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Technical Report

Post-surgical enteric fistula treatment with image-guided percutaneous injection of cyanoacrylic glue

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Introduction

Enteric fistulae represent a serious complication of abdominal surgery, associated with increased hospital stay and high postoperative morbidity and mortality.[1,2] Moreover, when non-surgical management fails, reoperation is burdened with high morbidity and mortality.[1,2] Therefore, a treatment that could shorten fistula closure time and avoid a second operation would be highly beneficial.

In recent years, interventional radiology has played an increasingly crucial role in the management of post-surgical complications.[3–5] Imaging-guided percutaneous drainage is one of the most used interventional radiological procedures, widely proven as a feasible, safe, and effective treatment of intra-abdominal abscess and fluid collections.[3,6] However, the concomitant presence of a fistula with this technique has proven to be associated to a lower success rate.[7]

The aim of this report is to describe our technique and initial experience in the treatment of post-surgical enteric fistulas using image-guided percutaneous injection of novel cyanoacrylic glue.

Materials and methods

Approval was obtained by the Institutional Review Board and patient consent was waived. This report concerns the description and the clinical outcome of three patients (median age 70 years) with post-surgical enteric fistula that were treated at IRCCS Istituto Clinico Humanitas with image-guided percutaneous injection of a novel cyanoacrylic glue (Glubran2, GEM, Viareggio, Italy).

Case 1

Seven days after undergoing a sub-total gastrectomy for gastric cancer (pT2N2), an 82-year-old man reported diffuse abdominal pain. Blood test revealed increased white blood cell count (WBC; 13,600/mm^3) and C-reactive protein (CRP) values (17.68 mg/dl). A computed tomography (CT) examination performed the same day revealed the presence of fluid collection between the liver, pancreas, and transverse colon (Fig 1a). A 10 F drainage catheter (Flexima catheter, Boston Scientific, Natich, MA, USA) was then placed into the fluid collection under CT guidance (Fig 1b). The injection of contrast medium through the drainage catheter demonstrated direct communication between the collection and the duodenum, which lead to a diagnosis of duodenal stump dehiscence and enteric fistula. The fistula did not heal, and 15 days later an increase of drained material was observed. Consequently, the same day the patient

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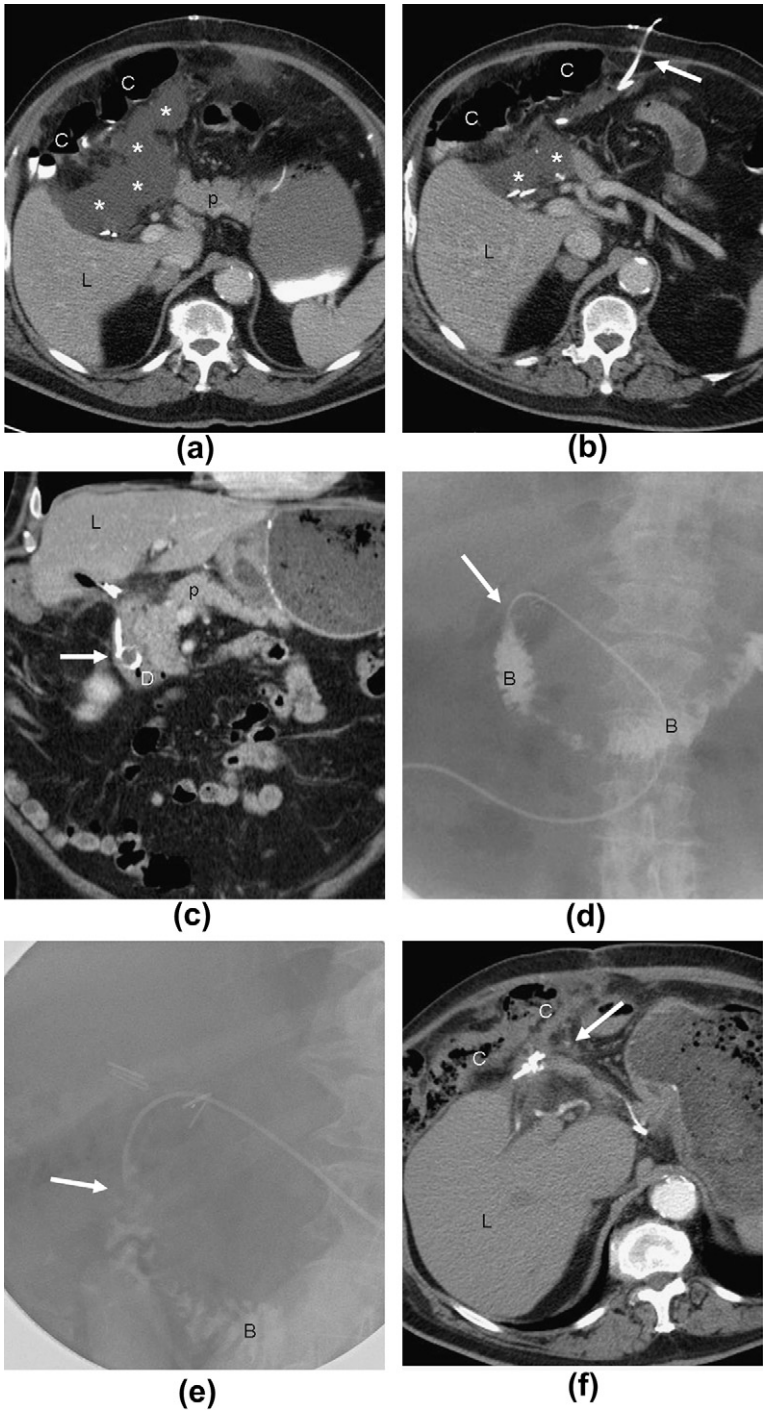

