Safety of colonic tattoo with sterile carbon particle suspension: a proposed guideline with illustrative cases (CME)

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Endoscopic tattooing of the colon to facilitate polyp or postpolypectomy scar location during subsequent colonoscopy or surgery is a reliable and widely used technique.[1] Sterile carbon particle suspension (SCPS) (Spot; GI-Supply, Camp Hill, Pa) was shown to be safe and effective and is increasingly used in place of India ink, which requires additional preparation and is associated with a low rate of complications.[2] Despite a recent review article,[3] there is little evidence to guide many of the practical aspects of SCPS injection, most importantly where to inject relative to the lesion. We report a case series of SCPS-related complications and suggest guidelines for future use.

METHODS

Westmead Hospital Endoscopy Unit is a high-volume, tertiary-care referral center for advanced endoscopic resection. Demographic and technical data were recorded prospectively for all patients referred for EMR of advanced colonic mucosal neoplasia. Colonoscopy was performed with patients under conscious sedation by using pediatric colonoscopes (Olympus PCF-Q180, Tokyo, Japan) and air insufflation. The unit's standardized sequential inject and resect colonic EMR technique was used. This was previously described in detail.[4] The submucosal injectant was normal saline solution with 0.04% indigo carmine and 1:100,000 epinephrine. A lower GI injector needle (Olympus) was used for submucosal injection. A 20-mm spiral snare (Olympus) with Endocut Q, Effect 3 (ERBE, Tubingen, Germany) was used for resection. Detailed review of all significant endoscopy complications occurred quarterly in a departmental morbidity and mortality meeting. Between 2005 and 2009, 4 cases of SCPS-related complications were identified.

Abbreviations: ASGE, American Society for Gastrointestinal Endoscopy; ESD, endoscopic submucosal dissection; SCPS, sterile carbon particle suspension.

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RESULTS

Case 1

A 76-year-old woman underwent colonoscopy and EMR of a 45-mm, Paris classification 0-IIa, granular, laterally spreading tumor of the descending colon (Fig. 1A). Eight weeks earlier, the referring endoscopist had taken two cold biopsy specimens from the center of the lesion by using standard cup size forceps and tattooed the proximal (oral) aspect with SCPS. The specimens showed tubulovillous adenoma with high-grade dysplasia.

EMR was commenced at the distal margin of the lesion, and 5 resections were performed (Fig. 1B and C). The final resection at the proximal margin (Fig. 1D) adjacent to the tattoo was complicated by a complete perforation, which was immediately recognized. The defect was closed endoscopically with 3 clips (Resolution; Boston Scientific, Natick, Mass) (Fig. 1E). While clips were being applied, the patient developed respiratory distress, so an endotracheal tube was inserted. A chest radiograph demonstrated a right-side tension pneumothorax. An intercostal catheter was placed, and the patient stabilized. Surgical consultation was obtained and laparoscopy performed. There was no peritoneal soiling and no peritonitis. Retroperitoneal gas escape communicating to the right pleural space was suspected. The patient was managed conservatively and made a full recovery, being discharged on day 3.

The EMR specimen histology confirmed tubulovillous adenoma with high-grade dysplasia. The specimen from the final EMR resulting in perforation demonstrated carbon particles throughout the submucosa, muscularis propria, and subserosa (Fig. 1F), with an associated dense inflammatory and fibrotic reaction centered on the submucosa.

Follow-up colonoscopy at 6 months revealed some minor residual adenoma at the proximal margin, which could not be removed at the initial procedure. This residual was cautiously resected successfully. Subsequent colonoscopy at 12 months revealed a scar only.

Case 2

An 80-year-old man was referred for endoscopic resection of a 3-cm hepatic flexure lesion. Endoscopic assessment suggested invasive malignancy, and therefore attempts at endoscopic removal did not proceed. A

