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Regional and temporal variations of spontaneous coronary artery dissection care according to consensus recommendations: a systematic review and meta-analysis

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ABSTRACT

Aim The first expert consensus documents on management of patients with spontaneous coronary artery dissection (SCAD) were published in 2018. Worldwide quality of care, as measured by adherence to these recommendations, has not been systematically reviewed. We aim to review the proportion of patients with SCAD receiving consensus recommendations globally, regionally and, determine differences in practice before and after 2018.

Methods and results A systematic review was performed by searching four main databases (Medline, Embase, SCOPUS, CINAHL) from their inception to 16 June 2022. Studies were selected if they included patients with SCAD and reported at least one of the consensus document recommendations. 53 studies, n=8456 patients (mean 50.1 years, 90.6% female) were included. On random effects meta-analysis, 92.1% (95% CI 89.3 to 94.8) received at least one antiplatelet, 78.0% (CI 73.5 to 82.4) received beta-blockers, 58.7% (CI 52.3 to 65.1) received ACE inhibitors or aldosterone receptor blockers (ACEIs/ARBs), 54.4% (CI 45.4 to 63.5) were screened for fibromuscular dysplasia (FMD), and 70.2% (CI 60.8 to 79.5) were referred to cardiac rehabilitation. Except for cardiac rehabilitation referral and use of ACEIs/ARBs, there was significant heterogeneity in all other quality-of-care parameters, across geographical regions. No significant difference was observed in adherence to recommendations in studies published before and after 2018, except for lower cardiac rehabilitation referrals after 2018 (test of heterogeneity, p=0.012).

Conclusion There are significant variations globally in the management of patients with SCAD, particularly in FMD screening. Raising awareness about consensus recommendations and further prospective evidence about their effect on outcomes may help improve the quality of care for these patients.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Consensus documents recommended five main interventions for patients with spontaneous coronary artery dissection (SCAD): (1) at least one antiplatelet agent, (2) beta-blocker, (3) ACE inhibitor or aldosterone receptor blocker for patient with left ventricular systolic dysfunction, (4) screening for fibromuscular dysplasia (FMD) and (5) cardiac rehabilitation.

WHAT THIS STUDY ADDS

⇒ This study provides a systematic review of the current practice in managing patients with SCAD worldwide. It identifies low adherence and likely under-reporting of FMD screening and cardiac rehabilitation.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Raising awareness among clinicians about these recommendations may help improve the quality of care for these patients.

INTRODUCTION

Spontaneous coronary artery dissection (SCAD) is an important cause of myocardial infarction (MI), especially in young women.[1 2] Once thought to be a rare condition, SCAD has been reported to be the cause of up to 4% of all acute coronary syndrome (ACS)[3] and up to 35% of ACS among women less than 50 years of age.[4 5] Despite its significance, our understanding about this potentially life-threatening condition remains incomplete. No randomised data have been published to guide treatment for SCAD, and clinicians have largely relied on standard ACS guidelines. This was not ideal as these guidelines are for atherosclerotic ACS.[1]

In 2018, the American Heart Association and the European Society of Cardiology published the world-first scientific statements on the management of SCAD.[1 2] The recommendations of these documents were based on data from mostly observational studies and, where no data were available, expert

opinions. Although there are some minor variations with regards to the use of antiplatelets, the consensus recommendations for SCAD treatment are similar and can be summarised as follows: (1) at least one antiplatelet agent, (2) beta-blocker, (3) ACE inhibitor (ACEI) or an angiotensin receptor blocker (ARB) in the presence of left ventricular (LV) systolic dysfunction, (4) referral to cardiac rehabilitation and (5) screening for fibromuscular dysplasia (FMD). So far, there have been no data about the effects of these treatments on major adverse cardiovascular events (MACE). The use of beta-blockers was found to be associated with lower risks of SCAD recurrence in a recent systematic review and meta-analysis.[6] As the use of antiplatelets, beta-blockers, ACEI or ARB, and cardiac rehabilitation was also present in guidelines for atherosclerotic ACS, it is worth highlighting the following differences in SCAD consensus recommendations compared with atherosclerotic ACS guidelines: (1) optimal time for antiplatelet therapy was not defined in SCAD and dual-antiplatelets therapy was only recommended if coronary stents were used, (2) ACEIs or ARBs were only recommended in patients with impaired LV systolic function, (3) statins were not recommended in patients with SCAD, and (4) FMD screening was specific for patients with SCAD only and was not recommended in patients with atherosclerotic ACS.

Since the publication of these consensus recommendations, there has been no evaluation of the international implementation of these recommendations. Current optimal quality of care for patients with SCAD around the world is based on the proportion of patients who receive consensus-recommended treatment. The primary aim of this systematic review was to evaluate the quality of care of patients with SCAD, as measured by adherence to global consensus recommendations. Secondary aims included the time from symptom onset to angiography or revascularisation, comparison of adherence to recommendations between geographic regions and before versus after 2018 (the year when the positional papers were published). In addition, for patients presenting with acute MI (AMI), the time from presentation to angiography or revascularisation is an important marker of quality of care, irrespective of the diagnosis of SCAD. As patients with SCAD are often young and without traditional cardiovascular risk factors,[7] we hypothesised that this time would be longer compared with patients with atherosclerotic MI.

METHOD

This systematic review complies with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statements.[8] Ethics approval was not required as only data from published literature was used. This systematic review was registered with the international prospective register of systematic reviews (PROSPERO), ID number CRD42022363414.

