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Case Report

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Hematemesis With Gastric Laceration After Tattooing a Polyp With Purified Carbon: A Review of the Literature

Ana Isabel Gonzalez-Tallon[a, b], Miguel Rivero-Fernandez[a], Irina Calvo-Ramos[a], Antonio Diaz-Sanchez[a], Maria del Rosario Gonzalez-Alonso[a], Elsa De la Fuente-Briongos[a], Rebeba Manzano-Fernandez[a], Eloisa Moya-Valverde[a], Jose Maria Riesco-Lopez[a], Rocio Campos-Cantero[a]

Abstract

Endoscopic tattooing is a simple and effective technique for marking small lesions, so they can be localized during surgery or in later endoscopies. Various agents can be used such as India ink or a solution of purified carbon particles. The number of complications from tattooing is relatively small, but not rare. The majority of the literature on the subject refers to complications in the colon. We present a case of gastric bleeding secondary to a laceration following tattooing with purified carbon, and a literature review.

Keywords: Tattoo; Purified carbon; India ink; Complication; Laceration; Hematemesis

Introduction

Certain endoscopic lesions will require to be marked in order to be found at a later stage, either during surgery or at posterior endoscopies. Some techniques are available for that purpose, such as radiological tests, the placement of clips, intraoperative endoscopy, or tattooing. The latter is widely used, as different substances can be applied and has a low complication rate in general [1-3].

Most of the complications that have been reported in the literature are described in the colon. We present a case of a patient with gastric bleeding secondary to a laceration following tattooing with purified carbon.

Case Report

The patient was a 68-year-old male with a past medical history of diabetes, hypertension, dyslipidemia and ischemic heart disease, for which he required the placement of three stents 2 years before the current episode. His current treatment included antiplatelet therapy with acetylsalicylic acid.

The patient was under gastroenterology follow-up for a mucosal lesion in the gastric antrum, 1.3 × 20 mm in size, detected at a gastroscopy. An endoscopic ultrasonography (EUS) was also performed, but was not conclusive. Therefore, the patient underwent an endoscopic mucosectomy and histopathology was consistent with an inflammatory fibroid polyp.

Nine months later, a second mucosectomy was performed due to the recurrence of the polyp, presenting the same histological findings. One year after that, the lesion recurred for the third time, and decision was made to treat the lesion surgically.

Prior to surgery, a gastroscopy was performed to tattoo the polyp. Antiplatelet therapy was withheld 7 days prior to the procedure. A total of 4 mL of sterile solution of highly purified carbon particles was injected into the submucosa sorrounding the lesion at several different spots (upper and lower quadrants proximal to the polyp 0.5 - 1 mL per injection). During the injection, no resistante was found. There were no immediate complications during the procedure.

The patient was discharged, but presented to the emergency room (ER) 4 h later with sudden epigastric pain and hematemesis. On arrival, the patient was hemodinamically stable and on examination, the epigastric area was tender, but without evidence of peritoneal irritation. Laboratory workup results were as follows: leukocytes 7.450 × 10^3/µL (neutrophils 82%), hemoglobin 13.5 g/dL, platelets 148,000/µL and a prothrombin time 14.2 s.

An urgent gastroscopy was performed, revealing a submucosal extension of the dye from the antrum towards the gastric body. In that area, a deep laceration in the gastric wall was found, measuring several centimeters and oozing blood (Fig. 1). Several injections of a diluted solution of adrenaline (1:10,000) were performed to stop the bleeding. However, given the size of the laceration, it could not be closed with hemoclips.

The patient was admitted on intravenous fluids and empiric antibiotic therapy. He was kept nil by mouth. An emergency computed tomography (CT) scan was also performed to exclude gastric perforation.

The CT scan revealed thickening of the stomach wall, compatible with an intramural hematoma and related inflammatory response, but no pneumoperitoneum, free fluid, or col-

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[a]Department of Gastroenterology, Hospital Universitario del Sureste, Arganda del Rey, Madrid, Spain
[b]Corresponding Author: Ana Isabel Gonzalez-Tallon, Department of Gastroenterology, Hospital Universitario del Sureste, Arganda del Rey, Madrid, Spain. Email: aigleztallon@gmail.com

