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ORIGINAL

Severe vitamin D deficiency upon admission in critically ill patients is related to acute kidney injury and a poor prognosis☆

A. Zapatero[a,b,c,*], I. Dot[a,b], Y. Diaz[a,b], M.P. Gracia[a,b,c], P. Pérez-Terán[a,b], C. Climent[a,b], J.R. Masclans[a,b,d], J. Nolla[a,b,d]

[a] *Servicio de Medicina Intensiva, Hospital del Mar, Barcelona, Spain*
[b] *Grupo de Investigación en Patología Crítica (GREPAC), Institut Hospital del Mar d'Investigacions Mèdiques (IMIM), Barcelona, Spain*
[c] *Universitat Autònoma de Barcelona, Barcelona, Spain*
[d] *Universitat Pompeu Fabra, Barcelona, Spain*

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KEYWORDS
Vitamin D;
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Abstract
Objectives: To evaluate the prevalence of vitamin D deficiency in critically ill patients upon admission to an Intensive Care Unit (ICU) and its prognostic implications.
Design: A single-center, prospective observational study was carried out from January to November 2015. Patients were followed-up on until death or hospital discharge.
Setting: The department of Critical Care Medicine of a university hospital.
Patients: All adults admitted to the ICU during the study period, without known factors capable of altering serum 25(OH)D concentration.
Interventions: Determination of serum 25(OH)D levels within the first 24 h following admission to the ICU.
Main variables of interest: Prevalence and mortality at 28 days.
Results: The study included 135 patients, of which 74% presented deficient serum 25(OH)D levels upon admission to the ICU. Non-survivors showed significantly lower levels than survivors (8.14 ng/ml [6.17–11.53] vs. 12 ng/ml [7.1–20.30]; $p = .04$), and the serum 25(OH)D levels were independently associated to mortality (OR 2.86; 95% CI 1.05–7.86; $p = .04$). The area under the ROC curve was 0.61 (95% CI 0.51–0.75), and the best cut-off point for predicting mortality was 10.9 ng/ml. Patients with serum 25(OH)D < 10.9 ng/ml also showed higher acute kidney injury rates (13 vs. 29%; $p = .02$).

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* Corresponding author.
E-mail address: 96022@hospitaldelmar.cat (A. Zapatero).

Conclusion: Vitamin D deficiency is highly prevalent upon admission to the ICU. Severe Vitamin D deficiency (25[OH]D < 10.9 ng/ml) upon admission to the ICU is associated to acute kidney injury and mortality.

PALABRAS CLAVE
Vitamina D;
Medicina Intensiva;
Mortalidad;
Fracaso renal agudo

La hipovitaminosis D grave al ingreso en el paciente crítico se asocia a fracaso renal agudo y mal pronóstico

Resumen
Objetivos: Determinar la prevalencia de hipovitaminosis D al ingreso en el Servicio de Medicina Intensiva (SMI), así como su asociación con el pronóstico del paciente crítico.
Diseño: Análisis observacional prospectivo llevado a cabo desde enero a noviembre de 2015. Los pacientes incluidos fueron seguidos hasta su fallecimiento o alta hospitalaria.
Ámbito: SMI polivalente de un hospital universitario.
Pacientes: Todos los individuos adultos que ingresaron en el SMI durante el periodo de estudio y que no presentaban factores conocidos que pudieran alterar los valores sanguíneos de 25(OH)D.
Intervenciones: Determinación de los niveles séricos de 25(OH)D en las primeras 24 h de ingreso en el SMI.
Principales variables de interés: Prevalencia de hipovitaminosis D al ingreso en UCI y mortalidad a los 28 días.
Resultados: Se incluyeron 135 individuos. El 74% de los pacientes presentó niveles bajos de 25(OH)D en el momento de su ingreso en el SMI. El grupo de pacientes que fallecieron presentaba niveles significativamente inferiores al grupo de pacientes que sobrevivieron (8,14 ng/mL [6,17-11,53] vs. 12 ng/mL [7,1-20,30], p = 0,04) y el valor en sangre de 25(OH)D al ingreso se mostró como factor de riesgo independiente en el análisis multivariado (OR 2,86; IC 95% 1,05-7,86, p = 0,04). La curva ROC fue de 0,61 (IC 95% 0,51-0,75) y el mejor punto de corte para predecir mortalidad fue de 10,9 ng/mL. Los pacientes con valores de 25(OH)D < 10,9 ng/mL también presentaron mayores tasas de fracaso renal agudo (13 vs. 29%, p = 0,02).
Conclusión: Existe una elevada prevalencia de hipovitaminosis D en el momento de ingreso en el SMI. La hipovitaminosis D severa (25[OH]D < 10,9 ng/mL) al ingreso en el SMI se asocia a mayor incidencia de fracaso renal agudo y mayor mortalidad.

Introduction

Vitamin D is a liposoluble vitamin fundamentally produced in the skin as a result of the action of ultraviolet B radiation. Its native forms (vitamins D2 and D3) are transported in plasma bound to albumin or to the vitamin D binding proteins, and must undergo two hydroxylation reactions to become active. The first reaction takes place in the liver and produces 25(OH)D. The second reaction takes place in the kidneys, with the mediation of the enzyme alpha-1-hydroxylase, and produces 1,25(OH)D, which exerts its function by binding to the vitamin D receptors.[1] Although 1,25(OH)D is the metabolically active form, it is considered that the blood 25(OH)D levels offer a better indication of vitamin D status in the body.[2,3] The classical functions of vitamin D have been studied for decades, and much is known about its effects upon mineral and bone metabolism. However, other non-classical functions have also been identified that are related to the presence of alpha-1-hydroxylase and of vitamin D receptors in many body tissues,[2] and to the capacity of vitamin D to modulate the expression of certain genes mediated by binding to these receptors—exerting an effect upon the regulation of hormone secretion, control of the innate and adaptive immune response, and on cell proliferation and differentiation.[1] In this way it has been possible to establish associations between hypovitaminosis D and cancer[4] and cardiovascular diseases.[5]

A high prevalence of hypovitaminosis D has been observed in the last decade in the general population, with the identification of geographical location and solar exposure as some of the conditioning factors.[6–9] A number of studies have reported a particularly high prevalence of hypovitaminosis D in critically ill patients.[10–14] However, the relationship between vitamin D deficiency and morbidity–mortality in terms of organ failure or infections in critical patients remains the subject of debate.[12,15–17]

Furthermore, although different recent randomized clinical trials that have evaluated the administration of vitamin D in critical patients have demonstrated normalization of the vitamin D levels as a result of supplementing,[18] discordant results have been obtained in terms of the effect upon patient survival or duration of admission,[19–24] and two