



ORIGINAL ARTICLE

Predicting the effectiveness of extracorporeal shock wave lithotripsy on urinary tract stones. Risk groups for accurate retreatment[☆]

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KEYWORDS

Extracorporeal shock wave lithotripsy;
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Risk model

Abstract

Introduction: Extracorporeal shock wave lithotripsy (ESWL) is a non-invasive, safe and effective treatment for urinary tract lithiasis. Its effectiveness varies depending on the location and size of the stones as well as other factors; several sessions are occasionally required. The objective is to attempt to predict its success or failure, when the influential variables are known beforehand.

Material and methods: We analyzed 211 patients who had had previous CT scans and were treated with ESWL between 2010 and 2014. The influential variables in requiring retreatment were studied using binary logistic regression models (univariate and multivariate analysis): maximum density, maximum diameter, area, location, disintegration and distance from the adipose panniculus. With the influential variables, a risk model was designed by assessing all possible combinations with logistic regression (version 20.0 IBM SPSS).

Results: The independent influential variables on the need for retreatment are: maximum density >864 HU, maximum diameter >7.5 mm and pyelocaliceal location. Using these variables, the best model includes 3 risk groups with a probability of requiring significantly different retreatment: group 1 – low risk (0 variables) with 20.2%; group 2 – intermediate risk (1–2 variables) with 49.2%; and group 3 – high risk (3 variables) with 62.5%.

Conclusions: The density, maximum diameter and pyelocaliceal location of the stones are determinant factors in terms of the effectiveness of treatment with ESWL. Using these variables, which can be obtained in advance of deciding on a treatment, the designed risk model provides a precise approach in choosing the most appropriate treatment for each particular case.

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PALABRAS CLAVE

Litotricia extracorpórea por ondas de choque; Retratamiento; Modelo de riesgo

Predicción de efectividad de litotricia extracorpórea por ondas de choque en cálculos del tracto urinario. Grupos de riesgo para precisar retratamiento

Resumen

Introducción: La litotricia extracorpórea por ondas de choque (LEOC) es un tratamiento no invasivo, seguro y efectivo para las litiasis del tracto urinario cuya efectividad varía según la localización y el tamaño del cálculo, entre otros factores; en ocasiones es necesario realizar varias sesiones. El objetivo es tratar de predecir el éxito o fracaso conociendo previamente las variables influyentes.

Material y métodos: Analizamos a 211 pacientes con TAC previa entre aquellos tratados mediante LEOC entre los años 2010 y 2014. Se estudian las variables influyentes en la necesidad de retratamiento utilizando modelos de regresión logística binaria (estudio uni- y multivariado): densidad máxima, diámetro máximo, área, localización, desintegración y distancia del pániculo adiposo. Con las variables influyentes se ha diseñado un modelo de riesgo valorando con regresión logística todas las posibles combinaciones (IBM SPSS versión 20.0).

Resultados: Las variables de influencia independiente en la necesidad de retratamiento son: densidad máxima >864 UH, diámetro máximo >7,5 mm y localización pielocalicial. Utilizando estas variables, el mejor modelo incluye 3 grupos de riesgo con probabilidades de necesitar retratamiento significativamente diferentes: grupo 1-bajo riesgo (0 variables) con 20,2%, grupo 2-riesgo intermedio (1-2 variables) con 49,2% y grupo 3-alto riesgo (3 variables) con 62,5%.

Conclusiones: La densidad, el diámetro máximo y la localización pielocalicial del cálculo son factores determinantes en la efectividad del tratamiento con LEOC. Con estas variables, que se pueden obtener antes de la decisión terapéutica, el modelo de riesgo diseñado permite una aproximación precisa de cara a elegir el tratamiento más adecuado para cada caso en particular.

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Introduction

Extracorporeal shock wave lithotripsy (ESWL) – from Greek lithos (stone) and Latin terere (grind) – is acoustic pulse therapy for urinary tract stones. Its use began in the early 1980s in Germany Medtech and has been generalized in the urological field thanks to Chaussy et al.¹ over the years. It is currently considered a non-invasive, safe and effective treatment. This effectiveness varies according to the location and size of the stone,² among other factors, which sometimes generates the need to carry out several sessions to solve the problem. This causes an impact, on the one hand, on the quality of life of the patients, who have to be treated through various procedures with their corresponding discomfort and, on the other hand, economic because of the associated costs that it entails.

Computed tomography (CT) is a very complete imaging test³ that has become the 'gold standard' for the diagnosis of renal colic or acute flank pain.⁴⁻⁶ It enables the diagnosis of the presence, number, size and exact location of the stone or stones that cause the symptoms, as well as any associated abdominal disease or that is responsible for the symptoms, once the urologic disease is ruled out. In addition, with this technique, different additional variables that may be important in the course of treatment, such as stone density,⁷⁻¹¹ area or distance to the skin¹²⁻¹⁷ have been studied to date.

It is, therefore, interesting to study the variables that may influence the need to carry out a retreatment after ESWL. The objective is to anticipate the effectiveness of the treatment to choose from the beginning another therapeutic approach. This would make it possible to save discomfort,

time, radiation, procedures and costs derived. In other words, it is a question of identifying predictors and choosing the right candidates.¹⁸⁻²⁰

Materials and methods

This is a retrospective analytical study which includes 211 patients among all those treated by ESWL at our center between January 2010 and December 2014. The selection criterion chosen is the presence of CT scan performed at diagnosis. Follow-up concluded in June 2015, so the time ranges between 6 and 27 months.

As clinical variables, we recorded sex, age, body mass index, and previous smoking history (previous or current).

The multislice helical CT was made with Siemens Somatom Definition CT and Siemens Sensation 64, with milliamps (mA) adjusted according to the image window, 120 kilovolts (kV), with cuts every 5 mm in its axial, coronal, and sagittal projections, without intravenous contrast and with it (0.5 ml/kg). Through the image viewer Syngo Studio fastView and its tools, we manually analyzed the radiological variables (Fig. 1): stone location (upper, middle, or lower calyx, renal pelvis, proximal, middle, or distal ureter), maximum diameter in millimeters (mm), area in square centimeters (cm²), distance from the skin to the stone in centimeters (cm), maximum density in Hounsfield units (HU), thickness of adipose panicle at umbilical level (cm), presence of catheter or of dilation of the urinary tract. The distances and diameters were calculated by means of a computer rule, as well as the area that defined the contour,

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