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Left Main Spontaneous Coronary Artery Dissection:

Clinical Features, Management, and Outcomes

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Abstract

BACKGROUND: Spontaneous coronary artery dissection (SCAD) is an uncommon cause of acute myocardial infarction (MI) and is associated with substantial adverse events. SCAD involving the left main coronary artery (LM) is a rare but potentially life-threatening condition. Currently, minimal data on LM SCAD have been reported.

OBJECTIVES: The aim of this study was to investigate clinical features, contemporary management, and clinical outcomes of patients with LM SCAD.

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METHODS: A systematic review and pooled analysis of published case reports was conducted using “left main” and “dissection” as keywords. The authors screened 1,106 papers in MEDLINE and Embase published between 1990 and 2023.

RESULTS: The final analysis included 132 patients (mean age 40 ± 11 years, 80% women) diagnosed with LM SCAD. Remarkably, 36% of cases occurred during pregnancy, and 95% presented with acute coronary syndrome, 22% with cardiogenic shock, and 8% with ventricular arrhythmias. At 120-day median follow-up, all-cause death occurred in 9%, left ventricular assist device implantation or heart transplantation in 4%, recurrent MI in 13%, and urgent myocardial revascularization (MR) in 21%. Compared with conservative management, early revascularization by percutaneous coronary intervention or coronary artery bypass grafting significantly reduced the composite endpoint of all-cause death, left ventricular assist device implantation or heart transplantation, recurrent MI, and urgent MR (adjusted HR: 0.37; 95% CI: 0.20-0.69; $P < 0.001$).

CONCLUSIONS: LM SCAD carried significant acute morbidity and mortality. Early revascularization (percutaneous coronary intervention or coronary artery bypass graft) was associated with a lower incidence of early adverse outcomes compared with conservative management, driven largely by reduction in recurrent MI and urgent MR. These hypothesis-generating data should be confirmed in future prospective registries and clinical trials.

Keywords

acute coronary syndrome(s); cardiogenic shock; ischemic heart disease; myocardial infarction; spontaneous coronary artery dissection

Spontaneous coronary artery dissection (SCAD) is an increasingly recognized, albeit underdiagnosed, etiology of acute coronary syndrome (ACS).[1,2] SCAD is characterized by the spontaneous disruption of coronary arterial wall layers because of the formation of an intramural hematoma, resulting from an intimal tear or a spontaneous hemorrhage, typically unrelated to atherosclerosis.[1] The prevalence of SCAD in all patients presenting with ACS might reach up to 4%,[3,4] with a disproportionately higher representation in young women, in whom it may explain as much as one-third of ACS events.[5] The advent of enhanced intracoronary imaging modalities, such as intravascular ultrasound (IVUS) and optical coherence tomography (OCT), has greatly improved the ability to accurately diagnose SCAD.[6,7] The management of this condition remains controversial because of the lack of randomized studies, although a recent prospective registry reported low rates of mortality and long-term major cardiovascular adverse events with conservative treatment.[8]

Left main coronary artery (LM) SCAD represents a particularly severe form of SCAD because of the potential for extensive myocardial ischemia and sudden cardiac death (SCD). Currently, only a few reports on LM SCAD have been published. Therefore, clinical presentation and outcomes of LM SCAD remain unclear, and no specific data to guide evidence-based treatment are available. Our aim was to conduct a systematic review and patient-level pooled analysis of all published cases of LM SCAD to shed light on the clinical presentation, current management, and outcomes of this condition.

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METHODS

SEARCH STRATEGY.

We conducted a systematic search in PubMed (MEDLINE) and Embase for case reports and case series published in English until December 31, 2023, using the keywords “left main” and “dissection.” We excluded case reports and case series reporting iatrogenic dissection, as this should be considered a separate entity. We performed backward snowballing on the reference lists of the included papers to identify any additional relevant publications that may not have been initially considered. Case series were considered only if individual patient data were available. Results of the present study were reported according to the updated Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.[9]

DATA EXTRACTION.

Two independent authors (C.G. and D.R.) analyzed abstracts and full-text papers, extracting all relevant data from text, tables, and figures into an electronic database. Discrepancies were resolved by a third author (A.B.), if necessary.

Data regarding patients’ demographics, risk factors, etiology, clinical presentation, management, and outcomes were collected solely from the published papers and supplementary materials. LM SCAD was diagnosed by coronary angiography, with or without intravascular imaging (IVUS and/or OCT), in all cases. Diagnosis of fibromuscular dysplasia (FMD) was defined according to the American Heart Association criteria, which require evidence of multifocal disease in at least 1 extracoronary arterial bed.[10] Data on FMD were considered available only if the report clearly mentioned screening for FMD via vascular imaging in at least 1 extracoronary arterial bed. Similarly, data on connective tissue disorders were included only if a detailed medical history and physical examination were clearly described. We divided the study cohort according to the initial treatment approach: patients receiving initial medical therapy were assigned to the conservative strategy group, while patients receiving initial revascularization through percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) were included in the invasive strategy group.

STUDY ENDPOINTS.

The primary endpoint was a composite of the following events: all-cause death, left ventricular assist device implantation, heart transplantation, recurrent myocardial infarction (MI), and urgent myocardial revascularization.

STATISTICAL ANALYSIS.

