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CASE REPORT

A rare case of peritoneal deposits with carbon pigmentation after preoperative endoscopic tattooing for sigmoid colon cancer

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Abstract

Purpose We report a case in which pigmented peritoneal deposits were found during laparoscopic surgery following preoperative endoscopic tattooing for sigmoid colon cancer.

Methods The patient's clinical, endoscopic, and histological data from the Niigata City General Hospital were reviewed, as well as the literature on laparoscopic surgery involving the preoperative endoscopic tattoo, with a focus on the relevance of peritoneal deposits and tattooing ink.

Results A 71-year-old man presented to our hospital complaining of vomiting and abdominal distention. Abdominal computed tomography revealed obstructive sigmoid colon cancer. An emergency endoscopic colon stenting procedure and injection of 0.2 ml India ink to the submucosal layer of the tumor's anal side were performed. Laparoscopic-assisted sigmoid colectomy was done 14 days after stenting. At surgery, seven small peritoneal deposits were seen in the rectovesical pouch and at the site adjacent to the tumor. All peritoneal deposits were stained by the ink. Gross leakage of the ink into extraintestinal sites was seen. The seven peritoneal deposits were resected under laparoscope. Histological findings revealed that the seven peritoneal deposits were composed of adenocarcinoma and carbon pigments. Immunohistochemical staining for cluster of differentiation 163 showed that the carbon pigments in the peritoneal deposits were within macrophages.

Conclusions The possibility of the tattooing procedure causing peritoneal dissemination cannot be completely denied, but it can be hypothesized that the carbon pigmentation was transferred to peritoneal deposits by macrophages. In the future, we hope that this phenomenon becomes a keystone for diagnoses and treatments for peritoneal dissemination.

Keywords Endoscopic tattooing · Peritoneal deposits · Colon cancer · Carbon pigmentation · India ink

Background

Endoscopic tattooing with India ink is considered to be an effective and safe method of tumor localization at the time of surgery [1–3]. No case has been reported of endoscopic tattooing definitively causing peritoneal deposits. We report a patient in whom the location of sigmoid colon cancer was preoperatively tattooed with colonoscopy, and pigmented peritoneal deposits were found at laparoscopic surgery.

Case presentation

A 71-year-old male presented to the emergency department of our hospital with vomiting and abdominal distention. On physical examination, the abdomen was distended and soft with tenderness, but there were no signs of peritoneal irritation. Blood biochemistry findings revealed an elevated white blood cell count of 12,400/μl. Enhanced abdominal computed tomography revealed wall thickening in the sigmoid colon and intestinal expansion on the oral side from the thickened sigmoid colon, as well as two small nodules in the liver (Fig. 1). Based on these findings, the diagnosis of obstructive

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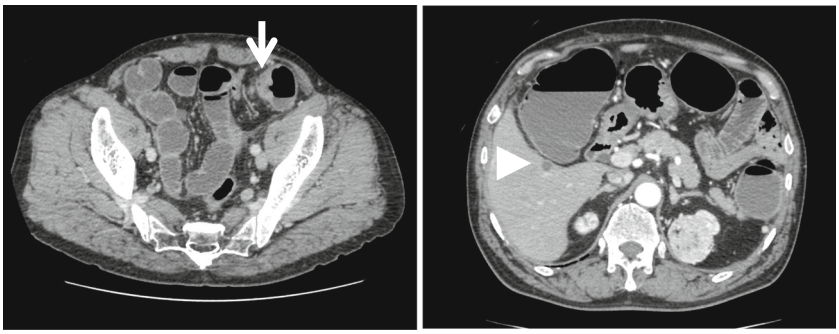

Fig. 1 Enhanced abdominal computed tomography. Wall thickening in the sigmoid colon (arrow), expansion of the oral side of the intestinal tract, and a small nodule in the liver (arrowhead)

sigmoid colon cancer with liver metastasis was made. An emergency endoscopic colon stenting procedure and injection of 0.2 ml India ink to the submucosal layer of the stent's anal side were performed (Fig. 2). Stenting improved the intestinal obstruction, and we performed laparoscopic-assisted sigmoid colectomy on day 14 after stenting.

Surgical findings

A 12-mm camera port was placed in the navel and four additional ports in the bilateral upper and lower abdomen. During the laparoscopic examination, tumor associated with wall deformation was identified in the sigmoid colon. Additionally, five small peritoneal deposits were seen in the rectovesical pouch and two small deposits at sites adjacent to the tumor. All peritoneal deposits were stained by the ink. The serosal ink staining at the sigmoid colon and gross leakage of ink to extraintestinal sites were visualized (Fig. 3). Sigmoidectomy and partial resection of the seven peritoneal deposits were performed. The patient showed good postoperative recovery and was discharged on postoperative day 5.

