A Case of Enterocutaneous Fistula Diagnosed with Tc-99m DTPA Fistulography Using Hybrid SPECT/CT

Hongyoon Choi · Jin Chul Paeng · In Kook Chun ·
Kyung Don Baik · Keon Wook Kang ·
June-Key Chung · Dong Soo Lee

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Abstract Enterocutaneous fistula (ECF) is a communication between the bowel lumen and the skin, which especially occurs post-operatively and is associated with significant morbidity and mortality. Correct diagnosis and anatomical information of ECF are crucial for a patient's management. Here, we present a case of ECF clearly diagnosed by hybrid single-photon emission computed tomography/computed tomography (SPECT/CT). A 61-year-old man was admitted to our hospital with persistent pus discharge from a surgical wound of previous cystectomy and ileal conduit formation. Initially, he was assessed with fistulography, and ECF was suspected by intraluminal contrast media. As clinical symptom and signs were not definitely matched with ECF, Tc-99m diethylene triamine pentaacetic acid (DTPA) SPECT/CT was performed for the evaluation of fistular tract as an alternative method. On the SPECT/CT after injection of Tc-99m DTPA to the putative fistular opening, fistular as well as intraluminal radioactivity was clearly visualized. SPECT/CT is a sensitive and safe diagnostic imaging tool for ECF.

Keywords Enterocutaneous fistula · SPECT/CT · Fistulography

Introduction

Enterocutaneous fistula (ECF) is a communication between the bowel lumen and skin, which is associated with significant morbidity and mortality. The most common cause of ECF is surgical operation, and it presents as abdominal distension, tenderness, and the appearance of enteric contents in a surgical wound [1]. Other common causes of ECF include inflammatory bowel disease, malignancy, trauma, or radiation therapy [2]. Treatment of ECF depends on the cause, location, function of the fistula and condition of the patient. Approximately one-third of patients might be cured spontaneously with supportive management. If nonoperative management and spontaneous fistula closure fails, the treatment of choice is surgery [3, 4]. Thus, correct diagnosis and anatomical information of ECF are crucial for a patient's management. Although conventional fistulography or enhanced CT may be used for the diagnosis, they have considerable limitations. Here, we present a case in which presence and location of an ECF was definitely diagnosed by Tc-99m diethylene triamine pentaacetic acid (DTPA) fistulography using single-photon emission computed tomography/computed tomography (SPECT/CT).

Case Report

A 61-year-old man who had metastatic bladder cancer underwent transurethral resection twice and chemotherapy with gemcitabine and carboplatin, followed by radical cystectomy with formation of an ileal conduit due to recurrence. After operation, laboratory tests revealed leukocytosis (10,530/ μ l), and a localized infection combined with fistula through a surgical wound where there was a drainage device (Jackson-Pratt drain) was

H. Choi · J. C. Paeng (✉) · I. K. Chun · K. W. Kang ·
J.-K. Chung · D. S. Lee
Department of Nuclear Medicine,
Seoul National University College of Medicine,
101 Daehak-ro, Jongno-gu,
Seoul 110-744, Korea
e-mail: paengjc@snu.ac.kr

K. D. Baik
Department of Urology, Seoul National University Hospital,
Seoul, Korea

Fig. 1 Fistulography showed a lower abdominal enhancement after contrast injection via fistular opening. The visualized pattern seemed like bowel enhancement (*arrow*), and enterocutaneous fistula was suspected

clinically suspected. A multiloculated and internally septated fluid collection was observed at the drainage removal site on CT. Pus culture showed the growth of *Staphylococcus anginosus* and *Citrobacter freundii*. After antibiotic treatment, the patient was discharged with decreased pus and improved general condition.

However, as pus discharge persisted and increased for 8 months, he was admitted again for further evaluation and management. To evaluate whether internal opening of fistula tract existed, fistulography was performed; the ileal lumen was visualized by contrast media, and thus, ECF was highly suggested (Fig. 1). Contrast fistulography was performed without any complications. However, as the pus was not dirty and no definite infection signs or specific symptoms such as abdominal tenderness and bad smells existed, additional specific studies were required.

