

Variation in the peritoneal cancer index scores between surgeons and according to when they are determined (before or after cytoreductive surgery)

D. Elias ^{a,*}, A. Souadka ^a, F. Fayard ^b, A. Mauguen ^b, F. Dumont ^a, C. Honore ^a, D. Goere ^a

^aDepartment of Surgical Oncology, Institut Gustave Roussy, Rue Camille Desmoulins, 94805 Villejuif, France

^bDepartment of Biostatistics, Institut Gustave Roussy, Rue Camille Desmoulins, 94805 Villejuif, France

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Abstract

Introduction: The prognosis of peritoneal carcinomatosis (PC) is highly dependent on the extent of the PC. This extent is calculated by the peritoneal cancer index (PCI). In the future, the indications for complete cytoreductive surgery (CRS) + hyperthermic intraperitoneal chemotherapy (HIPEC) should be partially based on the PCI. This raises the question of the concordance between the PCI scores calculated by different surgeons, and a possible variation before and after CRS.

Objective: To analyze variations in the PCI score between surgeons and according to when it is determined (before and after surgery).

Patients and methods: Prospective recording of the PCI score independently calculated by senior and junior surgeons, before CRS (when the surgeon decided to perform this procedure), and after CRS, in 75 consecutive patients. A concordance analysis was conducted.

Results: The origins of the PC were colorectal ($n = 38$), pseudomyxoma ($n = 22$), mesothelioma ($n = 8$) and miscellaneous lesions ($n = 7$). Concordance between the PCI score was very high (close to 90%) among the senior surgeons and junior surgeons before and after CRS. After CRS, the mean PCI score increased by 1.75 (IC-95%: 2.09–1.41). This high concordance was similar whatever the level of the PCI score and whatever the origin of the tumor.

Conclusion: The PCI is a reliable tool for measuring the extent of PC. It is easy to use and inter-surgeon concordance is high. It increases by approximately 2 before and after CRS.

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Keywords: Peritoneal carcinomatosis; Peritoneal cancer index; Extent; Cytoreductive surgery with HIPEC; Concordance analysis; Colorectal cancer

Introduction

The survival of patients with peritoneal carcinomatosis (PC) from colorectal cancer has significantly improved since the use of modern chemotherapies¹ and even more so since the introduction of a combined regional approach, when feasible.² This approach associates complete cytoreductive surgery (CRS) treating the macroscopic peritoneal implants combined with hyperthermic intraperitoneal chemotherapy (HIPEC) treating the remaining microscopic peritoneal implants. In addition, CRS + HIPEC is now

widely used to treat pseudomyxomas^{3–5} and malignant mesotheliomas of the peritoneum,⁶ and its superiority over the non-operative treatment of colorectal PC was proven in the Dutch randomized trial.⁷

The extent of the peritoneal disease is described worldwide with the peritoneal cancer index (PCI) defined in 1998 by Sugarbaker et al., which ranges from 1 to 39 (13 areas scored from 0 to 3).⁸ This PCI was recognized as the standard for describing PC during the Fifth International Workshop on Peritoneal Surface Malignancy held in Milan in December 2006,⁹ and later by an international group of experts.¹⁰ In parallel, apart from the completeness of CRS, the PCI gradually appeared to be the most important prognostic factor for overall and disease-free survival. Briefly, the greater the extent of peritoneal disease, the poorer the results of combined therapy, and this point was particularly demonstrated for PC from colorectal cancer.^{11–15}

Abbreviations: PC, Peritoneal Carcinomatosis; PCI, Peritoneal Cancer Index; CRS, Complete Cytoreductive Surgery; HIPEC, Hyperthermic Intraperitoneal Chemotherapy.

* Corresponding author. Tel.: +33 1 42 11 40 85; fax: +33 1 42 11 52 13.

E-mail address: elias@igr.fr (D. Elias).