Search strategy

A search strategy was developed with a university librarian and performed using the following databases: Medline, Embase, SCOPUS and CINAHL, from their inception up to 16 June 2022. The search was restricted to literature published in English only and using the following search terms: 'spontaneous coronary artery dissection' and 'spontaneous coronary dissection'. The full search strategy can be viewed in online supplemental table 1.

Study selection

To be included in the systematic review, studies either had to be an original cohort or original case series on consecutive patients diagnosed with SCAD and, report at least one of the quality-of-care parameters: that is, proportion of patients prescribed with antiplatelets, beta-blockers, ACEIs or ARBs (in the presence of LV systolic dysfunction) during index hospital admission or at the time of discharge, the proportion of patients screened for FMD, the proportion of patients referred to cardiac rehabilitation and, the time from symptom onset to coronary angiography or revascularisation (where appropriate). The sample size had to be more than 10 patients. Case reports, reviews including systematic reviews, editorials and comments, studies not in English and grey literature (eg, conference abstracts) were excluded.

Screening and data extraction

Literature screening using Covidence software (Covidence systematic review software, Veritas Health Innovation, Melbourne, Australia. Available at www.covidence.org) was performed by two pairs of investigators (QD-FO and QD-BS) independently, using the inclusion and exclusion criteria as defined above. An investigator (QD) performed data extraction while another coauthor (FO/BS/SZ/RZ) checked for consistency. For each study included the following parameters were extracted: author name, year of publication, country of study, site of study, city of study, study name, study aim, type of ACS, sample size, parent SCAD cohort or registry, mean or median age, proportion of female, study design, data collection time, baseline comorbidities, quality of care parameters (the proportion of patients receiving antiplatelets, beta-blockers, ACEIs/ARBs, cardiac rehabilitation, FMD screening, time to angiogram/revascularisation), in-hospital and follow-up MACE (cardiovascular death, MI and stroke) and median or mean follow-up time. With regards to FMD screening, current guidelines recommended CT angiography or magnetic resonance angiography from brain to pelvis. We defined the parameter of FMD screening as having either complete or partial screening.

Included studies were evaluated independently by two investigators for bias using the Newcastle-Ottawa Scale (NOS), a scoring system to evaluate the quality of

non-randomised studies in meta-analysis. The NOS scores studies in three domains, with higher scores mean higher quality thus lower risk of bias. The three domains of the NOS are: (1) selection, with a maximum of four points, (2) comparability, with a maximum of two points, and (3) exposure, with a maximum of three points. Included studies were classified based on their total NOS score: low risk for total score 7–9, medium risk for total score 4–6 and high risk for total score 0–3.

If there were multiple papers based on the same cohort (or registries) of SCAD patients, to avoid duplication, only the most recent publication and/or with the highest number of patients that reported the quality-of-care parameters was included in the meta-analysis. Although not included in the meta-analysis, multiple papers from the same cohort of patients offered an opportunity to assess how quality-of-care parameters for the same cohort changed with time. These studies were presented and discussed separately. If a study had a quality-of-care criterion as a selection requirement (e.g., a study on patients with SCAD who were screened for FMD), data for that criterion were not collected. At any stage of the screening and data extraction process, disagreements between two investigators were resolved by discussion and consensus, with the involvement of a third investigator (SZ) where required.

Statistical analysis

Descriptive statistics were reported using weighted means and SD. Random effects meta-analysis was used to estimate each quality-of-care parameter, reporting mean percentages and 95% CIs. The differences in these parameters across geographical regions and before and after 2018 were assessed using univariate metaregression. Heterogeneity was analysed using Cochran's Q test, which tests whether the variability in the observed effect sizes is larger than would be expected based on sampling variability alone. All analysis was conducted in R (R Foundation for Statistical Computing, Vienna, Austria), using the rma function in the metafor package.

RESULTS

The PRISMA flow chart is presented in figure 1. In total, 2554 articles were screened, and 398 articles were identified for full-text screening. From these, 325 articles were excluded (figure 1). From the remaining 73 articles, 29

