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Cardiological Society of India

Yearbook of CARDIOLOGY 2023

CVD in Women

Editor-in-Chief
Shibba Takkar Chhabra



Foreword
Vijay Bang

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SECTION 6

CVD in Women: Acute Coronary Syndrome

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ARTICLE 1

Gender Disparities in Prevalence by Diagnostic Criteria, Treatment and Mortality of Newly Diagnosed Acute Myocardial Infarction in Korean Adults

Kim SR, Bae S, Lee JY, Kim MS, Kim MN, Chung WJ, et al. Gender disparities in prevalence by diagnostic criteria, treatment and mortality of newly diagnosed acute myocardial infarction in Korean adults.
Sci Rep. 2023;13(1):4120.

Abstract

Objective: Acute myocardial infarction (AMI) is the leading cause of morbidity and mortality. AMI in women is under-recognized and undermanaged. This study was aimed to evaluate long-term data with respect to prevalence, management, and mortality in AMI by gender.

Material and methods: The study included 633,097 patients hospitalized for AMI [Code "121" of International Classification of Diseases, 10th revision (ICD-10)] according to Korean National Health Insurance Service (KNHIS) Claims Database from 2002 to 2018, out of which 40% were women. The KNHIS database includes almost all medical procedures done in Korea since 2002. Those who received only outpatient treatment were excluded. Also, patients who did not underwent cardiac enzymes testing were excluded. Those requiring readmission due to relapse or complications were not included subsequently, if their initial episode of first hospitalization was included.

Demographic data and performance rates of coronary angiography (CAG) and percutaneous transluminal coronary angioplasty (PTCA) were assessed. Medications prescribed during discharge were also assessed. In-hospital 3-day, 7-day, 30-day, and 1-year mortality rates were assessed.

Results: The occurrence rates of AMI have risen between 2011 and 2018, with an increase from 71 cases per 100,000 individuals to 110 cases per 100,000 individuals. Nonetheless, women exhibited lower hospitalization rates for AMI compared to men (53 vs. 88 per 100,000 individuals in 2011 and 82 vs. 139 per 100,000 individuals in 2018) ($p \leq 0.0001$). There was a consistent increase in the rates of CAG in male patients (44.6% in 2003, 68.4% in 2010, 73.6% in 2018), but the same

was not seen in women (30.7% in 2003, 46.0% in 2010, 45.7% in 2018). More than 85% of patients who were advised to undergo CAG opted for percutaneous coronary intervention (PCI). However, women exhibited a lower propensity for undergoing PCI compared to men. Since 2011, there has been a lower rate of PCI in women compared to men (81.1% vs. 88.3% in 2011 and 77.5% vs. 85.8% in 2018, $p < 0.0001$). Additionally, there has been an increase in in-hospital mortality from 2.2 to 5.3% since 2003 along with increased 30-day mortality (6.9% in 2018). Age-adjusted short-term mortality (at 3 and 7 days) was higher in women, but there was no significant difference in 30-day mortality. Further, age-adjusted 1-year mortality was lower in women than men.

Conclusion: This long-term study from the KNHIS database shows that for years, women have been under-recognized, underdiagnosed, and undertreated, be it revascularization or medical therapy, and necessary action needs to be taken to close the gender gap.

COMMENT

What was Known Prior to this Study?

Coronary artery disease (CAD) is regarded as a disease mainly affecting male population. Woman are underdiagnosed and undertreated.[1] Underdiagnosis can be due to relatively less prevalence of obstructive CAD[2] (because of probable hormonal protection) or due to atypical presentation. Undertreatment can be due to social/financial reasons or due to under-recognition of a nonobstructive cause of ischemic heart disease (IHD) in women.

