

# Successful closure of gastrocolic fistula using preoperative localization with charcoal nanoparticles tattooing

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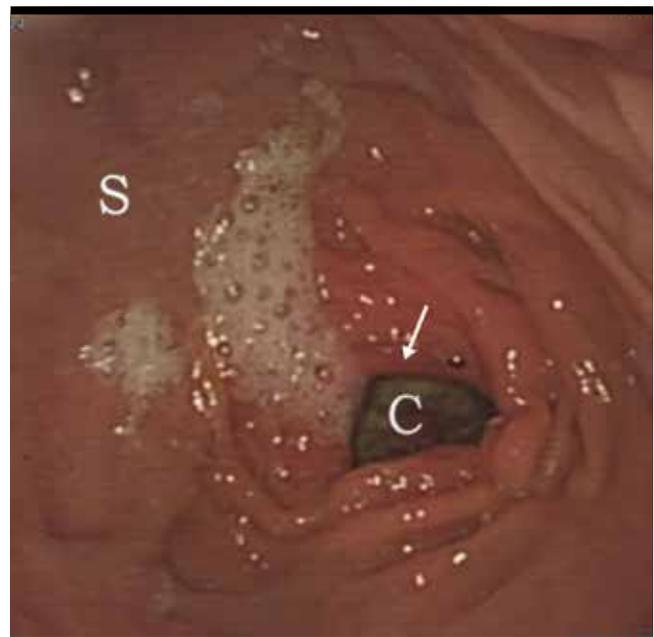
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Dear Editor,

Gastrocolic fistula is a rare disease. Locating the gastrocolic fistula is a challenge in surgery, particularly in the repeated surgery. Severe ankyloenteron wound may occur so that we can hardly distinguish the normal anatomical structure. Thus, an accurate preoperative localization of lesions has become increasingly important.

A 53-year-old man presented with chronic diarrhea, upper abdominal pain, and weight loss. Diarrhea occurred 10 times per day. Laboratory tests revealed a leukocyte count of  $13.1 \times 10^9/L$ , hemoglobin count of 105.0 g/L, and albumin count of 31.0 g/L. Fiber gastroscopy and upper gastrointestinal contrast both showed a fistula between the stomach and descending colon (Figure 1). Because of duodenal ulcer, he underwent two major gastrointestinal reconstruction surgeries 5 years ago. Therefore, severe ankyloenteron was suspected. Preoperative localization was performed using charcoal nanoparticles tattooing. One week before surgery, charcoal nanoparticle (Carbon Nanoparticles Suspension Injection, Lummy) was injected 0.5 cm distal to the anastomosis through an endoscope using a 26 G needle (Olympus injector nm-200U-0423, Olympus) (Figure 2). The injection dose was 0.5 mL (5 mg). During the surgery, we found that ankyloenteron was serious exceedingly. The bowel marked with the charcoal nanoparticle could be easily located (Figure 3). After locating the staining point, the gastrocolic fistula could be quickly located, and the surgery was completed within 1 h. During a subsequent follow-up, his condition has markedly improved. The patient received written informed consent.

In recent years, preoperative localization technology (such as metal clip, indocyanine green, methylene blue, and India ink) has been gradually used in various surgical procedures (1). However, metal clips are usually small and may be difficult to palpate. In addition, because of the peristalsis of the intestine, the metal clip may fall off and cause the failure of localization during surgery. India ink cannot be retained for long periods and may become invisible. Further, India ink and several nano dyeing agents may cause inflammation, allergic reactions, and other adverse events (2).



**Figure 1.** A fiber gastroscopy showed a 3×2 cm fistula opening (arrow) below the anastomosis, which communicated with the stomach (S) and the descending colon (C)

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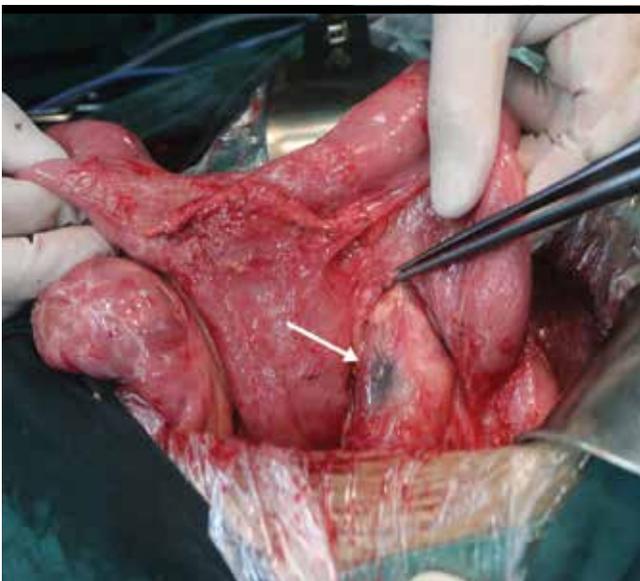
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**Figure 2.** Under the guidance of fiber endoscopy, the charcoal nanoparticle (arrow) was injected 0.5 cm distal to the anastomosis



**Figure 3.** The segment of the bowel marked with charcoal nanoparticle (arrow) was easily located

The diameter of charcoal nanoparticles is approximately 150-200 nm, whereas that of capillaries is 30-50 nm, which limits the dissemination of carbon nanoparticles via blood vessels (3). The internal network crosslinking structure of nano carbon particles can maximize the package for dyeing agent, forming nano gel dyeing particles. Thus, charcoal nanoparticle can reduce the residual time and adverse events. It has the advantages of safety and effectiveness, and has great potential application value.

In our previous studies, we have successfully used charcoal nanoparticles tattooing for preoperative localization during colon and breast cancer surgery and have proved its effectiveness and security (4,5). Charcoal nanoparticles have also been reported to be used for Delphian lymph node tracking in thyroid surgery.

Charcoal nanoparticles tattooing is an optimum Localization technique of lesions localization technique, particularly in the repeat surgery. We strongly believe that this technique is a major breakthrough as surgical strategies for various gastrocolic fistulas. Localization using charcoal nanoparticles tattooing for other surgical procedures need to be further explored.

**Informed Consent:** Written informed consent was obtained from patient who participated in this case.

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