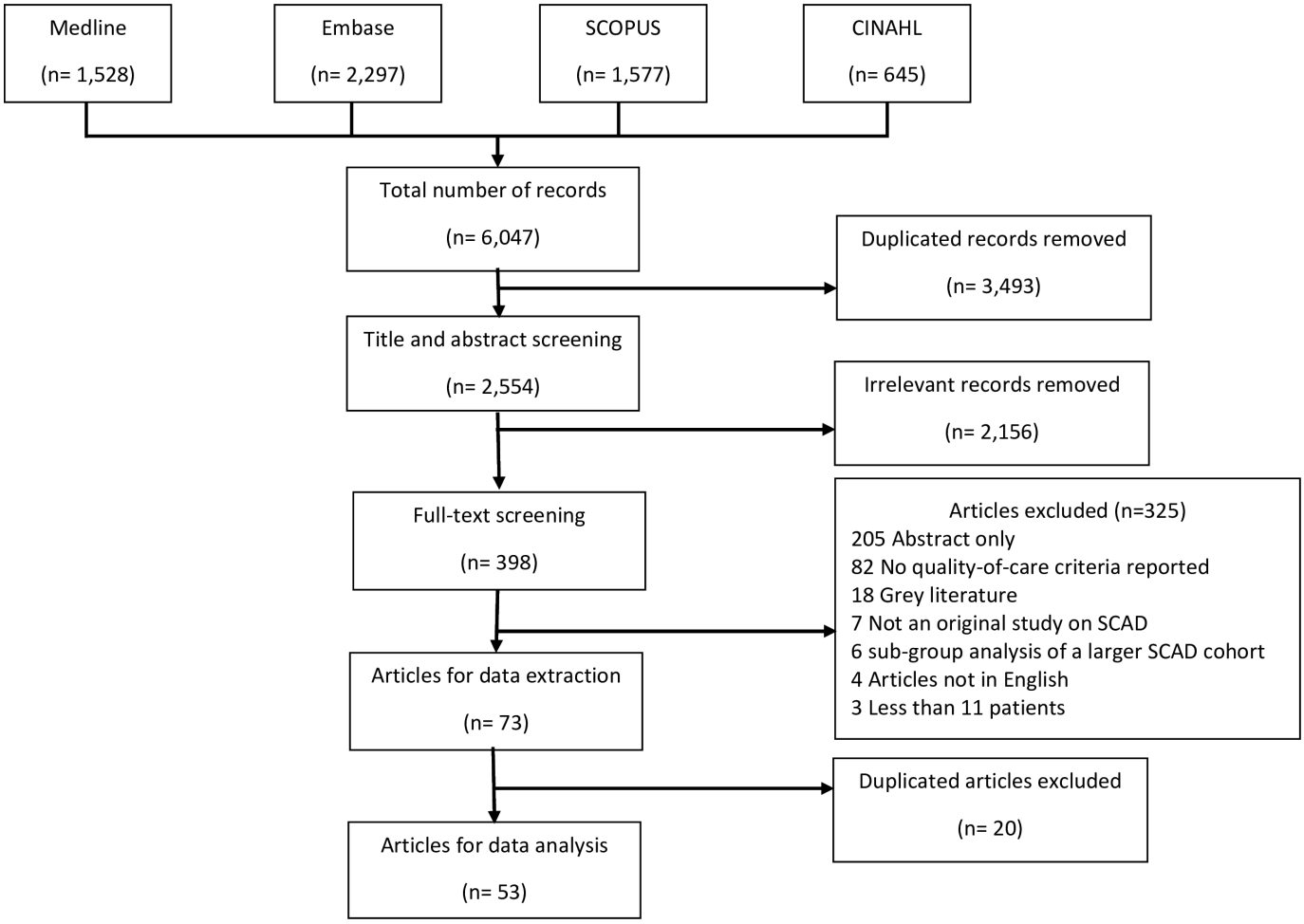

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow chart. SCAD, spontaneous coronary artery dissection.

Table 1 Studies excluded due to data duplication

Potentially duplicated studies	Common cohort	Selected study	Reason of selection
Daoulah *et al*, 2020[16] Daoulah *et al*, 2021[17] Daoulah *et al*, 2021[18] Daoulah *et al*, 2021[19] Daoulah *et al*, 2021[20]	Gulf SCAD Registry	Daoulah *et al*, 2021[20]	Latest study
Saw *et al*, 2014[21] Saw *et al*, 2017[22] Saw *et al*, 2019[23]	Canadian SCAD Registry	Saw *et al*, 2019[23]	Latest study with highest number of patients
Combaret *et al*, 2021[24] Combaret *et al*, 2022[25]	French DISCO Registry	Combaret *et al*, 2021[24]	Highest number of patients (2022 study a subgroup of the registry)
Alfonso *et al*, 2022[26] Diez-Villanueva *et al*, 2021[27] Diez-Villanueva *et al*, 2021[28] Garcia-Guimaraes *et al*, 2021[29] Garcia-Guimaraes *et al*, 2022[30]	Spanish Registry on SCAD	Garcia-Guimaraes *et al*, 2022[30]	Latest study with highest number of patients
Macaya *et al*, 2019[31] Carss *et al*, 2020[32]	UK SCAD Registry	Carss *et al*, 2020[32]	Latest study with highest number of patients
Rogowski *et al*, 2017[33] Seidl *et al*, 2021[34]	Kantonsspital St. Gallen cohort	Seidl *et al*, 2021[34]	Latest study with highest number of patients
Chen *et al*, 2019[35] Chen *et al*, 2021[36]	Kaiser Permanente Northern California cohort	Chen *et al*, 2021[36]	Latest study with highest number of patients
Kok *et al*, 2018[37] Johnson *et al*, 2022[38]	Mayo Clinic Virtual SCAD Registry	Johnson *et al*, 2022[38]	Latest study with highest number of patients
Eleid *et al*, 2014[39] Krittanawong *et al*, 2016[40] Tweet *et al*, 2014[41] Tweet *et al*, 2017[42] Tweet *et al*, 2020[43] Turley *et al*, 2020[44]	Mayo Clinic SCAD Registry	Turley *et al*, 2020[44]	Latest study with highest number of patients

DISCO, DIssezioni Spontanee COronariche; SCAD, spontaneous coronary artery dissection.

were identified to have clear or potential duplicated data from the same cohorts/registries of patients (table 1), with the most appropriate study selected for inclusion. In total, 53 articles, published between 1989 and 2022, were included, with characteristics of the included studies shown in table 2. Overall, n=8456 individuals with SCAD were analysed, mean age 50.1, 90.6% female. Studies were performed in 22 countries which were grouped into 6 geographical regions: Europe, North America, Oceania, East Asia, Middle East and South Asia. Europe had the highest number of studies (20 studies) while North American studies included the highest number of patients (4401). Medical therapy was reported in 39 studies, FMD screening in 24 and cardiac rehabilitation in 3 studies. On assessment of the included studies for risk of bias using NOS, 21 studies were classified as low risk, 28 as medium risk, and 4 as high risk (online supplemental table 2).