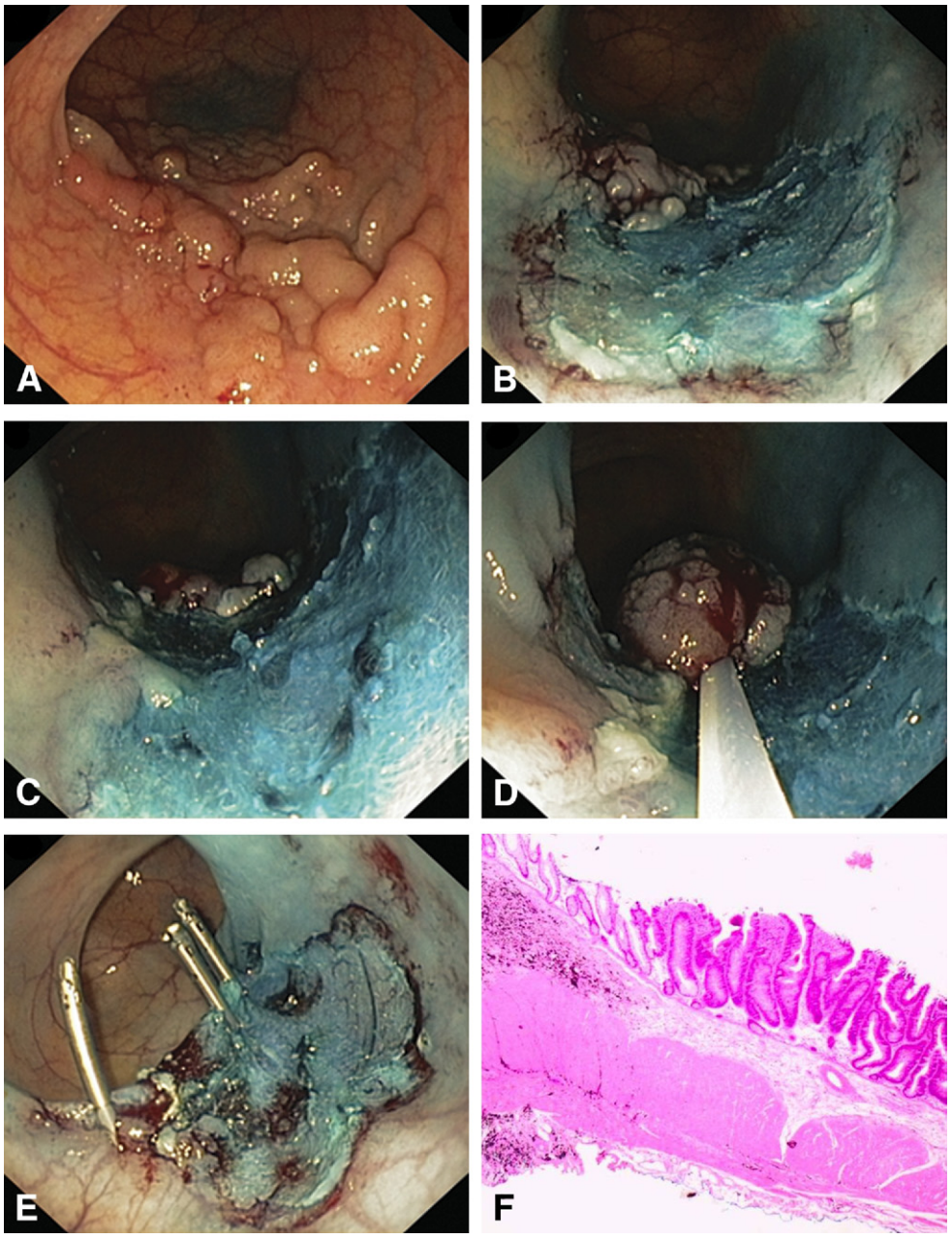

Figure 1. Case 1. **A,** 45-mm, Paris classification 0-IIa, granular, laterally spreading tumor of the descending colon. Tattoo visible adjacent to the proximal margin. **B** and **C,** 5 endoscopic mucosal resections performed from the distal margin of the lesion. **D,** Final resection adjacent to the tattoo was complicated by a complete perforation. **E,** Perforation closed with clips. **F,** The specimen from the final EMR resulting in perforation. Carbon particles are present throughout the submucosa, muscularis propria, and subserosa, with an associated dense inflammatory and fibrotic reaction centered on the submucosa (H&E, orig. mag. ×20).

submucosal injection of SCPS was made to mark the site for subsequent surgical resection. A submucosal saline cushion was not created before this injection. The patient was discharged feeling well. That evening he returned with severe abdominal pain and clinical features of peritonitis. At laparotomy there was generalized contamination of the peritoneal cavity with SCPS that was maximal in the region of the hepatic flexure. Neither pus nor fecal contamination was present. An extended right hemicolectomy was performed. On the third postoperative day, the patient developed rapid atrial fibrillation, which was subsequently complicated by a hemorrhagic cerebral stroke, from which the patient later died.

Case 3

A 65-year-old man underwent EMR of a 25-mm Paris 0-IIa, nongranular, laterally spreading tumor of the sigmoid colon (Fig. 2A). SCPS had been injected by the referring endoscopist 8 weeks earlier. The SCPS was noted immediately adjacent to the lesion. Submucosal injection