

**CARACTERÍSTICAS DE HALLAZGOS CLÍNICOS,
ELECTROCARDIOGRÁFICOS Y ANGIOGRÁFICOS DE PACIENTES JÓVENES
CON INFARTO AGUDO DE MIOCARDIO EN UNA CLÍNICA DE IV NIVEL DE LA
CIUDAD DE BARRANQUILLA**

FAIR DE JESÚS CLAVIJO TINOCO M.I
SHALLY SHAYDI FUENTES PINTO M.G.

Trabajo de Investigación presentado como requisito para optar el título de:

**ESPECIALISTA EN CARDIOLOGÍA
ESPECIALISTA EN MEDICINA INTERNA**

Tutores:

Dr. CARLOS HERNÁN COTES AROCA.

Dr. MANUEL URINA TRIANA.

RESUMEN

Introducción: Estudios realizados en diversas poblaciones señalan una conexión entre los principales factores de riesgo de enfermedad coronaria arteriosclerótica y la aparición directa del síndrome coronario agudo (SCA), especialmente el infarto agudo de miocardio (IAM), en individuos mayores de 55 años. En personas menores de 55 años, este fenómeno se asocia con mayor frecuencia a hipercoagulabilidad, vasculitis, vasoespasmo endógeno o vasoespasmo mediado por sustancias tóxicas, subestimando o ignorando los factores de riesgo fundamentales para la enfermedad coronaria como causa directa en esta población.

Objetivo: Caracterizar los hallazgos clínicos, electrocardiográficos y angiográficos de pacientes jóvenes con infarto agudo de miocardio en una clínica de IV nivel de la ciudad de Barranquilla.

Material y métodos: Estudio observacional-descriptivo, retrospectivo de corte transversal, con un total de 136 pacientes que ingresaron por el servicio de hemodinamia con diagnóstico de infarto agudo de miocardio que cumplieran los criterios de inclusión y se sometieron a cateterismo cardiaco izquierdo. El muestreo se llevó a cabo en una institución prestadora de salud (IPS) de alta complejidad durante el periodo comprendido entre enero del 2019 y mayo de 2023 en la ciudad de Barranquilla, Colombia. Se verificó en base de datos de servicio de hemodinamia variables sociodemográficas (edad, género) antropométricas [peso, talla, índice de masa corporal (IMC)], comorbilidades [hipertensión arterial (HTA), diabetes mellitus, (DM), obesidad, dislipidemia] y estilos de vida (tabaquismo, alcohol y consumo de drogas), resultado de biomarcador cardiaco tipo troponina de alta sensibilidad (PATHFAST TM hs-cTnI). El análisis de los datos obtenidos se llevó a cabo utilizando el Software: Minitab 20.3 ®. El estudio de asociación entre las variables cualitativas (categórica) se realizó por medio de la prueba chi-cuadrado y ANOVA, y para datos cuantitativos medidas de tendencia central, y para comparar variables t de student.

Resultados: 136 pacientes cumplieron con criterios de inclusión, de los cuales el 77,2% eran hombres, con una mediana de edad de 48 años. Los factores de riesgo más frecuentes fueron la hipertensión arterial 78,7%; el 40.4 % dislipidemia y el 33.1% diabetes. La mayor frecuencia de pacientes presentó una índice masa corporal entre 25 y 29.9 kg/m². La característica clínica más común al ingreso fue KK I (99.9%). Siendo más frecuente el infarto en los segmentos basales. El 61.76% de los pacientes presentaron IAMSEST de los cuales el 17.87 % (n=15) manifestaron un patrón electrocardiográfico de alto riesgo. A través de angiografía coronaria se evidenció enfermedad aterotrombótica en el 75% y coronaria sin lesiones en el 25 % de los pacientes. La enfermedad monovascular fue la más frecuente 30.8%. El vaso más afectado fue la ADA (50,7%). La fracción de eyección promedio fue de 50.34 %. El número total de pacientes con compromiso de la función sistólica del ventrículo izquierdo fue de 63 (47%). El procedimiento de revascularización miocárdica (RVM) fue realizado en el 69 % de los pacientes, destacándose la angioplastia con implantación de stent como la intervención más frecuente en este grupo, llevada a cabo en un 73.4% de los casos. Se trombolizó al 8.92% de la población estudiada.

