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CARACTERÍSTICAS IMAGENOLÓGICAS POR ANGIOTOMOGRAFÍA CORONARIA EN PACIENTES DE UN PROGRAMA DE TRASPLANTE RENAL EN BARRANQUILLA - COLOMBIA

Línea de investigación: Factores de riesgo en enfermedad cardiovascular

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RESUMEN

La enfermedad cardiovascular es la principal causa de morbilidad y mortalidad en pacientes con enfermedad renal crónica. En los pacientes trasplantados, la enfermedad arterial coronaria aumenta el riesgo de muerte y pérdida del injerto en 2,7 veces; esta condición es más común en el primer año después del trasplante.

Objetivo: Describir las características imagenológicas por angiotomografía de la enfermedad coronaria en los pacientes con enfermedad renal crónica en el programa de trasplante renal de una clínica de cuarto nivel en la ciudad de Barranquilla-Colombia.

Metodología: Se realizó un estudio analítico, retrospectivo, transversal, se tomaron las historias clínicas del programa de pretrasplante a todos los pacientes que requirieron valoración por el servicio de cardiología, se les realizó angiotomografía, con la finalidad de evaluar CAD-RADS, Carga de Placa y Tipo de Placa por segmento arterial coronario. Se realizó asociación entre estas variables a través de un χ^2 o un test exacto de Fisher, según el caso. Se realizó un análisis de frecuencia, y representación porcentual de acuerdo con el tipo de variable.

Resultados: La población estuvo conformada por 236 pacientes de los cuales 80 cumplieron criterios de inclusión y exclusión. La proporción sexual fue de dos mujeres por cada tres hombres, es decir con una representación del 60% hombres. La edad promedio fue de 56 ± 6.1 años sin diferencia significativa entre los sexos (W: 855; p-valor: 0.3948). La HTA fue la comorbilidad más frecuente. El 92% de los pacientes estaban en TRR. El 67.35% de los pacientes tenían CAD-RADS entre 1 y 2, con unas cargas de placa Leve (53.06%) a moderada (22.56%), se encontró asociación entre estos dos parámetros (p: 0.0000). En cuanto al tipo de placa relacionado con la Carga de placa no se evidenció relación entre estas dos variables ($p > 0.05$), siendo los tipos de placa más frecuentes el Calcifica y Fibrocalcifica No Alto Riesgo.

Conclusiones: Aunque el 45% de los pacientes no presentaron lesiones arteriales coronarias. En aquellos que se encontraron lesiones coronarias, no se evidenció un patrón específico de carga de placa o tipo placa o un segmento afectado, lo que de acuerdo con los grados de estenosis son tan bajos encontrados lleva a pensar que no se ha instaurado un síndrome renocardíaco.

Palabras clave: Angiotomografía coronaria; CAD-RADS; Carga de Placa; Trasplante renal, enfermedad cardiovascular, enfermedad renal crónica.



ABSTRACT

Cardiovascular disease is the leading cause of morbidity and mortality in patients with chronic kidney disease. In transplant patients, coronary artery disease increases the risk of death and graft loss by 2.7 times; this condition is most common in the first year after transplant.

Objective: To describe the imaging characteristics of coronary artery disease by CT angiography in patients with chronic kidney disease in the kidney transplant program of a fourth-level clinic in the city of Barranquilla-Colombia.

Methodology: An analytical, retrospective, cross-sectional study was carried out, the medical records of the pre-transplant program were taken from all the patients who required evaluation by the cardiology service, they underwent angiotomography, with the purpose of evaluating CAD-RADS, load of Plaque and Plaque Type by coronary artery segment. An association was made between these variables through a χ^2 or Fisher's exact test, depending on the case. An analysis of frequency and percentage representation according to the type of variable was performed.

