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Original Article

Use of Multidetector Computed Tomography for Locating the Site of Gastrointestinal Tract Perforations☆,☆☆

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ABSTRACT

Introduction: The purpose of this study was to evaluate the accuracy of multidetector computed tomography (MDCT) for locating the site of gastrointestinal tract perforations and to determine the most predictive signs in this diagnosis.

Material and methods: A total of 98 patients with pneumoperitoneum on MDCT were retrospectively analyzed. Two experienced radiologists reviewed the presence or absence of direct signs (extravasation of oral contrast, focal defect in the bowel wall, focal defect with multiplanar reformations images), and indirect signs (free air in supramesocolic, inframesocolic, supramesocolic, and inframesocolic compartments, concentration of extraluminal air bubbles adjacent to the bowel wall, extraluminal fluid, segmental bowel-wall thickening, perivisceral fat stranding, abscess) to identify the site of the perforation. The Kappa index was evaluated between radiologists to determine the site of perforation and for each predictive sign, as well as Kappa index between the site of perforation detected with MDCT and the site proven at surgery. The frequency, sensitivity, specificity, and positive and negative predictive value (PPV and NPV, respectively) were calculated.

Results: The perforation site was identified correctly in 80.4% of cases. Kappa index between radiologists to identify the site was excellent (0.919), varying between 0.5 and 1.0 for each radiological sign. The most frequent site of perforation at surgery (33.7%) and in MDCT (40.82%) was the sigmoid colon/rectum. Concentration of extraluminal air bubbles adjacent to the bowel wall was the most sensitive (91%) sign and "segmental bowel-wall thickening" had the highest PPV (90%).

Conclusion: MDCT is useful for locating the site of GI perforation, with a high sensitivity (80%) and an excellent agreement between radiologists.

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Utilidad de la tomografía computarizada multidetector para identificar la localización de las perforaciones gastrointestinales

Palabras clave:
Perforación gastrointestinal
Neumoperitoneo
Tomografia computarizada multidetector
Abdomen agudo

RESUMEN

Introducción: Valorar la capacidad de la tomografia computarizada multidetector (TCMD) para identificar la localización de la perforación gastrointestinal (GI).

Material y métodos: Análisis retrospectivo de 98 pacientes con neumoperitoneo en la TCMD. Dos radiólogos expertos evaluaron la presencia o ausencia de signos radiológicos directos (extravasación del contraste oral; defecto focal de la pared; defecto focal en reconstrucciones multiplanares) e indirectos (aire libre supramesocólico; inframesocólico; supra- e inframesocólico; burbujas de gas adyacentes a la pared; líquido libre; engrosamiento parietal segmentario; trabeculación de la grasa; abscesos) de perforación para identificar su ubicación. Se determinó la concordancia *kappa* entre los radiólogos para identificar el lugar de la perforación y la presencia o ausencia de cada uno de los signos radiológicos; así como la correlación *kappa* de la localización detectada mediante TCMD y su confirmación o no en la intervención quirúrgica. Se calculó para cada signo radiológico su frecuencia, sensibilidad, especificidad, valor predictivo positivo (VPP) y negativo (VPN).

Resultados: Se diagnóstico correctamente el sitio de la perforación en un 80% de los casos. El índice *kappa* entre radiólogos para la localización fue excelente (0,919), variando para cada signo radiológico entre 0,5 y 1. La localización más frecuente de la perforación en la intervención quirúrgica (33,7%) y en la TCMD (40,8%) fue colon sigmoideo/recto. ''Burbujas de gas adyacentes a la pared'' fue el signo con mayor S (91%) y el ''engrosamiento parietal segmentario'' el que tuvo un mayor VPP (90%).

Conclusión: La TCMD permite localizar las perforaciones gastrointestinales con una alta sensibilidad (80%) y excelente correlación interobservador.

Introduction

The finding of pneumoperitoneum in a patient with acute abdominal pain is the main diagnostic sign of gastrointestinal (GI) perforation,[1] which usually requires surgical treatment. GI tract perforation is a disruption in the integrity of the gastrointestinal wall that may be caused by various etiologies. Classically, simple standing chest radiography including the diaphragm is the first imaging test that is done in order to identify the presence of extraluminal gas, although it is sometimes difficult to establish the diagnosis because the symptoms are non-specific and pneumoperitoneum is only observed on 30%–59% of simple radiographs.[2,3] Several studies have demonstrated that computed tomography (CT) is the best technique for detecting free intraperitoneal air and for the diagnosis of GI perforation.[4] The pre-operative localization of the intestinal perforation site can help the surgeon in the therapeutic approach. For the surgical treatment of GI tract perforations, less-aggressive laparoscopic procedures are currently preferred over open laparotomy[5,6] but in lower GI tract perforations, laparotomy is usually required.[7] Thus, it is useful for the surgeon to know the location of the perforation before initiating the surgical procedure.

Multidetector CT (MDCT) provides multiplanar reconstruction (MPR) with optimal spatial resolution and high quality, which increases the sensitivity of CT for detecting the site of the perforation.[8,9] In recent years, several papers have been published with MDCT that have analyzed the value of different radiological signs in identifying the perforation site.[9–11]

The objective of our study is to analyze the capacity of MDCT to identify the site of GI perforations and to determine which radiological signs, either direct or indirect,[10] are the most predictive. We will also analyze the interobserver agreement for both diagnosis and identification of the localization.

Material and Methods

Patients

This is a retrospective study carried out in the emergency radiology area at Hospital Universitario La Paz for a period of 28 months (April 2007 to August 2009). We analyzed all the MDCT exams in our database of patients who came to the emergency room with acute abdominal symptoms and were later diagnosed with pneumoperitoneum or GI perforation on CT. In all patients, the presence of gastrointestinal perforation was confirmed during surgery.

Excluded from the study were those patients who had undergone surgery within the previous 15 days and those cases in which the exact site of the perforation was not confirmed during surgery.

Procedure

The studies were done with an MDCT (Toshiba Asteion) using the following parameters: FOV 400, cut thickness 0.5 mm, Pitch 3.00, 120 kV, and 180 mA. In most cases, the