The baseline characteristics of the 2 groups (conservative vs invasive strategy) were compared using descriptive statistics. Time-to-event analysis for the primary composite endpoint and its individual components were performed using the Kaplan-Meier method and Cox proportional hazards analysis. Subgroup analyses were performed to compare outcomes between patients in hemodynamically stable conditions and those in unstable condition and, within the invasive strategy group, between CABG and PCI. Given the nature of the study, ethics committee approval or Institutional Review Board authorization was not required.

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Statistical analyses were performed using R version 4.2.2 (R Foundation for Statistical Computing). A *P* value of <0.05 was considered to indicate statistical significance.

RESULTS

IDENTIFICATION, SCREENING, AND INCLUSION OF CASES.

The study selection flow diagram is outlined in Figure 1. A total of 1,106 studies were identified from the literature. After initial screening, 190 full reports were analyzed for eligibility. Of these studies, 29 were excluded because of lack of baseline clinical data, 9 because of lack of management strategy, and 39 because of lack of follow-up. Reports that identified LM SCAD as the cause of death through autopsy findings in patients with SCD were excluded from the study, as no management decision was taken. Consequently, 112 studies, which included 132 patients with LM SCAD from 1990 to 2023, met the inclusion criteria for the final analysis (Supplemental Appendix).

BASELINE CHARACTERISTICS.

Baseline characteristics of the included patients are presented in Tables 1 and 2. Most patients were women (80%), with a mean age at presentation of 40 ± 11 years. Traditional cardiovascular risk factors were present in only a minority of patients, with 20% being smokers and 15% diagnosed with hypertension. A history of MI was reported in 3 patients (2%). SCAD-predisposing conditions were identified in 46% of all cases. Pregnancy emerged as the most frequently associated condition (36%), with 4 of these cases occurring during delivery. FMD screening was performed in only a minority (10%) of cases.

Patients presented predominantly with chest pain (94%); less common presentations included dyspnea (26%), back pain (5%), and syncope (4%). Ventricular arrythmias occurred in 8% of patients. Nearly all patients (94%) presented with ACS, with ST-segment elevation MI diagnosed in 84 of these cases (64%). The left ventricular mean ejection fraction at admission was 40% ± 13% (range: 15%-65%). Overall, 38 patients (29%) were hemodynamically unstable at presentation, with cardiogenic shock in 30 cases (22%). Among patients in unstable condition, mechanical circulatory support was frequently required (92%), with intra-aortic balloon pumps being the most common devices (71%).

Patients often had angiographic evidence of flow-limiting (TIMI flow grade <3) dissection (74%). SCAD-involved vessels in addition to the LM were commonly observed (78%), with the left anterior descending coronary artery being the most frequently affected vessel (68%) and both left anterior descending and left circumflex coronary artery involvement present in 33% of patients. Intravascular imaging (IVUS and/or OCT) was used to aid diagnosis and/or to guide PCI in a minority of the cases (24%).

MANAGEMENT.

A conservative approach was adopted in 53 patients (40%), while an invasive strategy was adopted in 79 patients (60%), of whom 48 (61%) underwent CABG and 31 (39%) PCI. CABG was successful in 48 of 48 patients (100%), while PCI was successful in 25 of 31 patients (81%); unsuccessful cases were in 1 patient because of SCD with pulseless

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electrical activity during the procedure, in 1 patient because of cardiogenic shock after PCI requiring subsequent CABG, in 2 patients because of dissection extension proximal to the implanted stent, and in 2 patients because of inability to access the true lumen.

A conservative approach was more frequently selected for women (89% vs 73% for men; $P = 0.033$) and for those of younger age (38 years vs 42 years; $P = 0.022$). Conversely, an invasive management strategy was more common for patients with cardiogenic shock (28% vs 15%; $P = 0.056$) or for those with flow-limiting dissection (90% vs 51%; $P < 0.001$).

Among patients with available data on medication, 55% were treated with dual antiplatelet therapy, 63% with beta-blockers, and 31% with statins.

CLINICAL OUTCOMES.

Kaplan-Meier curves illustrating cumulative survival free of the primary composite endpoint are presented in the Central Illustration. A summary of the clinical outcomes is provided in Table 3.

The median follow-up period was 120 days (Q1-Q3: 30-365 days), with 35 of 43 primary endpoint events (81%) occurring during the in-hospital phase. Overall, the primary composite endpoint occurred in 32% of patients. Regarding the individual components of the primary endpoint, the rate of all-cause death was 9%, left ventricular assist device implantation or heart transplantation was performed in 4% of patients, recurrent MI occurred in 13% of patients, and urgent myocardial revascularization was required in 22% of patients. Treatment strategy (conservative vs invasive) and hemodynamic status at admission emerged as independent predictors of the primary endpoint in the Cox regression analysis (Supplemental Table 1). Indeed, the primary endpoint occurred in 27 patients managed conservatively compared with 13 patients managed invasively, with the invasive strategy demonstrating a significantly lower risk for the primary composite endpoint (adjusted HR: 0.37; 95% CI: 0.20-0.69; $P < 0.001$). Crossover from a conservative strategy to an invasive management was observed in 22 of 53 patients (42%). Of these patients, 13 (59%) underwent CABG and 9 (41%) underwent PCI.

The benefit of the invasive strategy was evident in patients in hemodynamically stable condition (HR: 0.24; 95% CI: 0.10-0.60; $P = 0.002$) and a trend toward a lower incidence of the primary endpoint was also present in patients in unstable condition (HR: 0.40; 95% CI: 0.15-1.09; $P = 0.075$). Indeed, there was no significant interaction between treatment strategy and hemodynamic status with respect to the primary endpoint (P for interaction = 0.640).

