Abdominal Manifestation and Complications in Systemic Lupus Erythematosus: Emphasis on CT findings

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Objective: *To describe computed tomography (CT) features in SLE patients with suspected abdominal involvement or complications.*
Material and Method: *SLE Patients who presented with suspected abdominal involvement or complications and underwent CT between 2001 and 2005 were retrospectively reviewed. All CT studies were performed within 21 days of the onset of symptoms.*
Results: *Thirty-two SLE patients with 53 CT examinations including imaging findings and clinical data were reviewed. There were 29 cases with abdominal findings related to SLE including gastrointestinal vasculitis (6 cases), acute pancreatitis (8 cases), genitourinary abnormality (13 cases), hepatosplenomegaly, and ascites. Bowel wall thickening with target sign in CT is characteristics of GI vasculitis. Mild pancreatitis by CT scoring index was found in most cases. Five cases had diffuse bladder wall thickening and three cases also had bilateral hydronephrosis and hydroureter. Sixteen cases had other findings not related to SLE including bowel obstruction, splenic infarction, appendicitis, and hematoma.*
Conclusion: *The common CT findings and complications in SLE patients who suspected abdominal involvement were presented. CT is useful for detecting the primary cause of abdominal symptoms, planning treatment, and monitoring for complication.*

Keywords: *Tomography, Spiral computed, Systemic lupus erythematosus, Abdomen, Complications*

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Systemic lupus erythematosus (SLE) is a fascinating multi-systemic autoimmune connective tissue disease. It is a disease of unknown cause in which tissues and cells are damaged by the deposition of pathogenic autoantibodies and immune complexes. SLE is characterized by remissions and exacerbations, and many inflammatory lesions occur in small blood vessels. Symptoms and signs solely depend on which organs are involved[1, 2]. Clinical presentations of abdominal manifestations of SLE are diverse, heterogeneous, and non-specific. Abdominal pain is a common presenting symptom, occurring in as many as half of all SLE patients during the course of their disease[3]. It could be due to the manifestations or complications by the disease itself or by a concomitant disease. The side effects of drugs or complications related to treatment can also be a diagnostic problem. It has been emphasized in the literature on the etiologies of abdominal pain in SLE patients such as peritonitis from polyserositis, dyspepsia from reflux, bowel edema, ascites, mesenteric ischemia, pancreatitis, pneumatosis intestinalis, and hepatobiliary abnormalities. Therefore, the diagnosis can be challenging. In this circumstance, an imaging study is usually a part of patient evaluation. The imaging study is often performed for aided diagnosis, determination of the extent and severity of the disease and monitoring the myriad complications that arise from the disease and its therapy[4].

Concerning imaging in SLE patients with suspected abdominal manifestations, the usage of

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computed tomography (CT) has the advantage of allowing evaluation of the entire abdomen with high spatial resolution and is not operator-dependent. Knowledge of the spectrum of radiological findings is useful for correct diagnosis and proper management. Several studies described imaging findings of gastrointestinal (GI) tract involvement in SLE i.e. GI vasculitis and those have been accepted as diagnostic criteria[5]. Unfortunately, there are only a few case reports on imaging findings of other manifestations and complication[6]. The purpose of the present study was to evaluate the CT features in SLE patients with suspected abdominal involvement or complications.

Material and Method

The present study was approved by the internal review board and ethics committee of Ramathibodi Hospital. From 2001 to 2005, there were 32 SLE patients, whose diagnoses were based on clinical and laboratory criteria for SLE by the American College of Rheumatology, presented with at least one abdominal symptom and undergone at least one computed tomography (CT). Their medical records and CT scans were reviewed. There were 30 female and two male patients, whose ages ranged from 6 to 60 years (mean, 28 years). The duration of being diagnosed SLE ranged from one to 30 years (mean, 4 years).