Conclusión: Se estableció que la población estudiada es menor de 50 años, en sobrepeso, cuya manifestación principal fue dolor de origen cardiaco con diagnóstico más incidente el IAMSEST sin patrones de alto riesgo, siendo los factores de riesgo más frecuentes la hipertensión, la dislipidemia y la diabetes. La enfermedad monovascular fue la más frecuente siendo la ADA el vaso el mayor porcentaje de obstrucción. Los pacientes egresaron con terapia médica indicada por guías que incluya estatinas betabloqueadores IECAS/ ARA 2, doble antiagregación plaquetaria siendo el segundo antiagregante mayor utilizado el clopidogrel.

Palabras clave: Infarto agudo de miocardio, joven, ruptura de placa, factor de riesgo, angiografía.

ABSTRACT

Introduction: Studies conducted in various populations indicate a connection between the main risk factors for arteriosclerotic coronary artery disease and the direct onset of acute coronary syndrome (ACS), especially acute myocardial infarction (AMI), in individuals over 55 years old. In individuals under 55 years old, this phenomenon is more frequently associated with hypercoagulability, vasculitis, endogenous vasospasm, or vasospasm mediated by toxic substances, often underestimating or disregarding the fundamental risk factors for coronary disease as a direct cause in this population.

Objective: Characterize the clinical, electrocardiographic, and angiographic findings of young patients with acute myocardial infarction at a level IV clinic in the city of Barranquilla.

Material and methods: This is a cross-sectional, retrospective observational-descriptive study involving 136 patients admitted through the emergency department with a diagnosis of acute myocardial infarction who met the inclusion criteria and underwent left heart catheterization. The sampling was conducted at a high-complexity healthcare institution during the period from January 2019 to May 2023 in Barranquilla, Colombia. Sociodemographic variables (age, gender), anthropometric measures (weight, height, body mass index (BMI)), comorbidities (hypertension (HTA), diabetes mellitus (DM), obesity, dyslipidemia), and lifestyle factors (smoking, alcohol, and drug consumption) were verified in medical records. The study also examined the results of high-sensitivity troponin cardiac biomarker (PATHFAST TM hs-cTnI). Data analysis was performed using Minitab 20.3® software. The association between qualitative (categorical) variables was assessed through chi-square and ANOVA tests, and for quantitative data, measures of central tendency were used, with student's t-test employed to compare variables.

Results: 136 patients met the inclusion criteria, of whom 77.2% were men, with a median age of 48 years. The most common risk factors were arterial hypertension (78.7%), dyslipidemia (40.4%), and diabetes (33.1%). The majority of patients had a body mass index between 25 and 29.9 kg/m². The most common clinical feature at admission was Killip Class I (99.9%). Infarction was more frequent in basal segments. Of the patients, 61.76% had non-ST-segment elevation myocardial infarction (NSTEMI), with 17.87% (n=15) showing a high-risk electrocardiographic pattern. Coronary angiography revealed atherothrombotic disease in 75% and coronary arteries without lesions in 25% of patients. Single vessel coronary disease was most frequent (30.8%), with the left anterior descending artery (LAD) being the most affected vessel (50.7%). The average ejection fraction was 50.34%. A total of 63 patients (47%) had compromised left ventricular systolic function. Myocardial revascularization (MR) was performed in 69% of patients, with angioplasty and stent implantation being the most frequent intervention (73.4%). Thrombolysis was performed in 8.92% of the studied population.

Conclusions: It was established that the studied population is under 50 years old, overweight, with the main manifestation being cardiac-origin pain, with the most incident diagnosis being non-ST-segment elevation myocardial infarction (NSTEMI) without high-risk patterns. The most frequent risk factors were hypertension, dyslipidemia, and diabetes. Monovascular disease was the most common, with the left anterior descending artery (LAD) having the highest percentage of obstruction. The patients were discharged with medical therapy as per guidelines, including statins, beta-blockers, ACE inhibitors/ARBs, dual antiplatelet therapy, with clopidogrel being the most commonly used second antiplatelet agent.

Keywords: Acute myocardial infarction, young, plaque rupture, risk factor, angiography.