Further comparison of revascularization strategies among patients treated invasively revealed that patients undergoing CABG had a lower incidence of the primary endpoint compared with those treated with PCI (HR: 0.16; 95% CI: 0.04-0.59; $P = 0.005$). This difference was driven mainly by patients in stable condition (CABG vs PCI: HR: 0.18; 95% CI: 0.04-0.98; $P = 0.04$). Conversely, when considering patients in unstable condition, no difference between the revascularization strategies in terms of the primary endpoint was identified (CABG vs PCI: HR: 0.21; 95% CI: 0.03-1.80; $P = 0.16$; P for interaction = 0.22).

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DISCUSSION

This is the first report based on a large series of published cases that provides data on the clinical presentation, diagnostic findings, contemporary management and clinical outcomes of patients with LM SCAD (Central Illustration). Given the rarity of this entity, this study significantly contributes to the understanding of a condition that has been underrepresented in the literature. The key findings of our study are as follows: 1) LM SCAD is linked to significant morbidity and mortality, with most adverse events occurring during the acute phase; 2) an early revascularization strategy (PCI or CABG) was superior to conservative management for patients with LM SCAD among published cases, irrespective of their hemodynamic status (stable or unstable); and 3) in patients with LM SCAD in hemodynamically stable condition, CABG might represent the preferred revascularization approach.

LM SCAD represents a rare subset of SCAD, with an incidence of 1.5% to 2% of total SCAD cases from large registry data.[11–13] In line with existent literature on SCAD, our data underscore the weak association of LM SCAD with traditional cardiovascular risk factors. Pregnancy was identified as the most prevalent known predisposing factor in our study, a finding that aligns with current research highlighting its role as cause of at least one-third of MIs in pregnant and postpartum patients.[14] Importantly, prior studies have confirmed that pregnancy-related SCAD is associated with an increased likelihood of LM involvement.[15,16]

FMD has only recently emerged as a key condition associated with SCAD, with registry data showing that more than one-half of patients with SCAD have evidence of FMD when systematic vascular screening is performed.[8,17] In our study, only a few patients underwent screening, likely because of 2 main factors: the inclusion of cases predating the widespread recognition of the association between FMD and SCAD and the occurrence of early adverse events precluding imaging.

The optimal management of patients with SCAD is based on observational data and expert consensus, as no randomized trials have been conducted to date on the topic. Current guidelines suggest a conservative approach for patients with SCAD in stable condition, while recommending urgent CABG (or PCI if feasible) for cases of ongoing ischemia or hemodynamic instability.[2,18] However, LM SCAD represents, per se, a particularly high-risk scenario and, even in patients in clinically stable condition, the guidelines algorithm proposes considering CABG, with a conservative strategy reserved for selected cases only. However, this recommendation is based exclusively on expert consensus and is not yet supported by data. Our analysis of published cases demonstrates an association of LM SCAD with substantial morbidity and mortality in the acute phase, with a 9% rate of allcause death, a 4% rate of heart transplantation or left ventricular assist device implantation, and a 13% rate of recurrent MI at 4-month median follow-up. The rate of hemodynamic instability at presentation reached 29%, along with a 74% rate of flow-limiting dissections and multivessel involvement in 78% of patients. Our study revealed that an early invasive revascularization strategy yielded superior outcomes compared with conservative management, regardless of the patient's hemodynamic condition. Importantly, this was driven largely by recurrent MI and the need for urgent myocardial revascularization

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among the patients with conservatively managed LM SCAD, consistent with the early natural history of SCAD.[19] Furthermore, our study suggested that among patients treated invasively, CABG might provide improved outcomes compared with PCI, primarily in patients in hemodynamically stable condition. Indeed, CABG has the advantage over PCI of avoiding manipulation of the fragile lumen of the diseased vessel and in fact has been associated in small observational studies with good short-term outcomes in the setting of SCAD.[20] Of note, native coronary artery healing might induce competitive flow between the graft and the native vessel, potentially leading to premature graft failure, as observed in a previous study that demonstrated only 31% of graft patency at a median follow-up of 3.5 years in patients with SCAD treated with CABG.[20] In contrast, PCI also has been linked to high rates of in-stent restenosis in SCAD.[20] In summary, this study provides hypothesisgenerating data supporting an early invasive revascularization strategy in patients presenting with LM SCAD, with CABG as the preferred choice whenever possible in patients in hemodynamically stable condition. Both CABG and PCI have their respective advantages and limitations, and careful consideration is required when selecting the most appropriate approach for each individual patient.

Notably, an invasive strategy was used more frequently in men than in women, despite no significant differences between the 2 groups in terms of hemodynamic instability at presentation (31.4% vs 18.5%; $P = 0.19$) or the primary outcome (HR: 1.22; 95% CI: 0.55-2.80; $P = 0.60$). Interestingly, a prior sex-specific subanalysis from a large registry reported no significant differences in management strategies or outcomes between men and women with SCAD.[21] However, women are less likely to recognize symptoms of ACS, and physicians often underestimate ACS risk in women, potentially delaying their presentation, diagnosis, and appropriate treatment.[22]

Intracoronary imaging is underused in patients with LM SCAD, with fewer than one-quarter of patients in our cohort undergoing IVUS or OCT. Nevertheless, it is noteworthy that the use of intravascular imaging in PCI has nearly tripled over the past decade,[23,24] a trend that adds context to our findings given that one-third of the reports included in our study were published prior to 2010. Intracoronary imaging can be useful in these cases, as it makes it possible to confirm the diagnosis, assess the position of the guidewire inside the true lumen, guide PCI, and evaluate its result. However, for cases in which the LM dissection is clearly visualized on angiography, particularly when no revascularization is performed, routine use of intracoronary imaging may not be necessary. Indeed, especially in case of hemodynamic instability, intracoronary imaging might be challenging and carry its own risks, such as reperfusion delay or distal propagation of the dissection.[25] Despite the limited use of imaging, procedural success of PCI in this cohort of patients with LM SCAD is notably 81%. This success rate surpasses what has been reported in large cohort studies, which typically indicate a procedural success rate of 50% to 70% for SCAD PCI,[26,27] and may be the result of publication bias in our study.