Study inclusion and MACE outcomes

Table 3 provides the baseline characteristics of the included studies. Before 2018, there were only 15 studies (n=1065), compared with 39 studies (n=7509) after 2018. The majority of included studies were retrospective (28), followed by prospective (12), cross-sectional (10) and mixed-method (4) studies.

Most studies reported MACE as a composite of death, non-fatal MI and revascularisation with stroke, heart failure, and recurrent or de novo SCAD also reported in some studies. MACE occurred in 7.3% of patients in-hospital and 12.4% on follow-up. Total mortality was reported in 20 studies. Follow-up time varied significantly between studies with mean follow-up ranging between 1 month and 49.2 months.

Time to angiography

Only three studies reported time to angiogram or revascularisation and the methods of report were highly heterogenous. Two studies reported the mean time from symptoms onset to angiogram, with one reported 95% CI (24 hours (4–48))[9] and the other reported standard deviation (7±5.4 days).[10] In another study,[11] door-to-balloon time was reported with the difference between patients with SCAD and other causes of AMI being not statistically significant (median 142 min for SCAD vs 99 min for other AMI, p=0.301). Due to heterogeneity, meta-analysis was not performed for this parameter.

Table 2 Characteristics of included studies

Author	Year	Sample size	Mean or median age	Female percentage	Quality-of-care parameters reported					
					Antiplatelets	Beta-blocker	ACEIs/ARBs	FMD screening	Cardiac rehabilitation	Time to angiogram
Daoulah *et al*[20]	2021	83	44	50.6	98.8	89.2	65.1	0	ND	ND
McGrath-Cadell *et al*[45]	2016	40	45	95	ND	ND	ND	47.5	ND	ND
Rashid *et al*[46]	2016	21	53.3	95.2	100	76.2	80.9	52.4	ND	ND
Adams *et al*[47]	2018	22	48.7	77.3	100	72.7	72.7	ND	ND	ND
Tarr *et al*[48]	2022	91	45.4	91.2	ND	ND	ND	47.3	ND	ND
Chou *et al*[49]	2016	70	52.3	100	95.7	85.7	48.6	ND	ND	ND
Bouchard *et al*[50]	2021	15	47.5	86.7	ND	100	ND	ND	ND	ND
Inohara *et al*[51]	2021	346	53.7	90.2	93.6	86.4	63.6	ND	ND	ND
Solomonica *et al*[52]	2020	16	52.3	93.7	25	25	18.8	ND	ND	ND
Saw *et al*[23]	2019	750	51.8	88.5	93.7	84.8	57.4	73.3	ND	ND
Sun *et al*[53]	2019	85	55	17.6	92.9	68.2	67.1	ND	ND	ND
Hui *et al*[54]	2020	70	50.8	74.3	ND	ND	ND	74.3	ND	ND
Chang *et al*[10]	2022	30	51.8	66.7	90	66.7	76.7	ND	ND	7 days
Mortensen *et al*[55]	2009	22	48.7	81	100	100	ND	ND	ND	ND
Combaret *et al*[24]	2021	373	51.5	90.6	88.3	ND	ND	74.3	ND	ND
Panneerselvam *et al*[56]	2017	64	53.8	6.3	98.4	79.7	81.3	ND	ND	ND
Almasi *et al*[57]	2022	15	48.2	100	92.2	71.4	64.3	ND	ND	ND
Lettieri *et al*[58]	2015	134	52	81	87.3	ND	ND	ND	ND	ND
Antonutti *et al*[59]	2021	70	47	86	100	81	55	ND	ND	ND
Solinas *et al*[60]	2022	58	54	86	100	95	78	31	ND	ND
Cerrato *et al*[61]	2021	199	52.3	88.9	ND	78.9	ND	ND	ND	ND
Nakashima *et al*[5]	2016	63	46	94	ND	ND	ND	39.7	ND	ND
Nishiguchi *et al*[62]	2017	12	63.1	58	100	33	75	ND	ND	ND
Inohara *et al*[63]	2020	322	52.8	100	89.1	62.1	49.4	ND	ND	ND
Inoue *et al*[64]	2021	19	48.7	100	94.7	ND	ND	ND	ND	ND
Kim *et al*[65]	2021	13	52.1	100	53.8	69.2	76.9	ND	ND	ND
McAlister *et al*[66]	2021	113	54	88	99	73	42	ND	ND	ND
Romero-Rodriguez *et al*[67]	2010	19	47.7	79	100	100	100	ND	ND	ND
Alfonso *et al*[9]	2012	17	48	82	ND	ND	ND	ND	ND	1 day
Alfonso *et al*[68]	2012	45	53	58	100	80	53.3	ND	ND	ND