From 32 patients, there were 53 CT studies for review. All CTs were studied by using 4-slice multidetector CT (LightSpeed plus; General Electric Medical System, Milwaukee, Wis., USA). There were nine upper abdominal CTs, 40 whole abdominal CTs, three lower abdominal CTs, and one CT angiogram of the abdominal aorta. Whole abdominal CTs of these patients were performed after the administration of oral and rectal contrast medium. Upper abdominal CTs were performed with oral contrast medium and all lower abdominal CTs were obtained after rectal contrast medium administration. The unenhanced axial scans were obtained with contiguous 10-mm-thick sections. All scans were obtained after intravenous administration of contrast material with contiguous 3.75-mm-thick section. A total of 90 mL of iopromide (Ultravist; Schering, Germany), iobitridol (Xenetic; Guerbet, Germany) or iohexol (Omnipaque; Amersham, China) was administered intravenously by using a mechanical power injector at a rate of 2-2.5 mL/sec via antecubital vein. The scanning was begun 25-30 seconds after the start of the injection, and the images covered the diaphragm to the pubic symphysis in case of whole abdomen and to the lower pole of the kidneys in cases of upper abdomen. The images of lower abdomen covered the upper pole of the kidneys to the pubic symphysis.

The imaging studies were performed within 21 days of the onset of symptoms. CT images were reviewed by a board certified radiologist (SP) or radiologist counter signed by a board certified radiologist (MB). Images were evaluated for bowel wall changes (bowel wall thickening patterns, involved segments, contrast enhancement patterns, dilatation of intestinal segments, and pneumatosis intestinalis) and mesenteric changes (engorged mesenteric vessels and increased attenuation of mesenteric fat). Other findings evaluated were the presence or absence of a fluid collection (ascites, pleural effusion, or pericardial effusion), pancreatic involvement, splenomegaly, or hepatomegaly. Any changes in other abdominal organs were also noted.

In the context of the clinical presentation and SLE history, the CT diagnosis of ischemic bowel disease was based on the presence of at least three of the following signs: bowel wall thickening, presence of a target sign, dilatation of intestinal segments, engorgement of mesenteric vessels, or increased attenuation of mesenteric fat[5]. Bowel wall thickening was diagnosed if the bowel wall was at least 3 mm thick in an area where the bowel was adequately distended. Contrast enhancement patterns were classified as heterogenous (target sign) or homogeneous. The target sign was defined as a thickened bowel wall with peripheral rim enhancement or an enhancing inner and outer rim with intervening hypoattenuation/low signal. Dilatation of an intestinal segment was diagnosed if the dilated bowel segment had a diameter of more than 3 cm[5].

The diagnosis of pancreatitis was made if there was glandular enlargement, peripancreatic edema, and mesenteric fatty infiltration around the pancreas[7]. Hepatomegaly was diagnosed when the craniocaudal dimension in the midclavicular line was greater than 15 cm. Splenomegaly was diagnosed when the craniocaudal span was greater than 14 cm. Lupus nephritis was diagnosed when kidneys were uniformly enlarged and had an abnormal contrast enhancement pattern in combination with proteinuria or cellular casts of any type at urinalysis or pathology proved to be lupus nephritis[5]. The diagnosis of bladder wall thickening was done when the thickness exceeded 10 mm.

Because the amount of ascites could not be quantified exactly with CT, it was classified as "small" if fluid was confined to the pelvic cavity or localized within the peritoneal cavity and "large" if fluid over-

flowed into the peritoneal cavity from the pelvic cavity. Other abnormal findings were also recorded.

Imaging findings were summarized and correlated with clinical context. The findings related to SLE were defined as findings, which may result from primary involvement due to SLE or its complications and the findings not related to SLE were defined as other findings may not result from primary involvement due to SLE or complications of therapy.

Results

In 32 cases, 24 patients had abdominal pain, two patients had prolonged fever, one patient had no extremity pulses, two patients had generalized edema, one patient had fatigue with weight loss, and two patients had no symptoms except abnormal blood tests. Of the 24 cases who presented with abdominal pain, 15 patients had tenderness and three patients had rebound tenderness. All patients were receiving a low dose of oral prednisolone (less than 10 mg per day) at the time the symptoms occurred. However, four patients not receiving prednisolone had abdominal manifestation as an initial presentation of SLE. There were 11 patients with active SLE, 4 patients with inactive SLE, and 17 patients with no information.