In line with current recommendations for the management of ACS,[28,29] beta-blockers were used in almost two-thirds of the cases. In fact, retrospective data support the protective effect of beta-blockers on SCAD recurrence.[30] The BA-SCAD (Beta-Blockers and Antiplatelet Agents in Patients With Spontaneous Coronary Artery Dissection) trial

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will hopefully answer the question on the optimal antiplatelet and beta-blocker therapy in patients with SCAD.[31] Notably, the use of statins was limited; this likely reflects the unique pathogenesis of SCAD, which is not associated with atherosclerotic plaque instability, and the correspondingly low prevalence of traditional cardiovascular risk factors in our cohort.

STUDY LIMITATIONS.

First, the analysis combined primarily retrospective case reports and small case series with inherent between-study heterogeneity. Therefore, publication bias may underestimate the true event rates and overestimate procedural success, favoring an interventional approach compared with the conservative one in our study. Also, many cases of LM SCAD may go undetected or misdiagnosed given the frequent presentation as SCD. Overall, FMD screening was performed in only 10% of patients, limiting the accuracy of prevalence estimates. Moreover, follow-up was limited to <1 year, so long-term implications of the management strategy remain unknown. Differences in clinical outcomes according to the revascularization strategy (PCI or CABG) might be affected by a selection bias, as PCI might have been preferred in more critical patients and CABG in those in more stable condition.

CONCLUSIONS

This systematic analysis of published cases provides valuable insights into clinical characteristics, contemporary management, and clinical outcomes of patients presenting with LM SCAD. This condition predominantly affects young women and carries substantial morbidity and mortality in the acute phase. Compared with a conservative strategy, early revascularization (via PCI or CABG) appears to be associated with a lower incidence of early adverse outcomes, driven primarily by reduction in recurrent MI and urgent revascularization. However, these findings should be interpreted with caution and serve as hypothesis-generating evidence supporting expert recommendations. Further validation through prospective registries and clinical trials is essential to confirm these observations and guide optimal care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Dr Beneduce has received speaker fees from Abiomed, Boston Scientific, and Medtronic, all outside the submitted work. Dr Baldetti has received speaker fees from Abiomed, outside the submitted work. Dr Pagnesi has received personal fees from Abbott Laboratories, AstraZeneca, Boehringer Ingelheim, Novartis, Roche Diagnostics, and Vifor Pharma, all outside the submitted work. Dr Tweet is supported by National Heart, Lung, and Blood Institute award K23HL155506. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

ABBREVIATIONS AND ACRONYMS

ACS	acute coronary syndrome(s)
CABG	coronary artery bypass grafting

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ECG	electrocardiogram
EF	ejection fraction
FMD	fibromuscular dysplasia
HF	heart failure
IVUS	intravascular ultrasound
LM	left main coronary artery
MI	myocardial infarction
OCT	optical coherence tomography
PCI	percutaneous coronary intervention
SCAD	spontaneous coronary artery dissection
SCD	sudden cardiac death
STEMI	ST-segment elevation myocardial infarction

REFERENCES

1. Saw J, Mancini GBJ, Humphries KH. Contemporary review on spontaneous coronary artery dissection. J Am Coll Cardiol. 2016;68:297–312. [PubMed: 27417009]
2. Hayes SN, Kim ESH, Saw J, et al. Spontaneous coronary artery dissection: current state of the science: a scientific statement from the American Heart Association. Circulation. 2018;137(19):e523–e557. [PubMed: 29472380]
3. Tweet MS, Hayes SN, Pitta SR, et al. Clinical features, management, and prognosis of spontaneous coronary artery dissection. Circulation. 2012;126:579–588. [PubMed: 22800851]
4. Nishiguchi T, Tanaka A, Ozaki Y, et al. Prevalence of spontaneous coronary artery dissection in patients with acute coronary syndrome. Eur Heart J Acute Cardiovasc Care. 2016;5:263–270. [PubMed: 24585938]
5. 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;207:341–348. [PubMed: 26820364]
6. Arnold JR, West NE, van Gaal WJ, Karamitsos TD, Banning AP. The role of Intravascular Ultrasound in the management of spontaneous coronary artery dissection. Cardiovasc Ultrasound. 2008;6:24. [PubMed: 18513437]
7. Alfonso F, Paulo M, Gonzalo N, et al. Diagnosis of spontaneous coronary artery dissection by optical coherence tomography. J Am Coll Cardiol. 2012;59:1073–1079. [PubMed: 22421300]
8. Saw J, Starovoytov A, Aymong E, et al. Canadian Spontaneous Coronary Artery Dissection Cohort Study: 3-year outcomes. J Am Coll Cardiol. 2022;80:1585–1597. [PubMed: 36265953]
9. Page MJ, McKenzie JE, Bossuyt PM, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71. [PubMed: 33782057]
10. Olin JW, Gornik HL, Bacharach JM, et al. Fibromuscular dysplasia: state of the science and critical unanswered questions: a scientific statement from the American Heart Association. Circulation. 2014;129:1048–1078. [PubMed: 24548843]
11. Samuel R, Alfadhel M, McAlister C, et al. De novo left main spontaneous coronary artery dissection. JACC Cardiovasc Interv. 2022;15:2349–2351. [PubMed: 36423986]

