

## PREVALENCIA DE ALTERACIONES DEL METABOLISMO MINERAL ÓSEO EN PACIENTES RECEPTORES DE TRASPLANTE RENAL SEGUIDOS DURANTE 2 AÑOS EN UNA INSTITUCIÓN DE CUARTO NIVEL DE LA COSTA ATLÁNTICA

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### RESUMEN

**Introducción:** Los trastornos Minerales Óseos son afecciones frecuentes en personas con Enfermedad Renal Crónica, El trasplante renal si bien es una terapia sustitutiva renal hereda la carga mórbida que tenía el sujeto previo a su trasplante, lo que a largo plazo aumenta el riesgo de alteraciones calcificantes y enfermedad cardiovascular, por lo cual la vigilancia de estos trastornos debe ser estricta en este tipo de población.

**Objetivos:** Determinar la prevalencia de trastornos del metabolismo mineral óseo en pacientes receptores de trasplante renal.

**Materiales y Métodos:** Se hizo un subanálisis observacional de pacientes de la Cohorte de Registro local de enfermedad renal crónica (ERC) y portadores de un aloinjerto renal funcional que fueron reclutados en un centro hospitalario de la ciudad de Barranquilla. Los criterios de Inclusión fueron: Pacientes  $\geq 18$  años, con mínimo 6 meses de seguimiento en el programa de Trasplante; A los cuales se les evaluó de manera retrospectiva variables clínicas y de laboratorio de sus exámenes del programa de seguimiento a su patología.

**Resultados:** Se incluyeron 138 pacientes, su gran mayoría fueron hombres (59%) con una edad promedio general fue de  $43,7 \pm 12,3$  años, Se encontró una prevalencia de al menos una alteración relacionada con el metabolismo mineral óseo en el 78,36% al primer mes postrasplante renal, 66,66% a los 3 meses, 69,56% a los 6 meses y 45,65% a los 12 meses. de los pacientes. La alteración encontrada con mayor proporción fue el Hiperparatiroidismo, en orden subsiguiente la Hipocalcemia, hiperfosfatemia y con menor frecuencia la Hipovitaminosis D.

**Discusión y Conclusión:** El hiperparatiroidismo en la enfermedad renal crónica esta usualmente relacionado con la hipercalcemia, en esta cohorte observamos que la hipercalcemia fue poco prevalente, inclusive se observó mayor proporción de personas con hipocalcemia, sin embargo, la prevalencia de hiperparatiroidismo fue alta y similar a la encontrada en las cohortes de enfermedad renal estadio Terminal. Por lo cual se concluye que los sujetos sometidos a trasplante renal tienen alta prevalencia de Hiperparatiroidismo persistente no relacionado con Hipercalcemia.

**Palabras clave:** Trasplante renal, receptor, mineral ósea, hiperparatiroidismo

## ABSTRACT

**Introduction:** Bone mineral disorders are common conditions in people with Chronic Kidney Disease. Renal transplantation, although it is a renal replacement therapy, inherits the morbidity that the subject had prior to the transplant, which in the long term increases the risk of calcifying disorders and disease. cardiovascular disease, for which reason surveillance of these disorders should be strict in this type of population.

**Objectives:** To determine the prevalence of bone mineral metabolism disorders in renal transplant recipients.

**Methods:** An observational sub-analysis of patients from the local Chronic Kidney Disease (CKD) Registry Cohort and carriers of a functional renal allograft who were recruited at a hospital in the city of Barranquilla was performed. The inclusion criteria were: Patients  $\geq 18$  years old, with a minimum of 6 months of follow-up in the Transplant program; To whom clinical and laboratory variables of their examinations of the follow-up program to their pathology were retrospectively evaluated

**Results:** 138 patients were included, the vast majority were men (59%) with a general average age of  $43.7 \pm 12.3$  years, A prevalence of at least one alteration related to bone mineral metabolism was found in 78.36% at the first month after renal transplantation, 66.66% at 3 months, 69.56% at 6 months, and 45.65% at the 12 months. from the patients. The alteration found with the highest proportion was Hyperparathyroidism, in subsequent order Hypocalcemia, hyperphosphatemia and less frequently Hypovitaminosis D.