The findings related to SLE from the 53 CT examinations are summarized on Table 1 and other findings not related to SLE are summarized in Table 2.

GI vasculitis

Six (19%) of the 32 cases had CT findings of ischemic bowel disease (Table 3). Five cases had circumferential and symmetric bowel wall thickening with a target sign (Fig. 1). In five of the six cases, bowel wall thickening was multisegmental involvement and variable length, and not confined to a single vascular territory. The ileum was the most common site of involvement. Only one case had bowel wall thickening in an anatomic segment (SMA territory). Mesenteric change was seen in five cases (Fig. 2). All patients with CT findings of ischemic bowel disease were initially treated conservatively with intravenous high-dose steroid therapy and recovered from the acute gastrointestinal symptoms.

Acute pancreatitis

The pancreatitis was seen in eight cases (25%). Of the eight cases with pancreatitis, glandular enlargement was seen in seven cases (85%), peripancreatic edema was seen in five cases (57%), and mesenteric fatty infiltration around the pancreas was

Table 1. Summary of abdominal findings related to SLE in 29 cases

CT findings	No. of cases
GI vasculitis	6
Acute pancreatitis	8
Genitourinary abnormality	13
Other	23
Hepatomegaly	4
Splenomegaly	4
Ascites	17

Table 2. Summary of other abdominal findings in 16 cases

CT findings	No. of cases
Neurogenic bladder	1
Splenic infarction	1
Gastric outlet obstruction	1
Small bowel obstruction	1
Portal hypertension	4
Gallstones	5
Appendicitis	2
Myoma uteri	1
Retroperitoneal hematoma	1
Subcapsular hematoma at kidney	1

Table 3. Summary of CT findings of GI vasculitis in 6 cases

CT findings	No. of cases
Bowel changes	
Bowel wall thickening	6
Target sign	5
Dilatation of intestinal segments	6
Pneumatosis intestinalis	0
Mesenteric changes	
Engorgement of mesenteric vessels	5
Increased attenuation of mesenteric fat	5
Involving sites	
Small bowel	
Duodunum	4
Jejunum	5
Ileum	6
Large bowel	
Ascending colon	5
Transverse colon	4
Descending colon	3
Rectosigmoid colon	3

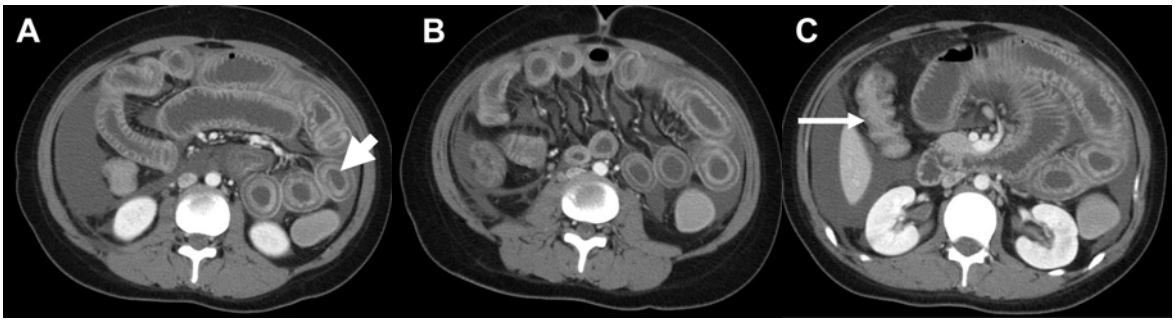

Fig. 1 Contrast-enhanced CT scans in a 17-year-old female with multifocal bowel wall thickening; (A) CT scan at the level of lower pole of the kidney shows symmetric and circumferential wall thickening of the jejunum and ileum, there are alternating layers of high and low attenuation within thickened small-bowel wall, demonstrating the "double halo" or target sign (short arrow); (B) CT scans obtained just below level (A) ascending colon reveals bowel wall thickening at the hepatic flexure (arrow in C)

