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Scientific letter

Value of three-dimensional reconstruction for non-invasive estimation of PCI in patients with peritoneal carcinomatosis of colorectal origin: A proof of concept

Valor de la reconstrucción tridimensional para la estimación no invasiva del PCI en pacientes con carcinomatosis peritoneal de origen colorrectal: Una prueba de concepto

Colorectal cancer is the third most common type of cancer worldwide. It has a favorable prognosis when diagnosed at an early stage and surgical treatment is considered with curative intent. However, 25% of patients presents with metastases at the time of diagnosis, 8% in form of peritoneal carcinomatosis (PC)[1].

The presence of PC worsens the prognosis and leads to shorter survival than metastases elsewhere. PC is traditionally regarded as the final stage of the oncological disease with survival times lesser than 6 months with systemic chemotherapy and palliative support. However, therapeutic advances in the last decades have made it possible to propose treatment with curative intent by cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) in selected cases, achieving survival times of up to 62 months[1]. An adequate patient selection is essential to achieve these results[2].

Estimation of peritoneal tumor burden using the *Peritoneal Cancer Index* (PCI) was described by Sugarbaker in 1998. PCI is the most important prognostic factor in patients with PC of colorectal origin, since there is a high correlation between PCI and 5-year survival after surgery. Numerous attempts have been made to establish a PCI breakpoint associated with better oncological outcomes to justify the indication of CRS and HIPEC without reaching consensus. It appears that PCI >17 is associated with similar survival rates (7% at 3 years) both with curative-intent treatment as with palliative treatment. Consequently, treatment with curative intent by CRS and HIPEC should not be indicated in patients with PCI >17, since no prolongation of survival compensates for the high morbidity[2].

For all these reasons, preoperative assessment of peritoneal tumor burden and careful patient selection are crucial when considering aggressive surgical treatment of PC with CRS and HIPEC, which may offer a survival benefit that compensates for the high morbidity[2–4]. Surgical exploration of the abdominal cavity after a complete exposure and examination of the entire peritoneal surface remains the gold standard for calculating the PCI, although it is an invasive procedure with high morbidity. It would be interesting to be able to perform a non-invasive preoperative assessment of the extent of peritoneal involvement that would allow us to predict the possibility of complete cytoreduction in order to offer our patients the optimal treatment based on their PCI. Thus, non-invasive preoperative PCI estimation in patients with PC would avoid overaggressive and unnecessary surgery in patients with a high peritoneal tumor burden[1], which would not contribute to their survival and would increase morbidity.

However, imaging techniques have important limitations for PC detection and estimation of peritoneal tumor burden, which is often underestimated: mean −3.8 points for magnetic resonance imaging (MRI) and −5.3 points for computed tomography (CT). CT offers a sensitivity of 11 to 94% depending on the size of the peritoneal implants, while MRI has better sensitivity and specificity (90 and 95.5%, respectively). The correlation between radiological and surgical findings in estimating PCI for PC of colorectal origin, expressed by the Pearson correlation coefficient (R), is greater using MRI (R = 0.929) than CT (R = 0.745), so the use of MRI instead of CT or an association of the two is recommended[3].

The limitations of imaging methods for diagnosis and non-invasive preoperative assessment of peritoneal tumor burden,

which is often underestimated[3], make PC a real diagnostic challenge for the surgeon. Therefore, we propose the utility of imaging-based three-dimensional reconstruction models for the non-invasive preoperative estimation of PCI in patients with PC of colorectal origin.

Data were retrospectively collected from four patients with PC of colorectal origin, in whom PCI was calculated during surgical exploration of the abdominal cavity. Subsequently, as a proof of concept, a three-dimensional reconstruction was performed using radiological segmentation of the preoperative CT images for non-invasive assessment of the PCI (Fig. 1) and the results of both techniques were compared. Statistical analysis of the data was performed using the Wilcoxon signed-rank test.

PCI calculated non-invasively from three-dimensional reconstruction models was underestimated (mean −7.5 points), although not statistically significant, compared to the calculation of the PCI during surgical exploration of the abdominal cavity (Table 1). However, three-dimensional reconstruction has the advantage of being non-invasive as well as able to assess in a more visual and intuitive way the anatomical relationships between peritoneal implants and abdominal viscera, therefore facilitating surgical planning.

In two of the cases (patients 1 and 2), staging laparoscopy was previously performed to estimate PCI, which in both cases was underestimated (−7 points). PCI calculation based on three-dimensional reconstruction models was closer to the real PCI value in these two cases.

Table 1 – PCI calculated by three-dimensional reconstruction models vs. surgical exploration of the abdominal cavity.

Patient	PCI 3D	PCI surgery	Difference	*p*
1	7	9	−2	0.125
2	13	17	−4	
3	11	20	−9	
4	12	27	−15	
Mean			−7.5	

It seems that non-invasive estimation of PCI using three-dimensional reconstruction models, such as imaging tests or staging laparoscopy, underestimates the peritoneal tumor burden in patients with PC of colorectal origin. Studies with a larger sample size are needed to evaluate this technique, and possibly an improvement in the development and quality of three-dimensional reconstruction models that allow for greater anatomical precision and greater sensitivity in the detection of peritoneal implants.

To date, non-invasive preoperative estimation of PCI in patients with PC of colorectal origin remains a pending issue.