What this study adds? The present study included 633,097 patients hospitalized for acute myocardial infarction (AMI) according to Korean National Health Insurance Service (KNHIS) database from 2002 to 2018. The aim of the study was to investigate the long-term trends of prevalence, treatment methodologies, and mortality of AMI by gender. Out of those hospitalized, 40% were women. Although the incidence of hospitalized patients has been increasing since 2011, women are less likely to be hospitalized than men. Women with AMI had increased short-term as well as long-term mortality than men. Age-adjusted mortality was higher in women for 3- and 7-day mortalities. There was no significant difference in 30-day mortality. However, 1-year mortality was lower in women compared to men. The prescription rate of blockers and statins was also lower in women similar to previous studies.[3]

Knowledge gaps identified: Long-term data should also include other components of major adverse cardiac and cerebrovascular events (MACCE) such as target vessel revascularization (TVR), nonfatal myocardial infarction (MI), and nonfatal stroke. Similar studies must be done in other developing countries.

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ARTICLE 2

Sex-specific and Hormone-related Differences in Vascular Remodeling in Atherosclerosis

Yerly A, van der Vorst EPC, Baumgartner I, Bernhard SM, Schindewolf M, Döring Y. Sex-specific and hormone-related differences in vascular remodelling in atherosclerosis.
Eur J Clin Invest. 2023;53(1):e13885.

Abstract

Cardiovascular diseases (CVDs) attributing to global mortality and morbidity have shown a complexity of pathophysiological mechanisms, affecting the final pathway to atherosclerosis and its complications. Sexual dimorphisms in CVD presentation and outcomes have unfolded some of the interesting sex-related differences in vascular remodeling in atherosclerosis. A greater number of men have been reported to have cardiovascular (CV) risk factors compared to women, which explains the greater prevalence and early onset of CVDs in men whereas women present with CVDs more commonly post menopause and they are more adversely affected by various risk factors. These biological sex-related disparities in CVDs could be partly explained by understanding the effects of sex hormones on immune expression, endothelial dysfunction, vascular smooth muscle cell proliferation, and plaque formation. Plaque morphological characteristics such as size, number, inflammation, composition, and stability have been shown to be modulated under the influence of sex hormones. Estrogens in women protect against atherosclerosis, thus decreasing the risk of CVDs whereas androgens in men act like a double-edged sword. Decreasing levels of estrogens with aging have been found to be associated with an increased risk of atherosclerotic CVDs; at the same time, they have also been implicated in promoting inflammatory cells recruitment at the site of endothelial injury. Though we have come a way long in delineating the mechanistic pathways involved in atherosclerosis, still a lot more needs to be explored to completely understand the sex as a biological variable of atherosclerosis. This review article is an attempt to highlight the role of sex hormones in the process of atherosclerotic vascular remodeling which can be harnessed for future therapeutics in CVDs.

COMMENT

Atherosclerotic cardiovascular disease (CVD), being the leading cause of death in both men and women at a global level, has always been an area of research since decades. Recently, there has been a tremendous enhancement in our knowledge about gender disparities in different cardiovascular (CV) risk factors, clinical presentation, immune expression, and hormonal impact on vascular remodeling in atherogenesis. This article provides a blanket review on sex as a biological determinant of atherosclerosis, which can affect its development and progression in various ways.[4-7]

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ARTICLE 3

Incidence and Outcomes of Cardiogenic Shock Among Women with Spontaneous Coronary Artery Dissection

Osman M, Syed M, Simpson TF, Bhardwaj B, Kheiri B, Divanji P, et al. Incidence and outcomes of cardiogenic shock among women with spontaneous coronary artery dissection.
Catheter Cardiovasc Interv. 2022;100(4):530-4.

Abstract

Background: Spontaneous coronary artery dissection (SCAD) is not an uncommon cause of acute myocardial infarction (AMI) in female patients. Although most SCAD can be treated conservatively, few patients can develop cardiogenic shock (CS) and may require mechanical circulatory support. But the incidence of cardiogenic shock and outcome in SCAD patients is not much studied.

Method: Data pertaining to women admitted with AMI with and without SCAD from October 1, 2015, to December 31, 2018, in the United States National Readmission Database was analyzed. After adjusting the baseline characteristics, the incidence of CS among women with AMI with and without SCAD and odds for developing CS were calculated. In addition to this, the research also calculated the utilization of percutaneous coronary intervention, need for mechanical circulatory support, severe disability surrogates, and 30-day readmission rates.

