0	0.94	0 5.0	0.33	–	–	0 0	1.00	5.6 10.0	0.61	27.8 20.0	0.56	–	–
2	Lettieri (2015)	Mean 31±30 months	2.7 3.8	0.71	–	–	4.0 3.8	0.98	1.3 9.4	**< 0.05**	–	–	1.3 1.9	0.79	0 0	1.00	–	–	–	–
3	Jensen (2023)	Median for C 4.6 years, Median for R 5.3 years	3.0 5.0	0.07	–	–	–	–	–	–	–	–	–	–	–	–	–	–	54* 55*	0.36
7	Liu (2019)	Kaplan-Meier estimates at 12 years	56.8** 77.6**	**< 0.05**	–	–	–	–	9.1** 7.1**	0.61	–	–	24.7** 47.8**	**< 0.05**	–	–	–	–	–	–

F/U, Follow-Up; ACS, Acute Coronary Syndrome; CVA, Cerebrovascular Accident; MACE, Major Adverse Cardiac Events (precise definition varies by study); IQR, Interquartile Range; –, data not included in source article; bolded if statistically significanct, determined by p < 0.05

**Kaplan-Meier analysis at 10-year follow up, reported as freedom from MACE (composite outcome of cardiac death, recurrent/progressive SCAD, target vessel revascularization, new diagnosis of heart failure)*

***Kaplan-Meier analysis at 12-year follow up, reported as freedom from given endpoint*

DISCUSSION

Aside from Liu et al., none of the aforementioned studies showed clear evidence that one strategy is significantly more effective at preventing death, recurrent SCAD, CHF, or ACS. Of these, Lettieri et al. was the only study to conclude that R-SCAD patients had a significantly higher degree of TVR. Liu et al. likely showed different results because of the dissimilar patient population with respect to the other studies. This study took place in China and had majority male subjects who had more HTN, DM, smoking, and advanced age than the subjects in the other studies. Atherosclerosis-related SCAD was predominant in their population, but it represented the minority of patients that presented with SCAD in the other studies described herein. Atherosclerosis-related SCAD is thought to be a different entity with more evidence suggesting early revascularization compared to medical management. While the remaining studies showed no major difference in cardiac outcomes, the C-SCAD and R-SCAD cohorts within each study were vastly different, partly because of their retrospective nature.

The medication regimen used in conservative therapy was heterogeneous in these studies, as optimal medical therapy is likewise not well defined. The medications used were customized for each patient and included a combination of single or dual antiplatelet therapy, beta-blockade, and antihypertensives.

Managing SCAD with revascularization is a highly technical procedure. Tweet et al. found a PCI failure rate of 53% owing to wire entry into the false lumen, final loss of flow after stent placement, and residual stenosis.5 There is also a risk of propagating the dissection flap at the time of intervention.[4] While C-SCAD is less invasive and, based on this systematic review, will yield similar cardiac outcomes, it is not always the appropriate choice. As seen in these studies, since none of them were randomized controlled trials, patients were selected for revascularization versus conservative therapy based on specific features. Appropriate selection of revascularization based on the individual patient is paramount to achieving these outcomes.[3]

Each study identified some risk factors that the treatment team used to opt for revascularization. Of the studies that found similar cardiac outcomes between C-SCAD and R-SCAD, ST-elevation, decreased LVEF, proximal vessel involvement, and low TIMI flow on presentation were associated with revascularization. As such, we suggest that these risk factors be used to determine treatment strategy when a patient presents with SCAD. Our proposed treatment algorithm is shown in **Figure 2**. Given the lack of prospective research on this topic, this approach is optimized based on retrospective analysis of what risk factors determined treatment strategy and the fact that cardiac outcomes were similar between C-SCAD and R-SCAD. Limitations of this systematic review include the selected articles being retrospective in nature, the lack of randomized controlled trials, the heterogeneous use of medications as part of conservative therapy, and the varying populations studied in the selected articles. Further investigation is needed to further elucidate which patients would benefit from revascularization and which medication regimen patients should receive.