**Discussion and Conclusión:** Hyperparathyroidism in chronic kidney disease is usually related to hypercalcemia. In this cohort, we observed that hypercalcemia was not very prevalent, and a higher proportion of people with hypocalcemia was even observed. However, the prevalence of hyperparathyroidism was high and similar to that found in End stage renal disease cohorts. Therefore, it is concluded that subjects undergoing renal transplantation have a high prevalence of persistent hyperparathyroidism not related to hypercalcemia.

**Key Words:** Kidney transplant, recipient, bone mineral, hyperparathyroidism

## REFERENCIAS BIBLIOGRÁFICAS

1. Mo V, A PB, Marazuela R. Legislación, ética y trasplante renal. 2021;74(10):165867. <https://medes.com/publication/165867>
2. Cuenta de alto costo. Situación de la enfermedad renal crónica, la hipertensión arterial y la diabetes mellitus en Colombia 2020. Cuenta Alto Costo. 2021;152(1):1–335. [https://cuentadealtocosto.org/site/wp-content/uploads/2021/07/CAC.Co\\_2021\\_07\\_14\\_Libro\\_Sit\\_ERC2020\\_v4\(1\).pdf](https://cuentadealtocosto.org/site/wp-content/uploads/2021/07/CAC.Co_2021_07_14_Libro_Sit_ERC2020_v4(1).pdf)
3. Fijo J, Fraile P, Dalmau ÁG, Hernández ANA, Jimeno L, López MO. Enfermedad mineral ósea del trasplante renal: clínica y diagnóstico. 2014;4(1):1–22. doi:10.3265/NefrologíaSuplementoExtraordinario.pre2013.Jan.11951
4. Medina OL, Luna RD, Pardo K, Dávila FA. Intensidad y frecuencia de

- alteraciones del metabolismo óseo postrasplante renal. *Rev Colomb Endocrinol Diabetes Metab.* 2017;3(4):6–10.  
<https://doi.org/10.53853/encr.3.4.3>
5. Altman AM, Sprague SM. Mineral and Bone Disease in Kidney Transplant Recipients. *Curr Osteoporos Rep.* 2018;16(6):703–11.  
<https://doi.org/10.1007/s11914-018-0490-4>
  6. Porrini EL, Díaz JM, Moreso F, Mallén PID, Torres IS, Ibernón M, et al. Clinical evolution of post-transplant diabetes mellitus. *Nephrol Dial Transplant.* el 1 de marzo de 2016;31(3):495–505. DOI: [10.1093/ndt/gfv368](https://doi.org/10.1093/ndt/gfv368)
  7. Zhou L, Fu P. The interpretation of KDIGO 2017 clinical practice guideline update for the diagnosis, evaluation, prevention and treatment of chronic kidney disease-mineral and bone disorder (CKD-MBD). *Chinese J Evidence-Based Med.* 2017;17(8):869–75. doi: [10.1016/j.kisu.2017.04.001](https://doi.org/10.1016/j.kisu.2017.04.001)
  8. Aleksova J, Ng KW, Jung C, Zeimer H, Dwyer KM, Milat F, et al. Bone health in chronic kidney disease-mineral and bone disorder: a clinical case seminar and update. *Intern Med J.* 2018;48(12):1435–46. doi: [10.1111/imj.14129](https://doi.org/10.1111/imj.14129)
  9. Cannata-Andía JB, Martín-Carro B, Martín-Vírgala J, Rodríguez-Carrio J, Bande-Fernández JJ, Alonso-Montes C, et al. Chronic Kidney Disease—Mineral and Bone Disorders: Pathogenesis and Management. *Calcif Tissue Int* [Internet]. 2021;108(4):410–22. Disponible en: <https://doi.org/10.1007/s00223-020-00777-1>
  10. Situación de la enfermedad renal crónica en Colombia 2008. 2008; <https://www.minsalud.gov.co/sites/rid/Lists/BibliotecaDigital/RIDE/INEC/CAC/Situacion%20de%20la%20Enfermedad%20Renal%20Cronica%20en%20Colombia%202008.pdf>
  11. Al-Shdaifat EA, Manaf MRA. The economic burden of hemodialysis in Jordan. *Indian J Med Sci.* 2013;67(5):103–16.  
<https://doi.org/10.4103/0019-5359.122734>
  12. Torres A, Lorenzo V, Salido E. Calcium metabolism and skeletal problems after transplantation. *J Am Soc Nephrol.* 2002;13(2):551–8. DOI: [10.1681/ASN.V132551](https://doi.org/10.1681/ASN.V132551)