Results: In this study 664,292 patients admitted with AMI were analyzed, out of which 6,643 patients had SCAD. SCAD patients were younger {57 years [interquartile range (IQR) 48–68] vs. 71 years (IQR 60–81), $p < 0.01$}. Patients with SCAD had fewer comorbidities but had a higher incidence of CS compared to patients without SCAD (9% vs. 5%, $p < 0.01$) and remained at an increased risk after adjusting for baseline comorbidities {adjusted odds ratio 1.5 [95% confidence interval (CI) 1.2–1.7]}. Among the cardiogenic shock group, patients with SCAD had better survival (rate) compared to non-SCAD patients (39% vs. 31%, $p < 0.01$) and were more likely to receive mechanical circulatory support.

Conclusion: The study shows that women with AMI due to SCAD had a higher risk of developing CS and needed more frequent use of mechanical circulatory support. Interestingly, the SCAD group has better survival rate at discharge compared to non-SCAD women patients.

COMMENT

The incidence of spontaneous coronary artery dissection (SCAD) is higher in young and middle-aged women acute myocardial infarction (AMI) patients, especially in the peripartum period. Mostly, SCAD publications in the past include case reports and small case series. In the general population, the incidence of SCAD is between 0.28% and 1.1%,[8] but there is a paucity of data regarding SCAD in women. The incidence of SCAD has increased significantly in the recent years, due to the increased use of coronary angiography in patients presented with AMI, as well as the use of high-resolution intracoronary imaging like intravascular ultrasound (IVUS) and especially optical coherence tomography

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(OCT) that enhances the diagnosis of SCAD more precisely than coronary angiogram.[9,10]

The sample statistics of the study was good enough to yield reliable results. It shows the real-world data regarding the incidence and prevalence of SCAD in women AMI patients. The present study corroborates the findings of previous such studies which support that there is a higher incidence of SCAD in young and middle-aged women AMI patients and establishes that the same trend continues to exists.

The incidence of cardiogenic shock (CS) varies from 1 to 16% in SCAD patients and even higher in peripartum cases (20–24%).[11] In accordance with previous such studies, this study also illustrates that the CS incidence in the SCAD group is 9% as compared to 5% in the non-SCAD group.

As per the previous recommendation, SCAD patients with CS require early hemodynamic support with inotropes and vasopressors, intra-aortic balloon pump (IABP), extracorporeal membrane oxygenation (ECMO), left ventricular (LV) assist device, and Impella. This study also puts forth the trend of more frequent use of mechanical circulatory support in SCAD CS patients compared to SCAD with no CS. Despite more frequent use of mechanical circulatory support, the SCAD group has a better survival rate upon discharge compared to non-SCAD women patients. It is mostly because of the less comorbidities and younger age of the presentation in SCAD women. Therefore, this study demonstrates that although CS incidence is high in SCAD women, these patients have better survival if treated judiciously with revascularization and mechanical circulatory support. Mechanical circulatory support provides sufficient time for healing of intramural hematoma and makes weaning easy in the SCAD group.

ARTICLE 4

Sex-related Differences in Thrombus Burden in STEMI Patients Undergoing Primary Percutaneous Coronary Intervention

Manzi MV, Buccheri S, Jolly SS, Zijlstra F, Frøbert O, Lagerqvist B, et al. Sex-related differences in thrombus burden in STEMI Patients undergoing primary percutaneous coronary intervention.
JACC Cardiovasc Interv. 2022;15(20):2066-76.

Abstract

Background: Women after ST-segment elevation myocardial infarction (STEMI) have a poorer prognosis in comparison to men. After STEMI, the predictive role of thrombus burden (TB) in influencing sex-related differences in clinical outcomes has not been understood well.

Objectives: The present study was designed to evaluate the sex-related differences in TB and its clinical implications in STEMI patients.

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Methods: From the three major randomized clinical trials of manual thrombus aspiration, individual patient data were collected and analyzed, including overall 19,047 STEMI patients; out of them 13,885 (76.1%) were men and 4,371 (23.9%) were women. The primary endpoints of the study consisted of 1-year cardiovascular (CV) death outcomes. The secondary endpoints consisted of parameters including recurrent myocardial infarction, heart failure, all-cause mortality, stroke, stent thrombosis (ST), and target vessel revascularization at 1-year outcomes.

