

RAPID COMMUNICATION

## Tuberculosis *versus* non-Hodgkin's lymphomas involving small bowel mesentery: Evaluation with contrast-enhanced computed tomography

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### Abstract

**AIM:** To evaluate the specific computed tomography (CT) imaging criteria for differentiating tuberculosis involving the small bowel mesenteric lymph nodes from lymphomas.

**METHODS:** We retrospectively reviewed the anatomic distribution, CT enhancement patterns of lymphoma in 18 patients with mesenteric tuberculosis and 22 with untreated non-Hodgkin's lymphomas (NHL) involving small bowel mesentery (SBM). Of the 18 patients with tuberculosis, 9 had purely mesenteric tuberculous lymphadenopathy (TL), and 9 had mesenteric TL accompanied with tuberculous mesenteritis (TLM).

**RESULTS:** CT showed that tuberculosis and NHL mainly affected lymph nodes in the body and root of SBM. Homogeneously enhanced lymph nodes in the body and root of SBM were found more often in the NHL ( $P < 0.05$ ). Homogeneously mixed peripheral enhanced lymph nodes in the body of SBM were found more often in mesenteric TL and TLM ( $P < 0.05$ ). Peripheral enhanced lymph nodes in the root of SBM were found more often in mesenteric TL and TLM ( $P < 0.01$ ). "Sandwich sign" in the root of SBM was observed more often in NHL ( $P < 0.05$ ).

**CONCLUSION:** Anatomic lymph node distribution, sandwich sign and specific enhancement patterns of lymphadenopathy in SBM on CT images can be used in differentiating between tuberculosis and untreated NHL involving SBM.

### INTRODUCTION

The incidence of tuberculosis is increasing<sup>[1-4]</sup>. Abdominal tuberculosis can affect the gastrointestinal tract, peritoneum and lymph nodes. When the prevalence of abdominal tuberculosis is high, it is difficult to establish its diagnosis<sup>[5-7]</sup>. Lymphadenopathy is the most common manifestation of abdominal tuberculosis and may be easily confused with lymphomas involving abdominal lymph nodes in up to 55% of cases without other evidence of abdominal involvement<sup>[8]</sup>. Clinical and radiologic differentiation between the two can be challenging<sup>[6,8,9]</sup>. To our knowledge, a comparison of computed tomography (CT) findings in tuberculosis and lymphoma of the mesenteric lymph nodes has not been reported<sup>[10]</sup>. Lymphoma<sup>[11]</sup> is the most common malignant neoplasm affecting the mesentery and Hodgkin's Lymphoma can rarely involve the mesentery<sup>[10]</sup>, so we conducted a comparison of CT findings in tuberculosis and non-Hodgkin's lymphoma (NHL) involving the small bowel mesentery (SBM) to improve the physicians' ability to distinguish between these entities.

### MATERIALS AND METHODS

We retrospectively reviewed the medical records of 40 consecutive patients with documented tuberculosis [18 (45%) with mesenteric tuberculosis and 22 (55%) with untreated non-Hodgkin's lymphomas (NHL) involving small bowel mesentery (SBM)] who underwent contrast-

Table 1 Anatomic distribution and enhancement patterns in mesenteric lymph nodes

	TL ( <i>n</i> = 9)			TLM ( <i>n</i> = 9)			NHL ( <i>n</i> = 22)		
	Margin of SBM	Body of SBM	Root of SBM	Margin of SBM	Body of SBM	Root of SBM	Margin of SBM	Body of SBM	Root of SBM
Homogeneous	0	2	3	0	5	5	5	20	18
Peripheral	1	2	6	0	0	4	0	0	0
Homogeneously mixed peripheral	0	4	0	0	4	0	0	2	4

TL: Tuberculous lymphadenopathy; TLM: Tuberculous lymphadenopathy accompanied with mesenteritis; NHL: Non-Hodgkin's lymphoma.