Results: The population consisted of 236 patients, of which 80 met the inclusion and exclusion criteria. The sexual proportion was two women for every three men, that is, with a representation of 60% men. The average age was 56 ± 6.1 years with no significant difference between the sexes (W: 855; p-value: 0.3948). Hypertension was the most frequent comorbidity. 92% of the patients were on RRT. 67.35% of the patients had CAD-RADS between 1 and 2, with Mild (53.06%) to moderate (22.56%) plate loads, an association was found between these two parameters (p: 0.0000). Regarding the type of plaque related to plaque load, there was no evidence of a relationship between these two variables ($p > 0.05$), with the most frequent types of plaque being Calcific and Fibrocalcific Non-High Risk.

Conclusions: Although 45% of the patients did not present coronary artery lesions. In what coronary lesions were found, there was no evidence of a specific pattern of plaque load or plaque type or an affected segment, which according to the degrees of stenosis found are so low that it leads to think that arenocardiac syndrome has not been established.

Keywords: Coronary angiotomography; CAD-RADS; Plate Load; Kidney transplant, cardiovascular disease, chronic kidney disease.



Referencias Bibliográficas:

1. Cardiovascular diseases [Internet]. [cited 2022 Oct 4]. Available from: https://platform.who.int/mortality/themes/theme-details/topics/topic-details/MD_B/cardiovascular-diseases
2. Hugo ACV. MinSalud - Mortalidad en Colombia 2020-2021. :45.
3. Go AS, Chertow GM, Fan D, McCulloch CE, Hsu C yuan. Chronic Kidney Disease and the Risks of Death, Cardiovascular Events, and Hospitalization. *N Engl J Med.* 2004 Sep 23;351(13):1296–305.
4. Shroff GR, Carlson MD, Mathew RO. Coronary Artery Disease in Chronic Kidney Disease: Need for a Heart–Kidney Team-Based Approach. *Eur Cardiol Rev.* 2021 Dec 7;16:e48.
5. Saran R, Robinson B, Abbott KC, Agodoa LYC, Albertus P, Ayanian J, et al. US Renal Data System 2016 Annual Data Report: Epidemiology of Kidney Disease in the United States. *Am J Kidney Dis Off J Natl Kidney Found.* 2017 Mar;69(3 Suppl 1):A7–8.
6. Go AS, Bansal N, Chandra M, Lathon PV, Fortmann SP, Iribarren C, et al. Chronic kidney disease and risk for presenting with acute myocardial infarction versus stable exertional angina in adults with coronary heart disease. *J Am Coll Cardiol.* 2011 Oct 4;58(15):1600–7.
7. Karohl C, D'Marco Gascón L, Raggi P. Noninvasive imaging for assessment of calcification in chronic kidney disease. *Nat Rev Nephrol.* 2011 Aug 23;7(10):567–77.
8. Wilkieson TJ, Rahman MO, Gangji AS, Voss M, Ingram AJ, Ranganath N, et al. Coronary artery calcification, cardiovascular events, and death: a prospective cohort study of incident patients on hemodialysis. *Can J Kidney Health Dis.* 2015;2:29.
9. Winther S, Svensson M, Jørgensen HS, Bouchelouche K, Gormsen LC, Pedersen BB, et al. Diagnostic Performance of Coronary CT Angiography and Myocardial Perfusion Imaging in Kidney Transplantation Candidates. *JACC Cardiovasc Imaging.* 2015 May;8(5):553–62.
10. Sarnak MJ, Amann K, Bangalore S, Cavalcante JL, Charytan DM, Craig JC, et al. Chronic Kidney Disease and Coronary Artery Disease: JACC State-of-the-Art Review. *J Am Coll Cardiol.* 2019 Oct 8;74(14):1823–38.
11. Libro de la salud cardiovascular del Hospital Clínico San Carlos y la Fundación BBVA [Internet]. FBBVA. [cited 2022 Oct 13]. Available from: <https://www.fbbva.es/publicaciones/libro-de-la-salud-cardiovascular-del-hospital-clinico-san-carlos-y-la-fundacion-bbva/>
12. Complicaciones cardiovasculares en el trasplante renal | Nefrología al día [Internet]. [cited 2022 Oct 13]. Available from: <http://www.nefrologiaaldia.org/es-articulo-143>
13. Mori H, Torii S, Kutyna M, Sakamoto A, Finn AV, Virmani R. Coronary Artery Calcification and its Progression: What Does it Really Mean? *JACC Cardiovasc Imaging.* 2018 Jan 1;11(1):127–42.
14. Arbab-Zadeh A, Fuster V. The Myth of the “Vulnerable Plaque”: Transitioning From a Focus on Individual Lesions to Atherosclerotic Disease Burden for Coronary Artery Disease Risk Assessment. *J Am Coll Cardiol.*



