

# Detection of an Infected N-butyl-2-cyanoacrylate Plug by F-18 FDG PET/CT Scan in a Patient Who Received Endoscopic Intervention for Gastric Variceal Bleeding

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Injection of N-butyl-2-cyanoacrylate has been used successfully for treatment of gastric variceal bleeding. Bacteremia after injection of N-butyl-2-cyanoacrylate is well known, however, the method for diagnosis of infected endovascular injected material has remained uncertain. This is the first case reporting use of F-18 FDG PET/CT in detection of the source of infection after control of endoscopic bleeding with N-butyl-2-cyanoacrylate.

**Key Words:** Bacteremia, Septic thrombophlebitis, FDG, PET/CT, N-butyl-2-cyanoacrylate

## Introduction

Injection of N-butyl-2-cyanoacrylate has been used successfully for treatment of gastric variceal bleeding [1]. Bacteremia after injection of N-butyl-2-cyanoacrylate is well known, however, the method for diagnosis of the primary source of infection has remained uncertain. We report on the first case of septic thrombophlebitis of gastric cardia after control of bleeding with N-butyl-2-cyanoacrylate diagnosed by F-18 FDG PET/CT. Improvements after treatment with antibiotics could also be seen on follow up FDG PET/CT.

## Case Report

A 63 year-old male with a history of hepatitis B associated liver cirrhosis (Child-Pugh Class A) was admitted to the emergency room with upper gastrointestinal bleeding. The hemoglobin level was 11.8 g/dL. Emergency upper endoscopy showed active bleeding from the cardiac varix (Gastro-esophageal varices-2 according to the Sarin classification). Hemostasis was achieved by injection of 2 mL of N-butyl-2-cyanoacrylate and he was discharged without complications.

The patient was readmitted one month later because of fever and myalgia, which started 10 days after discharge. The pa-

