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제2형 당뇨병 환자에서 발생한 기종성 신우신염에 동반된 간문맥 내 가스와 장벽기종 1예

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A Case of Pneumatosis Cystoides Intestinalis and Portal Venous Gas Accompanied by Emphysematous Pyelonephritis in Type 2 Diabetes Mellitus

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Abstract

Diabetes mellitus is a major risk factor for urinary tract infection (UTI); emphysematous pyelonephritis (EP), a complication of UTIs, often occurs in patients with underlying, poorly controlled diabetes mellitus. We report the case of an 87-year-old woman with EP in type 2 diabetes mellitus who developed pneumatosis cystoides intestinalis (PCI) with portal venous gas. PCI is a radiographic finding, which is found in a linear or cystic form of gas in the submucosa or subserosa of the bowel wall. PCI has two common presentations. Primary PCI is a benign idiopathic condition. Secondary PCI is associated with a wide variety of gastrointestinal and non-gastrointestinal diseases. PCI with portal venous gas in particular is associated with ischemic gastrointestinal disease. Initial pre-enhanced abdominopelvic computed tomography showed EP in the right kidney without PCI. Newly occurring PCI and hepatic portal venous gas were found in the right ascending colon after EP improved. This is a rare case of PCI accompanied by emphysematous pyelonephritis in type 2 diabetes mellitus. The patient's general condition improved with intravenous antibiotics and fluid therapy without a surgical approach. However, she was discharged without further treatment because the family refused any further evaluations and treatments. (J Korean Diabetes 2013;15:45-50)

Keywords: Pneumatosis cystoides intestinalis, Pyelonephritis, Diabetes mellitus

INTRODUCTION

Diabetes mellitus is a major risk factor for urinary tract infections (UTI)[1]. Emphysematous pyelonephritis (EP), a complication of UTI, is often found in patients with underlying, poorly controlled diabetes mellitus[2]. EP is a severe, necrotizing form of multifocal bacterial nephritis with gas formation within the renal parenchyma. This UTI complication is a common and potentially life-threatening condition in diabetic patients[2]. We report the case of an 87-year-old woman with severe hyperglycemia and EP in type 2 diabetes mellitus accompanying pneumatosis cystoides intestinalis (PCI) with portal venous gas. PCI is a rare radiological finding where the gas is generated in a cystic or linear form in the submucosa or subserosa of the bowel wall[3].

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According to its etiology, it can be classified as primary or secondary PCI. Primary PCI is an idiopathic condition, and it accounts for approximately 15% of all cases. In addition, it mainly affects the large intestine and has a good prognosis[4]. Secondary PCI accounts for approximately 85% of all cases, and their underlying conditions vary from benign diseases that can be cured solely with conservative treatments to life-threatening ones[5]. Based on an extensive review of the Korean and English literature, we conclude that this is a rare case of PCI and portal venous gas accompanied by EP in a patient with diabetes mellitus. Here, we report our case with a review of the literature.

CASE REPORT

An 87-year-old female first visited our hospital following an abrupt change in her mental state. The patient had a past history of taking metformin 250 mg per day and linagliptin 5 mg per day for the management of a seven-month-history of type 2 diabetes mellitus. On admission, the patient had a blood pressure of 170/90 mmHg, a heart rate of 58 beats/min, a respiratory rate of 20 breaths/min, and a body temperature 36.8℃. The patient had a height of 159 cm, a body weight of 70 kg and a body mass index (BMI) of 27.69 kg/m^2. On physical examination, the patient had no abnormalities of the head and neck, thorax or abdomen. The patient had dry mouth and tongue, which was suggestive of dehydration. Moreover, the patient had bilateral costovertebral angle tenderness. The arterial blood gas analysis showed pH: 7.34, $PaCO_2$: 15 mm Hg, PaO_2: 91 mmHg, HCO_3^-: 8.1 mEq/L, and SaO_2: 96%. On laboratory investigation, the patient had the following results: white blood cell (WBC) count: 14,520/mm^3 (neutrophils 92% and lymphocytes 2%), hemoglobin: 16.0 g/dL, platelet count: 10,000/mm^3, HbA1c: 8.5%, serum glucose: 657 mg/L, BUN: 135 mg/dL, and creatinine: 3.9 mg/dL. In addition, ketone was negative; serum osmolarity was 365 mOsm/kg, and effective serum osmolality was 292 mOsm/kg. The patient also showed a high-sensitivity C-reactive protein (hsCRP) of 19.09 mg/dL and an erythrocyte sedimentation rate (ESR) of 40 mm/hr. On urinalysis, the patient had WBC counts of 〉 100/high power field and bacteriuria. Pre-enhanced abdominopelvic computed tomography (APCT) demonstrated air densities in the right kidney, the right perirenal space, the right ureter, and the urinary bladder wall. These findings are suggestive of EP combined with perinephric emphysema (Fig. 1).