REFERENCIAS BIBLIOGRÁFICAS

1. Ralapanawa U, Sivakanesan R. Epidemiology and the magnitude of coronary Artery Disease and acute coronary syndrome: A narrative review. *J Epidemiol Glob Health* [Internet]. 2021;11(2):169–77. Disponible en: <http://dx.doi.org/10.2991/jegh.k.201217.001>
2. Correction to: Heart disease and stroke statistics-2023 update: A report from the American heart association. *Circulation* [Internet]. 2023;148(4):e4. Disponible en: <http://dx.doi.org/10.1161/CIR.0000000000001167>
3. Jennings RB, Ganote CE. Structural changes in myocardium during acute ischemia. *Circ Res* [Internet]. 1974;35(3_supplement). Available from: http://dx.doi.org/10.1161/res.35.3_supplement.iii-156
4. Gupta A, Wang Y, Spertus JA, et al. Trends in acute myocardial infarction in young patients and differences by sex and race, 2001 to 2010. *J Am Coll Cardiol*. 2014;64(4):337-345
5. Salari N, Morddarvanjoghi F, Abdolmaleki A, Rasoulpoor S, Khaleghi AA, Hezarkhani LA, et al. The global prevalence of myocardial infarction: a systematic review and meta-analysis. *BMC Cardiovasc Disord* [Internet]. 2023;23(1):206.
6. Mozaffarian D, Benjamin EJ, Go AS, et al; American Heart Association Statistics Committee; Stroke Statistics Subcommittee. Executive summary: heart disease and stroke statisticsd2016 update: a report from the American Heart Association. *Circulation*. 2016;133(4):447-454
7. Salud OMS. Enfermedades cardiovasculares Pagina oficial, Organización Mundial de la Salud: Organización Mundial de la Salud 2016. Available from: <http://www.who.int/mediacentre/factsheets/fs317/es/>.
8. Gupta A, Wang Y, Spertus JA, Geda M, Lorenze N, Nkonde-Price C, D'Onofrio G, Lichtman JH, Krumholz HM. Trends in acute myocardial infarction in young patients and differences by sex and race, 2001 to 2010. *J Am Coll Cardiol*. 2014 Jul 29;64(4):337-45. doi: 10.1016/j.jacc.2014.04.054. PMID: 25060366; PMCID: PMC4415523.

9. OPS. La carga de las enfermedades cardiovasculares en la Región de las Américas, 2000-2019. Portal de Datos de NMH. Organización Panamericana de la Salud; 2021. Available form: <https://www.paho.org/es/enlace/carga-enfermedades-cardiovasculares>
10. Gulati R, Behfar A, Narula J, Kanwar A, Lerman A, Cooper L, Singh M. Acute Myocardial Infarction in Young Individuals. Mayo Clin Proc. 2020 Jan;95(1):136-156. doi: 10.1016/j.mayocp.2019.05.001. PMID: 31902409.
11. Fetales y no fetales, D. (s/f). Estadísticas Vitales (EEVV). Gov.co. Recuperado el 23 de mayo de 2023, de https://www.dane.gov.co/files/investigaciones/poblacion/bt_estadisticasvital es_defunciones_IVtrim_2022pr.pdf. Disponible en: <http://dx.doi.org/10.1186/s12872-023-03231-w>
12. Sood A, Singh A, Gadkari C. Myocardial infarction in young individuals: A review article. Cureus [Internet]. 2023;15(4):e37102. Disponible en: <http://dx.doi.org/10.7759/cureus.37102>
13. Kannel WB, Abbott RD. Incidence and prognosis of unrecognized myocardial infarction: an update on the Framingham Study. N Engl J Med. 1984;311(18):1144-1147.
14. Yusuf S, Hawken S, Ounpuu S. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the interheart study): Case-control study. J Cardiopulm Rehabil [Internet]. 2005;25(1):56–7. Disponible en: <http://dx.doi.org/10.1097/00008483-200501000-00013>
15. Matsis K, Holley A, Al-Sinan A, Matsis P, Larsen PD, Harding SA. Differing clinical characteristics between young and older patients presenting with myocardial infarction. Heart Lung Circ [Internet]. 2017;26(6):566–71. Disponible en: <http://dx.doi.org/10.1016/j.hlc.2016.09.007>
16. Jernberg T, Hasvold P, Henriksson M, Hjelm H, Thuresson M, Janzon M. Cardiovascular risk in post-myocardial infarction patients: nationwide real world data demonstrate the importance of a long-term perspective. Eur Heart J [Internet]. 2015;36(19):1163–70. Disponible en: <http://dx.doi.org/10.1093/eurheartj/ehu505>