enhanced CT from October 1998 to May 2007 in our hospital. The patients with tuberculosis included 12 men and 6 women at the age ranging from 19 to 56 years (mean, 29 years) with no evidence of HIV infection, neoplastic disease, or opportunistic infection. Of the 18 patients with tuberculosis, 9 (50%) had purely mesenteric tuberculous lymphadenopathy (TL) [presented with a small quantity of ascites (*n* = 3), thickened peritoneum (*n* = 2), thickened small bowel wall (*n* = 1), "dirty" great omentum (*n* = 1), renal tuberculosis (*n* = 1), hepato-duodenum ligament tuberculosis (*n* = 1), omental bursa tuberculosis (*n* = 1), pleuritis (*n* = 2)], and 9 (50%) had mesenteric TL accompanied with tuberculous mesenteritis (TLM) [presented with ascites (*n* = 8), thickened peritoneum (*n* = 8), thickened small bowel wall (*n* = 5), "dirty" great omentum (*n* = 6), "caked" great omentum (*n* = 3), infra-bowel abscess (*n* = 1), renal tuberculosis (*n* = 1), pleuritis (*n* = 1)]. All the patients with tuberculosis had constitutional symptoms, such as weight loss, easy fatigability, night sweats, and obscure abdominal pains. Five of them had clinically palpable abdominal masses. Tuberculosis was diagnosed if lymphadenopathy was found through pathologic examination of specimens (*n* = 8) taken at laparotomy or microbiologic examination of abdominal tissues (*n* = 3). Tuberculosis was also diagnosed in patients for whom CT showed improvement in documented tuberculosis at extra-abdominal sites after anti-tuberculous chemotherapy (*n* = 7).

No evidence of HIV infection was found in the 22 patients (including 10 men and 12 women at the age ranging from 20 to 74 years, mean 49 years) with newly diagnosed and previously untreated NHL. The diagnosis was made by histologic examination of biopsy specimens of enlarged lymph nodes. Involvement of the left major psoas muscle in 2 patients and the adrenal gland in 1 patient was observed. Three patients had splenomegaly.

All patients giving their written informed consent were examined with a spiral CT scanner (Elscent HeliCAT Flash). Before undergoing CT, the patients drank 500 mL of a 1.5% diatrizoate solution. An 80-100 mL bolus of Ultravist (Schering Germany, 300 mgI/mL) at a rate of 2.5-3.0 mL/s was administered through veins. Contiguous axial images (5-8 mm thick) were obtained at 5-8 mm intervals from the dome of diaphragm to the symphysis pubis (120-140 KV, 212-250 Ma, pitch 1-1.5). Sixty seconds after injection of the contrast material, contrast-enhanced CT scan was performed.

Two observers unaware of the final diagnosis

independently reviewed each CT image and recorded a number of characteristics of enlarged lymph nodes in SBM, including anatomic location, enhancement patterns and "sandwich sign". Discrepancies in interpretation between observers were solved by consensus. Small bowel mesenteric lymph nodes were grouped anatomically into the following three sites: the root, margin (area including mesenteric marginal vessels and vasa rectas) and body of SBM (the area between the root and margin of SBM). The short-axis diameter of each node was measured. The CT images of enlarged lymph nodes were compared with those of normal lymph nodes as previously described<sup>[12]</sup>. The enhancement patterns of enlarged lymph nodes in the 40 patients were described as homogeneous, peripheral, and homogeneously mixed peripheral enhancement. Enhancement was considered peripheral when thick, irregular or thin rim was seen, and homogeneously mixed peripheral when some enlarged nodes showed homogeneous enhancement and other nodes at the same site showed peripheral enhancement. Additionally, we observed the extranodal sites of tuberculosis and NHL, including spleen and abdominal wall. Differences in anatomic distribution, enhancement patterns and presence of "sandwich sign" between the two groups were compared by statistical analysis. Because of the small number of cases, Fisher's exact test was used to compare tuberculosis with NHL involving SBM.

## RESULTS

The anatomic distribution and enhancement pattern findings are listed in Table 1 and the findings of "sandwich sign" are shown in Table 2.