Continued

Table 2 Continued

Author	Year	Sample size	Mean or median age	Female percentage	Quality-of-care parameters reported					
					Antiplatelets	Beta-blocker	ACEIs/ARBs	FMD screening	Cardiac rehabilitation	Time to angiogram
Camacho Freire *et al*[69]	2019	73	55	77	90	ND	ND	ND	ND	ND
Bastante[70]	2020	37	56	97	94	85	64	88	ND	ND
Macaya *et al*[71]	2020	78	53.2	85.9	94.8	80.5	ND	53.8	ND	ND
Mori *et al*[72]	2020	23	52.4	95.7	65.2	69.6	65.2	ND	ND	ND
Garcia-Guimaraes *et al*[30]	2022	389	53	88	93	80	51	27	ND	ND
Murugiah *et al*[11]	2022	67	44.5	92.5	100	83.6	52.2	ND	ND	142 min
Wilander *et al*[73]	2022	147	52.9	75.5	93.1	81.9	59.2	ND	ND	ND
Seidl *et al*[34]	2021	105	53.4	93	97	80	42	38.1	ND	ND
Smaardijk *et al*[74]	2020	172	52	100	ND	ND	ND	75.6	ND	ND
Carss *et al*[82]	2020	384	46.89	94.27	ND	ND	ND	60.4	ND	ND
Androulakis *et al*[75]	2022	144	49	87.5	ND	ND	ND	52.1	ND	ND
Kotecha *et al*[76]	2021	436	ND	93.1	95.2	83	69.7	ND	ND	ND
De Maio Jr *et al*[77]	1989	11	43.1	54.5	36.4	27.3	10.1	ND	ND	ND
Liang *et al*[15]	2014	158	45.2	97	86	62	30	ND	77	ND
Wagers *et al*[14]	2018	367	44.55	100	ND	ND	ND	ND	72	ND
Clare *et al*[78]	2019	208	49	88.9	70.2	83.2	57.2	43.3	ND	ND
Sharma *et al*[79]	2019	113	47	87%	ND	ND	ND	30	ND	ND
McNair *et al*[12]	2020	51	46.9	100	ND	ND	ND	98	ND	ND
Turley *et al*[44]	2020	667	46.7	100	ND	ND	ND	68.1	ND	ND
Chen *et al*[36]	2021	307	49.9	100	94.1	84	59.3	50	ND	ND
Baechler *et al*[13]	2022	115	55	97	88	72	43	41	60	
Johnson *et al*[38]	2022	1196	54	95.6	ND	ND	ND	68.8	ND	ND
White Solaru *et al*[80]	2019	11	47	ND	ND	ND	ND	72.7	ND	ND

ND, no data

Table 3 Baseline statistics of included studies

Total number of patients, n	8456
Mean age	50.1
Female	90.6%
Geographical location, number of studies (n)	
- Europe	21 (2992)
- North America	16 (4401)
- East Asia	8 (614)
- Oceania	5 (287)
- Middle East	2 (98)
- South Asia	1 (64)
Year of publication, number of studies (n)	
- Before 2018	15 (1065)
- After 2018	39 (7509)
Study design, number of studies (n)	
Prospective	12 (2757)
Retrospective	28 (3216)
Cross sectional	10 (1966)
Mixed	4 (635)
Past history, percentage (n)	
Smoking	
- Active	13.0% (4385)
- Past	23.0% (2620)
- Currency status not provided	30.1% (2731)
Hypertension	37.3% (7930)
Diabetes mellitus	4.4% (7945)
Migraine	30.8% (3889)
Peripheral vascular disease	1.5% (298)
Chronic kidney disease	1.9% (994)
History of previous coronary artery disease	8.8% (3077)
Thyroid disorders	13.2% (3122)
Peripartum	10.0% (1522)
Family history of cardiovascular disease	34.6% (2143)
Depression	18.5% (2409)
Anxiety	22.0% (1959)
In-hospital MACE	7.3% (2175)
Follow-up MACE	12.4% (4341)
Range of mean follow-up	1 month–49.2 months
Range of median follow-up	12 months–90 months

MACE, major adverse cardiovascular event; n, total number of patients for whom the data was reported.

Medical management, FMD screening and cardiac rehabilitation referral

Using random effects meta-analysis, 92.1% of patients (95% CI 89.3% to 94.8%) received at least one antiplatelet, 78.0% (95% CI 73.5% to 82.4%) received beta-blockers, 58.7% (95% CI 52.3% to 65.1%) received ACEIs/ARBs, 54.4% (95% CI 45.4% to 63.5%) were screened for FMD and 70.2% (95% CI 60.8% to 79.5%) were referred to cardiac rehabilitation (figure 2). Left ventricular ejection fraction (LVEF) was not reported in most studies. Among the few studies that reported LVEF, none reported if ACEIs/ARBs were given to patients with impaired LVEF. One study[12] reported the proportion of patients (29.6%) who received all consensus-document recommended treatments.

Meta regression analysis of the quality-of-care parameters differed significantly between geographical regions (figure 3) except for the use of ACEIs/ARBs (p=0.088) and cardiac rehabilitation (data for this were only available for North America). Use of at least one antiplatelet was most consistent, with proportions close to 100% in most regions, except for North America (at 78.2%). Use of beta-blockers was also consistently higher than 63% in all regions, while ACEIs/ARBs ranged from 44.2% to 81.3%. Screening for FMD was the most inconsistent parameter, which was lowest in the Middle East (0.6%) and highest in North America (60.5%). North America was also the only region where the rate of cardiac rehabilitation attendance or referral was reported (70.2%, CI 60.9% to 79.5%).