- 2015 Mar 3;65(8):846–55.
15. Seoane-Pillado MT, Pita-Fernández S, Valdés-Cañedo F, Seijo-Bestilleiro R, Pérgola-Díaz S, Fernández-Rivera C, et al. Incidence of cardiovascular events and associated risk factors in kidney transplant patients: a competing risks survival analysis. *BMC Cardiovasc Disord*. 2017 Mar 7;17(1):72.
 16. Heart Disease and Stroke Statistics—2018 Update: A Report From the American Heart Association | *Circulation* [Internet]. [cited 2022 Sep 27]. Available from: <https://www.ahajournals.org/doi/10.1161/CIR.0000000000000558>
 17. Gaziano TA, Prabhakaran D, Gaziano JM. Global Burden of Cardiovascular Disease. In: Libby P MD, Bonow RO MD, Mann DL MD, Tomaselli GF MD, Bhatt DL MD, MPH, Solomon SD MD, editors. *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine* [Internet]. 2022. p. 14–30. Available from: <https://www.clinicalkey.es/#!/content/3-s2.0-B9780323722193000025>
 18. Yusuf S, Joseph P, Rangarajan S, Islam S, Mente A, Hystad P, et al. Modifiable risk factors, cardiovascular disease, and mortality in 155 722 individuals from 21 high-income, middle-income, and low-income countries (PURE): a prospective cohort study. *The Lancet*. 2020 Mar 7;395(10226):795–808.
 19. Statistics (US) NC for H. Health, United States, 2015 [Internet]. National Center for Health Statistics (US); 2016 [cited 2022 Sep 27]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK367640/>
 20. WHO report on the global tobacco epidemic 2019: offer help to quit tobacco use [Internet]. [cited 2022 Sep 27]. Available from: <https://www.who.int/publications-detail-redirect/9789241516204>
 21. Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980–2017: a systematic analysis for the Global Burden of Disease Study 2017 - *The Lancet* [Internet]. Available from: [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(18\)32203-7/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)32203-7/fulltext)
 22. Wang C, Yuan Y, Zheng M, Pan A, Wang M, Zhao M, et al. Association of Age of Onset of Hypertension With Cardiovascular Diseases and Mortality. *J Am Coll Cardiol*. 2020 Jun 16;75(23):2921–30.
 23. Más de 700 millones de personas con hipertensión sin tratar [Internet]. [cited 2022 Sep 28]. Available from: <https://www.who.int/es/news/item/25-08-2021-more-than-700-million-people-with-untreated-hypertension>
 24. Arterial hypertension – Clinical trials update 2021 - Nutrition, Metabolism and Cardiovascular Diseases [Internet]. [cited 2022 Sep 28]. Available from: [https://www.nmcd-journal.com/article/S0939-4753\(21\)00447-6/fulltext](https://www.nmcd-journal.com/article/S0939-4753(21)00447-6/fulltext)
 25. Genest J, Mora S, Libby P. Lipoprotein Disorders and Cardiovascular Disease. In: Libby P MD, Bonow RO MD, Mann DL MD, Tomaselli GF MD, Bhatt DL MD, MPH, Solomon SD MD, editors. *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine* [Internet]. 2022. p. 502-524.e1. Available from: <https://www.clinicalkey.es/#!/content/3-s2.0-B978032372219300027X>



26. Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes Res Clin Pract* [Internet]. 2019 Nov 1 [cited 2022 Sep 28];157. Available from: [https://www.diabetesresearchclinicalpractice.com/article/S0168-8227\(19\)31230-6/fulltext](https://www.diabetesresearchclinicalpractice.com/article/S0168-8227(19)31230-6/fulltext)
27. Brownlee M, Aiello LP, Sun JK, Cooper ME, Feldman EL, Plutzky J, et al. Complicaciones de la diabetes mellitus. In: Melmed S MB ChB, MACP, Auchus RJ MD, PhD, Goldfine AB MD, Koenig RJ MD, PhD, Rosen CJ MD, editors. *Williams Tratado de endocrinología* [Internet]. 2021. p. 1438–524. Available from: <https://www.clinicalkey.es/#!/content/3-s2.0-B9788491138518000377>
28. Marx N, Inzucchi SE, McGuire DK. Diabetes and the Cardiovascular System. In: Libby P MD, Bonow RO MD, Mann DL MD, Tomaselli GF MD, Bhatt DL MD, MPH, Solomon SD MD, editors. *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine* [Internet]. 2022. p. 556–78. Available from: <https://www.clinicalkey.es/#!/content/3-s2.0-B9780323722193000311>
29. Obesity and overweight [Internet]. [cited 2022 Sep 29]. Available from: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>
30. Katta N MD, Loethen T MD, Lavie CJ MD, Alpert MA MD. Obesity and Coronary Heart Disease: Epidemiology, Pathology, and Coronary Artery Imaging. *Curr Probl Cardiol*. 2021 Mar 1;46(3):100655.
31. Hubert HB, Feinleib M, McNamara PM, Castelli WP. Obesity as an independent risk factor for cardiovascular disease: a 26-year follow-up of participants in the Framingham Heart Study. *Circulation*. 1983 May;67(5):968–77.
32. Kannel WB, D'Agostino RB, Cobb JL. Effect of weight on cardiovascular disease. *Am J Clin Nutr*. 1996 Mar;63(3 Suppl):419S-422S.
33. Bosch Genover X. Cardiopatía isquémica. In: von Domarus A, Farreras P, Rozman C, Cardellach F, Nicolás JM^a, Cervera R, et al., editors. *Farreras Rozman Medicina Interna* [Internet]. 2020. p. 475–95. Available from: <https://www.clinicalkey.es/#!/content/3-s2.0-B9788491135456000545>
34. Sarwar MF, Searles BE, Stone ME, Shore-Lesserson L. Anestesia para intervenciones de cirugía cardíaca. In: Gropper MA MD, PhD, Miller RD MD, Cohen NH MD, MPH, MS, Eriksson LI MD, PhD, FRCA, Fleisher LA MD, Leslie K MBBS, MD, MEpid, MHIthServMt, Hon DMedSci, FANZCA, et al., editors. *Miller Anestesia* [Internet]. 2021. p. 1717–814. Available from: <https://www.clinicalkey.es/#!/content/3-s2.0-B9788491137368000545>
35. Silverstein RL. Atherothrombosis. In: Hoffman R MD, Benz EJ MD, Silberstein LE MD, Heslop HE MD, DSc (Hon), Weitz JI MD, Anastasi J MD, et al., editors. *Hematology: Basic Principles and Practice* [Internet]. 2018. p. 2122–32. Available from: <https://www.clinicalkey.es/#!/content/3-s2.0-B978032335762300144X>
36. Hill MF, Bordoni B. Hyperlipidemia. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 [cited 2022 Oct 9]. Available from: <http://www.ncbi.nlm.nih.gov/books/NBK559182/>
37. Kelsey MD, Nelson AJ, Green JB, Granger CB, Peterson ED, McGuire