17. Naghavi M, Libby P, Falk E, et al. From vulnerable plaque to vulnerable patient: a call for new definitions and risk assessment strategies: Part I. *Circulation*. 2003;108(14):1664-1672.
18. Towfighi A, Markovic D, Ovbiagele B. National gender specific trends in myocardial infarction hospitalization rates among patients aged 35 to 64 years. *Am J Cardiol*. 2011; 108(8):1102-1107
19. Izadnegahdar M, Singer J, Lee MK, et al. Do younger women fare worse? sex differences in acute myocardial infarction hospitalization and early mortality rates over ten years. *J Womens Health (Larchmt)*. 2014;23(1):10-17
20. McGill HC, McMahan CA, Zieske AW, Sloop GD, Walcott JV, Troxclair DA, et al. Associations of coronary heart disease risk factors with the intermediate lesion of atherosclerosis in youth. The pathobiological determinants of atherosclerosis in youth (PDAY) research group. *Arterioscler Thromb Vasc Biol*. 2000;20(8):1998-2004.
21. Vischer UM, Emeis JJ, Bilo HJ, Stehouwer CD, Thomsen C, Rasmussen O, et al. von Willebrand factor (vWf) as a plasma marker of endothelial activation in diabetes: improved reliability with parallel determination of the vWf propeptide (vWf:AgII). *Thromb Haemost*. 1998;80(6):1002–7.
22. Sobel BE, Woodcock-Mitchell J, Schneider DJ, Holt RE, Marutsuka K, Gold H. Increased plasminogen activator inhibitor type 1 in coronary artery atherectomy specimens from type 2 diabetic compared with nondiabetic patients: a potential factor predisposing to thrombosis and its persistence: A potential factor predisposing to thrombosis and its persistence. *Circulation* [Internet]. 1998;97(22):2213–21. Disponible en: <http://dx.doi.org/10.1161/01.cir.97.22.2213>
23. Ceriello A, Giugliano D, Quatraro A, Marchi E, Barbanti M, Lefèbvre P. Evidence for a hyperglycaemia-dependent decrease of antithrombin III-thrombin complex formation in humans. *Diabetologia* [Internet]. 1990;33(3):163–7. Disponible en: <http://dx.doi.org/10.1007/bf00404044>

24. Tiffany M. Powell-Wiley, Paul Poirier, Lora E. Burke, Jean-Pierre Després, Penny Gordon-Larsen, Carl J. Lavie, Scott A. Lear, Chiadi E. Ndumele, Ian J. Neeland. Obesity and Cardiovascular Disease: A Scientific Statement From the American Heart Association. CIRCULATION.2021;143:e984-e1010. Disponible en: <https://doi.org/10.1161/CIR.0000000000000973>
25. Ilic M, Grujicic Sipetic S, Ristic B, Ilic I. Myocardial infarction and alcohol consumption: A case-control study. PLoS One [Internet]. 2018;13(6):e0198129. Disponible en: <http://dx.doi.org/10.1371/journal.pone.0198129>
26. Russell M, Fan AZ, Freudenheim JL, Dorn J, Trevisan M. Lifetime drinking trajectories and nonfatal acute myocardial infarction. Alcohol Clin Exp Res [Internet]. 2019;43(11):2384–94. Disponible en: <http://dx.doi.org/10.1111/acer.14190>
27. Ma I, Genet T, Clementy N, Bisson A, Herbert J, Semaan C, et al. Outcomes in patients with acute myocardial infarction and history of illicit drug use: a French nationwide analysis. Eur Heart J Acute Cardiovasc Care [Internet]. 2021;10(9):1027–37. Disponible en: <http://dx.doi.org/10.1093/ehjacc/zuab073>
28. Moreno-Ruiz NC-PN. Acute myocardial infarction associated with cocaine use [Internet]. 2021 dic. Disponible en: <http://dx.doi.org/10.36104/amc.2020.1642>.
29. Garshick MS, Vaidean GD, Vani A, Underberg JA, Newman JD, Berger JS, et al. Cardiovascular risk factor control and lifestyle factors in young to middle-aged adults with newly diagnosed obstructive coronary artery disease. Cardiology [Internet]. 2019;142(2):83–90. Disponible en: <http://dx.doi.org/10.1159/000498891>
30. Herrero-Fernandez B, Gomez-Bris R, Somovilla-Crespo B, Gonzalez-Granado JM. Immunobiology of atherosclerosis: A complex net of interactions. Int J Mol Sci [Internet]. 2019;20(21):5293. Disponible en: <http://dx.doi.org/10.3390/ijms20215293>