Histopathological findings

Histopathological examination of the primary tumor revealed moderately differentiated tubular adenocarcinoma and mucinous adenocarcinoma with invasion to the subserosa sigmoid colon. Hematoxylin and eosin stained sections of the sigmoid colon wall at the primary tattoo site showed carbon pigments within the submucosa and inner muscle layer, tracking of pigment along the serosa, and vertical lymphovascular channels traversing the muscularis propria containing carbon pigment and pigment-laden macrophages (Fig. 4a, b). The seven peritoneal deposits were composed of adenocarcinoma and carbon pigments (Fig. 4c). Immunohistochemical staining for cluster of differentiation 163 (CD 163) shows that the carbon pigments in the peritoneal deposits were located within macrophages (Fig. 4d).

Discussion

In our facility, between January 2014 and June 2018, 33 cases of colorectal cancer with peritoneal dissemination underwent surgery in which preoperative endoscopic tattooing was performed. The median interval was 17 days from tattooing to surgery. Only the case presented here showed peritoneal deposits pigmented by the carbon ink.

A literature search concerning peritoneal deposits with carbon pigmentation was done using PubMed, searching publications between 1990 and July 2018 using the terms "peritoneal deposits" and "carbon," "ink," or "tattoo" as keywords; there was 1 case report by Tutticci et al. [4] In their case report, submucosal injection of India ink was performed at colonoscopy proximally and distantly to the lesion in what appeared to be unaffected tissue. Surgery

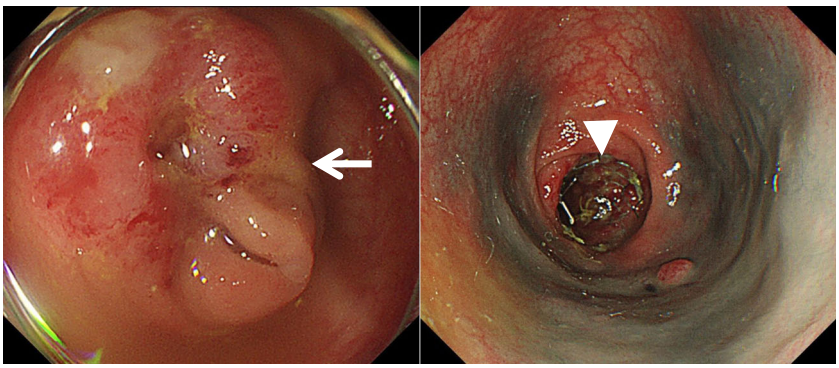

Fig. 2 Sigmoid colonoscopy findings. Circumferential ulcerated tumor of the sigmoid colon (arrow) and submucosal tattoo distal to the tumor and stent (arrowhead)

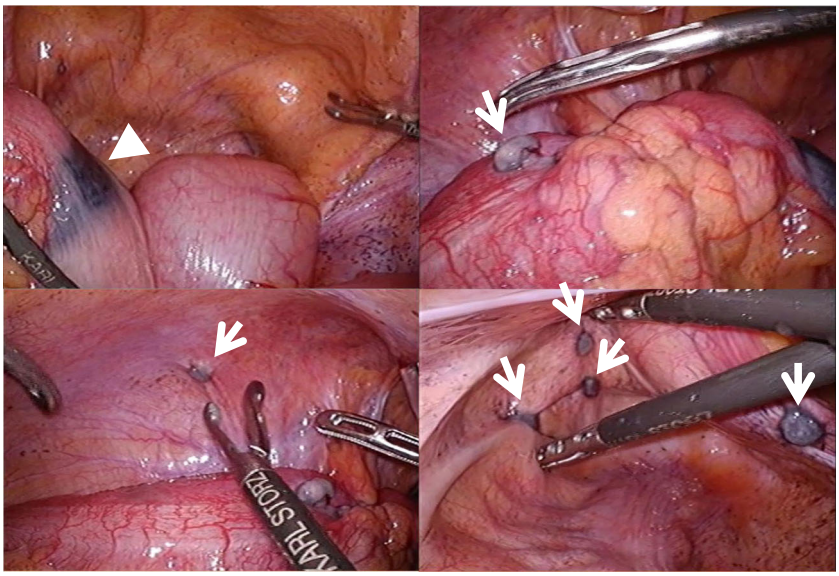

Fig. 3 Laparoscopic findings. All peritoneal deposits were colored by the ink (arrows), and serosal ink staining was seen at the sigmoid colon (arrowhead)

performed 75 days after the injection revealed six small peritoneal deposits with carbon pigmentation adjacent to the cecal pole. Gross leakage of ink during tattooing seemed unlikely as no generalized peritoneal staining was identified at surgery. They concluded that although the mechanism by which the peritoneal deposits were stained with carbon pigment is unclear, there is a possibility of a causal association with peritoneal metastatic deposits. The differences between our case and their case were that we performed surgery 14 days after injection of Indian ink and that our case had potential leakage of the ink into the peritoneal cavity, in addition to tattooing of the primary lesion. In our case, immunohistochemical staining for CD 163, a marker of cells from the macrophage lineage [5], in the peritoneal deposits shows that all of the carbon pigment fragments were present within macrophages.