- DK, et al. Guidelines for Cardiovascular Risk Reduction in Patients With Type 2 Diabetes: JACC Guideline Comparison. *J Am Coll Cardiol.* 2022 May 10;79(18):1849–57.
38. Zhang Y, Pletcher MJ, Vittinghoff E, Clemons AM, Jacobs DR, Allen NB, et al. Association Between Cumulative Low-Density Lipoprotein Cholesterol Exposure During Young Adulthood and Middle Age and Risk of Cardiovascular Events. *JAMA Cardiol.* 2021 Dec 1;6(12):1406–13.
39. Bertomeu Ruiz A, Zambón Rados D. La placa aterogénica: fisiopatología y consecuencias clínicas. *Med Integral.* 2002 Nov 15;40(9):394–405.
40. Scirica BM, Libby P, Morrow DA. Infarto de miocardio con elevación del segmento ST: fisiopatología y evolución clínica. In: Zipes DP MD, Libby P MD, Bonow RO MD, Mann DL MD, Tomaselli GF MD, Braunwald E MD, MD(HON), SCD(HON), FRCP, editors. *Braunwald Tratado de cardiología [Internet].* 2019. p. 1095–122. Available from: <https://www.clinicalkey.es/#!/content/3-s2.0-B9788491133988000587>
41. Giugliano RP, Braunwald E. Síndromes coronarios agudos sin elevación del segmento ST. In: Zipes DP MD, Libby P MD, Bonow RO MD, Mann DL MD, Tomaselli GF MD, Braunwald E MD, MD(HON), SCD(HON), FRCP, editors. *Braunwald Tratado de cardiología [Internet].* 2019. p. 1181–208. Available from: <https://www.clinicalkey.es/#!/content/3-s2.0-B9788491133988000605>
42. Alexánder Rosas E, González AM, Jiménez-Santos M. Angiografía mediante tomografía computarizada cardiaca: una técnica versátil. *Rev Esp Cardiol.* 2011 Apr 1;64(4):255–7.
43. Cury RC, Leipsic J, Abbara S, Achenbach S, Berman D, Bittencourt M, et al. CAD-RADS™ 2.0 - 2022 Coronary Artery Disease-Reporting and Data System: An Expert Consensus Document of the Society of Cardiovascular Computed Tomography (SCCT), the American College of Cardiology (ACC), the American College of Radiology (ACR), and the North America Society of Cardiovascular Imaging (NASCI). *J Cardiovasc Comput Tomogr [Internet].* 2022 Jul 8 [cited 2022 Oct 4]; Available from: <https://www.sciencedirect.com/science/article/pii/S1934592522002404>
44. Cury RC, Leipsic J, Abbara S, Achenbach S, Berman D, Bittencourt M, et al. CAD-RADS™ 2.0 - 2022 Coronary Artery Disease-Reporting and Data System. *J Cardiovasc Comput Tomogr [Internet].* 1970 Jan 1; Available from: <https://www.clinicalkey.es/#!/content/1-s2.0-S1934592522002404>
45. Shaw LJ, Blankstein R, Bax JJ, Ferencik M, Bittencourt MS, Min JK, et al. Society of Cardiovascular Computed Tomography / North American Society of Cardiovascular Imaging - Expert Consensus Document on Coronary CT Imaging of Atherosclerotic Plaque. *J Cardiovasc Comput Tomogr.* 2021 Apr;15(2):93–109.
46. Xie JX, Cury RC, Leipsic J, Crim MT, Berman DS, Gransar H, et al. The Coronary Artery Disease-Reporting and Data System (CAD-RADS): Prognostic and Clinical Implications Associated With Standardized Coronary Computed Tomography Angiography Reporting. *JACC Cardiovasc Imaging.* 2018 Jan;11(1):78–89.
47. Bittner DO, Mayrhofer T, Budoff M, Szilveszter B, Foldyna B, Hallett TR, et al. Prognostic Value of Coronary CTA in Stable Chest Pain: CAD-RADS,



CAC, and Cardiovascular Events in PROMISE. *JACC Cardiovasc Imaging.* 2020 Jul;13(7):1534–45.