During the last years, it was proposed that a PCI greater than 20 should be a contraindication to using CRS + HIPEC because survival results were very poor. For example, among the 523 patients treated with this combined approach for colorectal PC in the multicentric French study, the PCI score appeared to be the main prognostic factor, and the 5-year survival rate of the 69 patients with a PCI score greater than or equal to 20 was only 7% (whereas it was 44% for the 181 patients with a PCI score of 1–6).¹⁴ Finally, in the future, we will probably use a PCI score cut-off (possibly different for each origin of PC) as one of the tools to indicate or contraindicate CRS + HIPEC. Consequently, a critical issue is to have solid data concerning the reliability of the calculated score. If we consider how the PCI score was calculated in the literature, it was always determined at the end of surgery by a senior surgeon. This raises two questions: (1) If a PCI score greater than 20 appears to be a contraindication in the future, it should be reliably calculated at the end of the exploration phase which is the first step of the surgical procedure. Question: Is the score calculated after the exploration phase similar to that determined after the end of surgery? (2) Is there any variation between a senior surgeon and a junior surgeon in the PCI scores calculated, before surgery and after surgery?

The purpose of this prospective trial was to compare the PCI score determined before and after CRS, by two different surgeons.

Patients and methods

Patients

From June 2009 to September 2010, 75 consecutive patients undergoing CRS + HIPEC for PC were prospectively studied for this trial. The definition of the PCI³ was well known by the two surgeons before surgery. The PCI is an assessment combining tumor distribution in 13 areas with the size of the lesions in each area (0 if no tumor, 1 when tumor seeding measures from 1 mm to 5 mm, 2 when it measures from 5 mm to 5 cm, and 3 when it is greater than 5 cm or when it involves the whole area). Thus, the PCI score ranges from 0 to 39.³

Methods

The rules were as follows: The senior surgeon and the junior surgeon (resident) did not discuss the PCI before, during or after surgery, and they independently determined the PCI score and the number of invaded areas before and after CRS. The first PCI determination was after the initial exploration phase (which can last from 10 min to more than 120 min) in order to begin the CRS, i.e. when the surgeon decides that CRS + HIPEC is feasible and indicated. The second PCI determination is after the end of CRS. The PCI and area scores were borne in mind by the two

surgeons, and just after the end of the surgery or the day after, the two surgeons independently filled in the information sheet. We arbitrarily decided to prospectively collect 75 consecutive information sheets.

Statistics

We had at our disposal the following items for each patient that were independently provided by the two surgeons: the PCI score and the number of invaded areas before and after CRS, and if they were different, the description of the modifications (areas and score).

The analysis of the concordance of the scores was performed with the Kendall method. This index ranges from 0 to 1, 0 signifying no concordance and 1 signifying perfect concordance. The Bland–Altman plot graph was used to represent the concordance of the different scores on figures, according to the different the PCI scores.¹⁶ It allows one to present the two scores for each patient versus the mean of the scores. It presents the results by reference to an ideal line (in gray in our figures) which corresponds to no difference and the 95% confidence intervals (dotted line in the figures). When the cut-off was tested for the PCI score, we used the Kappa test to study concordance: it ranges from 0 to 1, 1 signifying perfect concordance.

Results

This prospective study included 75 consecutive patients who underwent complete CRS + HIPEC. Two different senior surgeons and six different junior surgeons participated in this study. The origins of the PC were colorectal in 38 cases, pseudomyxomas in 22 cases, mesotheliomas in 8 cases and other lesions in 7 cases.

Concordance between surgeons for the PCI scores

As shown in [Table 1](#), the description of the PCI was virtually similar for the two surgeons, before and after surgery. The Kendall scores for concordance between the two surgeons before CRS and after CRS were high, respectively 0.89 and 0.91, close to 1, signifying a high level of concordance. This was true for any PCI score, as shown in [Fig. 1](#).

Table 1
PCI and areas determined by the surgeons (senior or junior) and according to when the PCI score was determined (before CRS and after CRS).

		Before CRS	After CRS
PCI (median)	Senior	12	14
	Junior	12	14
Invaded areas	Senior	7	9
	Junior	8	9

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