The patient was diagnosed with EP and then admitted to an intensive care unit (ICU), where she received fluid therapy and an empirical antibiotic regimen using imipenem (250 mg q 6 h). On hospitalization day 5, *Escherichia coli (E. coli)* grew in the patient's blood and urine cultures. Based on antimicrobial susceptibility test results, imipenem was changed to ciprofloxacin (400 mg q 24 h). Thereafter, however, the patient presented with increased WBC count accompanied by an aggravation of mental status. On hospitalization day 7, ciprofloxacin was replaced with piperacillin/tazobactam (2.25 g q 6 h). A follow-up pre-enhanced APCT demonstrated an improvement of EP and the almost complete disappearance of the air densities in the right kidney on hospitalization day 9. At the same time, new findings were observed, including PCI, portal venous gas and mesenteric venous gas (Fig. 2). The patient also presented with abdominal tenderness and rebound tenderness, leading to speculation of PCI due to bowel infarction or intestinal ischemia. We considered a

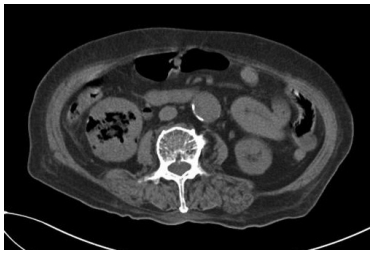

Fig. 1.
Pre-enhanced abdominopelvic computed tomography showed intraparenchymal, intracalyceal and intrapelvic mottled air densities in the right kidney.

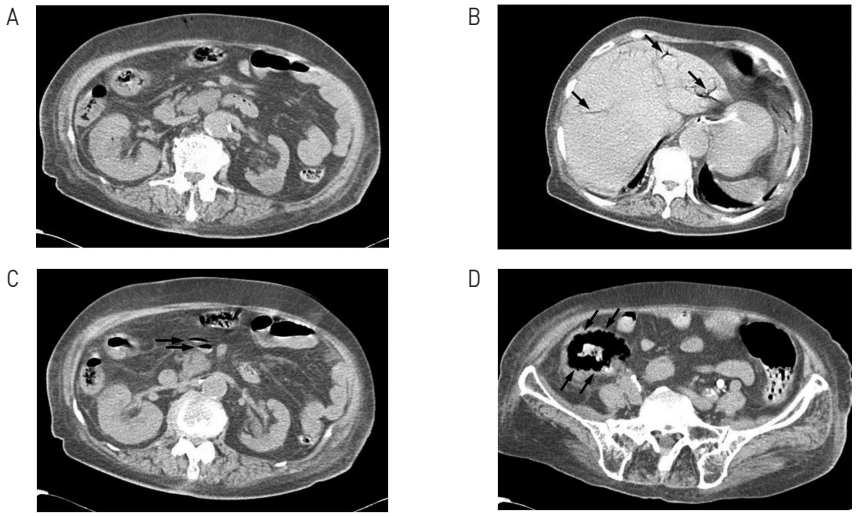

Fig. 2.