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12. Benenati S, Giacobbe F, Zingarelli A, et al. Interventional versus conservative strategy in patients with spontaneous coronary artery dissections: insights from DISCO Registry. Circ Cardiovasc Interv. 2023;16(6):e012780. [PubMed: 37259861]
13. Clare R, Duan L, Phan D, et al. Characteristics and clinical outcomes of patients with spontaneous coronary artery dissection. J Am Heart Assoc. 2019;8:e012570. [PubMed: 31084345]
14. Tweet MS, Lewey J, Smilowitz NR, Rose CH, Best PJM. Pregnancy-associated myocardial infarction. Circ Cardiovasc Interv. 2020;13:e008687.
15. Tweet MS, Hayes SN, Codsi E, Gulati R, Rose CH, Best PJM. Spontaneous coronary artery dissection associated with pregnancy. J Am Coll Cardiol. 2017;70:426–435. [PubMed: 28728686]
16. Cade JR, Szarf G, de Siqueira MEM, et al. Pregnancy-associated spontaneous coronary artery dissection: insights from a case series of 13 patients. Eur Heart J Cardiovasc Imaging. 2017;18:54–61. [PubMed: 26928981]
17. Combaret N, Gerbaud E, Dérimay F, et al. National French registry of spontaneous coronary artery dissections: prevalence of fibromuscular dysplasia and genetic analyses. EuroIntervention. 2021;17:508–515. [PubMed: 33319763]
18. Adlam D, Alfonso F, Maas AHEM, et al. European Society of Cardiology, Acute Cardiovascular Care Association, SCAD Study Group: a position paper on spontaneous coronary artery dissection. Eur Heart J. 2018;39:3353–3368. [PubMed: 29481627]
19. Waterbury TM, Tweet MS, Hayes SN, et al. Early natural history of spontaneous coronary artery dissection. Circ Cardiovasc Interv. 2018;11:e006772. [PubMed: 30354594]
20. Tweet MS, Eleid MF, Best PJM, et al. Spontaneous coronary artery dissection revascularization versus conservative therapy. Circ Cardiovasc Interv. 2014;7:777–786. [PubMed: 25406203]
21. McAlister C, Alfadhel M, Samuel R, et al. Differences in demographics and outcomes between men and women with spontaneous coronary artery dissection. JACC Cardiovasc Interv. 2022;15:2052–2061. [PubMed: 36265936]
22. Chieffo A, Buchanan GL, Mauri F, et al. ACS and STEMI treatment: gender-related issues. EuroIntervention. 2012;8(suppl P):P27–P35. [PubMed: 22917787]
23. Smilowitz NR, Mohananey D, Razzouk L, Weisz G, Slater JN. Impact and trends of intravascular imaging in diagnostic coronary angiography and percutaneous coronary intervention in inpatients in the United States. Catheter Cardiovasc Interv. 2018;92:E410–E415. [PubMed: 30019831]
24. Koskinas KC, Nakamura M, Räber L, et al. Current use of intracoronary imaging in interventional practice—results of a European Association of Percutaneous Cardiovascular Interventions (EAPCI) and Japanese Association of Cardiovascular Interventions and Therapeutics (CVIT) clinical practice survey. EuroIntervention. 2018;14:e475–e484. [PubMed: 29537966]
25. Krittanawong C, Gulati R, Eitzman D, Jneid H. Revascularization in patients with spontaneous coronary artery dissection: where are we now? J Am Heart Assoc. 2021;10:e018551. [PubMed: 34187166]
26. Lettieri C, Zavalloni D, Rossini R, et al. Management and long-term prognosis of spontaneous coronary artery dissection. Am J Cardiol. 2015;116:66–73. [PubMed: 25937347]
27. Saw J, Starovoytov A, Humphries KH, et al. Canadian spontaneous coronary artery dissection cohort study: in-hospital and 30-day outcomes. Eur Heart J. 2019;40:1188–1197. [PubMed: 30698711]
28. Byrne RA, Rossello X, Coughlan JJ, et al. 2023 ESC guidelines for the management of acute coronary syndromes. Eur Heart J. 2023;44(38):3720–3826. [PubMed: 37622654]
29. Lawton JS, Tamis-Holland JE, Bangalore S, et al. 2021 ACC/AHA/SCAI guideline for coronary artery revascularization: executive summary: a report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. J Am Coll Cardiol. 2022;79:197–215. [PubMed: 34895951]
30. Saw J, Humphries KH, Aymong E, et al. Spontaneous coronary artery dissection: clinical outcomes and risk of recurrence. J Am Coll Cardiol. 2017;70:1148–1158. [PubMed: 28838364]
31. Alfonso F, de la Torre Hernández JM, Ibáñez B, et al. Rationale and design of the BA-SCAD (Beta-Blockers and Antiplatelet Agents in Patients With Spontaneous Coronary Artery Dissection) randomized clinical trial. Rev Esp Cardiol (Engl Ed). 2022;75:515–522. [PubMed: 34561195]

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PERSPECTIVES

WHAT IS KNOWN?

