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The presence of cardiophrenic angle lymph nodes is not an indicator of peritoneal carcinomatosis from colorectal cancer on MDCT: Results of a case-control study

M. Barat [a,*], P. Soyer [a,b,c], C. Eveno [b,c,d], R. Dautry [a], L. Perronne [a], Y. Guerrache [a], M. Boudiaf [a], M. Pocard [b,c,d], A. Dohan [a,b,c]

[a] *Department of Body and Interventional Imaging, Hôpital Lariboisière, AP-HP, 2 rue Ambroise Paré, 75475 Paris Cedex 10, France*

[b] *Université Paris-Diderot, Sorbonne-Paris Cité, 10 rue de Verdun, 75010 Paris, France*

[c] *UMR INSERM 965, Hôpital Lariboisière, 2 rue Amboise Paré, 75010 Paris, France*

[d] *Department of Digestive Surgery, Hôpital Lariboisière, AP-HP, 2 rue Ambroise Paré, 75475 Paris Cedex 10, France*

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Abstract

Objective: To determine if the presence of cardiophrenic angle lymph nodes (CPALNs) on multidetector-row computed tomography (MDCT) can be considered as an indicator of peritoneal carcinomatosis (PC) in patients with colorectal cancer (CRC).

Material and methods: Two groups of 101 patients each were retrospectively included. Group 1 included patients with PC from CRC and Group 2 included patients with CRC without PC. MDCT examinations were analyzed by two readers working in consensus for the presence or absence of CPALNs and, when present for their dimensions (short and long axis), location (right, left or bilateral) and shape (oval or rounded).

Results: Prevalence of CPALNs was 29% in Group 1 and 32% in Group 2. No differences in prevalence of CPALNs were found between the two groups ($P = 0.458$). Presence of CPALNs had a sensitivity of 29% (95%CI: 23–35%) for the diagnosis of PC and a specificity of 68% (95%CI = 62–74%). No differences in CPALN dimensions, location and shape were found between these two groups.

Conclusion: Presence of CPALNs cannot be considered as an indicator of PC in patients with CRC. In addition, when present, CPALNs have similar dimensions, location and shapes in patients with PC from CRC than in those without PC.

Keywords: Peritoneal carcinomatosis; Computed tomography; Cardiophrenic angle lymph nodes; Colorectal cancer

Introduction

In patients with colorectal cancer (CRC), peritoneal carcinomatosis (PC) corresponds to the peritoneal spread of the primary disease.[1] PC is found intra-operatively in 7% of patients with CRC who have surgery, and develops in up to 19% of patients after curative surgery.[2] However, the outcome and life-expectancy of patients with PC from CRC have been markedly improved during recent years owing to the use of cytoreductive surgery in combination with hyperthermic intraperitoneal chemotherapy (HIPEC).[1,3–9] As a limitation, cytoreductive surgery with HIPEC carries relatively high degrees of morbidity so

Abbreviations: PC, peritoneal carcinomatosis; HIPEC, hyperthermic intraperitoneal chemotherapy; MDCT, multidetector row computed tomography; MRI, magnetic resonance imaging; PET-CT, positron emission tomography coupled with computed tomography; CPLAN, cardiophrenic angle lymph node.

* Corresponding author.

E-mail addresses: maxime.barat89@gmail.com (M. Barat), philippe.soyer@lrb.aphp.fr (P. Soyer), Clarisse.eveno@lrb.aphp.fr (C. Eveno), raphael.dautry@aphp.fr (R. Dautry), laetitia.perronne@gmail.com (L. Perronne), youcef.guerrache@lrb.aphp.fr (Y. Guerrache), mourad.boudiaf@lrb.aphp.fr (M. Boudiaf), Marc.pocard@lrb.php.fr (M. Pocard), anthony.dohan@aphp.fr (A. Dohan).