Pneumatosis cystoides intestinalis (PCI), portal venous gas and mesenteric venous gas were newly observed in pre-enhanced abdominopelvic computed tomography. (A) The air densities in the right kidney have nearly disappeared. (B) Portal venous gas (arrow). (C) Air density within the superior mesenteric vein and the mesenteric vessels (arrow). (D) PCI in the wall of the right ascending colon (arrow).

surgical approach, but the family strongly refused. We therefore decided to maintain conservative medical treatments. The antibiotic regimen was changed to imipenem (250 mg q 6 h). On hospitalization day 11, the patient showed mental status improvement accompanied by a decreased WBC count. On hospitalization day 12, a follow-up pre-enhanced APCT showed a marked improvement in PCI and portal venous gas and the almost complete disappearance of mesenteric venous gas as compared with a previous study. The patient became mentally alert and experienced improvement of her general condition. On hospitalization day 17, the patient was transferred from the ICU to a ward, at which point the patient had the following laboratory results: WBC count: 8,220/mm^3, platelet count: 203,000/mm^3, BUN: 17.1 mg/dL, and creatinine: 0.8 mg/dL. However, the patient suffered from economic difficulties and refused further treatments. Therefore, the patient was transferred to another hospital.

DISCUSSION

PCI is not a diagnosis but a radiological finding. Its incidence has increased with the technical advancement of imaging modalities such as a computed tomography (CT) [5,6]. Primary PCI is a benign idiopathic condition, and cysts of the bowel may be found incidentally through radiography or endoscopy. The underlying diseases of secondary PCI include gastrointestinal diseases (e.g., bowel infarction, intestinal ischemia, necrotic enteritis, Crohn's disease, ulcerative colitis, and intestinal obstruction), pulmonary diseases (e.g., chronic obstructive pulmonary disease and asthma), collagen-vascular disease, acquired immunodeficiency syndrome, anticancer therapy, organ transplantation, and surgery[5]. Most patients with PCI are asymptomatic, and specific therapy is not needed other than treatment of the underlying cause of PCI for these patients. However, if symptoms are present, they are typically related to either the presence of PCI or the underlying disorder associated with PCI. Symptoms of PCI depend upon the affected region of the intestine. The most common symptoms of small intestinal PCI are vomiting, abdominal distention, weight loss, abdominal pain, and diarrhea. Colonic PCI most often produced

diarrhea, hematochezia, abdominal pain, abdominal distention, and constipation. The physical examination of patients with PCI can be completely normal or may show non-specific findings, such as abdominal distention. A mass can be palpated occasionally on abdominal or digital rectal examination[7].

Abdominal plain film and CT are the most common imaging techniques used to diagnose PCI [8]. PCI is often first detected on plain film, where the gas of the intestinal wall is observed to be linear, curvilinear or circular in appearance. CT is more sensitive than plain film and can often identify the underlying cause[9]. Characteristic findings of PCI on CT are circumferential collections of air near the lumen of the bowel. The presence of PCI often is helpful in diagnosing serious disease. However, an erroneous diagnosis of PCI may be made when intraluminal beads of gas are trapped within or between feces and the adjacent mucosal folds, producing pseudo-pneumatosis intestinalis. CT findings useful for differentiating PCI from pseudo-pneumatosis intestinalis include the location, distribution and pattern of the gas. Portal or mesenteric venous gas, intramural gas superior to a gas-fluid level, continuous gas outlining the bowel wall, and dissecting gas in the bowel wall edge are features characteristic of PCI. In contrast, these findings are absent in pseudo-pneumatosis intestinalis. Gas confined to the inner wall of the cecum or proximal right colon that terminates at a gas-fluid level is strongly suggestive of pseudo-pneumatosis[8].

The prognosis of this condition varies depending on the underlying conditions[5]. When PCI complications, such as bowel ischemia, necrotizing enterocolitis and bowel obstruction occur, surgical treatments usually are required in these patients, who are reported to have a relatively high mortality[8]. In particular, ischemic or necrotic gastrointestinal diseases are involved in the occurrence of PCI accompanied by portal venous gas and mesenteric venous gas[10]. Conversely, conservative management strategies are valid when PCI results from non-life-threatening causes. Antibiotics, an elemental diet and inhalation oxygen or fluid therapy can be prescribed for these patients.