Results: Worse 1-year outcomes were noted in patients with high TB (HTB) when compared with patients who were presented with low TB [adjusted hazard ratio (HR) for CV death: 1.52; 95% confidence interval (CI) 1.10–2.12; $p = 0.01$]. Female sex was found to be associated with an increased risk for 1-year CV death irrespective of TB, in unadjusted analyses. But in women with HTB, the risk for 1-year CV death was noted to be higher (HR 1.23; 95% CI 1.18–1.28; $p < 0.001$); they also showed an increased risk for all-cause death and ST than men, after adjustment analysis.

Conclusion: Angiographic evidence suggestive of HTB negatively affects prognosis in patients with STEMI. Here, women had shown an increased risk for ST, CV, and all-cause mortality when compared to men, among patients presented with HTB. For a better understanding of the pathophysiological mechanisms leading to excess mortality in women with STEMI and HTB in the future, more research is required.

COMMENT

STEMI with high thrombus burden and women: A double whammy: ST-elevation myocardial infarction (STEMI) in women is associated with poorer short- and long-term outcomes compared to men.[12] Various factors such as old age, delayed presentation, undertreatment, smaller vessel diameter, and more comorbidities have been contributed to poorer outcomes in women. High thrombus burden (TB) in STEMI leads to distal embolization and increased slow-flow or no-reflow leading to increased cardiac events. STEMI in women has already been associated with high mortality, but whether it is primarily due to high TB or due to some other factor is not clear.

In this study, authors have analyzed data from three major trials: (i) TAPAS (Thrombus Aspiration during Percutaneous coronary intervention in Acute myocardial infarction Study), (ii) TASTE (Thrombus Aspiration in ST-Elevation myocardial infarction in Scandinavia), and (iii) TOTAL (Thrombectomy with PCI vs. PCI Alone in Patients with STEMI) trials, focusing on the outcome depending upon sex and TB. A total of 18,256 patients were included in the study, women comprising 4,371 (23.9%). When compared to men, women were more elderly and hypertensive and had a longer median ischemic time. High TB was defined as Thrombolysis in Myocardial Infarction (TIMI) thrombus grade ≥3 and low TB as TMI thrombus grade <3. High TB was seen less frequently in women (71.4%) when compared to men (75.5%). There was no significant difference in treatment given among women and men.[13] The use of newer P2Y12 inhibitors was <40% in both groups. The incidence of cardiovascular death in patients categorized by sex and TB showed the highest mortality in females with high TB followed by females with low TB, followed by men with high TB, and the lowest seen in men with low TB. After adjusting the confounding factors, the difference between mortality among women and men was found not significant in the low TB group but higher in women in the high TB

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group. Women with high TB had significantly higher rates of cardiovascular death, all-cause death, stent thrombosis, and heart failure, with the highest frequency during the first 30 days. Though overall women had a low incidence of high TB compared to men, in women the prognosis was poorer in the presence of high TB. The reason for the low thrombus burden in women compared to men can be postulated due to the protective effect of estrogens which decreases the risk of thrombus formation.

The challenge is how to address this high TB. The trials have shown that routine thrombus aspiration has no benefit in terms of cardiovascular mortality and event rate but increases the risk of stroke. The antithrombotic agent and timely intervention have been shown to decrease the event rate, but various trials have shown that they are underprescribed in women in view of the high bleeding risk. Guideline-directed medical therapy (GDMT) should be strictly followed in women, especially with high TB. Further studies are warranted to address this issue of high thrombus burden and its treatment in women.

Key messages

- ***Women with STEMI are older, have more comorbidities, are late presenters, are undertreated, and have a lower incidence of high TB compared to men.***
- ***In STEMI with high TB, women have worse outcomes in terms of cardiovascular mortality, all-cause mortality, and stent thrombosis compared to men.***
- ***Antithrombotic treatment should be prescribed more aggressively in women to decrease this gap of event rates compared to men.***

ARTICLE 5

Ischemia with No Obstructive Coronary Arteries (INOCA): A Review of the Prevalence, Diagnosis and Management

Hansen B, Holtzman JN, Juszczynski C, Khan N, Kaur G, Varma B, et al. Ischemia with No Obstructive Arteries (INOCA): A review of the prevalence, diagnosis and management.
Curr Probl Cardiol. 2023;48(1):101420.