Overall, no significant difference was observed in the proportion of patients receiving each of the recommended treatments between studies published before and after 2018 (figure 4), except for a small deterioration in the proportion of patients undergone cardiac rehabilitation (74.1% vs 60.0%, p=0.012). This parameter, however, was only reported on in North America.

Temporal changes within the same cohorts

The change of quality-of-care parameters within the same cohorts was explored in table 4. Apart from the use of antiplatelets, which consistently increased with time, other parameters fluctuated significantly between the cohorts. The greatest change was observed in the Kantonsspital St. Gallen cohort (drop in FMD screening rate from 62.5% to 38.1%) and Mayo Clinic SCAD Registry (rise in FMD screening rate from 45.5% to 68.1%). There were no data for the change in the rate of referral to cardiac rehabilitation.

DISCUSSION

This systematic review is the first to measure adherence to consensus recommendations in patients with SCAD. Overall, adherence to consensus recommendations in SCAD care was highest for antiplatelet therapy and lowest for FMD screening, with significant variations across geographical regions. There was little change in adherence to consensus recommendations before and after the publication of consensus recommendations in 2018.

Medical management and antiplatelet therapy

The proportions of patients with SCAD receiving antiplatelets, beta-blockers, FMD screening and cardiac rehabilitation were 94.5%, 78%, 54.6% and 70.5%,

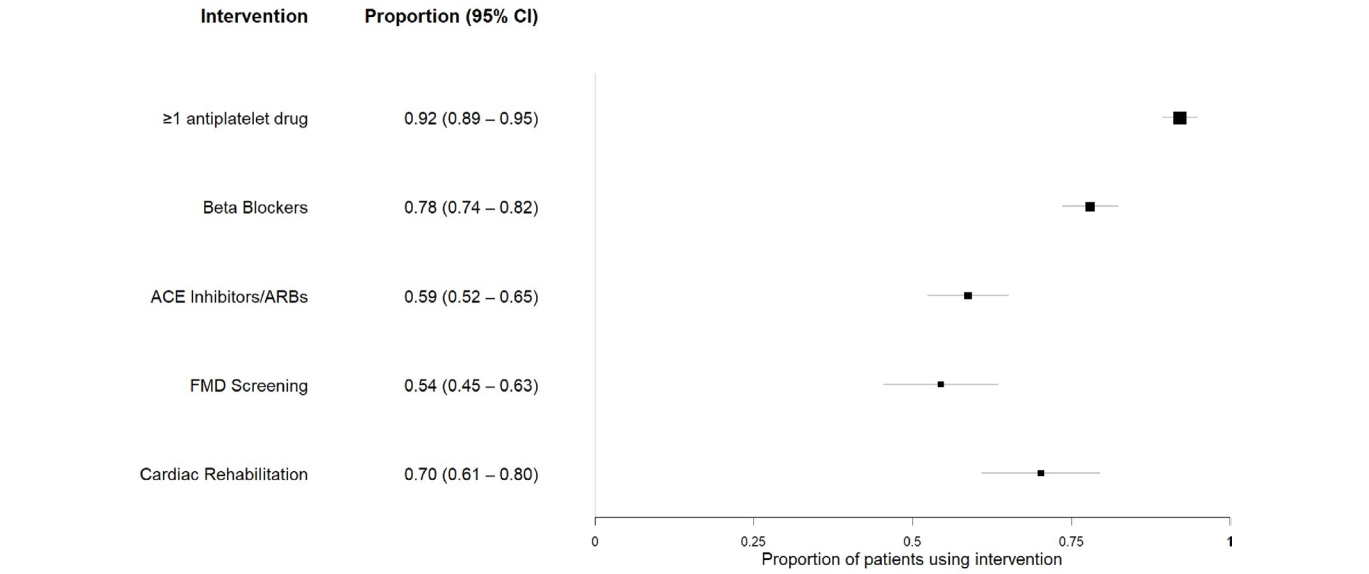

Figure 2 Meta-analysis of quality-of-care parameters—forest plot depiction for random effect meta-analysis of the proportion of patients received each of the recommended interventions using data from all included studies. Note: ARB, angiotensin receptor blocker; FMD, fibromuscular dysplasia.

respectively. With regards to antiplatelet therapy, there is no quality evidence guiding the use of single versus dual antiplatelet, or the duration of therapy. In our review, the proportions of patients on single-antiplatelet therapy were provided in almost all studies which reported on this parameter (35 out of 37 studies), while the use of dual therapy was only provided in half (17 out of 37 studies).

Temporal and geographical trends in SCAD care

No significant change in practice was observed for studies published before and after 2018. The proportion of patients who received all of the recommended treatments would have been a good indicator of overall quality of care. Unfortunately, there was only one paper (Baechler *et al*[13]) that reported this composite parameter,