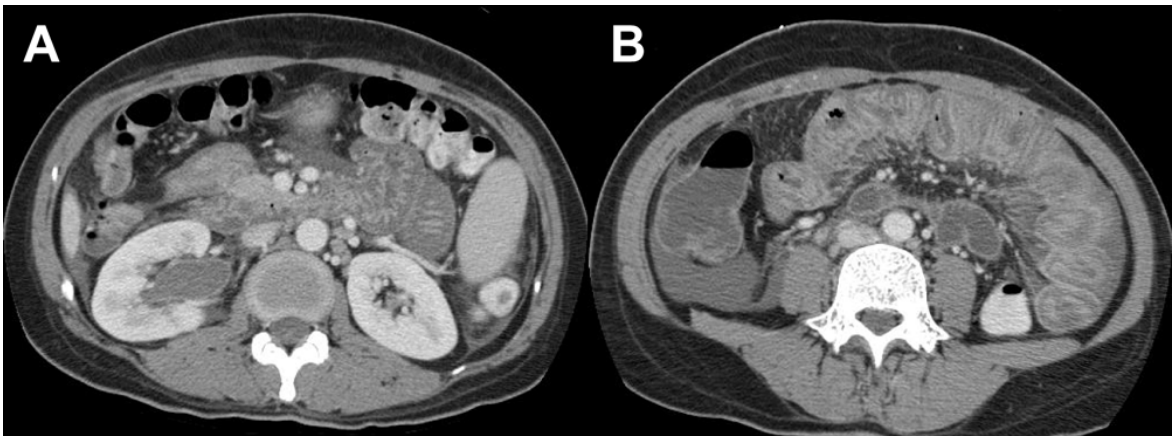

Fig. 2 Contrast-enhanced CT scans in a 37-year-old female had GI vasculitis and genitourinary tract abnormality; (A) and (B) CT scans show inhomogeneous circumferential wall thickening at jejunum with mesenteric change, right hydronephrosis is also depicted (A)

seen in two cases (28%) (Fig. 3 and 4). Most cases had grade C of CT severity score. One case had pancreatic necrosis (more than 50%, which the follow up CT found a pancreatic abscess with splenic vein thrombosis (Fig. 5). Two cases of pancreatitis occurred as the result of medication (Na valproate in one case and corticosteroid in the other).

All eight patients with initial CT findings of pancreatitis were initially treated conservatively with intravenous high-dose steroid therapy and recovered from the acute symptoms in six cases. The remaining two cases had no clinical improvement. One case had follow up CT two weeks later and found progression of disease. Intravenous high-dose steroid therapy was still treated until there was satisfactory clinical improvement. The other case with pancreatic abscess was treated by percutaneous drainage. The follow up CT was performed seven times and showed improvement.

Genitourinary tract abnormality

Thirteen (41%) of the 32 cases had genitourinary tract abnormality. Six cases had abnormal contrast enhancement of the kidney in combination with proteinuria and/or cellular casts of any type at urinalysis. Three had abnormal size of kidney (small in two cases and large in one case) in combination with proteinuria and/or cellular casts of any type at urinalysis. Five cases had diffuse bladder wall thickening and three cases also had bilateral hydronephrosis and hydroureter

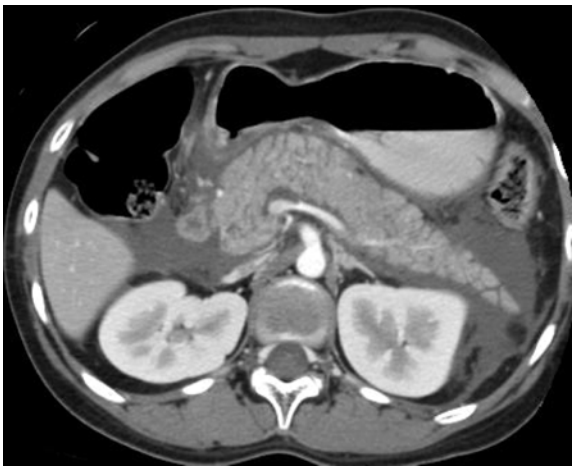

Fig. 3 Contrast-enhanced CT scans in a 13-year-old male had drug-induced acute pancreatitis (grade E): CT scan shows diffuse glandular enlargement of the pancreas with peripancreatic fluid collections

(Fig. 6). None had complete imaging criteria for diagnosis of lupus nephritis.