There is no established theory to explain the etiology of PCI, but the following hypotheses have been proposed. The first mechanical theory is that PCI occurs when intestinal gas is directly absorbed into the submucosa through damaged mucosa or when the gas in mesenteric blood vessels is absorbed into the subserosa [11, 12]. This theory has been proposed to explain the occurrence of PCI in patients with ischemic bowel diseases or inflammatory and necrotic ones where the intestinal mucosa is damaged [13]. Moreover, the mechanical theory can also explain the concurrent presence of PCI in patients with chronic obstructive pulmonary disease. That is, the alveolar air is eventually absorbed into the intestinal wall because of the alveolar rupture that occurs due to chronic cough [14]. The second theory is bacterial; PCI occurs when gas-forming bacteria, including anaerobic ones, invade the intestinal wall [15, 16]. The third theory is biochemical; when ingested foods are fermented by normal intestinal flora, the intestinal gas pressure is elevated, and PCI occurs when that gas enters the intestinal wall [17].

Based on these hypotheses, we analyzed the possible causes of PCI in the current case. It has been reported that PCI in diabetic patients is highly associated with the use of α-glucosidase inhibitors as well as other secondary causes[18]. Kojima et al. suggested that carbohydrates are fermented by normal intestinal flora after their intestinal absorption has been inhibited by α-glucosidase inhibitors[18]. However, there are no cases or other literature describing the relationship between other oral hypoglycemic agents and PCI. Considering that PCI developed following the onset of EP, PCI is less likely to occur because of metformin and linagliptin. After EP of the right kidney improved, PCI occurred in the right large intestine, ipsilateral to the right kidney. On contrast-enhanced APCT taken after the improvement of azotemia, there was poor enhancement in the wall of the right colon. This

sign indicates that it is highly probable that the patient had a bowel infarction. In support of this, *E. coli* was cultured from blood and urine cultures. Therefore, it can be inferred that the mucosal damage in the right colon occurred because of bowel infarction or intestinal ischemia resulting from sepsis, and the gas in the right kidney moved to the wall of the right colon. Considering that the symptoms and laboratory findings improved with the maintenance of antibiotic therapy despite the lack of a surgical approach, it cannot be completely ruled out that the intestinal gas was generated after gas-forming bacteria directly invaded the intestinal wall at the time of mucosal damage to the right colon. Presumably, PCI, portal venous gas and mesenteric venous gas might have been generated by the complex involvement of various causes, such as the mucosal damage due to sepsis, the transfer of gas formed with the EP and the secondary invasion of the intestinal wall by bacteria.

We determined that the patient should be surgically treated. According to a review of the literature, surgical treatments might be required for patients with PCI accompanied by portal venous gas and mesenteric venous gas who are suspected of having ischemic gastrointestinal diseases[19]. However, we could not perform surgery because the family refused. In this case, the symptoms and laboratory findings improved with the continual use of conservative medical treatments including antibiotics and fluids. Moreover, a follow-up APCT also demonstrated the improvement of PCI, illustrating that PCI may also be improved solely with conservative medical treatments instead of surgery.

UTI is common in diabetes mellitus and EP, a UTI complication associated with diabetes mellitus, is often found in patients with poorly controlled diabetes mellitus. EP is a severe necrotizing form of multifocal bacterial nephritis, and the prognosis is commonly poor. Therefore, early diagnosis, proper clinical and radiological assessment, and appropriate antibiotic therapy are necessary to improve prognosis [1]. Other diseases also were often combined with EP in diabetes mellitus. In this case, the patient was older and presented with severe hyperglycemia. She had poorly controlled diabetes mellitus and also suffered from EP. PCI presented in the right colon, and severe gastrointestinal disease was suspected. According to a review of both the Korean and English literature, only one other case has been reported involving PCI-related EP or acute pyelonephritis [20].

In summary, we experienced a case of PCI, portal venous gas and mesenteric venous gas accompanied by EP in a diabetic patient, and successfully treated our patient without surgery. PCI is a radiological finding that may be concurrently present with various diseases and systemic conditions for which surgical treatments may be needed depending on the symptoms and underlying diseases. Therefore, we suggest that gastrointestinal studies are necessary in complicated UTI in patients with diabetes mellitus.

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