Abstract

Ischemia with No Obstructive Coronary Artery Disease (INOCA) refers to patients who exhibit ischemia during coronary angiography but do not have any evidence of obstructive coronary artery disease (CAD). INOCA is estimated to be prevalent in approximately 3–4 million individuals, with a higher occurrence among females. It comprises various endotypes, which include microvascular dysfunction, vasospasm, and a combination of both conditions. The diagnosis of INOCA necessitates the use of noninvasive or invasive techniques to evaluate coronary flow reserve (CFR), the Index of Microcirculatory Resistance (IMR), and the presence of spasm induced

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by acetylcholine injection. Despite the fact that INOCA is linked to a higher risk of major adverse cardiovascular event (MACE) and a decline in quality of life, it is concerning that less than half of the patients receive appropriate treatment. The treatment of INOCA remains challenging, as current therapeutics are customized to target specific endotypes. Ongoing clinical trials are being conducted to evaluate the effectiveness of traditional medications used for CAD.

COMMENT

Ischemia with No Obstructive Coronary Artery Disease (INOCA) is an important entity which was previously denied its due place in the myriad array of cardiovascular diseases.[14] Women are more at risk and have been undertreated and misdiagnosed to a great degree. Awareness and proper testing can promote better identification and treatment of INOCA. This is imperative to reduce the morbidity and mortality of this disease. The present article comprehensively guides the approach to and management of INOCA.[15] With the existing treatments and drugs available, symptom control and disease modification should be attempted. Cardiac rehabilitation is an effective nonpharmacological therapy which should be widely used for all patients with INOCA.

A recent study has classified four different endotypes of INOCA:[16]

1. Coronary microvascular disease
2. Epicardial vasospastic angina
3. Microvascular vasospastic angina
4. Masked diffuse disease

Identification of the endotypes by invasive and noninvasive tests is a requirement to a methodical approach to managing INOCA.

European Society of Cardiology chronic coronary syndromes (ESC CCS) 2019 guidelines indicate noninvasive methods as first-line testing for anginal patients. It is imperative to stress the utility of echocardiograms due to the wider availability and lesser costs. Transthoracic Doppler–coronary flow reserve (TTD-CFR) is known to reflect the presence of macrovascular as well as microvascular disease in the coronary circulation.[17] Most frequently, the technique is used with an adenosine/dipyridamole protocol in conjunction with a stress echocardiography examination. Mid and distal left anterior descending (LAD) and right coronary artery posterior/descending artery (RCA/PDA) vessels are imaged and assessed.[18]

The results of ongoing trials such as the INOCA IT, WARRIOR, EXAMINE-CAD, iCorMicA, and DISCOVER INOCA are awaited for more understanding and effective strategies to deal with patients living with INOCA.

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ARTICLE 6

Less Revascularization in Young Women but Impaired Long-term Outcomes in Young Men after Myocardial Infarction

Kerola AM, Palomäki A, Rautava P, Kyto V. Less revascularization in young women but impaired long-term outcomes in young men after myocardial infarction.
Eur J Prevent Cardiol. 2022;29:1437-45.

Abstract

Aim: Female gender has been linked to worse poor outcomes following a myocardial infarction (MI); however, there is limited evidence available for young patients. Our research aimed to investigate disparities in cardiovascular outcomes between sexes after MI in the young patient population.