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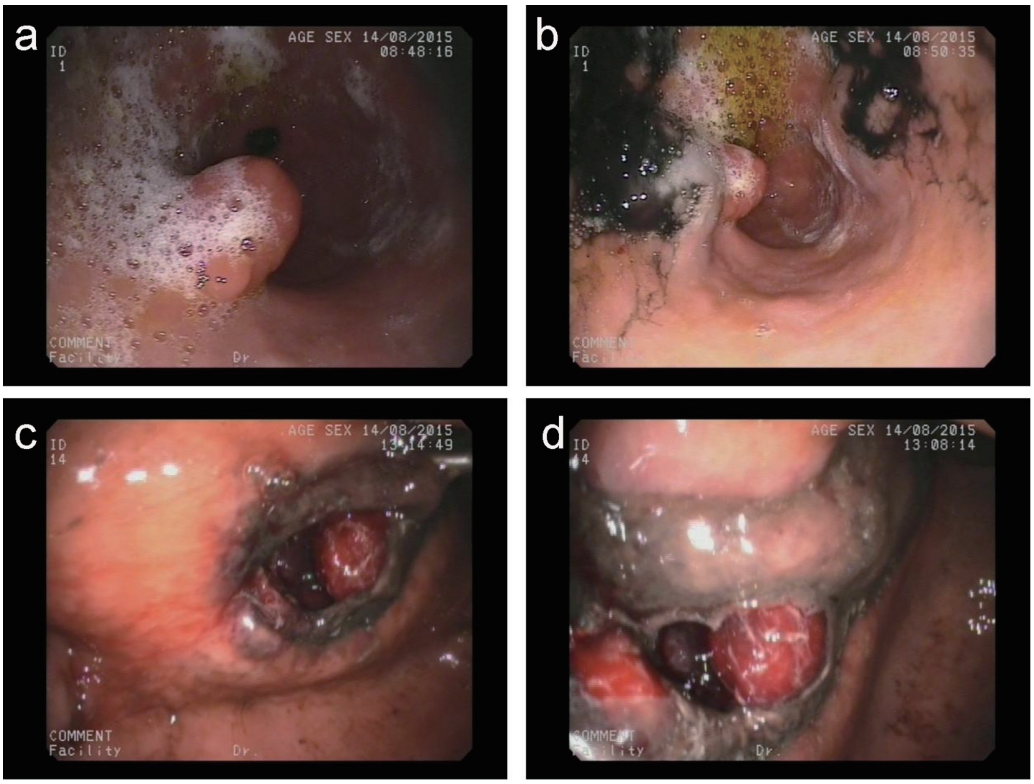

Figure 1. (a) Gastric polyp. (b) Tattooed gastric polyp. (c, d) Laceration after tattooing.

lections were seen.

Over the 7-day admission, the patient evolved favorably, with no recurrence of bleeding and oral diet could be restarted with no further complications.

A follow-up CT scan was performed and showed a normal gastric wall. Three months later, the patient underwent surgical resection of the fibroid polyp, wich was located by intraoperative gastroscopy. The patient was discharged after surgery and is currently asymptomatic. The 6-month postoperative gastroscopy also showed no evidence of polyp recurrence.

Discussion

Identifying intestinal lesions during surgery is often difficult, particularly with laparoscopic surgery. Since palpation is not possible, small lesions, such as polyps, vascular lesions, or diverticula, may go unnoticed [1, 2]. To facilitate localization, different techniques are used, such as radiological tests, intraoperative endoscopy, clips or tattooing. The latter is long-lasting and effective, so it is widely used [3].

Tattooing as a method of marking the base of a polyp was first described in 1958 [4]. The use of this technique to locate colonic lesions during surgery was first described in 1975 [5]. Ever since, different tattooing agents have been tested, such as indocyanine green, methylene blue, indigo carmine, India ink, or solutions of highly purified carbon particles (SPOT^{TM}). The latter two are the most commonly used today because they remain visible 3 - 12 months after tattooing in 68-88% of patients [6, 7]. Other agents such as indocyanine green, are visible for only 3 - 8 days [8, 9], while methylene blue remains for 7 days. If the surgery is performed outside of these time frames, it is possible that the marker will not be identifiable. As a result, these agents are less frequently used [10, 11].

Various case series have proven the safety and efficacy of these agents to mark lesions in the gastrointestinal tract. None of them reported complications (Table 1) [1, 7-9, 11-19]. Most of the avalilable studies involve the colon, but there are also some studies showing safety and efficacy of tattooing techniques in other parts of the gastrointestinal tract, such as the esophagus and the stomach [15, 16, 20-22]. Likewise, India ink appears safe when used in children [23].

However, India ink needs to be diluted and sterilized before use [24], unlike highly purified carbon particles, which are dispensed ready-to-use. Highly purified carbon has proven to be safe and effective, with a low rate of complications [17-19] and in many cases, it is preferred over India ink.