Ascites

Ascites was presented in 17 cases. Five cases had ischemic bowel disease and seven cases had pancreatitis. Five cases had only ascites. Ascites was classified as small in 14 of the 32 cases and large in three cases.

Treatment complications

Of these 32 cases, three cases had complications from treatment. One case had retroperitoneal hematoma at the right psoas muscle and the perinephric space due to Warfarin-induced coagulopathy. One case had a subcapsular hematoma at the left kidney due to post-biopsy and another case had a small bowel obstruction from a previous surgery.

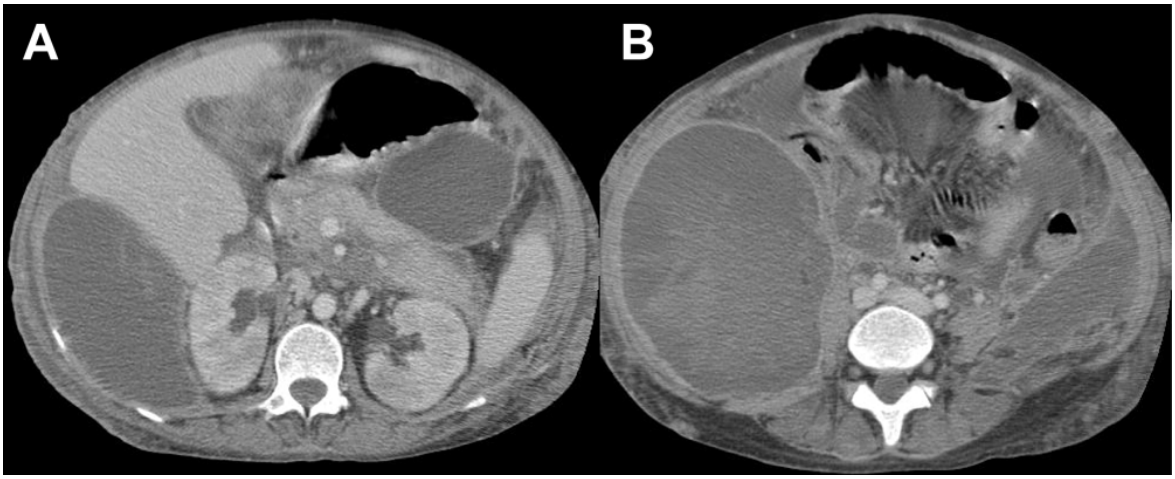

Fig. 4 Contrast-enhanced CT scans in a 24-year-old female had acute pancreatitis (grade E): (A) and (B) CT scans show multiple fluid collections, the largest one with high density content locates at right subhepatic space and right paracolic gutter

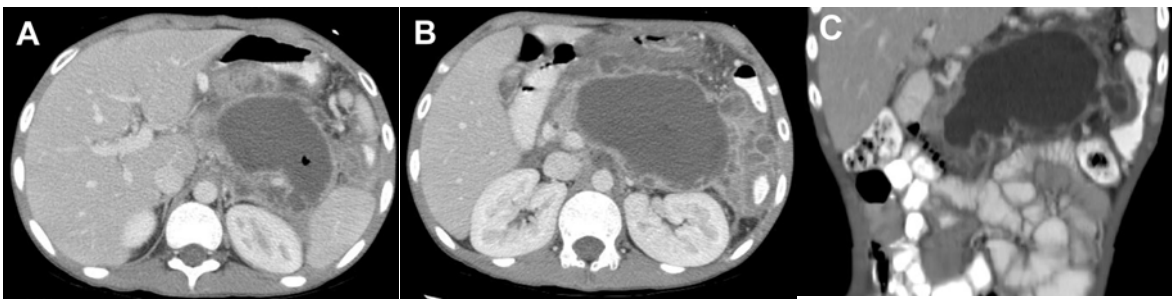

Fig. 5 Contrast-enhanced CT scans in a 19-year-old male had acute necrotizing pancreatitis with pancreatic abscess: (A) and (B) CT scans in axial view and (C) CT scan in coronal view show pancreatic abscess with internal air involving body and tail