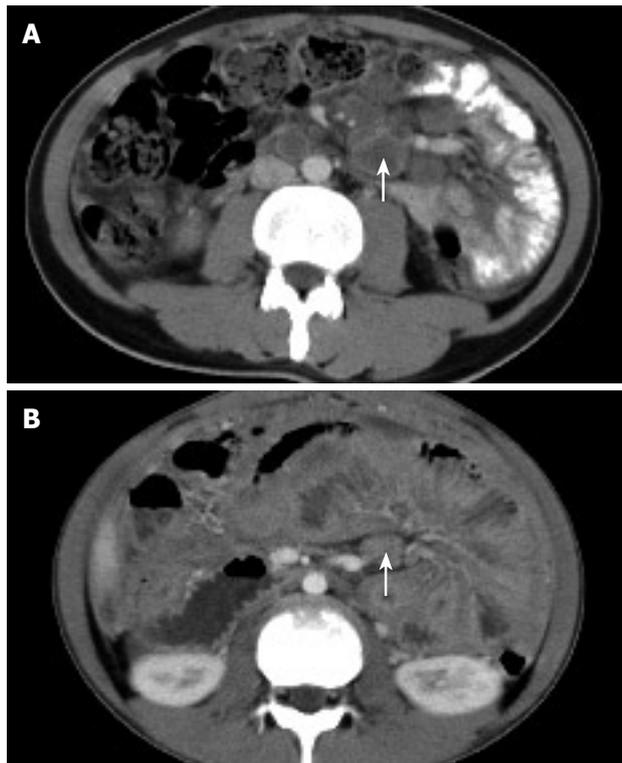
CT revealed that TL and NHL affected mainly lymph nodes in the body and root of SBM (Figures 1 and 2). The margin of SBM was involved in NHL [5 patients (23%)], TL [1 patients (11%)], and TLM [0 patient (0%)].

Homogeneous enhancement (in the body of SBM) was found more often in NHL than in mesenteric TL and TLM ( $P < 0.01$ ,  $P < 0.05$ ). Homogeneously mixed peripheral enhancement (in the body of SBM) was observed more often in mesenteric TL and TLM than in NHL ( $P < 0.05$ ). Homogeneous enhancement (in the root of SBM) was demonstrated more often in NHL than in TL ( $P < 0.05$ ). Peripheral enhancement (in the root of SBM) was revealed more often in mesenteric TL and TLM than in NHL ( $P < 0.01$ ). Enlarged lymph nodes

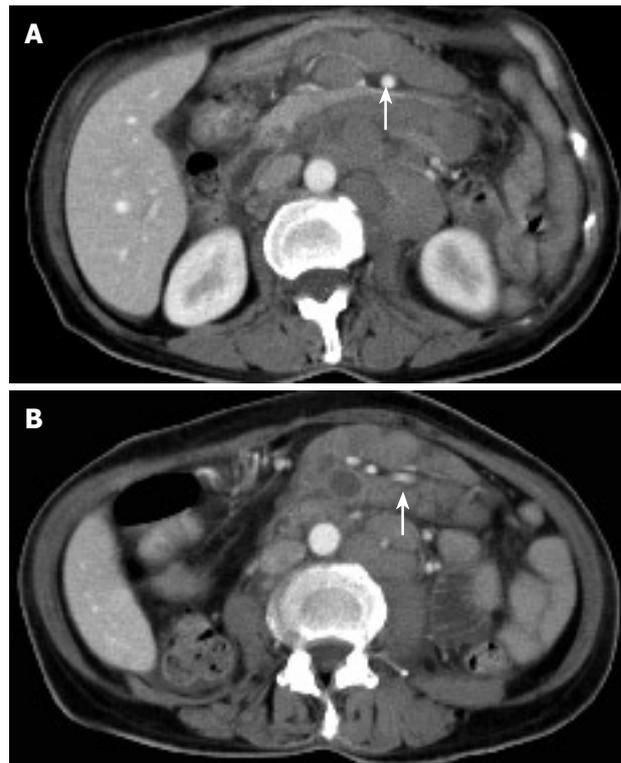
Table 2 Distribution of TL, TLM and NHL in mesenteric lymph nodes