SCAD involving the LM is a rare but potentially life-threatening condition. Data on clinical features, contemporary management, and clinical outcomes of this condition are lacking.

WHAT IS NEW?

LM SCAD carries substantial morbidity and mortality in the acute phase. This pooled analysis of published cases provides hypothesis-generating data supporting current expert recommendations on the management of LM SCAD by demonstrating improved outcomes with an early revascularization strategy (PCI or CABG) compared with medical therapy, irrespective of patient's initial hemodynamic status.

WHAT IS NEXT?

Further studies are warranted to understand actual prevalence and derive evidence-based treatment algorithms to improve outcomes of this deadly condition.

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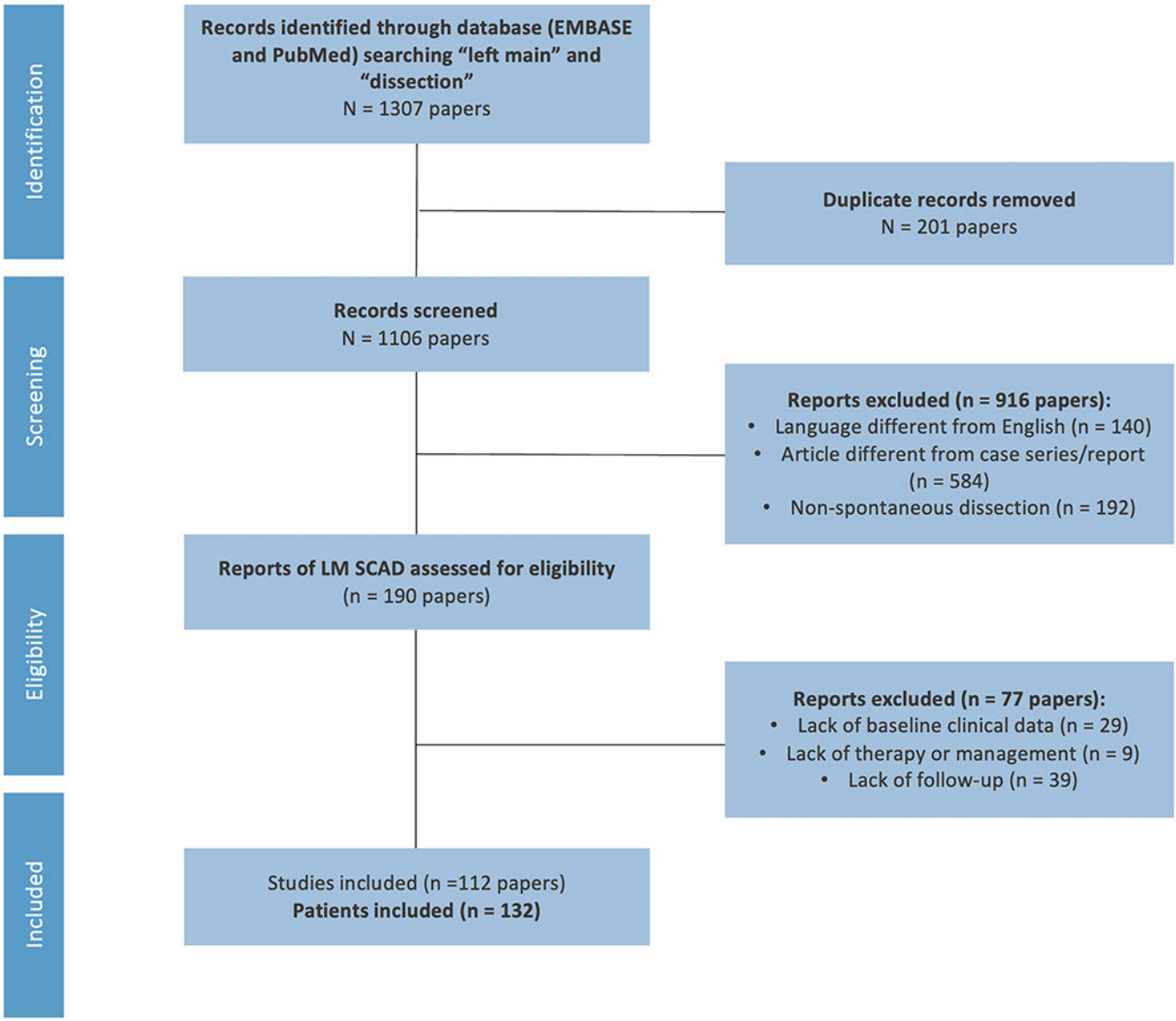

FIGURE 1. Study Selection Flow Diagram

LM = left main coronary artery; SCAD = spontaneous coronary artery dissection.