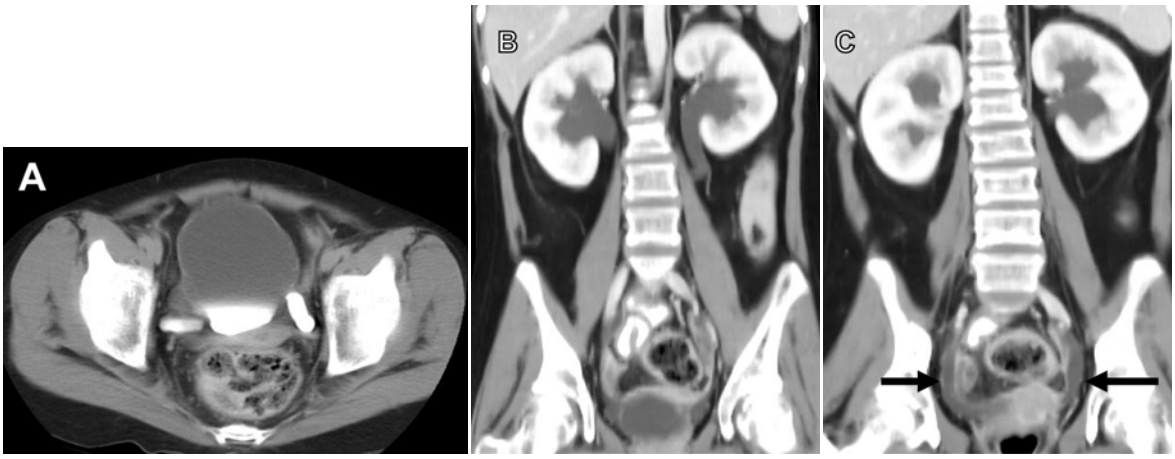

Fig. 6 Delayed phase contrast-enhanced CT scans in a 17-year-old female, presented with acute appendicitis; (A) CT scan shows bilateral hydroureter down to the level of ureterovesical junctions; (B) and (C) coronal CT scans show bilateral hydronephrosis and hydroureter (arrows)

Discussion

The present study describes the various CT findings in SLE patients with abdominal involvement or complications. The findings are divided into three major groups, which are GI vasculitis, acute pancreatitis, and genitourinary tract abnormality.

GI vasculitis due to SLE or lupus enteritis is known to be relatively uncommon. The previously reported prevalence ranged between 0.2 and 53% depending on what symptoms were included in analyses, the type of examinations and investigations, the selection of patients, and the research interest of the investigators[8]. The present study found six (19%) of 32 cases with ischemic bowel disease due to vasculitis. The diagnosis of GI vasculitis is difficult to make only from clinical information. Besides the symptoms that indicated GI vasculitis including cramping or persistent abdominal pain, nausea and vomiting, fever, diarrhea and bloody stool, further investigation by CT, which has the ability to visualize the bowel wall and mesenteric vessels, is useful due to its high accuracy in detection of mesenteric ischemia. Typical CT findings of GI vasculitis are bowel wall thickening with dilated bowel loops, abnormal bowel wall enhancement (target sign), and prominence of mesenteric vessels[9]. However, not all findings are presented in every case. Target sign was believed to be the most characteristic finding. The inner and outer layers of the target sign represent the mucosa and the muscularis propria and/or serosa, respectively, with the high attenuation being a consequence of contrast enhancement. The lower attenuation of the middle layer is believed to result from edema (thought to be the dominant component of this layer) and is assumed to be located in the submucosa. Pneumatosis intestinalis, which could be a consequence of GI vasculitis, has been reported[10]. However, none in the present study had this complication.