48. Basha MAA, Aly SA, Ismail AAA, Bahaaeldin HA, Shehata SM. The validity and applicability of CAD-RADS in the management of patients with coronary artery disease. *Insights Imaging.* 2019 Dec 4;10(1):117.
49. Rodriguez-Granillo GA, Carrascosa P, Goldsmit A, Arbab-Zadeh A. Invasive coronary angiography findings across the CAD-RADS classification spectrum. *Int J Cardiovasc Imaging.* 2019 Nov;35(11):1955–61.
50. Muscogiuri G, Chiesa M, Trotta M, Gatti M, Palmisano V, Dell'Aversana S, et al. Performance of a deep learning algorithm for the evaluation of CAD-RADS classification with CCTA. *Atherosclerosis.* 2020 Feb;294:25–32.
51. Shaikh K, Ahmed A, Gransar H, Lee J, Leipsic J, Nakanishi R, et al. Extent of subclinical atherosclerosis on coronary computed tomography and impact of statins in patients with diabetes without known coronary artery disease: Results from CONFIRM registry. *J Diabetes Complications.* 1970 Jan 1;108309.
52. Johnson KM, Johnson HE, Zhao Y, Dowe DA, Staib LH. Scoring of Coronary Artery Disease Characteristics on Coronary CT Angiograms by Using Machine Learning. *Radiology.* 2019 Aug;292(2):354–62.
53. Winther S, Svensson M, Jørgensen HS, Bouchelouche K, Gormsen LC, Pedersen BB, et al. Diagnostic Performance of Coronary CT Angiography and Myocardial Perfusion Imaging in Kidney Transplantation Candidates. *JACC Cardiovasc Imaging.* 2015 May;8(5):553–62.
54. Sarnak MJ, Amann K, Bangalore S, Cavalcante JL, Charytan DM, Craig JC, et al. Chronic Kidney Disease and Coronary Artery Disease: JACC State-of-the-Art Review. *J Am Coll Cardiol.* 2019 Oct 8;74(14):1823–38.
55. Stevens PE, Levin A, Kidney Disease: Improving Global Outcomes Chronic Kidney Disease Guideline Development Work Group Members. Evaluation and management of chronic kidney disease: synopsis of the kidney disease: improving global outcomes 2012 clinical practice guideline. *Ann Intern Med.* 2013 Jun 4;158(11):825–30.
56. Levey AS. Defining AKD: The Spectrum of AKI, AKD, and CKD. *Nephron.* 2022;146(3):302–5.
57. McCullough PA, Jurkovitz CT, Pergola PE, McGill JB, Brown WW, Collins AJ, et al. Independent components of chronic kidney disease as a cardiovascular risk state: results from the Kidney Early Evaluation Program (KEEP). *Arch Intern Med.* 2007 Jun 11;167(11):1122–9.
58. Matsushita K, Coresh J, Sang Y, Chalmers J, Fox C, Guallar E, et al. Estimated glomerular filtration rate and albuminuria for prediction of cardiovascular outcomes: a collaborative meta-analysis of individual participant data. *Lancet Diabetes Endocrinol.* 2015 Jul;3(7):514–25.
59. Impaired global myocardial flow dynamics despite normal left ventricular function and regional perfusion in chronic kidney disease: a quantitative analysis of clinical 82Rb PET/CT studies - PubMed [Internet]. [cited 2022 Oct 10]. Available from: <https://pubmed.ncbi.nlm.nih.gov/22562499/>
60. Mohandas R, Segal MS, Huo T, Handberg EM, Petersen JW, Johnson BD, et al. Renal function and coronary microvascular dysfunction in women