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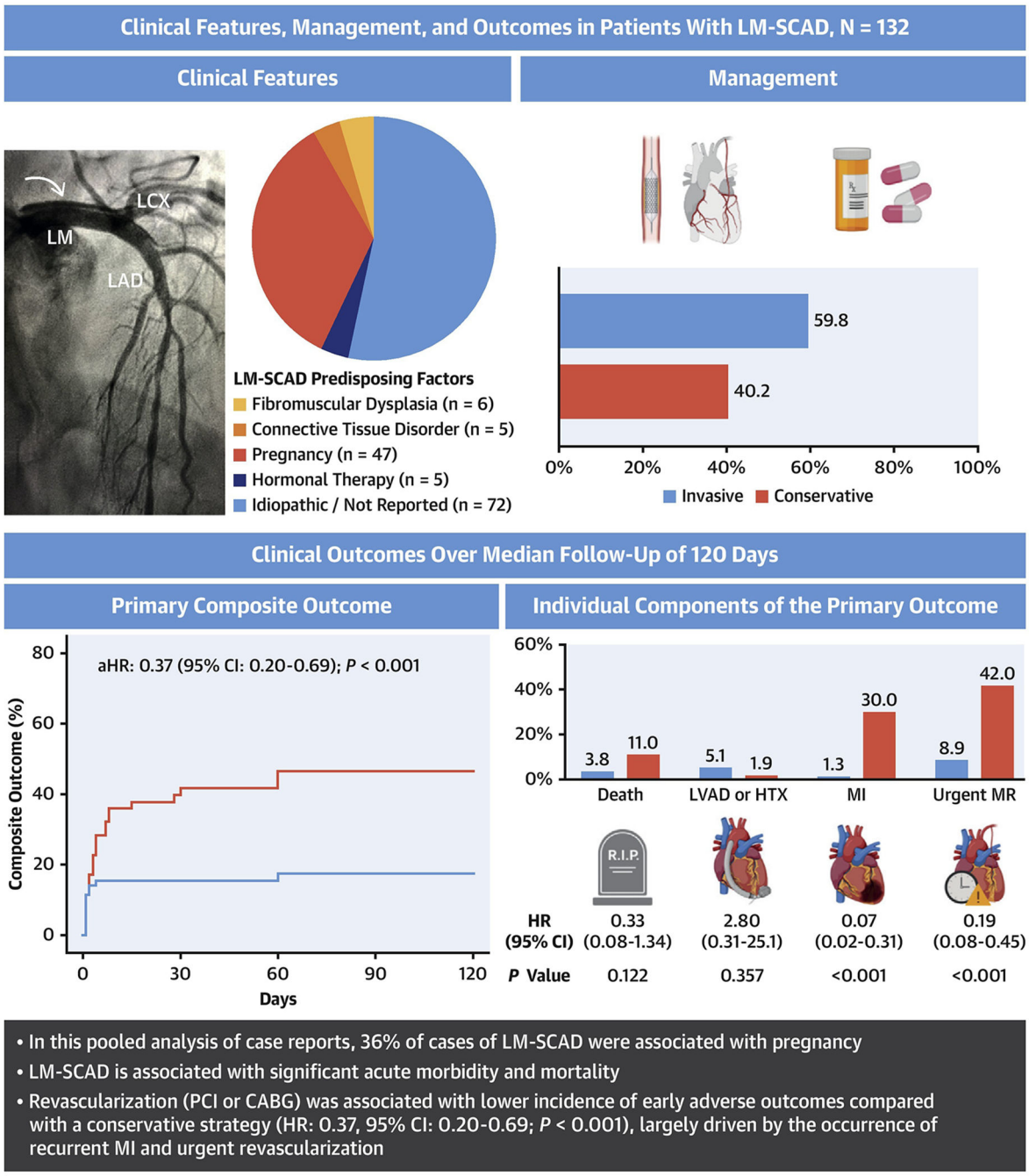

CENTRAL ILLUSTRATION. Left Main Spontaneous Coronary Artery Dissection

The primary composite outcome was death, left ventricular assist device (LVAD) implantation or heart transplantation (HTX), recurrent myocardial infarction (MI), and urgent myocardial revascularization (MR). aHR = adjusted HR; CABG = coronary artery bypass grafting; LAD = left anterior descending coronary artery; LCX = left circumflex coronary artery; LM = left main coronary artery; PCI = percutaneous coronary intervention; SCAD = spontaneous coronary artery dissection.

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TABLE 1

Patients' Clinical Characteristics

	Number of Patients With Available Data	Overall (N = 132)	Invasive (n = 79)	Conservative (n = 53)	*P* Value
Demographics					
Age, y	132	40 ± 11	42 ± 11	38 ± 9.0	0.022
Female	132	105 (80)	58 (73)	47 (89)	0.033
Cardiovascular risk factors					
Diabetes	127	6 (4.7)	5 (6.8)	1 (1.9)	0.400
Hypertension	127	19 (15)	15 (20)	4 (7.5)	0.047
Dyslipidemia	127	10 (7.9)	5 (6.8)	5 (9.4)	0.741
Current smoking	127	26 (21)	16 (22)	10 (19)	0.705
Previous MI	127	3 (2.4)	1 (1.4)	2 (3.8)	0.571
Predisposing conditions					
Fibromuscular dysplasia	13[a]	6 (46)	1 (17)	5 (71)	0.039
Connective tissue disorder	102[b]	5 (4.9)	4 (6.5)	1 (2.4)	0.648
Pregnancy associated	130	47 (36)	24 (30)	23 (43)	0.385
Current pregnancy	130	11 (25)	6 (25)	5 (22)	
Postpartum	130	36 (75)	18 (75)	18 (78)	
Hormonal therapy	131	5 (3.8)	3 (3.8)	2 (3.8)	0.988
Idiopathic/unspecified etiology	132	72 (54)	47 (59)	24 (45)	0.179
Precipitating factors					
Exercise	128	9 (7)	4 (5.2)	5 (9.8)	0.482
Emotional stress	130	6 (4.7)	3 (3.9)	3 (5.9)	0.682
Delivery	130	4 (3.1)	2 (2.6)	2 (3.9)	0.333
Recreational drugs	130	3 (2.3)	2 (2.6)	1 (2.0)	0.820
Clinical presentation					
Chest pain	130	122 (94)	73 (95)	49 (93)	0.715
Dyspnea	127	33 (26)	21 (28)	12 (23)	0.523
Back pain	127	7 (5.5)	5 (6.7)	2 (3.8)	0.699
Syncope	127	5 (4)	3 (4.0)	2 (3.9)	0.988
VT/VF	127	10 (8)	6 (8.0)	4 (7.7)	0.982
Cardiac arrest	132	13 (10)	8 (10)	5 (9.4)	0.896
Cardiogenic shock	132	30 (22)	22 (28)	8 (15)	0.056
STEMI	132	84 (64)	51 (65)	33 (62)	0.788
NSTEMI	132	36 (27)	20 (25)	16 (30)	0.538
Unstable angina	132	8 (6)	5 (6.3)	3 (5.7)	0.548
Hemodynamic instability	132	38 (29)	25 (32)	13 (25)	0.376
LVEF, %	73	40 ± 13	40 ± 14	40 ± 11	0.923

