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ORIGINAL ARTICLE

Total serum calcium and corrected calcium as severity predictors in acute pancreatitis☆

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KEYWORDS
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Abstract
Objectives: To evaluate total serum calcium (TC) and albumin-corrected calcium (ACC) as prognostic severity factors in acute pancreatitis (AP).
Methods: Ninety-six patients were included in the study. They were diagnosed with AP and admitted to the Hospital Regional de Veracruz within the time frame of January 2010 to December 2012. AP severity was determined through the updated Atlanta Classification (2013). TC and ACC values were measured in the first 24 hours of admittance and the percentages of sensitivity (S), specificity (Sp), positive predictive value (PPV), negative predictive value (NPV), positive likelihood ratio (LR+), and negative likelihood ratio (LR-) were calculated through ROC curves and contingency tables.
Results: In accordance with the updated Atlanta Classification, 70 patients presented with mild AP, 17 with moderately severe AP, and 9 with severe AP. Of the patient total, 61.5% were women, and 69.8% presented with biliary etiology. The maximum TC cut-off point was 7.5 mg/dL, with values of S, 67%; Sp, 82%; PPV, 27%, and NPV, 96%. The maximum ACC cut-off point was 7.5 mg/dL, with values of S, 67%; Sp, 90%; PPV, 40%; NPV, 96%. Both had values similar to those of the Ranson and APACHE II prognostic scales.
Conclusions: TC and ACC, measured within the first 24 hours, are useful severity predictors in acute pancreatitis, with sensitivity and predictive values comparable or superior to those of the conventional prognostic scales.

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PALABRAS CLAVE
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Severidad

Calcio sérico total y calcio corregido como predictores de severidad en pancreatitis aguda

Resumen
Objetivo: Evaluar el calcio sérico total (CT) y el calcio corregido por albúmina (CCA) como factores pronósticos de severidad en pancreatitis aguda (PA).
Métodos: Se incluyó a 96 pacientes con diagnóstico de PA ingresados de enero del 2010 a diciembre del 2012 en el Hospital Regional de Veracruz. La severidad de la PA se determinó utilizando la Clasificación de Atlanta actualizada (2013). Se recolectaron los valores de CT y CCA en las primeras 24 h a partir del ingreso y se calcularon los porcentajes de sensibilidad (S), especificidad (E), valores predictivos positivo y negativo (VPP y VPN) y razones de verosimilitud (RVP y PVN) por medio de curvas ROC y tablas de contingencia.
Resultados: De acuerdo con los criterios de la Clasificación de Atlanta actualizada, 70 pacientes presentaron PA leve, 17 PA moderadamente grave y 9 PA grave. Del total de pacientes, 61.5% fueron mujeres, y el 69.8% presentó etiología biliar. El CT tuvo un punto de corte óptimo de 7.5 mg/dl, con valores de S, 67%; E, 82%; VPP, 27% y VPN, 96%. El CCA tuvo un punto de corte óptimo de 7.5 mg/dl, con valores de S 67%; E, 90%; VPP, 40%; VPN, 96%. Ambos obtuvieron valores similares a los de las escalas pronósticas de Ranson y APACHE II.
Conclusiones: El CT y CCA tomados en las primeras 24 h son útiles como predictores de severidad en pancreatitis aguda, con valores de S y predictivos comparables o superiores a los de las escalas pronósticas tradicionales.

Introduction

Acute pancreatitis (AP) is an acute inflammatory process of the pancreas that affects other regional tissues and more distant organ systems in a variety of ways.[1] Histologically it is characterized by acinar cell necrosis and the presence of inflammatory infiltrate in the parenchyma.[2] Every year there are between 5 and 80 new cases per 100,000 inhabitants.[3] In the last decade, in the U.S. and in Europe, a decrease in the number of fatal cases and a noticeable increase in hospitalizations due to AP, specifically those related to biliary etiology, have been reported.[4]

The general consensus is that 2 of the following 3 characteristics are necessary for making AP diagnosis: intense epigastric pain, a serum amylase or lipase concentration 3 times higher than the normal limit, and characteristic AP findings through computed tomography.[5] The clinical course varies significantly from person to person. Although it is generally self-limited, through the AP classification criteria from 1992, it has been determined that on average, 20% of the patients present with severe disease, with a mortality rate of 50%.[6,7] The use of prognostic scales enables severe cases to be detected and opportune and adequate management to be established.[8] The most widely used are the Ranson and APACHE-II scores[5,9,10] and the Balthazar computed tomography severity index. [11] Biochemical markers have also turned out to be useful predictors. Examples of some of them are: C-reactive protein, procalcitonin, interleukin-6, thioredoxin-1, and polymorphonuclear elastase. [6,12–14]

Hypocalcemia has been associated with AP severity but its etiopathogenesis has been a subject of debate for decades. Centuries-old literature reported that in 1890 Langerhans observed calcium deposits in areas of fat necrosis. Later Edmondson, in 1944, postulated that hypocalcemia was due to the formation of calcium soaps. [15] In 1975, Condon et al. reported on the increase in parathyroid hormone in patients with hypocalcemia and normocalcemia and suggested that parathyroid hormone depletion was the main induction factor of persistent hypocalcemia in AP.[16] In 1976, Imrie et al. associated hypocalcemia with hypoalbuminemia and proposed that total serum calcium (TC) should be corrected in accordance with albumin concentration before taking therapeutic measures.[17] AP studies using animal experimental models have shown that ionized calcium and total calcium concentrations decrease 6 to 18 h after pancreatitis induction, in addition to the fact that the onset of hypocalcemia is associated with the accumulation of calcium in the soft tissues.[18,19] More recently, the role of the parathyroid hormone has been taken up again in relation to the pathogenesis of hypocalcemia in AP, and it has been postulated that the condition is the result of an inadequate parathyroid response; it is even probable that, just as in other critical diseases, its origin is multifactorial.[20–23]Given its importance, TC has a place in some of the AP prognostic severity scales. [10,24] Individually, it has been evaluated as a mortality prognostic factor [25,26] and it has also been evaluated as a predictor of severe AP with infection.[27] Albumin-corrected calcium (ACC) has also been associated with severity,[28,29] but we have not found studies that evaluate it as a prognostic severity factor within the first 24 h of the patient's hospital admittance.

Due to the availability of TC determination tests in secondary care health centers in Mexico, we feel that TC and ACC can be used as easily accessible AP severity tests in the Mexican health system. Therefore the aim of the present study was to evaluate TC and ACC as prognostic severity markers in AP.