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that accurate preoperative selection of patients who are potentially amenable to curative resection is paramount.[4,5] In this regard, it is crucial to best predict preoperatively the extent of the disease and anticipate the need and the feasibility of cytoreductive surgery with HIPEC.[7–9] However, there is currently no optimal technique that may help predict resectability of the disease with high degrees of confidence. In this regard, the performances of multidetector row computed tomography (MDCT), magnetic resonance imaging (MRI) and positron emission tomography coupled with computed tomography (PET-CT) remain relatively disappointing.[9–14] Although the adjunct of diffusion-weighted (DW) sequences to the more conventional MR imaging techniques helps improve overall sensitivity, the preoperative detection of small peritoneal implants (*i. e.*, < 1 cm) remains challenging.[15]

In order to improve confidence in diagnosis PC from CRC, some researchers have tested to what extent the presence of cardiophrenic angle lymph nodes (CPALN) as observed on MDCT might be an indicator of PC in patients with CRC.[16,17] The results of their studies have suggested that the presence of CPLANs could be used as an indicator of PC in patients with CRC with relatively high degrees of sensitivity, specificity and predictive values.[16,17] However, CPLANs can be observed in a variety of diseases including lymphoma, hepatocellular carcinoma or liver cirrhosis.[18–20] In addition, small physiological lymph nodes can be visualized in the cardiophrenic space in patients with no underlying malignant disease.[21,22]

Accordingly, the purpose of this study was to determine if the presence of CPALN or specific features of CPALN as observed on MDCT can be considered as indicators of PC in patients with CRC using a case-control study.

Materiel and methods

Patients

From September 2008 through September 2013 inclusively, the prospectively maintained database of our institution was retrospectively queried to identify all adult patients with PC from CRC who had MDCT examination of the thorax, abdomen and pelvis in our department less than two months prior cytoreductive surgery with HIPEC. The medical records, including clinical, surgical and histopathological files of the initially identified patients were reviewed to ascertain that they actually had CRC and PC. Patients with PC from another origin than CRC were excluded. This group (Group 1) ultimately consisted of 101 patients (48 men, 53 women) with a mean age of 57 years $\pm$ 11 (standard deviation [SD]) (range: 35–61 years).

Then a second query was performed to retrieve a group of 101 patients with CRC who had surgical resection of their tumor and for whom surgery performed by two surgeons experts in the management of PC (CE, MP) showed no evidence of PC at the time of surgery. In addition, the follow-up data of these patients were retrieved and analyzed by the study coordinator (RD) to ascertain that they did not develop PC the 12 months following surgery. All patients had MDCT examination of the thorax, abdomen and pelvis in our department less than two months prior surgery. This group (Group 2) consisted of 101 patients (77 men, 24 women) with a mean age of 65 years $\pm$ 14 (SD) (range: 28–84 years) who had CRC without PC.

This study was approved by our institutional review board. A waiver of informed consent was granted.

MDCT protocol

MDCT examinations were performed with a single source CT unit equipped with 32 rows of detectors with use of a z-flying focal spot yielding 64 slices (Somatom Sensation 64®, Siemens Healthcare, Forcheim, Germany) with the following parameters: voltage, 120 kVp; tube current, 120–170 effective mAs; axial resolution, 0.6-mm; slices thickness reconstruction, 1.5-mm; beam collimation, 38.4-mm; gantry rotation time, 0.5 s; table speed, 46-mm/gantry rotation; beam pitch, 1.2. An online tube current modulation technique (Care Dose®, Siemens Healthcare) was used to decrease the radiation dose. All patients in groups 1 and 2 underwent contrast-enhanced MDCT of the thorax, abdomen and pelvis with the same protocol. A mechanical power injector (OptiVantage®, Mallinckrodt-Tyco/Healthcare, Cincinnati, OH, USA) was used to administrate 100–120 mL of intravenous nonionic iodinated contrast material (iomeprol, Iomeron 350®, Bracco Imaging, Milan, Italy, or ioversol, Optiray 350®, Guerbet, Roissy-Charles de Gaulle, France) at a rate of 3 mL/s. Contrast-enhanced imaging phase started 70 s after initiating intravenous administration of contrast material.

Image analysis

For this retrospective study, MDCT examinations of the two groups were reviewed using a picture archiving and communication system (PACS) workstation (Directview®, V 11.3, Carestream Health Inc, Rochester, NY, USA) by two abdominal radiologists (M.B, A.D) working in consensus. During the reading sessions, original axial images and 1.5-mm thickness multiplanar reconstructions were analyzed as a single imaging set. To limit potential bias, the two observers analyzed MDCT examinations with no information relative to the patient.

Several variables were evaluated using a standardized data collection form. CPALN diameters were calculated with electronic calipers on magnified images by the two observers who agreed on the results for each measurement. The shortest and the largest axial diameters of CPALNs were measured on strict axial views (Fig. 1).[21] Measurements were repeated twice and the maximal value for each dimension was tabulated. The number of visible CPALNs (1 *vs.* $\geq$2) and location (left side, right side or