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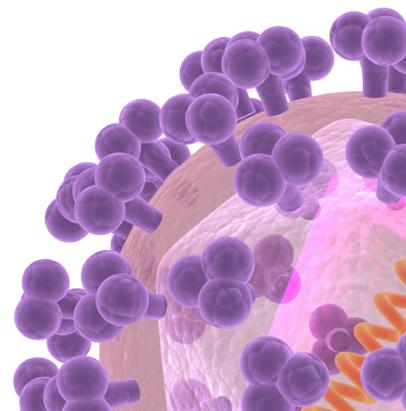
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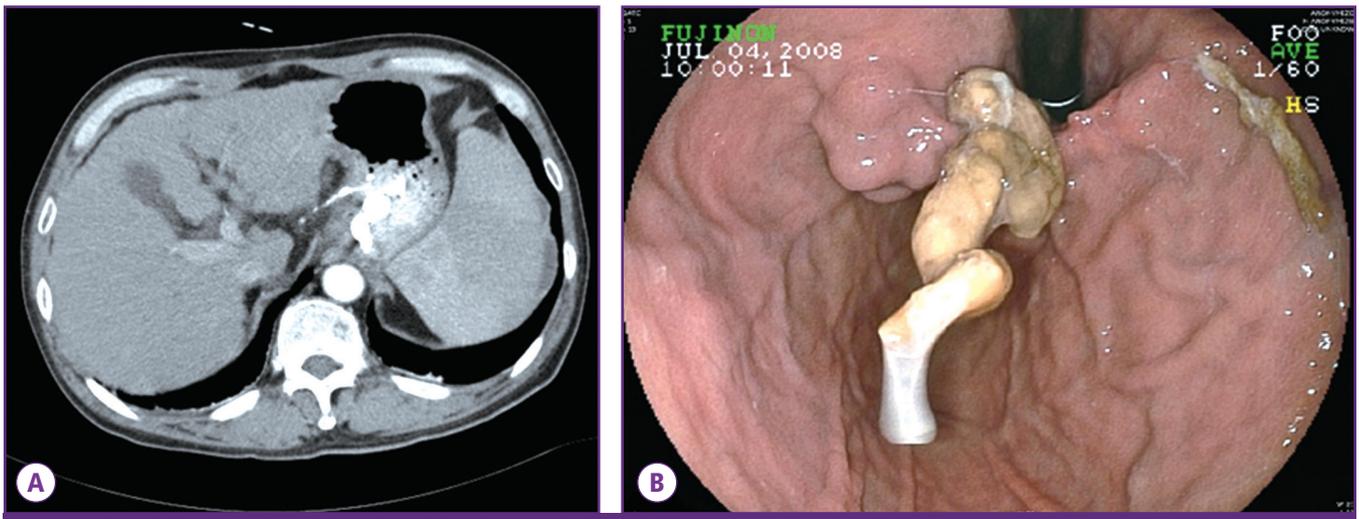
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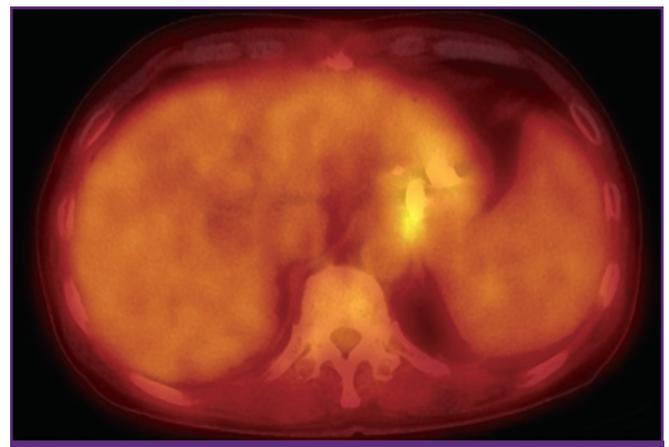
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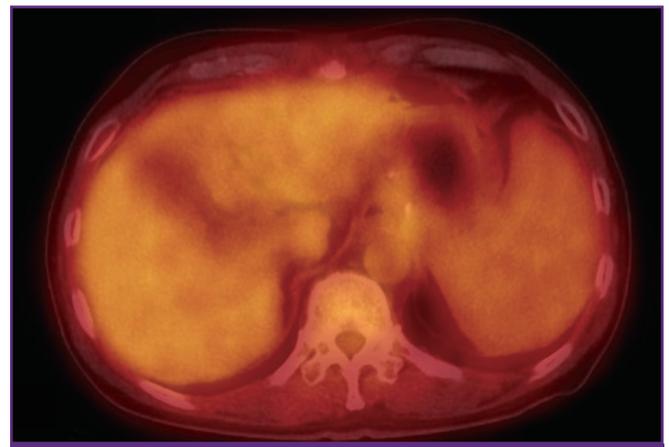


**Figure 1.** Abdominal CT (A) and gastroscopy (B) show a remnant N-butyl-2-cyanoacrylate plug protruding into the cardia.

tient's vital signs at admission were as follows: temperature of 38.2°C, blood pressure of 126/70 mmHg, pulse rate of 124 beats/min, and a respiratory rate of 20 breaths/min. Physical examination showed no abnormalities. Results of laboratory tests were as follows: white blood cell 6,500/mm<sup>3</sup> (neutrophil 84.9%), hemoglobin 10.4 g/dL, and platelet count 70,000/mm<sup>3</sup>. Erythrocyte sedimentation rate and C-reactive protein were elevated at 31 mm/hr and 3.89 mg/dL. Albumin was slightly decreased to 2.9 g/dL, aspartate aminotransferase (AST) was slightly increased to 42 IU/L, and other blood chemistry results were within the normal range: alanine aminotransferase (ALT) 28 IU/L, blood urea nitrogen (BUN) 8.4 mg/dL, and creatinine 0.80 mg/dL. Prothrombin time (PT) and activated partial thromboplastin time (aPTT) were prolonged at INR 1.38 and 45 seconds. Because the patient had a history of N-butyl-2-cyanoacrylate injection for gastric variceal bleeding control, infection through the N-butyl-2-cyanoacrylate plug was suspected and piperacillin/tazobactam and amikacin were started empirically. Abdominal CT (Fig. 1A) and follow up gastroscopy (Fig. 1B) showed an N-butyl-2-cyanoacrylate plug. Leukocyte scintigraphy showed only hypersplenism. Both TTE and TEE were performed in order to exclude infective endocarditis; both findings were negative. F-18 FDG (FDG) PET/CT performed on a Siemens/Biography Duo PET/CT scanner 60 minutes after intravenous injection of 12 mCi (444 MBq) of FDG showed focal FDG uptake (maximum SUV = 3.41) around the N-butyl-2-cyanoacrylate plug in the stomach cardia on fusion transverse images of FDG PET/CT (Fig. 2). Viridans streptococcus was isolated from three separate blood cultures on the same day. It was suspected that the infected N-butyl-2-cyanoacrylate plug in the gastric varices