	TL (n = 9)			TLM (n = 9)			NHL (n = 22)		
	Margin of SBM	Body of SBM	Root of SBM	Margin of SBM	Body of SBM	Root of SBM	Margin of SBM	Body of SBM	Root of SBM
Disperse	1	6	7	0	9	9	5	14	10
Confluence	0	2	2	0	0	0	0	8	12
Sandwich sign	0	1	1	0	0	0	0	6	12

TL: Tuberculous lymphadenopathy; TLM: Tuberculous lymphadenopathy accompanied with mesenteritis; NHL: Non-Hodgkin's lymphoma.



**Figure 1** Contrast enhanced CT scan for a 25-year-old man with mesenteric TL showing enlarged lymph nodes in the body and root of SBM with peripheral enhancement (arrow) (A) and in the body of SBM with homogeneous enhancement (arrow) (B). The SBM was contracted and the wall of the small bowel was thickened.



**Figure 2** Contrast enhanced CT scan for a 56-year-old woman with NHL involving SBM showing enlarged lymph nodes in the root of SBM encasing the superior mesenteric artery (arrow), producing the "sandwich sign" (A) and homogeneously mixed peripheral enhancement of lymph nodes in the body of SBM encasing the small bowel mesenteric vessels (arrow), producing the "sandwich sign" (B).

(in the root of SBM) were dispersed in TLM, whereas confluence was found in NHL ( $P < 0.01$ ). "Sandwich sign" (in the root of SBM) was displayed more often in NHL than in mesenteric TL and TLM ( $P < 0.05$ ,  $P < 0.01$ ).

## DISCUSSION

TL is the most common manifestation of abdominal tuberculosis, and tuberculous infection may result in mesenteric lymphadenopathy<sup>[10,13]</sup>. It may be transmitted by three major routes. The first route is ingestion of materials infected with tubercle bacilli which are carried from a lesion in the intestinal submucosal layer to the lymph nodes draining the bowel segment. Drainage is usually from the lymphatics of the ileocecum, jejunum, ileum, and right side of colon to the peripancreatic and superior mesenteric lymph nodes. The second route is

hematogenous spread. Bacteria are disseminated from a distant site of infection, usually the lungs, to the abdominal lymphatic system. Because this process is systemic, it may cause infection of mesenteric lymph nodes. The third route is infection spreading directly to the abdominal lymph nodes from the serosa of adjacent infected structures. Literature *et al*<sup>[14]</sup> reported that most patients with a past history of TB come from areas with a high prevalence of active tuberculosis and have epigastric pain, fever and weight loss, and enlarged nodules with focal calcification sometimes.

SBM, in a series of fan-like ruffles, suspends the jejunum and ileum to the posterior abdominal wall consisting of two posterior peritoneal layers. It is composed of fatty, extraperitoneal connective tissue, blood vessels, nerves, lymph nodes, and peritoneal

investment. The attached border of SBM root extends obliquely from the distal duodenum at the lower border of pancreas on the left side of L2 to the cecum in the right iliac fossa. The line of attachment passes from the duodenojejunal junction over the third portion of the duodenum, then obliquely across the aorta, inferior vena cava, right ureter and psoas major muscle, to the right ilica region<sup>[15-17]</sup>.

The mesenteric lymph nodes can be divided into three subgroups: some lie close to the wall of small intestine, others occur in relation to primary branches of mesenteric vessels, and some consisting of central nodes along the main trunk of the superior mesenteric artery<sup>[18]</sup>.

In this study, 18 patients with tuberculosis and 22 patients with NHL mainly involved mesenteric lymph nodes in the body and root of SBM. Hence, distribution of enlarged lymph nodes in the diseases closely paralleled to the anatomic distribution.

Pathologic findings from surgical specimens of TL indicated that caseation or liquefactive substances at the center of enlarged lymph nodes had a low attenuation presumably resulting from insufficient blood supply, whereas peripheral inflammatory lymphatic tissue had a higher attenuation on enhanced CT resulting from the preserved blood supply<sup>[19]</sup>.

