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REVIEW

Preoperative assessment of peritoneal carcinomatosis of colorectal origin

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Computed tomography;
Magnetic resonance imaging

Summary The goal of preoperative assessment of patients with peritoneal carcinomatosis (PC) from colorectal origin is to select candidates for curative surgery by evaluating the possibility of complete resection, and to plan the surgical procedure. Quantitative and qualitative evaluation of lesional localization remains difficult even with current technical progress in imaging. Computed tomography (CT), the reference imaging technique, allows detection of both peritoneal and extra-peritoneal lesions. Sensitivity and specificity for detecting PC are 83% (95%CI: 79—86%) and 86% (95%CI: 82—89%), respectively. Functional imaging, with diffusion-weighted magnetic resonance imaging (MRI) and positron emission tomography PET-CT allows efficient exploration of peritoneal lesions. MRI is operator-dependent, with a long learning curve, and is, at present, essentially used only in expert centers. A standardized protocol provided by the radiologists working with the French National Center for rare peritoneal tumors RENA-RAD (http://www.renape-online.fr/fr/espace-professionnel/rena-rad.html) is however available on line. PET-CT is particularly useful for identifying and defining extra-peritoneal disease. Combining imaging techniques, particular CT with MRI, seems to improve the calculation of the Peritoneal Cancer Index compared to CT alone. Surgical exploration is the reference

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technique to evaluate PC. Currently, the literature cannot confirm whether laparoscopy performs as well as laparotomy, but laparoscopy is, *de facto*, the fundamental tool to decrease the number of unnecessary laparotomies in these patients. To optimize the pre-, intra- and post-operative reporting of the extent of PC, the French National Network for management of PC (RENAPE and BIG-RENAPE: http://www.e-promise.org/) has offered on-line a free-of-charge, standardized, multidisciplinary and transversal software.

Introduction

Complete cytoreductive surgery (CRS) combined with hyperthermic intraperitoneal chemotherapy (HIPEC) and systemic chemotherapy has become the reference treatment for peritoneal carcinomatosis (PC) of colorectal origin (CRPC). The efficacy of this treatment was validated in 2003 by a randomized clinical trial that compared CRS combined with HIPEC versus systemic chemotherapy alone (median survival: 22.3 vs 12.6 months, $P = 0.032$) [1]. Macroscopically complete CRS (CRS-R0) is a major prognostic factor, with 5-year survival rates as high as 45% compared to < 10% when CRS is incomplete [2]. The extent of peritoneal disease remains the main prognostic factor when CRS is complete (CRS-R0) and can be quantified by using the Peritoneal Cancer Index (PCI), which ranges from 0 to 39. The operative indication becomes debatable from the carcinological point of view when the preoperative PCI is greater than 20, even if all the lesions are resectable. Pre-operative imaging therefore has come to play an increasingly important role over the last few years, notwithstanding the persistent difficulty in precisely calculating the PCI, allowing determination of the number of regions involved and signs of non-resectability [3,4]. Optimal preoperative evaluation allows the surgeon to provide better information to the patient regarding the surgical gesture and its consequences (e.g., temporary stoma) as well as to avoid unnecessary laparotomy in case of non-resectable lesions.

The goal of preoperative exploration is therefore double: to provide a precise roadmap of lesions with quantitative or semi-quantitative evaluation of their size as well as a qualitative evaluation of the criteria of resectability of these lesions. If CRS cannot be complete, operative morbidity can worsen the patient's prognosis and medical oncological management [5]. This complex surgery must therefore be reserved for patients who are most likely to benefit from the procedure, that is those for whom complete resection is possible. The predictive criteria for non-resectability depend on the clinical context, the nature of the primitive tumor and the level of expertise of the centers.

Quantification of PC

The PCI, described by Sugarbaker et al., is the reference score that was chosen during the 2006 Peritoneal Surface Oncology Group International (PSOGI) world meeting to standardize the operative description of PC (Fig. 1) [6]. The abdomen is divided into nine regions and the small bowel into four segments. The size of peritoneal lesions is calculated in each region or segment according to a semi-quantitative scale ranging from 0 to 3 (0: absence of tumor; 1: tumor of less than 0.5 cm; 2: tumor measuring between 0.5 and 5 cm; 3: tumor greater than 5 cm). Confluent nodules of PC should count as one large tumor. The PCI corresponds to the sum of values in each of the 13 regions and therefore ranges from 0 to 39. Sugarbaker et al. found that the prognosis of candidates for CRS and HIPEC who had a PCI less than 20/39 was better because of improved possibility of complete resection. At completion of surgery, the resection is classified as complete or incomplete: CRS-R0 corresponds to absence of macroscopic residual tumor; CRS-R1 to residual tumor ≤ 0.25 cm; CRS-R2 to residual tumor between 0.25 and 2.5 cm; CRS-R3 to residual tumor ≥ 2.5 cm [6].

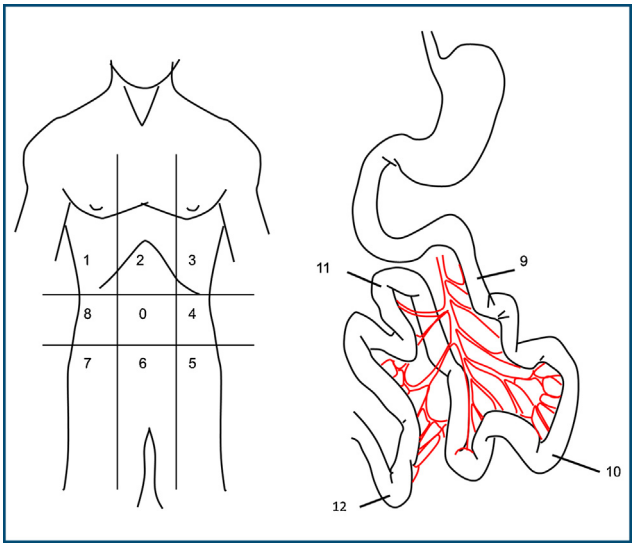

Figure 1. The thirteen regions of the abdomen and small bowel: 0: central: greater omentum, transverse colon, abdominal wall, midline and anterior parietal peritoneum; 1: right upper: superior surface of right hepatic lobe, peritoneal surface of right diaphragm, right retro-hepatic space; 2: epigastrium: epigastric fatty tissue, left lobe of liver, hepatogastric ligament, falciform ligament; 3: left upper: peritoneal surface of left diaphragm, spleen, pancreatic tail, superior and posterior aspect of stomach; 4: left flank: descending colon, left parietocolic gutter; 5: left lower: left lateral wall of pelvis and sigmoid colon; 6: pelvis: female genital organs (ovaries, fallopian tubes, uterus), Douglas cul-de-sac, recto-sigmoid junction; 7: right lower: right lateral wall of pelvis, cecum and appendix; 8: right flank: ascending colon, right parieto-colic gutter; 9: proximal jejunum: small bowel and adjacent mesentery; 10: distal jejunum: small bowel and adjacent mesentery; 11: proximal ileum: small bowel and adjacent mesentery; 12: distal ileum: small bowel and adjacent mesentery.

PCI is an independent prognostic factor. In the French Association of Surgery (AFC) report that included 440 patients with CRPC, a high PCI was found to be an

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