The number of complications from tattooing with India ink or highly purified carbon is relatively small, but not rare. Most complications are secondary to transmural injections spreading the dye to the submucosa, peritoneum, or pericolic adipose tissue [25-29]. Most cases are asymptomatic. Nevertheless, there have been reports of intracavitary and abdominal wall abscesses [30-32], focal peritonitis [33, 34], hematoma [35], inflammatory pseudotumor formation [36, 37], idiopathic inflammatory bowel disease [38], simulated intestinal infarction [39], intestinal perforation [40], and mesenteric air embolism [41]. A compilation of the aforementioned complications

Table 1. Summary of Efficacy Studies on Dyes

Author	Number of cases	Agent	Tattooed area	Efficacy (%)	Invisible (%)
Beretvas and Ponsky [11]	15	Methylene blue	Colon	100	0
Miyoshi et al [8]	41	Indocyanine green	Colon	92.7	7.3
Hammond et al [9]	15	Indocyanine green	Colon	100	0
Aboosy et al [7]	19	India Ink	Colon	68.4	31.5
Cho et al [1]	96	India Ink	Colon	97.9	2.1
Shatz et al [12]	55	India Ink	Colon	NA	NA
McArthur et al [13]	195	India Ink	Colon	100	0
Arteaga-Gonzalez et al [14]	21	India Ink	Colon	100	0
Shaffer et al [15]	19	India Ink	Esophagus	94.7	5.3
Sun et al [16]	53	India Ink	Stomach	96.2	3.8
Feingold et al [17]	50	Purified carbon	Colon	88	12
Askin et al [18]	113	Purified carbon	Colon	100	0
Park et al [19]	63	Purified carbon	Colon	96.8	1.6

NA: not available.

is shown in Table 2 [25-41].

Most of the complications reported in the literature refer to the colon and the small intestine. Our case report, however, relates to a gastric complication. The patient underwent multiple prior mucosal resections, and the subsequent wall fibrosis could have been the cause of the complication. Despite the fact that inflammatory fibroid polyps tend to have dilated and abnormal vessels, tattooing is usually performed on the surrounding healthy gastric wall, so it does not seem probable that the laceration could have been a consequence of vascular disruption by the needle, although it cannot be completely excluded as a cause. Purified carbon is not a biologically inert substance, and given the location and characteristics of the laceration, a chemical reaction with the compounds in the dye could have also played a role.

In conclusion, endoscopic tattooing is a very useful tool for the surgical localization of digestive tract lesions. India ink has been used for several decades with a good safety profile

Table 2. Summary of Complications From the Endoscopic Tattooing Described Above

Author	Location	Material	Complication
Cappell et al [25]	NA	India ink	Black macular patches on peritoneum
Mitrani-Boyle et al [26]	Sigmoid colon	India ink	Spreading of dye to pericolic adipose tissue
Hellmig et al [27]	Sigmoid colon	India ink	Spreading of dye to submucosa
Del Rio et al [28]	NA	India ink	Spreading of dye to peritoneum
Tutticci et al [29]	Rectum	Purified carbon	Peritoneal pigmentation
Park et al [30]	Descending colon	Indiaink	Colonic abscess and focal peritonitis
Chang et al [31]	Sigmoid colon	India ink	Colonic abscess
Alba et al [32]	Sigmoid colon	India ink	Rectus muscle abscess
Singh et al [33]	Recto sigmoid colon	India ink	Focal peritonitis
Moss et al [34]	Hepatic flexure	Purified carbon	Peritonitis
Marques et al [35]	Rectum	Purified carbon	Rectum hematoma
Dell'Abate et al [36]	Colon	India ink	Pseudotumor
Coman et al [37]	Colon	India ink	Pseudotumor
Gopal et al [38]	Colon	India ink	Idiopathic inflammatory bowel disease
Bahardursingh et al [39]	Sigmoid	India ink	Simulating intestinal infarction
Gianom et al [40]	Right colon	India ink	Retroperitoneal perforation
Chen et al [41]	Small bowel	India ink	Mesenteric air embolism

NA: not available.

and the commercial availability of ready-to-use sterile preparations (SPOT™) has led to a wider use of endoscopic tattooing. However, the long-term safety and efficacy data for these compound are limited. The mechanism by which the reported complications have arisen is not currently known. One posibility could be extra-enteric bacterial inoculation through the injection needle, but if we consider that carbon particles are not biologically inert, development of chemical reactions producing damage cannot be ruled out. Further evaluation is needed to compare the different known agents used in such injections, as well as comparison with other marking techniques now in use, such as clips or radiological tests.

Conflicts of Interest

All the authors declare that they have no conclicts of interest.

Author Contributions

This study was designed and coordinated by GTAI as the principal investigator. RLJM, CRI, FBE and CCR provided conceptual and technical guidance for all aspects of the project. DSA, RFM, MFE, MVE and GAMR contributed in the clinical and technical aspects of the study. The manuscript was written by GTAI, commented and approved by all authors.

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