In most patients with untreated NHL, lymph nodes in the SBM increased homogeneously. In 9% of patients with NHL involving the body of SBM and 18% of patients with NHL involving the root of SBM, lymph nodes had a homogeneous and peripheral enhancement. Our findings on the morphology of lymph nodes are similar to those of previous reports, in which the enhancement patterns of untreated NHL are homogeneous or less frequently necrotic with central hypodensity in the neck and mediastinum<sup>[20-22]</sup>.

In this study, 25% of patients had mesenteric TL in the body of SBM, lymph nodes had peripheral enhancement. In 50% of patients with mesenteric TL and 44% of patients with TLM in the root of SBM, lymph nodes had a homogeneous and peripheral enhancement, more than that in NHL.

The focus of this study was to differentiate mesenteric tuberculosis from untreated NHL involving the SBM using contrast-enhanced CT. Anatomic distribution in patients with NHL involving SBM was similar to that in patients with mesenteric TL and TLM. Oliver *et al*<sup>[23]</sup> reported that enlarged lymph nodes have a decreased density and mesenteric stranding in 20% of patients with lymphoma after treatment. However, if relapse of the disease occurs, the lymph nodes appear homogeneous, suggesting that it is important to know if patients with NHL have undergone therapy that may have caused central low attenuation within nodes or mesenteric stranding in SBM, simulating TL involving the SBM.

Neoplastic involvement of the mesentery can be diagnosed in lymphoma on the basis of a characteristic appearance of “sandwich-sign” encasement of the superior mesenteric artery<sup>[18,24]</sup>. In our study, one patient with TL had “sandwich-sign” in the body and root of

SBM. However, it was detected in 27.3% of patients with NHL involving the body of SBM and in 54.5% of patients with NHL involving the root of SBM. When “sandwich-sign” is considered, mesenteric TL and TLM are rarely confused with NHL involving SBM in clinical practice.

One limitation of this study is the relatively small number of cases of tuberculosis involving SBM. Enlarged lymph nodes with a peripheral enhancement in SBM can also be seen in metastatic malignancy and other diseases. In general, if primary malignancy is known, most metastatic malignancies are easily diagnosed. Other causes for mesenteric lymphadenopathy that characteristically demonstrates central low attenuation on CT are Whipple disease<sup>[25]</sup> and cavitating mesenteric lymph node syndrome of celiac disease<sup>[26,27]</sup>. Mesenteric lymphadenopathy has also been reported in patients with familial Mediterranean fever during an acute abdominal attack, Castleman disease and Crohn's disease<sup>[28-31]</sup>.

In conclusion, contrast-enhanced CT can be used in differentiating mesenteric TL and TLM from NHL involving SBM on the basis of enhancement patterns of enlarged lymph nodes and presence of “sandwich-sign”. Mesenteric tuberculosis involves predominantly lymph nodes in the root and body of SBM. Lymph nodes at the margin of SBM are involved in only 5.5% of patients with mesenteric tuberculosis. In contrast, lymph nodes at the margin of SBM are involved in 22.7% of patients with NHL involving SBM. The presence of “sandwich sign” can be more frequently observed in NHL involving SBM than in mesenteric TL and TLM. A distinct difference in characteristic nodal enhancement patterns can also be observed.

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## COMMENTS

### Background

The incidence of tuberculosis is increasing. When the prevalence of abdominal tuberculosis is high, it is difficult to establish its diagnosis. Lymphadenopathy is the most common manifestation of abdominal tuberculosis and may be easily confused with lymphoma involving abdominal lymph nodes. Lymphoma is the most common malignant neoplasm affecting mesentery, and Hodgkin's Lymphoma rarely involves mesentery. We conducted a comparison of CT findings in tuberculosis and non-Hodgkin's lymphoma (NHL) involving small bowel mesentery (SBM) to improve physicians' ability to distinguish between these entities.