Methods and results: We conducted a study on consecutive young patients aged 18–54 years who experienced out-of-hospital myocardial infarction (MI). These patients were admitted to 20 hospitals in Finland, totaling 8,934 cases, of which 17.3% were women. The data were collected from national registries from 2004 to 2014. The median duration of follow-up for the participants was 9.1 years, with a maximum period of 14.8 years. Young women who experienced MI had a higher number of comorbidities at baseline. Additionally, they underwent revascularization procedures less frequently compared to young men with MI. Moreover, after the MI event, young women received fewer evidence-based secondary prevention medications, including P2Y12 inhibitors, renin–angiotensin signaling pathway inhibitors, and statins. There were no significant differences observed between the sexes regarding long-term mortality or the occurrence of major adverse cardiovascular events (MACE, recurrent MI, stroke, or cardiovascular-related death) in the unadjusted analysis,

However, men had poorer outcomes after MI after baseline feature and treatment-difference adjustment. Adjusted long-term mortality was 21.3% in men versus 17.2% in women [hazard ratio (HR) 1.29; 95% confidence interval (CI) 1.10–1.53; $p = 0.002$]. The cumulative MACE rate was 33.9% in men versus 27.9% in women during follow-up (HR 1.23; 95% CI 1.09–1.39; $p = 0.001$) Among the participants, the frequency of recurrent MI and cardiovascular-related deaths was higher in men compared to women. However, there were no significant differences in the occurrence of stroke between the two genders.

Conclusion: In our study, we observed that young women received less active treatment after experiencing MI compared to young men. We found that male sex was associated with worse long-term cardiovascular outcomes in young patients who had suffered an MI after adjusting for baseline features.

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COMMENT

The incidence of myocardial infarction (MI) has decreased in older populations; however, it remains a significant cause of morbidity and mortality among young individuals.[19] The risk-factor profile differs significantly from that of older adults compared to younger patients with MI. Some traditional cardiovascular risk factors, such as smoking and having a family history of premature coronary artery disease (CAD), are more prevalent in this younger population. Additionally, women in this group are more likely to be premenopausal. On the other hand, many comorbidities and frailties, which are more commonly seen in older adults, are less frequent among younger MI patients. These variations in risk factors and health characteristics underscore the need for tailored approaches in managing and preventing MI in the younger population.[20,21]

Based on previous studies, the prevailing perception has been that women tend to experience worse outcomes after suffering a MI compared to men.[22] Indeed, it is crucial to highlight that the majority of studies indicating worse MI prognoses in women has primarily focused on short-term outcomes following the MI event. The available evidence regarding sex differences in long-term outcomes after MI among young is limited and contradictory. More extensive and focused studies are needed to gain comprehensive insights into the impact of MI in young patients.

This nationwide study that involved linking various registers investigated the potential sex differences in early mortality and long-term outcomes among Finnish patients who experienced a MI and were under the age of 55 years. The study followed these patients for a maximum period of 14.8 years.

To account for a wide array of potential confounding factors, such as various comorbidities and the type and treatment of MI, the authors employed two effective methods: (i) Propensity scoring and (ii) inverse probability weighting (IPW). These methods are valuable tools in observational studies as they help control for confounding variables and enhance the validity of the study's findings.[23] After accounting for various confounding factors, it became evident that young men had poorer long-term outcomes following MI compared to young women. Surprisingly, there were no significant sex differences in short-term survival rates. Despite these findings, it was observed that young women with MI were less likely to receive guideline-recommended pharmacological therapies and were less frequently subjected to revascularization procedures. These results suggest that although young women may have received less aggressive treatment, they still exhibited better long-term outcomes compared to young men after an MI event.

The study has certain limitations, including the absence of data on laboratory results, angiographical data, and more detailed clinical information (e.g., Killip class, heart rate, blood pressure). Additionally, the study lacks data on socioeconomic status, delays in care, and sex-specific risk factors such as early menarche or menopause, adverse pregnancy outcomes, or lifestyle-related factors. These missing data points may lead to residual confounding, meaning that some unmeasured or unaccounted factors could still influence the observed outcomes, potentially affecting the study's conclusions.

Indeed, based on the results of this study, it is imperative to give equal attention to coronary procedures for both

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men and women. The findings highlight the significance of providing timely and appropriate coronary interventions to young patients of all genders who experience an MI.

ARTICLE 7

Updates on MINOCA and INOCA through the 2022 Publications in the International Journal of Cardiology

Pelliccia F, Camici PG. Updates on MINOCA and INOCA through the 2022 publications in the International Journal of Cardiology.
Int J Cardiol. 2023;374:8-11.