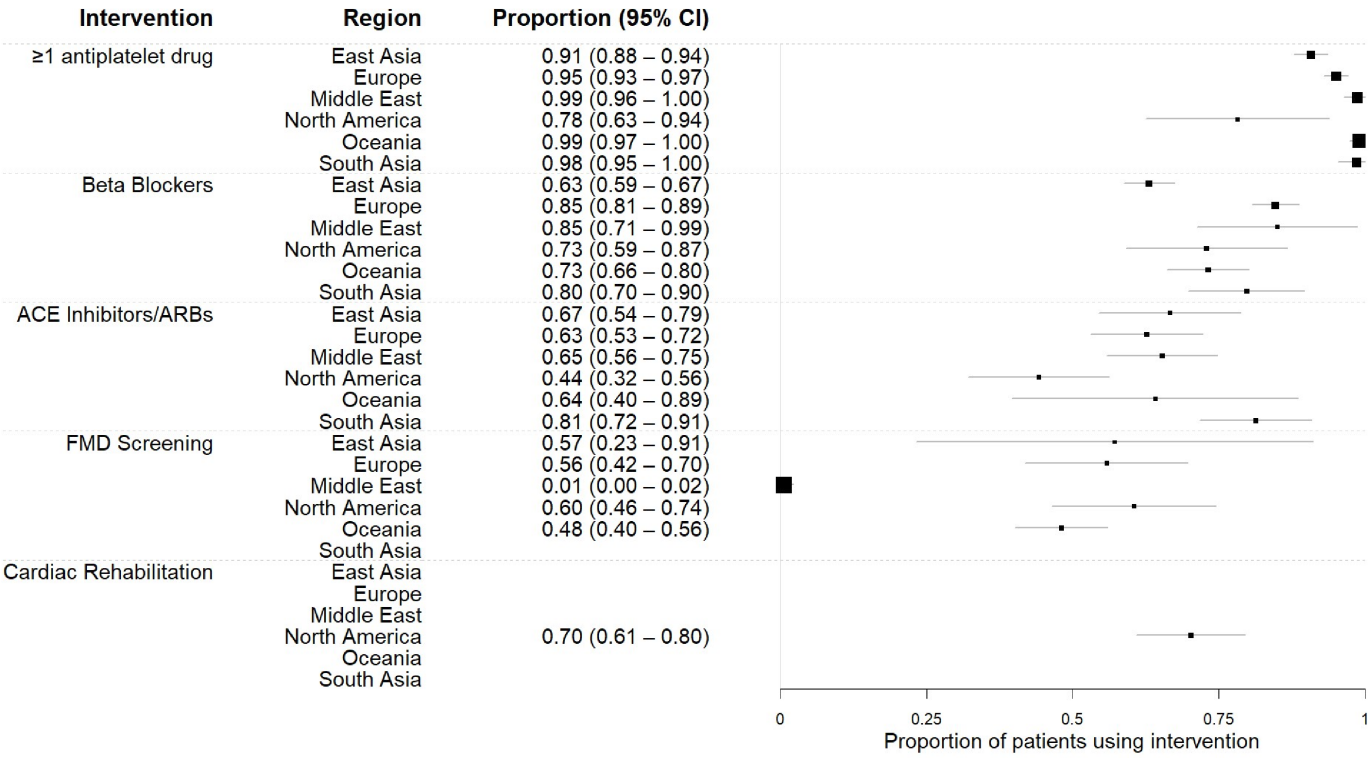

Figure 3 Meta-analysis of quality-of-care parameters by regions—forest plot depiction of random effect meta-analysis of the proportion of patients received each of the recommended interventions, grouped by regions. Note: ARB, angiotensin receptor blocker; FMD, fibromuscular dysplasia.