Figure 1 Treatment of an enteric fistula in a patient who underwent subtotal gastrectomy for gastric cancer. (a) A CT image 7 days after surgical resection demonstrated fluid collection (asterisks) between the pancreas (*P*), liver (*L*), and transverse colon (*C*). (b) A percutaneous drainage catheter (arrow) was inserted into the collection (asterisks) under CT guidance. *L*, liver; *C*, colon. (c) Fifteen days after insertion, a CT examination demonstrated the resolution of the fluid collection and migration of the tip of the catheter (arrow) into the duodenum (*D*). *P*, pancreas. (d) Contrast medium injection through the percutaneous drainage catheter (arrow) determined direct opacification of the bowel lumen (*B*). (e) Glubran2 was injected under fluoroscopic guidance at the level of the fistula (arrow) and the drainage catheter was removed. *B*, bowel. (f) CT image at 10 months showed complete resolution of the fluid collection (arrow). *C*, colon; *L*, liver.

underwent another CT examination, which showed drainage migration into the duodenum through the fistula (Fig 1c), confirmed by contrast medium injection through the drainage catheter that determined direct opacification of the bowel (Fig 1d). At this time, the drainage catheter was retracted and used to inject a mixture of 1:1 cyanoacrylic glue and iodized oil (Lipiodol; Laboratoire Guerbet, RoissyCharles-de-Gaulle Cedex, France) inside the fistula (Fig 1e). The drainage catheter was then removed.

Case 2

A 70-year-old man presented with abdominal distension, vomiting, increased WBC count (16,800/mm^3) and CRP values (20.53 mg/dl) after a sub-total colectomy for colorectal cancer. An ileal enema and an abdominal CT examination performed 14 days after surgery showed a jejunal fistula and abdominal fluid collection (Fig 2a,b). The same day a CT examination detected the presence of contrast material in both the bowel and fluid collection (Fig. 2c) and a 12 F drainage catheter (Flexima catheter, Boston Scientific, Natich, MA, USA) was then placed under CT guidance (Fig 2d) with the tip at the level of the fistula. Seven days later, the abdominal collection resolved but a discrete amount of fluid was still draining from the catheter; therefore, a mixture of 1:1 cyanoacrylic glue and iodized oil was injected at the site of the fistula under fluoroscopic and endoscopic guidance and the drainage catheter was removed.