31. Poston RN. Atherosclerosis: integration of its pathogenesis as a self-perpetuating propagating inflammation: a review: Integration of its pathogenesis as a self-perpetuating propagating inflammation. Cardiovascular Endocrinology & Metabolism [Internet]. 2019;8(2):51–61. Disponible en: <http://dx.doi.org/10.1097/xce.0000000000000172>
32. Kiaie N, Gorabi AM, Penson PE, Watts G, Johnston TP, Banach M, et al. A new approach to the diagnosis and treatment of atherosclerosis: the era of the liposome. Drug Discov Today [Internet]. 2020;25(1):58–72. Disponible en: <http://dx.doi.org/10.1016/j.drudis.2019.09.005>
33. McGill HC Jr, McMahan CA, Zieske AW, Sloop GD, Walcott JV, Troxclair DA, et al. Associations of coronary heart disease risk factors with the intermediate lesion of atherosclerosis in youth. The Pathobiological Determinants of Atherosclerosis in Youth (PDAY) Research Group. Arterioscler Thromb Vasc Biol [Internet]. 2000;20(8):1998–2004. Disponible en: <http://dx.doi.org/10.1161/01.atv.20.8.1998>
34. Mendizábal B, Urbina EM. Subclinical atherosclerosis in youth: Relation to obesity, insulin resistance, and polycystic ovary syndrome. J Pediatr [Internet]. 2017;190:14–20. Disponible en: <http://dx.doi.org/10.1016/j.jpeds.2017.06.043>
35. Abrignani MG, Lucà F, Favilli S, Benvenuto M, Rao CM, Di Fusco SA, et al. Lifestyles and cardiovascular prevention in childhood and adolescence. Pediatr Cardiol [Internet]. 2019;40(6):1113–25. Disponible en: <http://dx.doi.org/10.1007/s00246-019-02152-w>
36. Van De Maele K, Devlieger R, Gies I. In utero programming and early detection of cardiovascular disease in the offspring of mothers with obesity. Atherosclerosis [Internet]. 2018;275:182–95. Disponible en: <http://dx.doi.org/10.1016/j.atherosclerosis.2018.06.016>
37. Poorzand H, Tsarouhas K, Hozhabrossadati SA, Khorrampazhouh N, Bondarsahebi Y, Bacopoulou F, et al. Risk factors of premature coronary artery disease in Iran: A systematic review and meta-analysis. Eur J Clin

Invest [Internet]. 2019;49(7):e13124. Disponible en:
<http://dx.doi.org/10.1111/eci.13124>