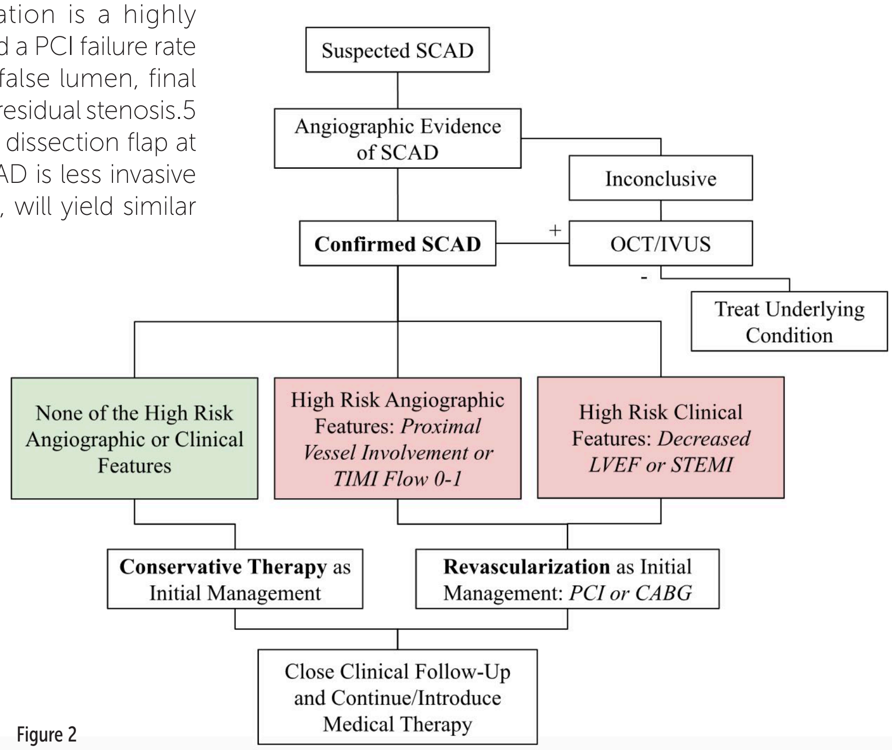

Figure 2

CONCLUSION

Our review exhibits the varied approaches to SCAD treatment that have been utilized and the lack of consensus around optimal management. The results highlight the importance of selecting a management strategy based on the presence or absence of high risk angiographic and clinical features which is demonstrated in our proposed algorithm.

REFERENCES

1. Feldbaum E, Thompson EW, Cook TS, et al. Management of spontaneous coronary artery dissection: Trends over time. Vasc Med. 2023;28(2):131-138. doi:10.1177/1358863X231155305

2. Lettieri C, Zavalloni D, Rossini R, et al. Management and Long-Term Prognosis of Spontaneous Coronary Artery Dissection. Am J Cardiol. 2015;116(1):66-73. doi:10.1016/j.amjcard.2015.03.039

3. Jensen CW, Kang L, Moya-Mendez ME, et al. Initial Management Strategy and Long-Term Outcomes in 186 Cases of Spontaneous Coronary Artery Dissection. Semin Thorac Cardiovasc Surg. Published online August 25, 2023. doi:10.1053/j.semtcvs.2023.05.001

4. Pergola V, Continisio S, Mantovani F, et al. Spontaneous coronary artery dissection: the emerging role of coronary computed tomography. Eur Heart J Cardiovasc Imaging. 2023;24(7):839-850. doi:10.1093/ehjci/jead060

5. Tweet MS, Eleid MF, Best PJ, et al. Spontaneous coronary artery dissection: revascularization versus conservative therapy. Circ Cardiovasc Interv. 2014;7(6):777-786. doi:10.1161/CIRCINTERVENTIONS.114.001659

6. Buja P, Coccato M, Fraccaro C, et al. Management and outcome of spontaneous coronary artery dissection: conservative therapy versus revascularization. Int J Cardiol. 2013;168(3):2907-2908. doi:10.1016/j.ijcard.2013.03.116

7. Liu X, Xu C, Liu C, Su X. Clinical characteristics and long-term prognosis of spontaneous coronary artery dissection: A single-center Chinese experience. Pak J Med Sci. 2019;35(1):106-112. doi:10.12669/pjms.35.1.321