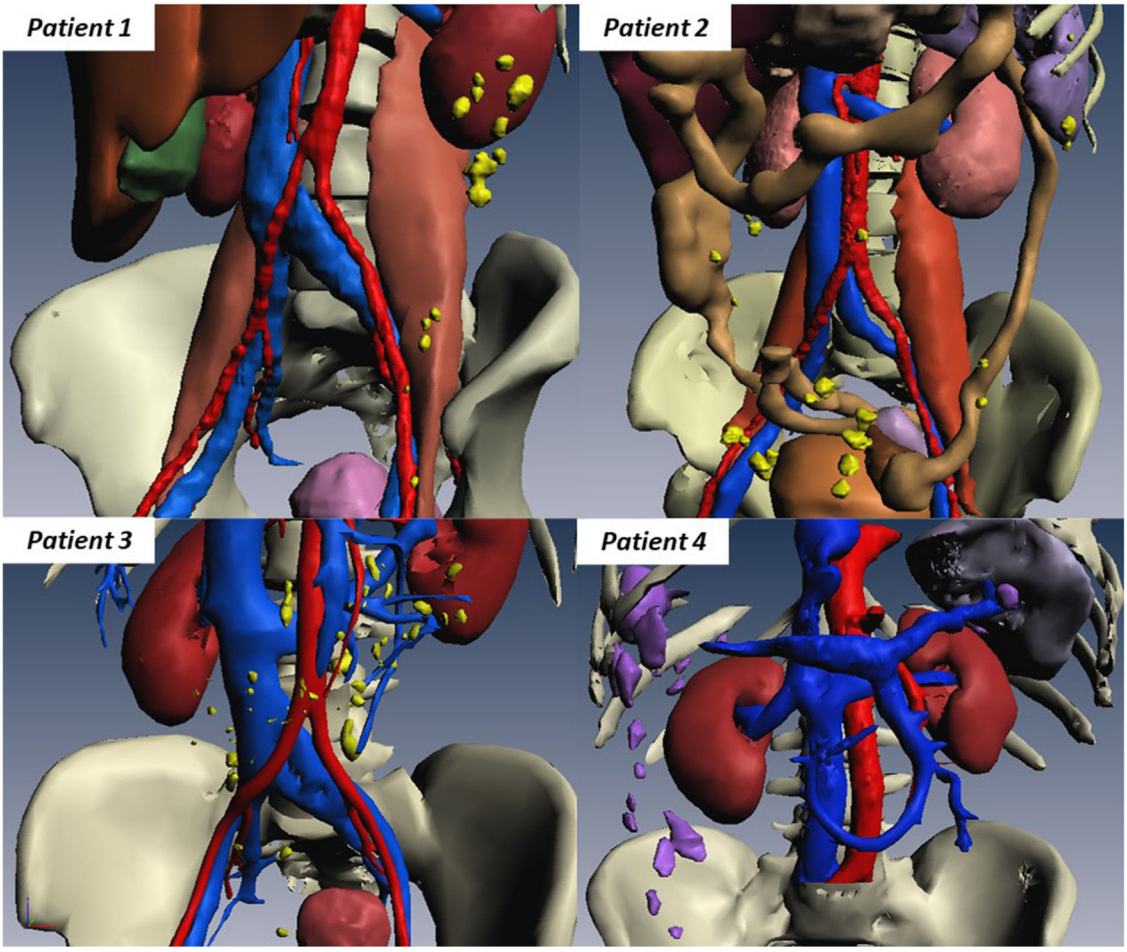

Figure 1 – Three-dimensional reconstructions based on the preoperative CT images showing peritoneal implants (yellow in patients 1-3, purple in patient 4).

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Manejo terapéutico de las masas inflamatorias de origen apendicular

Therapeutic management of inflammatory appendiceal masses

La apendicitis aguda es un cuadro quirúrgico agudo frecuente[1,2]. Su evolución natural es la perforación parietal con opción a la peritonitis difusa, o el bloqueo epiploico-visceral y localización del proceso inflamatorio-infeccioso[3].

Estas formas evolucionadas se denominan masas inflamatorias de origen apendicular (MIA)[3-5]. La definición, anglosajona, abarca entidades que se conocen como plastrón apendicular o plastrón apendicular abscedado. En nuestro centro asistencial, entre el 2019 y el 2021, se asistió a 456 pacientes adultos con apendicitis aguda, 12 presentaron MIA (3%) (ver tabla 1). En su mayoría fueron mujeres (n = 9) obesas (n = 8), de semiología dificultosa para el clínico y para el cirujano en vistas al manejo quirúrgico; 3 presentaban enfermedad psiquiátrica que dificultaba la anamnesis, lo que explica parte de los retrasos diagnósticos. La presentación más frecuente fue dolor en fosa ilíaca derecha, fiebre y tumoración palpable. La evolución mediana fue 11,5 días. Siete pacientes habían hecho consultas previas y 3 habían recibido antibióticos.

El diagnóstico se confirmó con tomografía computarizada (TC). La identificación del apéndice es elemento que considerar para las decisiones terapéuticas. El neumoperitoneo o líquido libre sugestivo de macroperforación excluyen el manejo conservador, que adquiere mayor valor en pacientes añosos, dado el aumento de prevalencia de enfermedad neoplásica[6]. Aun con TC, hay un grupo de pacientes en los que el diagnóstico no es claro. Tekin et al., de 98 pacientes con diagnóstico clínico tomográfico de MIA, excluyeron a 4 luego de videocolonoscopía con diagnóstico de cáncer de colon, diverticulitis y enfermedad de Crohn. El común denominador fue la ausencia de respuesta a las medidas terapéuticas[5].

El manejo terapéutico es objeto de controversia[1,3,4]. La bibliografía publicada es testigo y el debate, la norma. El abanico terapéutico abarca la antibioticoterapia exclusiva, drenaje percutáneo guiado por imagen y el drenaje quirúrgico, con o sin apendicectomía. Puede ser sistematizado en cirugía de inicio o tratamiento conservador.