Case 3

52-year-old man presented with a rise in inflammatory indices and bile discharge from the abdominal wound 11 days after a Miles' resection for rectal cancer (pT3N2). A CT examination performed the same day showed an air–fluid collection in the subcutaneous tissue at the level of the surgical wound (Fig 3a). Therefore, a naso-jejunal tube was placed to aspirate at the level of the ileum and a fistulogram was performed by placing a 6 F catheter (Fogarty arterial embolectomy catheter, Edwards Life Sciences, Irvine, CA, USA) into the abdominal wound (Fig 3b). On postoperative day 24, the fistula remained evident, and embolization with gelfoam and a mixture of 1:1 cyanoacrylic glue and iodized oil was performed under fluoroscopic guidance at the level of the fistula using a 12 F drainage catheter (Flexima catheter, Boston Scientific, Natich, MA, USA; Fig 3c). The drainage catheter was removed after embolization.

Results

In all cases the fistula was successfully reached using the percutaneous drainage catheter and glue injection was easily performed as planned. No immediate complication related to the injection procedure occurred. In the first two patients presented, glue injection through the drainage catheter lead to an immediate and stable resolution of the fistula, as demonstrated at CT in case 1 (Fig 1f) and by both ileal enema and CT in case 2 (Fig 2e,f). The healing process was longer for the third patient who, after an immediate reduction of the amount of fluid drained, required an additional 15 days for the fistula to completely heal. A CT examination performed after clinical recovery confirmed that the fistula was no longer present (Fig 3d). No patient presented any fistula recurrence or any complication related to the procedure