### Research frontiers

The incidence of tuberculosis is increasing. Lymphadenopathy is the most common manifestation of abdominal tuberculosis. A comparison of CT findings in tuberculosis and lymphomas of retroperitoneal lymph nodes has been reported.

### Innovations and breakthroughs

SBM, in a series of fan-like ruffles, suspends the jejunum and ileum to the posterior abdominal wall consisting of two posterior peritoneal layers. NHL and tuberculous lymphadenopathy may involve SBM, and the correct diagnosis and

differential diagnosis are important for their clinical treatment. We compared CT findings in tuberculosis and NHL involving SBM to improve the physicians' ability to distinguish between these entities.

### Applications

This study may improve the physicians' ability to distinguish tuberculosis from NHL involving SBM, and specific CT imaging criteria may be used in the differential diagnosis of other malignant tumors involving SBM.

### Peer review

This study evaluated the specific CT imaging criteria for differentiating tuberculosis involving small bowel mesenteric lymph nodes from lymphomas, showing that distribution of anatomic lymph nodes, sandwich sign and specific enhancement patterns of lymphadenopathy in SBM on CT images can be used in differentiating tuberculosis from NHL involving SBM. The study is well designed and interesting.

## REFERENCES

- 1 Goodman PC. Tuberculosis and AIDS. *Radiol Clin North Am* 1995; **33**: 707-717
- 2 Collins FM. Tuberculosis: the return of an old enemy. *Crit Rev Microbiol* 1993; **19**: 1-16
- 3 Cantwell MF, Snider DE Jr, Cauthen GM, Onorato IM. Epidemiology of tuberculosis in the United States, 1985 through 1992. *JAMA* 1994; **272**: 535-539
- 4 Raviglione MC, Snider DE Jr, Kochi A. Global epidemiology of tuberculosis. Morbidity and mortality of a worldwide epidemic. *JAMA* 1995; **273**: 220-226
- 5 Leder RA, Low VH. Tuberculosis of the abdomen. *Radiol Clin North Am* 1995; **33**: 691-705
- 6 Jadvar H, Mindelzun RE, Olcott EW, Levitt DB. Still the great mimicker: abdominal tuberculosis. *AJR Am J Roentgenol* 1997; **168**: 1455-1460
- 7 Dong P, Wang B, Sun YQ. Tuberculous abscess in hepatoduodenal ligament: Evaluation with contrast-enhanced computed tomography. *World J Gastroenterol* 2008; **14**: 2284-2287
- 8 Hulnick DH, Megibow AJ, Naidich DP, Hilton S, Cho KC, Balthazar EJ. Abdominal tuberculosis: CT evaluation. *Radiology* 1985; **157**: 199-204
- 9 Epstein BM, Mann JH. CT of abdominal tuberculosis. *AJR Am J Roentgenol* 1982; **139**: 861-866
- 10 Yang ZG, Min PQ, Sone S, He ZY, Liao ZY, Zhou XP, Yang GQ, Silverman PM. Tuberculosis versus lymphomas in the abdominal lymph nodes: evaluation with contrast-enhanced CT. *AJR Am J Roentgenol* 1999; **172**: 619-623
- 11 Whitley NO, Bohlman ME, Baker LP. CT patterns of mesenteric disease. *J Comput Assist Tomogr* 1982; **6**: 490-496
- 12 Lucey BC, Stuhlfaut JW, Soto JA. Mesenteric lymph nodes: detection and significance on MDCT. *AJR Am J Roentgenol* 2005; **184**: 41-44
- 13 Lucey BC, Stuhlfaut JW, Soto JA. Mesenteric lymph nodes seen at imaging: causes and significance. *Radiographics* 2005; **25**: 351-365
- 14 Xia F, Poon RT, Wang SG, Bie P, Huang XQ, Dong JH. Tuberculosis of pancreas and peripancreatic lymph nodes in immunocompetent patients: experience from China. *World J Gastroenterol* 2003; **9**: 1361-1364