13. Julian BA, Quarles LD, Niemann KMW. Musculoskeletal Complications After Renal Transplantation: Pathogenesis and Treatment. *Am J Kidney Dis* [Internet]. 1992;19(2):99–120. Disponible en: [http://dx.doi.org/10.1016/S0272-6386\(12\)70118-X](http://dx.doi.org/10.1016/S0272-6386(12)70118-X)
14. Torregrosa JV, Ferreira AC, Cucchiari D, Ferreira A. Bone Mineral Disease After Kidney Transplantation. *Calcif Tissue Int* [Internet]. 2021;108(4):551–60. Disponible en: <https://doi.org/10.1007/s00223-021-00837-0>
15. Ramsey-Goldman R, Dunn JE, Dunlop DD, Stuart FP, Abecassis MM, Kaufman DB, et al. Increased risk of fracture in patients receiving solid organ transplants. *J Bone Miner Res*. 1999;14(3):456–63. doi: 10.1359/jbmr.1999.14.3.456.
16. Lane NE. Glucocorticoid-Induced Osteoporosis: New Insights into the Pathophysiology and Treatments. *Curr Osteoporos Rep*. 2019;17(1). <https://doi.org/10.1007/s11914-019-00498-x>
17. Haller MC, Royuela A, Nagler E V., Pascual J, Webster AC. Steroid avoidance or withdrawal for kidney transplant recipients. *Cochrane Database Syst Rev*. 2016;2016(8). DOI:10.1002/14651858.CD005632.pub3.
18. Pelletier RP, Akin B, Ferguson RM. Prospective, randomized trial of steroid withdrawal in kidney recipients treated with mycophenolate mofetil and cyclosporine. *Clin Transplant*. 2006;20(1):10–8. DOI: 10.1111/j.1399-0012.2005.00430.x
19. Kanaan N, Claes K, Devogelaer JP, Vanderschueren D, Depresseux G, Goffin E, et al. Fibroblast growth factor-23 and parathyroid hormone are associated with post-transplant bone mineral density loss. *Clin J Am Soc Nephrol*. 2010;5(10):1887–92. doi: 10.2215/CJN.00950110
20. Bleskestad IH, Bergrem H, Leivestad T, Gøransson LG. Intact parathyroid hormone levels in renal transplant patients with normal transplant function. *Clin Transplant*. 2011;25(5):566–70. DOI: 10.1111/j.1399-0012.2011.01515.x
21. Jamal SA, Miller PD. Secondary and Tertiary Hyperparathyroidism. *J Clin Densitom* [Internet]. 2013;16(1):64–8. Disponible en:

<http://dx.doi.org/10.1016/j.jocd.2012.11.012>

22. Goodman WG, Quarles LD. Development and progression of secondary hyperparathyroidism in chronic kidney disease: Lessons from molecular genetics. *Kidney Int.* 2008;74(3):276–88. doi:10.1038/sj.ki.5002287
23. Naveh-Many T, Marx R, Keshet E, Pike JW, Silver J. Regulation of 1,25-dihydroxyvitamin D3 receptor gene expression by 1,25-dihydroxyvitamin D3 in the parathyroid in vivo. *J Clin Invest.* 1990;86(6):1968–75. doi: [10.1172/JCI114931](https://doi.org/10.1172/JCI114931)
24. Gilat H, Feinmesser R, Vinkler Y, et al. Clinical and operative management of persistent hyperparathyroidism after renal transplantation: a single-center experience, 2007; *Head Neck* 29: 996e1001. DOI: [10.1002/hed.20628](https://doi.org/10.1002/hed.20628)
25. Evenepoel P, Meijers BKI, de Jong H, Naesens M, Bammens B, Claes K, et al. Recovery of hyperphosphatemia and renal phosphorus wasting one year after successful renal transplantation. *Clin J Am Soc Nephrol.* 2008;3(6):1829–36. doi: [10.2215/CJN.01310308](https://doi.org/10.2215/CJN.01310308)
26. Klotho D. The Great Role of Klotho. 2021;29(1):25–35. DOI: <https://doi.org/10.18359/rmed.5021>
27. Ozdem S, Yilmaz VT, Ozdem SS, Donmez L, Cetinkaya R, Suleymanlar G, et al. Is klotho F352V polymorphism the missing piece of the bone loss puzzle in renal transplant recipients? *Pharmacology.* 2015;95(5–6):271–8. DOI: [10.1159/000398812](https://doi.org/10.1159/000398812)
28. Matei A, Bilha SC, Constantinescu D, Pavel-Tanasa M, Cianga P, Covic A, et al. Body composition, adipokines, FGF23-Klotho and bone in kidney transplantation: Is there a link? *J Nephrol [Internet].* 2022;35(1):293–304. Disponible en: <https://doi.org/10.1007/s40620-021-00972-9>  
<https://doi.org/10.1007/s40620-021-00972-9>
29. Egbuna OI, Taylor JG, Bushinsky DA, Zand MS. Elevated calcium phosphate product after renal transplantation is a risk factor for graft failure. *Clin Transplant.* 2007;21(4):558–66. DOI: [10.1111/j.1399-0012.2007.00690.x](https://doi.org/10.1111/j.1399-0012.2007.00690.x)
30. Gwinner W, Suppa S, Mengel M, Hoy L, Kreipe HH, Haller H, et al. Early calcification of renal allografts detected by protocol biopsies: Causes and

- clinical implications. *Am J Transplant.* 2005;5(8):1934–41. doi: 10.1111/j.1600-6143.2005.00938.x
31. Levi M. Post-transplant hypophosphatemia. *Kidney Int* [Internet]. 2001;59(6):2377–87. Disponible en: <http://dx.doi.org/10.1046/j.1523-1755.2001.00755.x>
32. Seeherunvong W, Wolf M. Tertiary excess of fibroblast growth factor 23 and hypophosphatemia following kidney transplantation. *Pediatr Transplant.* 2011;15(1):37–46. doi:10.1111/j.1399-3046.2010.01405.x.
33. Shantanam S, MUELLER. 乳鼠心肌提取 HHS Public Access. *Physiol Behav.* 2018;176(1):139–48. doi:10.1038/nrneph.2009.192.Bone
34. Barros X, Torregrosa JV, De Osaba MJM, Casals G, Paschoalin R, Durán CE, et al. Earlier decrease of FGF-23 and less hypophosphatemia in preemptive kidney transplant recipients. *Transplantation.* 2012;94(8):830–6. DOI: 10.1097/TP.0b013e318264fc08
35. Boudville NC, Hodsman AB. Renal function and 25-hydroxyvitamin D concentrations predict parathyroid hormone levels in renal transplant patients. *Nephrol Dial Transplant.* 2006;21(9):2621–4. doi:10.1093/ndt/gfl201
36. Querings K, Girndt M, Geisel J, Georg T, Tilgen W, Reichrath J. Brief report: 25-Hydroxyvitamin D deficiency in renal transplant recipients. *J Clin Endocrinol Metab.* 2006;91(2):526–9. doi: 10.1210/jc.2005-0547
37. Bienaimé F, Girard D, Anglicheau D, Canaud G, Souberbielle JC, Kreis H, et al. Vitamin D status and outcomes after renal transplantation. *J Am Soc Nephrol.* 2013;24(5):831–41. doi: 10.1681/ASN.2012060614
38. Holick MF. Vitamin D: A millenium perspective. *J Cell Biochem.* 2003;88(2):296–307. DOI 10.1002/jcb.10338
39. Ponticelli C, Cucchiari D, Bencini PL. Skin cancer in kidney transplant recipients. *J Nephrol.* 2014;27(4):385–94. DOI 10.1007/s40620-014-0098-4
40. Lopez Payares GM, Ali FA. Vitamin D deficiency. *5-Minute Clin Consult Stand* 2016 Twenty Fourth Ed. 2015;266–81. <https://studylib.net/doc/25638149/vitamin-d-deficiency-assignment>