Multifocal bowel wall involvement, which is not confined to a single vascular territory, has also been described in lupus mesenteric vasculitis[5]. A recent study[11] has shown that the abnormality preferentially affected the territory supplied by the superior mesenteric artery (SMA). This observation was similar in the present study. There was one case that the involved segment confined only in the SMA territory.

Pancreatitis was seen in 8-28% of patients with SLE and can be focal or diffuse. The etiology of pancreatitis in SLE is not clear. It might result from vasculitis, microthrombi, anti-pancreas antibody, side-effect of medicine, intimal thickening, and viral infection. Most lupus pancreatitis is found in patients with long-standing SLE who have multi-organ involvement and are already on steroids, diuretic, or immunosuppressive therapy, all of which have been implicated in etiology of pancreatitis by a hypersensitivity phenomenon or possibly through the accumulation of a toxic metabolite[12-14]. In the present study, there were eight cases (25%) of lupus pancreatitis. Two cases of acute pancreatitis were related to medications i.e., corticosteroids and Na valproate. For the rest of the patients for whom an identifiable cause was not found, the underlying SLE was postulated to be the etiology of acute pancreatitis.

CT imaging findings of lupus pancreatitis are categorized the same as acute pancreatitis from other causes. CT severity score can be applied in these patients and is certainly helpful in evaluation and monitoring the patients' condition. CT severity score combined an earlier grading system and percentages of pancreatic necrosis provided statistically significant differences in the incidence of morbidity and mortality. In the present study, most cases had a severity index of 0-3, which after treatment with steroid, pancreatitis subsided. Except for only one case that had a CT severity score of 10; a follow up CT found a pancreatic abscess that needed intervention. To the authors' knowledge, there was no previous report on CT severity score in lupus pancreatitis.

Genitourinary tract abnormality is another common manifestation in SLE. The present study found 13 cases (41%) with genitourinary tract abnormality. It is known that lupus nephritis is the most common of the genitourinary tract involvement and is one of the criteria to diagnose SLE. Unfortunately, there was no patient in the present study who full-filled imaging criteria for lupus nephritis. Besides lupus nephritis, renal vein thrombosis also can be found, reported in seven (12%) of 54 patients in one study[15]. None was found in the present study.

The recognition of bladder involvement in SLE is important because it may be a partially reversible cause of renal failure in SLE patient. It is also possible that early identification and treatment of the inflammatory phase will preserve bladder size and function. The association between lupus cystitis and hydronephrosis could be either due to detrusor muscle spasm resulting in vesicoureteric reflux or due to fibrosis of the ureterovesical junction[16]. Various imaging studies including intravenous pyelography, ultrasound, CT and MRI can help in early detection and prompt management. There is also strong association between lupus cystitis and gastrointestinal involvement such as GI vasculitis or intestinal pseudo-obstruction[10, 17]. Therefore, abdominal CT scan can be a useful tool to investigate both gastrointestinal and genitourinary tracts involvement.

Other common CT findings related to SLE patients include ascites and hepatosplenomegaly. Ascites without primary cause could be the result of lupus serositis or peritonitis[10]. In this particular case, contrast CT scan might demonstrate ascites and asymmetric thickening of the small bowel wall[15]. Mild hepatic and splenic enlargement in SLE may result from increased immune system activity[5]. CT usually shows diffuse hepatomegaly and splenomegaly, without space-occupying lesion.

Complications related to treatment can occur during the course of the disease including retroperitoneal hematoma due to Warfarin-induced coagulopathy, subcapsular hematoma after post-biopsy and small bowel obstruction from a previous surgery. There were also incidental findings that were not related to SLE including acute appendicitis, gallstone, splenic infarction, gastric outlet obstruction, portal hypertension, myoma uteri, and neurogenic bladder. Using both clinical context and certain imaging findings, correct diagnosis can be achieved in most cases.