- 15 Okino Y, Kiyosue H, Mori H, Komatsu E, Matsumoto S, Yamada Y, Suzuki K, Tomonari K. Root of the small-bowel mesentery: correlative anatomy and CT features of pathologic conditions. *Radiographics* 2001; **21**: 1475-1490
- 16 Oliphant M, Berne AS. Computed tomography of the subperitoneal space: demonstration of direct spread of intraabdominal disease. *J Comput Assist Tomogr* 1982; **6**: 1127-1137
- 17 Oliphant M, Berne AS, Meyers MA. Spread of disease via the subperitoneal space: the small bowel mesentery. *Abdom Imaging* 1993; **18**: 109-116
- 18 Mueller PR, Ferrucci JT Jr, Harbin WP, Kirkpatrick RH, Simeone JF, Wittenberg J. Appearance of lymphomatous involvement of the mesentery by ultrasonography and body computed tomography: the "sandwich sign". *Radiology* 1980; **134**: 467-473
- 19 Griffith RC, Janney CG. Lymph nodes. In: Kissance JM, editor. *Anderson's pathology*, 9th ed. St. Louis: Mosby, 1990: 1429-1492
- 20 Pombo F, Rodriguez E, Caruncho MV, Villalva C, Crespo C. CT attenuation values and enhancing characteristics of thoracoabdominal lymphomatous adenopathies. *J Comput Assist Tomogr* 1994; **18**: 59-62
- 21 Lee YY, Van Tassel P, Nauert C, North LB, Jing BS. Lymphomas of the head and neck: CT findings at initial presentation. *AJR Am J Roentgenol* 1987; **149**: 575-581
- 22 Hopper KD, Diehl LF, Cole BA, Lynch JC, Meilstrup JW, McCauslin MA. The significance of necrotic mediastinal lymph nodes on CT in patients with newly diagnosed Hodgkin disease. *AJR Am J Roentgenol* 1990; **155**: 267-270
- 23 Oliver TW Jr, Bernardino ME, Sones PJ Jr. Monitoring the response of lymphoma patients to therapy: correlation of abdominal CT findings with clinical course and histologic cell type. *Radiology* 1983; **149**: 219-224
- 24 Sheth S, Horton KM, Garland MR, Fishman EK. Mesenteric neoplasms: CT appearances of primary and secondary tumors and differential diagnosis. *Radiographics* 2003; **23**: 457-473; quiz 535-536
- 25 Friedman HD, Hadfield TL, Lamy Y, Fritzing D, Bonaventura M, Cynamon MT. Whipple's disease presenting as chronic wastage and abdominal lymphadenopathy. *Diagn Microbiol Infect Dis* 1995; **23**: 111-113
- 26 Schmitz F, Herzig KH, Stuber E, Tiemann M, Reinecke-Luthge A, Nitsche R, Folsch UR. On the pathogenesis and clinical course of mesenteric lymph node cavitation and hyposplenism in coeliac disease. *Int J Colorectal Dis* 2002; **17**: 192-198
- 27 Al-Kawas FH, Murgo A, Foshag L, Shiels W. Lymphadenopathy in celiac disease: not always a sign of lymphoma. *Am J Gastroenterol* 1988; **83**: 301-303
- 28 Zissin R, Rathaus V, Gayer G, Shapiro-Feinberg M, Hertz M. CT findings in patients with familial Mediterranean fever during an acute abdominal attack. *Br J Radiol* 2003; **76**: 22-25
- 29 Ferreiros J, Gomez Leon N, Mata ML, Casanova R, Pedrosa CS, Cuevas A. Computed tomography in abdominal Castleman's disease. *J Comput Assist Tomogr* 1989; **13**: 433-436
- 30 Avila NA, Ling A, Worobec AS, Mican JM, Metcalfe DD. Systemic mastocytosis: CT and US features of abdominal manifestations. *Radiology* 1997; **202**: 367-372
- 31 Healy JC, Reznick RH. The peritoneum, mesenteries and omenta: normal anatomy and pathological processes. *Eur Radiol* 1998; **8**: 886-900

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