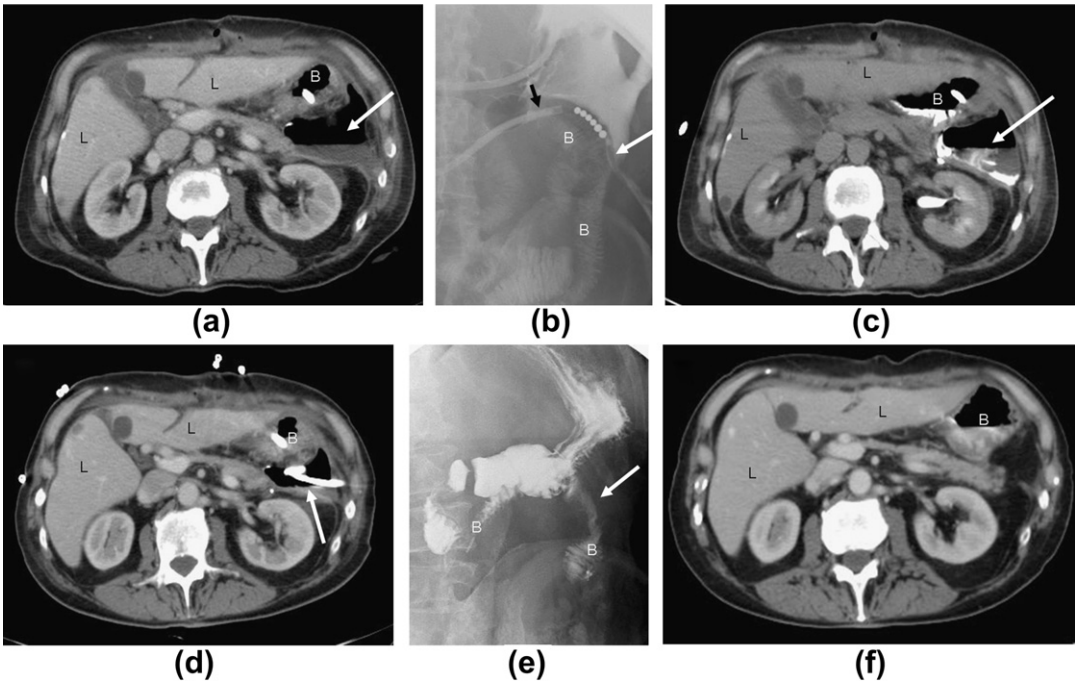

Figure 2 Treatment of an enteric fistula in a patient who underwent partial colon resection for colon cancer. (a) A CT examination 7 days after surgery demonstrated an air–fluid collection (arrow) in the left paracolic space. *L*, liver; *B*, bowel. (b) A contrast enema demonstrated the presence of an enteric fistula at the Trietz level (white arrow). *B*, bowel; black arrow, naso-jejunal tube. (c) A CT examination demonstrated the presence of contrast material in both the bowel (*B*) and the fluid collection after the ileal enema (arrow). *L*, liver. (d) A CT-guided percutaneous drainage (arrowheads) was placed into the fluid collection, with the tip of the drainage catheter close to the site of the fistula and, Glubran2 was injected after collection resolution. *B*, bowel. (e) An ileal enema demonstrated the occlusion of the fistula. Arrow indicates the location of previous fistula; *B*, bowel. (f) A CT examination 13 months after the procedure demonstrated complete resolution of the fistula. *B*, bowel; *L*, liver.

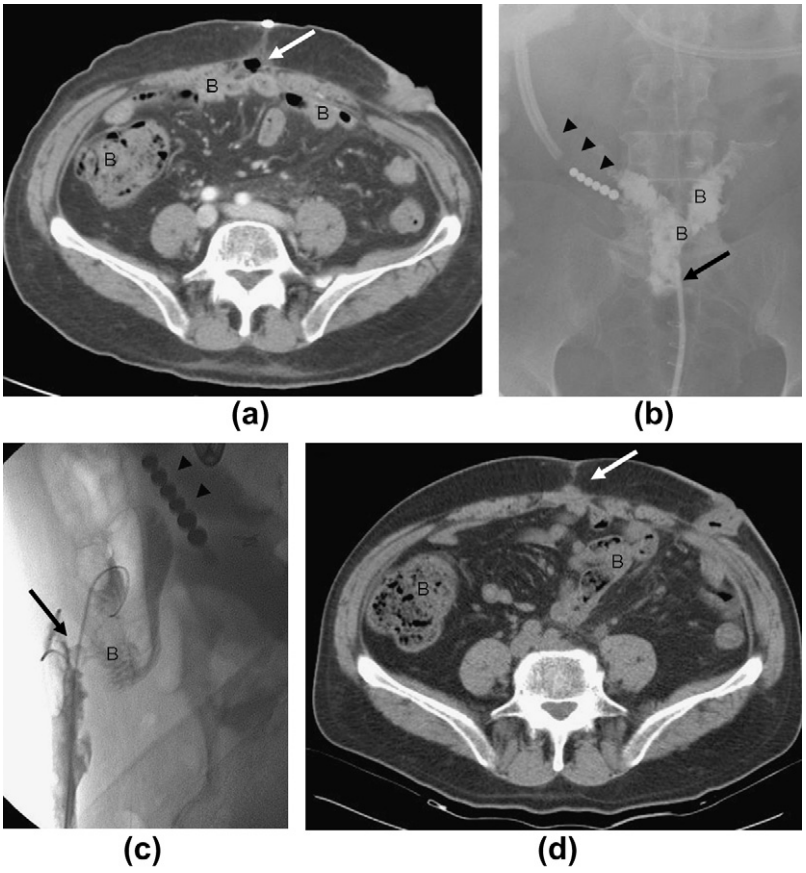

Figure 3 Treatment of an enteric fistula in a patient who underwent Miles' resection for rectal cancer. (a) A CT examination 11 days after surgery demonstrated an air–fluid collection (arrow) at the level of the surgical wound. *B*, bowel. (b) Contrast medium injection in the abdominal wound through a Fogarty catheter (arrow) demonstrated a direct connection with the bowel (*B*). Arrowheads indicate the naso-jejunal tube. (c) Glubran2 and Spongostan were injected through the percutaneous drainage catheter close to the site of the fistula (arrow). *B*, bowel; arrowheads indicate the naso-jejunal tube. (d) A CT examination at 10 months demonstrated the complete resolution of the fistula (arrow). *B*, bowel.