38. Ahmadi A, Argulian E, Leipsic J, Newby DE, Narula J. From subclinical atherosclerosis to plaque progression and acute coronary events: JACC state-of-the-art review. *J Am Coll Cardiol* [Internet]. 2019;74(12):1608–17. Disponible en: <http://dx.doi.org/10.1016/j.jacc.2019.08.012>
39. Gomes ÉIL, Zago VH de S, Faria EC de. Evaluation of lipid profiles of children and youth from Basic Health Units in Campinas, SP, Brazil: A cross-sectional laboratory study. *Arq Bras Cardiol* [Internet]. 2020;114(1):47–56. Disponible en: <http://dx.doi.org/10.5935/abc.20190209>
40. Murtaza G, Mukherjee D, Gharacholou SM, Nanjundappa A, Lavie CJ, Khan AA, et al. An updated review on myocardial bridging. *Cardiovasc Revasc Med* [Internet]. 2020;21(9):1169–79. Disponible en: <http://dx.doi.org/10.1016/j.carrev.2020.02.014>
41. Beijk MA, Vlastra WV, Delewi R, van de Hoef TP, Boekholdt SM, Sjauw KD, et al. Myocardial infarction with non-obstructive coronary arteries: a focus on vasospastic angina. *Neth Heart J* [Internet]. 2019;27(5):237–45. Disponible en: <http://dx.doi.org/10.1007/s12471-019-1232-7>
42. Agewall S, Beltrame JF, Reynolds HR, Niessner A, Rosano G, Caforio ALP, et al. ESC working group position paper on myocardial infarction with non-obstructive coronary arteries. *Eur Heart J* [Internet]. 2017;38(3):143–53. Disponible en: <http://dx.doi.org/10.1093/eurheartj/ehw149>
43. Niccoli G, Scalone G, Crea F. Acute myocardial infarction with no obstructive coronary atherosclerosis: mechanisms and management. *Eur Heart J* [Internet]. 2015;36(8):475–81. Disponible en: <http://dx.doi.org/10.1093/eurheartj/ehu469>
44. Brochado B, Luz A, Silveira J, Carvalho HC, Torres S. Successful treatment of spontaneous coronary artery dissection with intracoronary imaging guidance. *Coron Artery Dis* [Internet]. 2017;28(5):440–2. Disponible en: <http://dx.doi.org/10.1097/mca.0000000000000473>

45. Hayes SN, Kim ESH, Saw J, Adlam D, Arslanian-Engoren C, Economy KE, et al. Spontaneous coronary artery dissection: Current state of the science: A scientific statement from the American heart association. Circulation [Internet]. 2018;137(19):e523–57. Disponible en: <http://dx.doi.org/10.1161/CIR.0000000000000564>
46. Adlam D, Alfonso F, Maas A, Vrints C, Writing Committee. European Society of Cardiology, acute cardiovascular care association, SCAD study group: a position paper on spontaneous coronary artery dissection. Eur Heart J [Internet]. 2018;39(36):3353–68. Disponible en: <http://dx.doi.org/10.1093/eurheartj/ehy080>
47. Saw J, Starovoytov A, Aymong E, Inohara T, Alfadhel M, McAlister C, et al. Canadian spontaneous coronary artery dissection cohort study: 3-year outcomes. J Am Coll Cardiol [Internet]. 2022;80(17):1585–97. Disponible en: <http://dx.doi.org/10.1016/j.jacc.2022.08.759>
48. Lobo AS, Cantu SM, Sharkey SW, Grey EZ, Storey K, Witt D, et al. Revascularization in patients with spontaneous coronary artery dissection and ST-segment elevation myocardial infarction. J Am Coll Cardiol [Internet]. 2019;74(10):1290–300. Disponible en: <http://dx.doi.org/10.1016/j.jacc.2019.06.065>
49. Patel RS, Kamil SH, Bachu R, Adikey A, Ravat V, Kaur M, et al. Marijuana use and acute myocardial infarction: A systematic review of published cases in the literature. Trends Cardiovasc Med [Internet]. 2020;30(5):298–307. Disponible en: <http://dx.doi.org/10.1016/j.tcm.2019.08.003>
50. Westover AN, Nakonezny PA, Haley RW. Acute myocardial infarction in young adults who abuse amphetamines. Drug Alcohol Depend [Internet]. 2008;96(1–2):49–56. Disponible en: <http://dx.doi.org/10.1016/j.drugalcdep.2008.01.027>
51. Ehlers A, Marakis G, Lampen A, Hirsch-Ernst KI. Risk assessment of energy drinks with focus on cardiovascular parameters and energy drink consumption in Europe. Food Chem Toxicol [Internet]. 2019;130:109–21. Disponible en: <http://dx.doi.org/10.1016/j.fct.2019.05.028>