There were limitations in the present study. First, it was a retrospective study that limited evaluation of the true prevalence of abdominal manifestation and the sensitivity and specificity in detection and diagnosis. Abdominal manifestations that were found in the present study may only represent SLE patients at the institute. Moreover, not every SLE patient who had suspected intraabdominal diseases was sent for imaging studies. Second, many abdominal diseases had no pathological proof such as GI vasculitis or interstitial cystitis. However, most cases were confirmed by follow up clinical investigation or imaging after treatment. Pathological diagnosis is usually preserved only when there is no response to therapy. Even with these limitations, the present study successfully demonstrated CT findings of intraabdominal manifestation of SLE, which can be varied according to clinical presentation, disease activity, and therapy that patients received. CT has a major role in confirming diagnosis or narrowed differential diagnosis and guiding the treatment. Lastly, the present study also demonstrated that CT could show other abdominal diseases not related to SLE. Therefore, this may affect therapeutic selection.

In conclusion, the present study showed the common CT findings and complications in patients with SLE who had suspected abdominal involvement. CT is useful for detecting the primary cause of abdominal symptoms, planning treatment, and monitoring for complications.

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การศึกษาภาพเอกซเรย์คอมพิวเตอร์ของผู้ป่วยลูปัสที่เกิดรอยโรคหรือภาวะแทรกซ้อนของอวัยวะภายในช่องท้อง

สิทธิ์ พงษ์กิจการุณ, มนชยา บุญนำศิริกิจ, จันทร์จิรา ชัชวาลา, พนิดา ทองอุทัยศรี

วัตถุประสงค์: *การศึกษานี้ แสดงลักษณะภาพเอกซเรย์คอมพิวเตอร์ส่วนท้องในผู้ป่วยลูปัส ที่มีอาการสำแดงของโรค หรือ ภาวะแทรกซ้อนเกิดขึ้นกับอวัยวะในช่องท้อง*

วัสดุและวิธีการ: *จากฐานข้อมูลของโรงพยาบาลในช่วงปี พ.ศ. 2544 ถึงพ.ศ. 2548 พบผู้ป่วยลูปัส ที่มีการสำแดงของโรค หรือ ภาวะแทรกซ้อนเกิดขึ้น กับอวัยวะในช่องท้องทั้งสิ้น 32 ราย โดยมีเอกซเรย์คอมพิวเตอร์ พร้อมศึกษา 53 ครั้ง และมีข้อมูลทางคลินิคครบถ้วน*

ผลการศึกษา: *มีผู้ป่วย 29 รายที่มีอาการสำแดงของโรคลูปัสของอวัยวะในช่องท้องซึ่งประกอบด้วย การอักเสบของเส้นเลือดที่เลี้ยงลำไส้, ตับอ่อนอักเสบเฉียบพลัน, ไตและกระเพาะปัสสาวะอักเสบ และตับม้ามโต จากการตรวจเอกซเรย์คอมพิวเตอร์พบรอยโรคที่มีลักษณะเฉพาะของความผิดปกติเหล่านี้ เช่น ผนังลำไส้หนาร่วมกับเห็นสารทึบรังสีที่ฉีดทางหลอดเลือดดำเด่นชัดในชั้นของเยื่อบุและผนังส่วนนอกของลำไส้เป็นวงแหวน หรือการพบผนังกระเพาะปัสสาวะหนาร่วมกับการอุดตันของท่อไต เป็นต้น ในขณะเดียวกันมีผู้ป่วยลูปัส 16 รายที่พบความผิดปกติในช่องท้องอื่น ๆ ที่ไม่สัมพันธ์กับโรคลูปัสโดยตรงเช่น ลำไส้อุดตันหลังการผ่าตัด ไส้ติ่งอักเสบและพบก้อนเลือดหลังการเจาะไต*

สรุป: *ลักษณะภาพเอกซเรย์คอมพิวเตอร์ช่องท้องของโรคลูปัสที่สำแดงกับอวัยวะภายในช่องท้องที่พบบ่อย และภาวะแทรกซ้อนต่าง ๆ ได้ถูกนำเสนอในการศึกษานี้ ซึ่งการตรวจด้วยเอกซเรย์คอมพิวเตอร์สามารถช่วยในการวินิจฉัยสาเหตุ วางแผนการรักษาและตรวจหาภาวะแทรกซ้อนต่าง ๆ ในผู้ป่วยลูปัสที่มีอาการทางช่องท้องได้*