- with symptoms/signs of ischemia. *PloS One.* 2015;10(5):e0125374.
61. Wanner C, Tonelli M, Kidney Disease: Improving Global Outcomes Lipid Guideline Development Work Group Members. KDIGO Clinical Practice Guideline for Lipid Management in CKD: summary of recommendation statements and clinical approach to the patient. *Kidney Int.* 2014 Jun;85(6):1303–9.
 62. Barbagelata L, Masson W, Rossi E, Lee M, Lagoria J, Vilas M, et al. Cardiovascular Risk Stratification and Appropriate Use of Statins in Patients with Chronic Kidney Disease According to Different Strategies. *High Blood Press Cardiovasc Prev.* 2022 Sep 1;29(5):435–43.
 63. Fakhry M, Sidhu MS, Bangalore S, Mathew RO. Accelerated and intensified calcific atherosclerosis and microvascular dysfunction in patients with chronic kidney disease. *Rev Cardiovasc Med.* 2020 Jun 30;21(2):157–62.
 64. Mach F, Baigent C, Catapano AL, Koskinas KC, Casula M, Badimon L, et al. 2019 ESC/EAS Guidelines for the management of dyslipidaemias: lipid modification to reduce cardiovascular risk. *Eur Heart J.* 2020 Jan 1;41(1):111–88.
 65. London GM, Guérin AP, Marchais SJ, Métivier F, Pannier B, Adda H. Arterial media calcification in end-stage renal disease: impact on all-cause and cardiovascular mortality. *Nephrol Dial Transplant Off Publ Eur Dial Transpl Assoc - Eur Ren Assoc.* 2003 Sep;18(9):1731–40.
 66. Foley RN, Parfrey PS, Sarnak MJ. Epidemiology of cardiovascular disease in chronic renal disease. *J Am Soc Nephrol JASN.* 1998 Dec;9(12 Suppl):S16–23.
 67. Lentine KL, Rey LAR, Kolli S, Bacchi G, Schnitzler MA, Abbott KC, et al. Variations in the Risk for Cerebrovascular Events after Kidney Transplant Compared with Experience on the Waiting List and after Graft Failure. *Clin J Am Soc Nephrol CJASN.* 2008 Jul;3(4):1090–101.
 68. Jardine AG, Gaston RS, Fellstrom BC, Holdaas H. Prevention of cardiovascular disease in adult recipients of kidney transplants. *Lancet Lond Engl.* 2011 Oct 15;378(9800):1419–27.
 69. Weiner DE, Carpenter MA, Levey AS, Ivanova A, Cole EH, Hunsicker L, et al. Kidney function and risk of cardiovascular disease and mortality in kidney transplant recipients: the FAVORIT trial. *Am J Transplant Off J Am Soc Transplant Am Soc Transpl Surg.* 2012 Sep;12(9):2437–45.
 70. Seoane-Pillado MT, Pita-Fernández S, Valdés-Cañedo F, Seijo-Bestilleiro R, Pértiga-Díaz S, Fernández-Rivera C, et al. Incidence of cardiovascular events and associated risk factors in kidney transplant patients: a competing risks survival analysis. *BMC Cardiovasc Disord.* 2017 Mar 7;17(1):72.
 71. Guerra Cabrera C, Vila Díaz J, Apolinaire Pennini J, Cabrera Romero A, Santana Carballosa I, Almaguer Sabina P. Factores de riesgo asociados a sobrepeso y obesidad en adolescentes. *MediSur.* 2009 Apr;7(2):25–34.
 72. Martínez AG, Vásquez M, Ferreras R, Canto I, Calderón K. Descripción del riesgo cardiovascular en pacientes diabéticos tipo 1 en República Dominicana. *Cienc Salud.* 2021 Jun 10;5(2):87–94.
 73. Wang C, Yuan Y, Zheng M, Pan A, Wang M, Zhao M, et al. Association of Age of Onset of Hypertension With Cardiovascular Diseases and Mortality. *J*



- Am Coll Cardiol. 2020 Jun 16;75(23):2921–30.
74. Más de 700 millones de personas con hipertensión sin tratar [Internet].
[cited 2022 Oct 20]. Available from:
<https://www.who.int/es/news/item/25-08-2021-more-than-700-million-people-with-untreated-hypertension>
75. Cachofeiro DV. Alteraciones del colesterol y enfermedad cardiovascular.