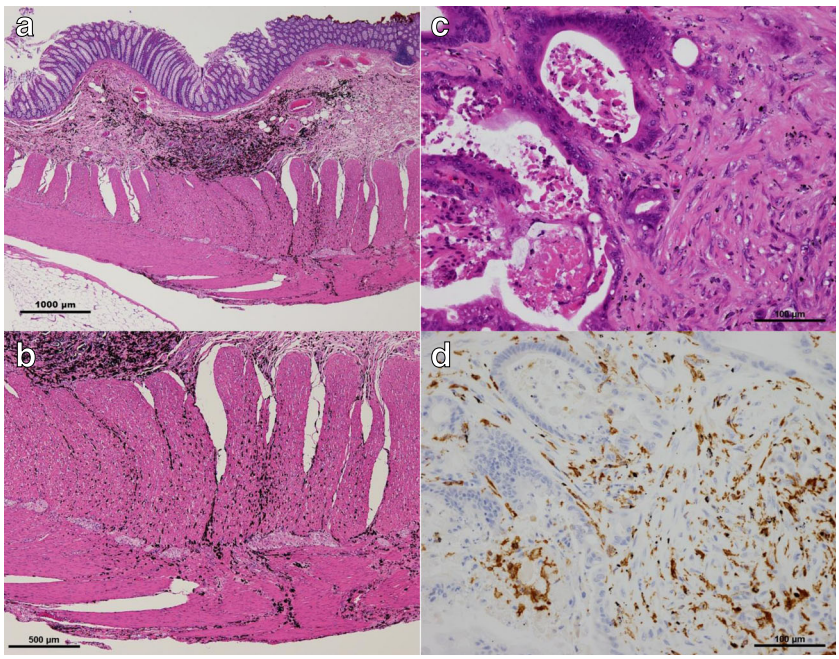

Fig. 4 Histopathological findings. a: Hematoxylin and eosin (HE) staining of the sigmoid colon wall at the primary tattooed site. The carbon pigments are contained in the submucosa and inner muscle layer, and tracking of pigment is visible along the serosa (magnification × 2). b: HE staining of the muscularis propria at the primary tattooed site. A vertical lymphovascular channel containing carbon pigment traverses the muscularis propria; this lymphovascular channel contains pigment-laden macrophages (magnification × 4). c: HE staining of a peritoneal deposit. The peritoneal deposit is composed of adenocarcinoma and carbon pigments (magnification × 20). d: Immunohistochemical staining for CD163 in the peritoneal deposit. The carbon pigments in the peritoneal deposits were within macrophages (magnification × 20)

We feel that there is no possibility of a causal association between the peritoneal metastatic deposits and the endoscopic tattooing procedure in our case for the following reasons. While a needle contaminated during the saline lift could have led to local tumor inoculation during tattooing in our case, the presence of the seven peritoneal deposits 14 days after injection was too soon to suggest a causal relationship. Additionally, the pigmented peritoneal deposits were distant from the injection site.

The proposed mechanism for carbon pigmentation of the peritoneal deposit is the migration of pigment-laden macrophages via an as-yet unidentified route. In a case report by Cappell et al., the mechanism by which endoscopic tattoo ink spreads from preoperative endoscopic tattoo sites to extraintestinal sites was the migration of pigment-laden macrophages via lymphovascular channels [6]. In recent research, tumor-associated macrophages (TAMs) have attracted attention in the field of pathology and immunology [7, 8]. In many tumor types, the TAM infiltration level has been shown to be of significant prognostic value. TAMs have been linked to poor prognosis in breast cancer, ovarian cancer, and certain types of glioma and lymphoma; TAMs are also associated with better prognosis in colon and stomach cancers and both worse and better prognoses in lung and prostate cancers [9]. Although the association between macrophages with carbon pigment in peritoneal deposits in the current case and TAMs is currently unclear, it could be clarified by future pathologic studies.

Conclusion

We present a rare case of peritoneal deposits with carbon pigmentation associated with endoscopic tattooing of sigmoid colon cancer. The possibility of the tattooing procedure causing peritoneal dissemination cannot be completely denied, but it can be hypothesized that the carbon was transferred to the peritoneal deposits by macrophages, within 14 days of the initial tattooing, in our case. In the future, we hope this phenomenon becomes a keystone for diagnoses and treatments for peritoneal dissemination.

Author contributions H Uehara reviewed the medical record and scientific literature and wrote the manuscript. T Yamazaki supervised and reviewed critically the manuscript. H Hashidate interpreted the histological specimens and reviewed critically the manuscript. I Shioi proofread and reviewed critically the manuscript. All other authors reviewed critically the manuscript. All authors approved the final version of the manuscript.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Institutional review board statement The publication of this case report was approved by the ethics committee of Niigata City General Hospital.

Informed consent statement The patient's written consent was obtained for publication of this case report.

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