52. Liu Y, Han T, Gao M, Wang J, Liu F, Zhou S, et al. Clinical characteristics and prognosis of acute myocardial infarction in young smokers and non-smokers (≤ 45 years): a systematic review and meta-analysis. *Oncotarget* [Internet]. 2017;8(46):81195–203. Disponible en: <http://dx.doi.org/10.18632/oncotarget.21092>
53. Correction: Development of a systemic lupus erythematosus cardiovascular risk equation. *Lupus Sci Med* [Internet]. 2020;7(1):e000346corr1. Disponible en: <http://dx.doi.org/10.1136/lupus-2019-000346corr1>.
54. Maor E, Fefer P, Varon D, Rosenberg N, Levi N, Hod H, et al. Thrombophilic state in young patients with acute myocardial infarction. *J Thromb Thrombolysis* [Internet]. 2015;39(4):474–80. Disponible en: <http://dx.doi.org/10.1007/s11239-014-1166-2>
55. Lorenze NP, et al. Sex differences in the presentation and perception of symptoms among young patients with myocardial infarction: Evidence from the VIRGO study (Variation in Recovery: Role of Gender on Outcomes of young AMI patients): Evidence from the VIRGO study (Variation in Recovery: Role of Gender on Outcomes of young AMI patients). *Circulation* [Internet]. 2018;137(8):781–90. Disponible en: <http://dx.doi.org/10.1161/CIRCULATIONAHA.117.031650>
56. Gillis NK, Arslanian-Engoren C, Struble LM. Acute coronary syndromes in older adults: a review of literature. *J Emerg Nurs* [Internet]. 2014;40(3):270–5; quiz 292. Disponible en: <http://dx.doi.org/10.1016/j.jen.2013.03.003>
57. Grosmaître P, Le Vavasseur O, Yachouh E, Courtial Y, Jacob X, Meyran S, et al. Significance of atypical symptoms for the diagnosis and management of myocardial infarction in elderly patients admitted to emergency departments. *Arch Cardiovasc Dis* [Internet]. 2013;106(11):586–92. Disponible en: <http://dx.doi.org/10.1016/j.acvd.2013.04.010>
58. Lv J, Ni L, Liu K, Gao X, Yang J, Zhang X, et al. Clinical characteristics, prognosis, and gender disparities in young patients with acute myocardial infarction. *Front Cardiovasc Med* [Internet]. 2021;8:720378. Disponible en: <http://dx.doi.org/10.3389/fcvm.2021.720378>

59. Haider KH, Alshoabi SA, Alharbi IA, Gameraddin M, Abdulaal OM, Gareeballah A, et al. Clinical presentation and angiographic findings of acute myocardial infarction in young adults in Jazan region. BMC Cardiovasc Disord [Internet]. 2023;23(1):302. Disponible en: <http://dx.doi.org/10.1186/s12872-023-03335-3>
60. Diercks DB, Peacock WF, Hiestand BC, Chen AY, Pollack CV Jr, Kirk JD, et al. Frequency and consequences of recording an electrocardiogram >10 minutes after arrival in an emergency room in non-ST-segment elevation acute coronary syndromes (from the CRUSADE Initiative). Am J Cardiol [Internet]. 2006;97(4):437–42. Disponible en: <http://dx.doi.org/10.1016/j.amjcard.2005.09.073>
61. Neumann JT, Sörensen NA, Ojeda F, Schwemer T, Lehmacher J, Gönner S, et al. Immediate rule-out of acute myocardial infarction using electrocardiogram and baseline high-sensitivity troponin I. Clin Chem [Internet]. 2017;63(1):394–402. Disponible en: <http://dx.doi.org/10.1373/clinchem.2016.262659>
62. Alfonso F, Sionis A, Bueno H, Ibáñez B, Sabaté M, Cequier Á, et al. Comments on the 2017 ESC guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Rev Esp Cardiol (Engl Ed) [Internet]. 2017;70(12):1039–45. Disponible en: <http://dx.doi.org/10.1016/j.rec.2017.11.009>
63. Sugraliyev AB, S.D. Asfendiyarov Kazakh National Medical University, Almaty c., Republic of Kazakhstan. Brief review of the 2017 ESC guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Int Prof J Med [Internet]. 2018;195(9):15–23. Disponible en: <http://dx.doi.org/10.31082/1728-452x-2018-195-9-15-23>
64. Usuda D, Tanaka R, Suzuki M, Takano H, Hotchi Y, Shimozawa S, et al. ST-elevation acute myocardial infarction in a young man. J Med Cases [Internet]. 2022;13(6):281–9. Disponible en: <http://dx.doi.org/10.14740/jmc3939>
65. Tung BW, Ng ZY, Kristanto W, Saw KW, Chan S-P, Sia W, et al. Characteristics and outcomes of young patients with ST segment elevation