Abstract

In recent times, there has been growing interest in the syndromes of Myocardial Infarction or Ischemia with No Obstructive Coronary Artery Disease (referred to as MINOCA and INOCA). Several diagnostic uncertainties related to these conditions have been addressed and better understood. Contrary to initial beliefs, there is now evidence indicating that patients with MINOCA and INOCA experience major adverse cardiovascular events (MACE) that are not less serious than those seen in patients with obstructive coronary artery disease (CAD). Several articles published in the International Journal of Cardiology in 2022 have contributed significant and valuable insights into the intricate puzzle of MINOCA and INOCA.

COMMENT

Graziani and colleagues conducted a study involving almost 3,000 patients with hypertrophic cardiomyopathy (HCM) and Fabry's disease. Their research revealed that electrocardiographic left ventricular hypertrophy (LVH) and echocardiographic left ventricular (LV) wall thickness were independently linked to Myocardial Infarction with No Obstructive Coronary Artery Disease MINOCA.[24] In an Italian study conducted by Magnani et al. focusing on early myocardial infarction (MI), it was found that the mortality rate was lower in the MINOCA group. However, the incidences of nonfatal reinfarction, ischemic stroke, and all-cause mortality were found to be similar.[25]

Recent research focusing on MINOCA has examined the prognosis of affected patients, revealing a 12-month all-cause mortality rate of 4.7% (with a 95% confidence interval ranging from 2.6 to 6.9%). Comparative studies consistently indicate that individuals experiencing MINOCA tend to have a more favorable prognosis compared to those who suffer from acute myocardial infarction (AMI) associated with obstructive coronary artery disease.[26]

In the study conducted by Williams et al., the impact of sex on MINOCA was studied, and it was found that men were more susceptible to MINOCA caused by myocarditis and Takotsubo syndrome, while women were

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more prone to stroke. Additionally, the study identified age and left ventricular ejection fraction (LVEF) as independent predictors of mortality.[27]

As of now, there have been no randomized controlled trials conducted specifically on secondary treatment preventions for MINOCA. Indeed, the SWEDEHEART registry, which included data from over 9,000 patients, demonstrated a decrease in major adverse cardiovascular event (MACE) in patients who received treatment with statins or angiotensin-converting enzyme inhibitors (ACEIs). Treatment with beta-blockers demonstrated a positive trend in improving outcomes for MINOCA patients. On the other hand, the use of dual antiplatelet therapy 1 year after diagnosis did not show a significant impact on patient outcomes. However, it is crucial to note that this study was retrospective and observational in nature, which means that there is a risk of residual confounding.

In the context of Ischemia with No Obstructive Coronary Artery Disease (INOCA), Mehta et al. conducted an insightful review.[28] Their analysis revealing a substantial number of patients with suspected CAD exhibiting INOCA and highlights the prevalence of INOCA. Importantly, INOCA is linked to recurrent hospital admissions due to episodes of severe chest pain, reduced functional capacity, diminished health-related quality of life, and substantial healthcare costs.

ARTICLE 8

Updates on Pharmacologic Management of Microvascular Angina

Soleymani M, Masoudkabir F, Shabani M, Vasheghani-Farahani A, Behnoush AH, Khalaji A. Updates on pharmacologic management of microvascular angina.
Cardiovasc Ther. 2022:6080258.

Abstract

Anginal chest pain in absence of significant coronary obstruction is gaining recognition with microvascular angina (MVA) being a key contributor. Previously thought to be a benign entity, MVA is now known to be associated with higher incidences of major adverse cardiac events. Due to lack of evidence-based guidelines for management, the therapy is mainly empirical. In this review article, authors have discussed about various suspected mechanisms behind the development of MVA and targeted therapies.

COMMENT

Microvascular angina (MVA) refers to symptomatic myocardial ischemia without evidence of coronary obstruction or impedance to coronary circulation. The incidence has increased over the past decades probably due to better understanding of the pathophysiology and diagnostic testing available. Previously thought to be benign, this is

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