A SPECT/CT was performed to evaluate fistula tract, with reference to previous studies in colovesical fistula [5] or ureterovaginal fistula [6]. Tc-99m DTPA (37 MBq) was administered aseptically into the putative fistula tract via an inserted catheter, and 30 min after injection, planar and

Fig. 2 Tc-99m DTPA was injected into the fistular opening via a catheter and was followed by SPECT/CT. **a–c** On Tc-99m DTPA SPECT/CT, radioactivity was spread to distal ileum through the fistular tract. **d** Maximum intensity projection planar image of anterior-posterior view from Tc-99m DTPA SPECT/CT. **a–d** The *gray arrow*

indicated the catheter insertion site where the fistula opening existed; the *red arrow* indicates the urine radioactivity from the drainage bag connected to the ileal conduit. These findings were strongly suggestive of enterocutaneous fistula

SPECT/CT images were acquired using a hybrid SPECT/CT scanner (Discovery NM/CT 670, GE Healthcare, USA). Helical CT images were acquired first for the abdomen and pelvis (120 kVp, 50 mAs) and SPECT images for the same field-of-view were acquired with a step-and-shoot method (20 s/step, with a step interval of 3°). SPECT image was reconstructed using an iterative reconstruction algorithm.

SPECT/CT clearly demonstrated radioactivity in the fistular tract as well as in the lumen of ileum, which was confirmative for ECF (Fig. 2). As there was no evidence of infectious complications, such as abscess formation or peritonitis, and no bacteria were found in culture of the drained pus, he was discharged after conservative management such as correction of fluid and electrolyte imbalance.

Discussion

The primary point of diagnosis of ECF is to confirm the presence, anatomic origin, and function of fistula. Therefore, imaging studies are required for initial diagnosis, monitoring, and treatment planning. Radiological images may provide anatomical details regarding the cause of fistula and the predisposing process. Fistulography has been the first choice in the diagnosis of ECF, because of rapid and direct information with minimal cost [1]. However, fistulography provides limited anatomical information on the ECF and gastrointestinal tracts [7]. Additionally, contrast media like barium may cause peritoneal inflammation and adhesion if leaked [8, 9].

When fistulography fails to find etiology of the ECF and anatomical details, small bowel enterography (SBE) or CT studies can be performed. SBE has the drawbacks of lower sensitivity and longer imaging time compared with CT, and thus it is used in limited conditions, such as Crohn's disease [10]. CT with intravenous and oral contrast has a greater diagnostic accuracy than conventional fistulography [11] and provides anatomical information in detail. However, CT is not free from contrast agents, which may cause patient discomfort or complication [11]. Moreover, fistular tract may not be directly visualized on CT. Thus, radioisotope fistulography aided by SPECT/CT may be a valuable alternative imaging method.

To our knowledge, there has been no report on radioisotope fistulography to visualize ECF tract. There was a report in which direct radioisotope cystography detected colovesical fistula and provided further information on fistula [5]. In another report, Tc-99m sulfur colloid SPECT/CT found peritoneal fistula successfully after kidney transplantation [12]. Our case demonstrated that SPECT/CT image using a hybrid SPECT/CT scanner is very sensitive for the detection of fistula tract and anatomical information of ECF. The

absolute amount of radiopharmaceutical is very small and it hardly causes serious complication, only some reported adverse reaction of Tc-99m DTPA in case of intrathecal injection [13]. Therefore, SPECT/CT is a very safe imaging tool compared with radiological imaging methods. Contrast CT needs not only a larger amount of contrast agent than radiopharmaceuticals, but sometimes negative contrast for distension of the bowel to get additional information concerning bowel mucosa [11]. Fistulography using SPECT/CT can be more convenient method with small amount of radiopharmaceuticals, providing equivalent anatomical information and sensitivity to contrast CT.

There is no established method for fistulography with radiopharmaceuticals. Tamam et al. [5] reported cystography imaging in colovesical fistula with Tc-99m DTPA and provided dynamic subsequent images. We also chose Tc-99m DTPA, as it is a water-soluble, non-irritant, and particularly, easily absorbed radiopharmaceutical in case of unexpected leakage through the fistula. A radiolabeled colloid could be one of the available options, with the advantage of less absorbable characteristics to increase diagnostic sensitivity. In our study, SPECT/CT was performed at 30 min after Tc-99m DTPA injection to aim the visualization of distal ileal tract. Further studies will be needed to optimize scan time and choose proper radiopharmaceuticals.

In conclusion, SPECT/CT is a sensitive and safe imaging tool in ECF, providing anatomical and functional details with less complication.

Conflicts of Interest None.

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