(the follow-up was 22, 15, and 8 months for patients 1, 2, and 3, respectively). No re-operations were needed.

Discussion

Our experience demonstrated that image-guided percutaneous injection of cyanoacrylic glue is a feasible and safe procedure that may be effective in the treatment of non-healing postsurgical enteric fistulae.

Postsurgical fistulae represent a serious complication of several surgical procedures and are currently considered to be among the major causes of prolonged hospitalization and delayed return to social activity, having a major impact on patient morbidity and mortality.[1,2] Moreover, when non-surgical management fails, re-operation is burdened with high morbidity and mortality.[1,2] When a post-surgical gastrointestinal fistula occurs, intra-abdominal collections and abscesses represent the most common associated findings.[6]

To date, several interventional radiology techniques have played a role in the non-surgical management of post-operative fistulae.[3–7] Khairy et al.[8] reported the successful use of percutaneous gelfoam embolization in the management of a patient with duodenal fistula following blunt abdominal trauma, which persisted for 14 weeks of conservative management. Lisle et al.[9] subsequently reported its use in the management of three patients with enterocutaneous fistulas using a percutaneous imaging-guided method. Percutaneous embolization using fibrin glue as a treatment for enteric fistula has also been described.[3] Although these series reported positive outcomes, all procedures were performed using temporary embolic agents, such as gelfoam or a fibrin glue, that do not provide the tensile and adhesive strength that cyanoacrylic glues provide.[10,11]

Glubran2 is a cyanoacrylic glue based on n-butyl[2] cyanoacrylate (monomer), methacryloxysulpholane (monomer), which demonstrated high adhesive and haemostatic properties and was effectively used both in open and in laparoscopic surgery.[10,11] As soon as the glue comes into contact with living tissues it starts to polymerize, generating a film with high tensile resistance in about 60–90 s.[10,11] To enable its visibility under imaging-guidance, the glue was made radiopaque by adding a small amount of Lipiodol.

Because of the above-mentioned chemical and physical features, we believe that this kind of cyanoacrylic glue may represent the ideal agent for percutaneous sealing of post-surgical fistulae.

A CT examination can be helpful for both diagnosing and precisely locating a suspected postoperative fistula and for depicting eventual associated findings, such as intra-abdominal fluid collections or abscesses. When a fluid collection or abscess is found, its complete drainage before performing the embolization is crucial to obtain the best substrate for the cyanoacrylic glue and to minimize hypothetical complications related to the sticking of adjacent structures. The percutaneous drainage catheter must be placed with the tip as close as possible to the site of the fistula. A contrast medium injection through the percutaneous drainage catheter or an ileal enema is helpful to obtain a fistulogram and to outline the anatomy of the fistula, obtaining precise definition of the point of communication between the bowel and the collection. Once the associated fluid collection has been completely drained, imaging-guided treatment with cyanoacrylic glue injection can be performed under fluoroscopic or CT guidance.

Cyanoacrylate glue immediately sealed the fistula in two of the cases in the present series and delayed closure in the third patient. However, because of the small number of patients treated and the lack of comparison with other treatment strategies, no definitive conclusion can be drawn from the present results. Moreover, because of the high success rate of percutaneous drainage, glue injection should be reserved to those patients in which percutaneous drainage management has failed. Thus, the present results have to be considered as preliminary, and this treatment should still be considered experimental. To the authors' knowledge, the use of cyanoacrylic glue for percutaneous treatment of enteric fistulae has never been described.

In conclusion, image-guided percutaneous injection of cyanoacrylic glue is a feasible and safe procedure and may be effective in the treatment of post-surgical enteric fistulae. Furthermore, this technique could be potentially helpful in reducing the healing time of postoperative enteric fistulae and in reducing the number of re-operations. However, further prospective studies on a larger patient population are necessary to confirm these preliminary results.

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