**Figure 2.** Focal FDG uptake around the N-butyl-2-cyanoacrylate plug in the stomach cardia is visible on fusion transverse images of FDG PET/CT.



**Figure 3.** Follow up FDG PET/CT after two weeks of treatment shows markedly decreased FDG uptake around the N-butyl-2-cyanoacrylate plug on fusion transverse images.

was the source of bacteremia and antibiotics were changed to penicillin G and gentamicin. Follow up blood culture after one week of intravenous antibiotic treatment was negative for *Viridans streptococcus*. Follow up FDG PET/CT performed after two weeks of treatment with intravenous antibiotics showed a marked decrease in FDG uptake around the N-butyl-2-cyanoacrylate plug (Fig. 3). Treatment consisted of only intravenous antibiotics, without surgery or endoscopic intervention. The patient was discharged without fever or any sign of infection after four weeks of intravenous antibiotics. The patient visited the outpatient department five days after discharge without any sign of relapse.

## Discussion

This is the first case report on use of FDG PET/CT in diagnosis of an infected N-butyl-2-cyanoacrylate plug after endoscopic intervention for gastric variceal bleeding. Endoscopic intervention with disruption of the mucosa on the upper gastrointestinal tract is associated with bacteremia ranging from 0-50% [2-6]. This is usually transient and without clinical consequences, however, when persistent fever exists, infection of an N-butyl-2-cyanoacrylate plug of the gastric vein should be suspected.

Despite improvement of diagnostic techniques, the appropriate tool for diagnosis of an infected N-butyl-2-cyanoacrylate plug has remained a challenge. This paper reports that FDG PET/CT clearly showed an abnormal hypermetabolic lesion around the N-butyl-2-cyanoacrylate plug with improvement after treatment with antibiotics and finally diagnosing the site of infection. Liao SC et al. reported on a case in which gallium-67 scan was used in identification of the infection site [7] and Wahl P et al. reported on a case in which gastroscopy along with abdomen CT postulated the source of infection [8]. In a study on FUO patients who underwent both FDG PET and Ga scintigraphy, Blockmans et al. [9] found that FDG PET showed more abnormalities than Ga scintigraphy (77% vs 67% respectively). Stumpe et al. [10] reported 98% sensitivity, 75% specificity, and 91% accuracy for FDG PET in 39 patients with suspected infection. FDG PET imaging is useful for screening active lesions, compared to CT, which cannot differentiate active from inactive lesions [11]. Our case also showed the N-butyl-2-cyanoacrylate plug on abdomen CT but could not confirm whether this was the source of infection.

FDG PET/CT can better delineate the focus of infection anatomically, compared to gallium-67 scan, and improvements

after antibiotics use could be seen on follow up FDG PET/CT [12]. FDG PET/CT can become an excellent tool for diagnosis of infected material as the source of bacteremia and for assessment of the effects of treatment. However, future studies are needed in order to evaluate the accuracy of FDG PET/CT in diagnosing the source of infection.

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