- myocardial infarction undergoing primary percutaneous coronary intervention: retrospective analysis in a multiethnic Asian population. *Open Heart* [Internet]. 2021;8(1):e001437. Disponible en: <http://dx.doi.org/10.1136/openhrt-2020-001437>
66. Safiri S, Ashrafi-Asgarabad A. Causes of troponin elevation and associated mortality in young patients: Methodological issues. *Am J Med* [Internet]. 2018;131(6):e285. Disponible en: <http://dx.doi.org/10.1016/j.amjmed.2018.01.055>
67. Mueller C, Twerenbold R, Reichlin T. Early diagnosis of myocardial infarction with sensitive cardiac troponin assays. *Clin Chem* [Internet]. 2019;65(3):490–1. Disponible en: <http://dx.doi.org/10.1373/clinchem.2018.298638>
68. SEC Working Group for the 2020 ESC Guidelines for the Management of Acute Coronary Syndromes in Patients Presenting Without Persistent ST-segment Elevation, Expert Reviewers for the 2020 ESC Guidelines for the Management of Acute Coronary Syndromes in Patients Presenting Without Persistent ST-segment Elevation, SEC Guidelines Committee. Electronic address: asambola@vhebron.net, SEC Working Group for the 2020 ESC guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation, Expert reviewers for the 2020 ESC guidelines for the management of acute coronary syndromes in patients presenting without persistent ST segment elevation, SEC Guidelines Committee. Comments on the 2020 ESC guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. *Rev Esp Cardiol (Engl Ed)* [Internet]. 2021;74(6):482–7. Disponible en: <http://dx.doi.org/10.1016/j.rec.2020.12.018>
69. Twerenbold R, Badertscher P, Boeddinghaus J, Nestelberger T, Wildi K, Puelacher C, et al. 0/1-hour triage algorithm for myocardial infarction in patients with renal dysfunction. *Circulation* [Internet]. 2018;137(5):436–51. Disponible en: <http://dx.doi.org/10.1161/CIRCULATIONAHA.117.028901>
70. Flachskampf FA, Schmid M, Rost C, Achenbach S, DeMaria AN, Daniel WG. Cardiac imaging after myocardial infarction. *Eur Heart J* [Internet].

2011;32(3):272–83.

Disponible

en:

<http://dx.doi.org/10.1093/eurheartj/ehq446>

71. Khan JN, McCann GP. Cardiovascular magnetic resonance imaging assessment of outcomes in acute myocardial infarction. World J Cardiol [Internet]. 2017;9(2):109. Disponible en:

<http://dx.doi.org/10.4330/wjc.v9.i2.10>

72. Mewton N, Liu CY, Croisille P, Bluemke D, Lima JAC. Assessment of myocardial fibrosis with cardiovascular magnetic resonance. J Am Coll Cardiol [Internet]. 2011;57(8):891–903. Disponible en:

<http://dx.doi.org/10.1016/j.jacc.2010.11.013>

73. Nordlund D, Heiberg E, Carlsson M, Fründ E-T, Hoffmann P, Koul S, et al. Extent of myocardium at risk for left anterior descending artery, right coronary artery, and left circumflex artery occlusion depicted by Contrast-enhanced steady state free precession and T2-weighted short tau inversion recovery magnetic resonance imaging. Circ Cardiovasc Imaging [Internet]. 2016;9(7). Disponible en: <http://dx.doi.org/10.1161/circimaging.115.004376>

74. Ahmed IAM, Khalid NHM, Abd-Elmagid AEM, Abdullah MAM, Musa AMI, AL-Qarni NO. Common coronary artery occlusions in patients with myocardial infarction. Pan Afr Med J [Internet]. 2022;42. Disponible en: <http://dx.doi.org/10.11604/pamj.2022.42.254.34762>.

75. Byrne RA, Rossello X, Coughlan JJ, Barbato E, Berry C, Chieffo A, et al. 2023 ESC Guidelines for the management of acute coronary syndromes. Eur Heart J [Internet]. 2023;44(38):3720–826. Disponible en: <http://dx.doi.org/10.1093/eurheartj/ehad191>.

76. Marín F, Ospina LF. Infarto agudo del miocardio en adultos jóvenes menores de 45 años. Rev Col Car diol. 2004; Vol. 11 No. 4