Values are mean ± SD or n (%).

[a]Data on fibromuscular dysplasia were considered available only if the report clearly mentioned screening for fibromuscular dysplasia using angiography, computed tomography, or magnetic resonance imaging in at least one extracoronary arterial bed.

[b]Data on connective tissue disorders were included only if a detailed medical history and physical examination were clearly described.

LVEF = left ventricular ejection fraction; MI = myocardial infarction; NSTEMI = non–ST-segment elevation myocardial infarction; STEMI = ST-segment elevation myocardial infarction; VF = ventricular fibrillation; VT = ventricular tachycardia.

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TABLE 2

Angiographic Findings and Initial Patient Management

	Number of Patients With Available Data	Overall (N = 132)	Invasive (n = 79)	Conservative (n = 53)	*P* Value
Angiographic characteristics					
LM only involvement	131	30 (22)	22 (28)	8 (15)	0.091
Involvement of other vessels	131	101 (78)	56 (72)	45 (85)	0.150
LAD only		40 (40)	22 (39)	18 (40)	
LCx only		11 (11)	7 (13)	4 (9)	
LAD plus LCx		44 (43)	26 (46)	18 (40)	
LAD plus RCA		3 (3)	1 (2)	2 (4)	
LCx plus RCA		0	0	0	
LAD plus LCx plus RCA		3 (3)	0	3 (7)	
Flow-limiting dissection (TIMI flow grade <3)	132	97 (74)	70 (90)	27 (51)	<0.001
Intravascular imaging (IVUS/OCT)	132	32 (24)	19 (24)	13 (25)	0.950
In-hospital management					
Conservative	132	53 (40)	0	53	
Revascularization	132	79 (60)	79	0	
CABG	132	48 (36)	48 (61)	0	
PCI	132	31 (24)	31 (39)	0	
Inotropes/vasopressors		29 (22)	22 (28)	7 (13)	0.046
MCS use		35 (26)	26 (33)	9 (17)	0.042
IABP		23 (65)	17 (65)	6 (67)	
pVAD		0	0	0	
VA ECMO		8 (23)	5 (19)	3 (33)	
VA ECMO plus IABP		2 (6)	2 (8)	0	
VA ECMO plus pVAD		2 (6)	2 (8)	0	
DAPT	87	48 (55)	25 (53)	23 (58)	0.687
Anticoagulation	87	44 (51)	23 (50)	21 (51)	0.910
Beta-blocker	79	50 (63)	20 (49)	30 (79)	0.005
ACEI/ARB	79	24 (30)	12 (29)	12 (32)	0.823
Statin	78	24 (31)	11 (27)	13 (35)	0.427

Values are n (%).

ACEI = angiotensin-converting enzyme inhibitor; ARB = angiotensin receptor blocker; CABG = coronary artery bypass grafting; DAPT = dual antiplatelet therapy; ECMO = extracorporeal membrane oxygenation; IABP = intra-aortic balloon pump; IVUS = intravascular ultrasound; LAD = left anterior descending coronary artery; LCx = left circumflex coronary artery; MCS = mechanical circulatory support; OCT = optical coherence tomography; PCI = percutaneous coronary intervention; pVAD = percutaneous ventricular assist device (ie, percutaneous transvalvular microaxial flow pump); RCA = right coronary artery; VA = venoarterial.

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TABLE 3

Composite Primary Endpoint and its Individual Components

	Overall (N = 132)	Invasive (n = 79)	Conservative (n = 53)	HR (95% CI)	*P* Value
Primary endpoint	43 (32)	13 (17)	27 (51)	0.31 (0.16-0.60)	<0.001
All-cause death	12 (8.9)	3 (3.8)	6 (11)	0.33 (0.08-1.34)	0.122
LVAD or HTX	5 (3.7)	4 (5.1)	1 (1.9)	2.80 (0.31-25.1)	0.357
Recurrent MI	17 (12.6)	1 (1.3)	16 (30)	0.07 (0.02-0.31)	<0.001
Urgent MR	29 (21.5)	7 (8.9)	22 (42)	0.19 (0.08-0.45)	<0.001

Values are n (%).

HTX = heart transplantation; LVAD = left ventricular assist device; MI = myocardial infarction; MR = myocardial revascularization.