41. Ormsby RT, Findlay DM, Kogawa M, Anderson PH, Morris HA, Atkins GJ. Analysis of vitamin D metabolism gene expression in human bone: Evidence for autocrine control of bone remodelling. *J Steroid Biochem Mol Biol* [Internet]. 2014;144(PART A):110–3. Disponible en: <http://dx.doi.org/10.1016/j.jsbmb.2013.09.016>
42. Rodríguez ASánchez MP, Caicedo A, Huérfano MA, García PK, Berrío F, Rosselli D. Hiperparatiroidismo secundario luego de trasplante renal Experiencia de un centro de trasplante TT - Secondary hyperparathyroidism after kidney transplant Experience of a transplant center. *Acta méd colomb* [Internet]. 2016;41(2):100–1. Disponible en: [http://www.scielo.org.co/scielo.php?script=sci\\_arttext&pid=S0120-24482016000200100](http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0120-24482016000200100)
43. Evenepoel P, Claes K, Kuypers D, Maes B, Bammens B, Vanrenterghem Y. Natural history of parathyroid function and calcium metabolism after kidney transplantation: A single-centre study. *Nephrol Dial Transplant*. 2004;19(5):1281–7. DOI: 10.1093/ndt/gfh128
44. Alfieri C, Vettoretti S, Ruzhytska O, Gandolfo MT, Cresseri D, Campise M, et al. Vitamin D and subclinical cardiac damage in a cohort of kidney transplanted patients: a retrospective observational study. *Sci Rep* [Internet]. 2020;10(1):1–10. Disponible en: <https://doi.org/10.1038/s41598-020-76261-5>
45. Sociedad Española de Diálisis y Trasplante. A, Bustamante Bustamante J, Mendiluce Herrero A. Evolución del metabolismo óseo-mineral y de la lesión vascular y ósea tras el trasplante renal. *Diálisis y Traspl publicación Of la Soc Española Diálisis y Traspl* ISSN-e 1886-2845, Vol 38, Nº 2, 2017, págs 64-67 [Internet]. 2017;38(2):64–7. Disponible en: <https://dialnet.unirioja.es/servlet/articulo?codigo=6126770>
46. Evenepoel P, Van Den Bergh B, Naesens M, De Jonge H, Bammens B, Claes K, et al. Calcium metabolism in the early posttransplantation period. *Clin J Am Soc Nephrol*. 2009;4(3):665–72. DOI: 10.2215/CJN.03920808
47. Pascual J, Zamora J, Galeano C, Royuela A, Querada Steroid avoidance or

withdrawal for kidney transplant recipients. *Cochrane Database Syst Rev.*  
2019;2019(8). DOI: 10.1002/14651858.CD005632.pub2.