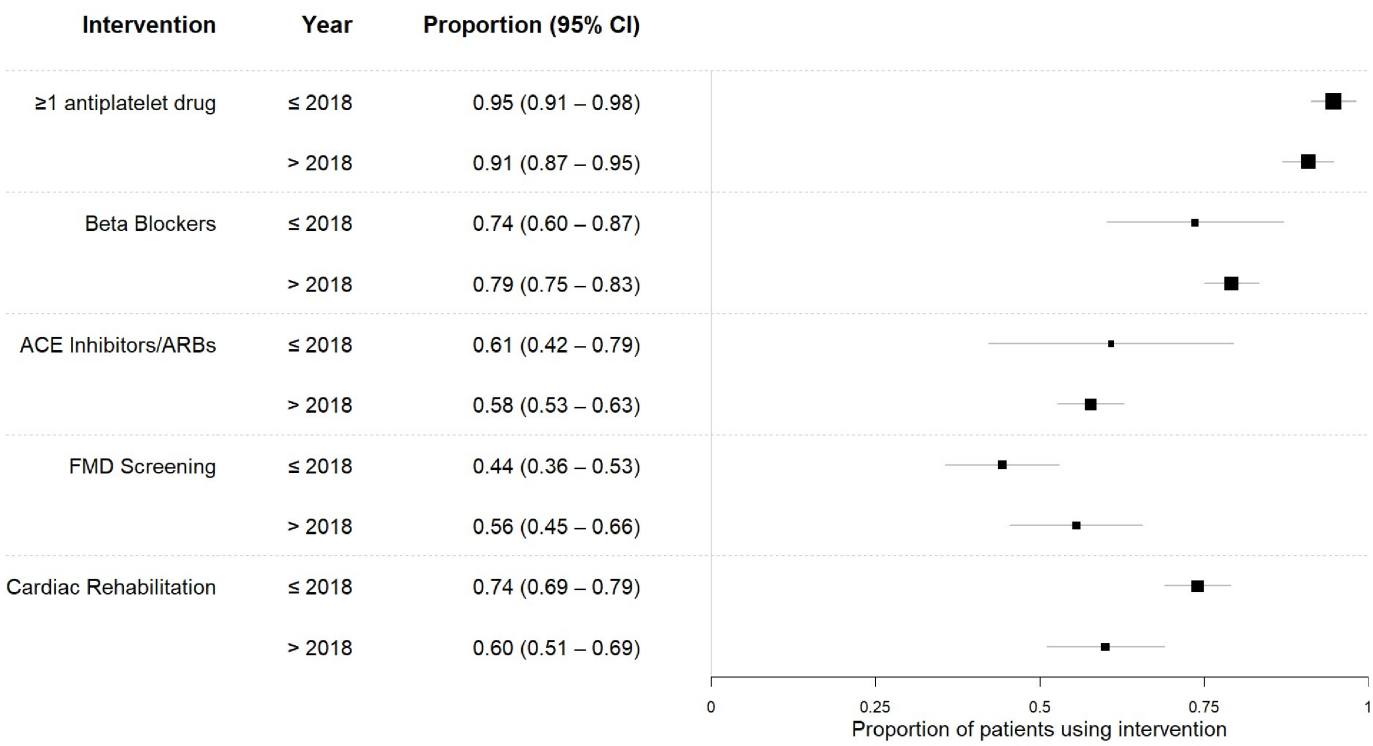

Figure 4 Meta-analysis of quality-of-care parameters by year of publication—forest plot depiction of random effect meta-analysis of the proportion of patients received each of the recommended interventions, grouped by year of publication. Note: ARB, angiotensin receptor blocker; FMD, fibromuscular dysplasia.

with the number relatively low at 29.6%. Notably, there was significant heterogeneity across studies and regions in FMD screening, ranging from 0.6% to 60.6%. This is despite the well-known association between SCAD and FMD, with screening recommended in all patients to look for extracardiac vascular manifestations. Most of the studies included in our systematic review were from higher income countries, highlighting a paucity of data from lower income countries. It is possible that adherence would be lower than our current data, particularly for FMD screening and rehab referral, due to limitations in resources in these countries.

SCAD awareness and cardiac rehabilitation referral

SCAD is an increasingly recognised condition and, consistent with this, we found nearly eight times the number of patients studied in the past 4 years, compared with the 30 years prior. Although there was no significant change in most of the quality-of-care parameters in studies published before and after 2018, this was likely a consequence of later studies including patients recruited historically, diluting any change in the quality-of-care with time. The drop in the proportion of patients who underwent cardiac rehabilitation was related to under reporting and differences in type of reporting. Only 3/53 studies provided information on cardiac rehabilitation, with the method of reporting varied. While one provided the rate of referral to cardiac rehabilitation,[14] the other two reported on the proportion of patients who attended cardiac rehabilitation.[13 15]

LIMITATIONS

This systematic review is limited by the under reporting of several quality-of-care measures, particularly cardiac rehabilitation and FMD screening. We were also unable to determine use of single vs dual antiplatelet therapy in many studies. The benefit of medical therapy in SCAD, such as antiplatelets and beta blockers remains controversial, with no randomised data to support their use. Most studies reported discharge medical therapy whereby adverse effects related to antiplatelets or beta blockers may have led to early cessation, and we cannot comment on adherence to such therapy. The included studies were heterogenous and were conducted with different aims. In a small number of studies, the percentage of females was low, and it is possible that some atherosclerotic dissections may have been included in these studies. There was an under-reporting of the practice of FMD screening (24 studies) and cardiac rehabilitation (three studies). The risk of reporting bias could not be excluded.

CONCLUSION

There are significant variations in the management of SCAD globally, particularly with regards to FMD screening and cardiac rehabilitation referral. An improvement in adherence to recommended therapies is thus needed. Raising awareness among clinicians about these recommendations, together with further prospective evidence on their effectiveness in reducing MACE, may help improve quality of care for patients with SCAD.

Table 4 Change of quality-of-care parameters on the same cohorts with time

Cohort	Study	N	Time from	Time to	Antiplatelets	Beta-blocker	ACEIs/ARBs	FMD screening	Cardiac rehabilitation
Canadian SCAD	Saw *et al*[22] 2017	327	04/2012	12/2016	92	83	57.6	80.7	ND
	Saw *et al*[23] 2019	750	06/2014	06/2018	93.7	84.8	57.4	73.3	ND
Spanish Registry for SCAD	Garcia-Guimaraes *et al*[29] 2021	318	06/2015	04/2019	92	79	51	29	ND
	Garcia-Guimaraes *et al*[30] 2022	389	06/2015	12/2020	93	80	51	27	ND
Kantonsspital St. Gallen cohort	Rogowski *et al*[33] 2017	64	01/1998	01/2015	97	86	36	63	ND
	Seidl *et al*[34] 2021	105	01/1998	12/2020	97	80	42	38.1	ND
Kaiser Permanente Northern California cohort	Chen *et al*[35] 2019	111	01/2003	12/2012	94	88	63	49.5	ND
	Chen *et al*[36] 2021	307	09/2002	06/2017	94.1	84	59.3	50	ND
Mayo Clinic Virtual SCAD Registry	Kok *et al*[37] 2018	585	01/2010	01/2017	89	59	ND	57.3	ND
	Johnson *et al*[38] 2022	1196	08/2011	03/2020	ND	ND	ND	68.8	ND
Mayo Clinic SCAD Registry	Eleid *et al*[39] 2014	246	01/1979	12/2013	ND	ND	ND	45.5	ND
	Turley *et al*[44] 2020	667	08/2011	08/2018	ND	ND	ND	68.1	ND

ND, No data; SCAD, spontaneous coronary artery dissection.

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