CT APPEARANCE OF AMOEBIC AND PYOGENIC LIVER ABSCESSES

Phuvitoo SUNGTONG, M.D.[1]

OBJECTIVE. A retrospective review was performed to compare CT appearance of amoebic and pyogenic liver abscesses.

MATERIAL AND METHODS. Fifteen patients of proven amoebic or pyogenic liver abscess, which underwent CT scan, were retrospectively reviewed. The CT appearance was analyzed for number, location, size, shape, central homogeneity, central attenuation coefficient, rim enhancement, peripheral low-attenuation rim, and the presence of extrahepatic manifestations.

RESULTS. There were five cases of amoebic liver abscesses. All amoebic liver abscesses were solitary hypoattenuating mass with rim enhancement and all were in the right lobe. Four patients of amoebic abscess showed "double target sign". There were nine cases of pyogenic liver abscesses. Pyogenic liver abscesses could be located in any lobe and mostly appeared as cluster of microabscesses or a macroabscess with adjacent microabscesses. Pyogenic abscess could appear as miliary abscesses, solitary macroabscess or multiple separated macroabscesses. One patient of proven mixed amoebic and pyogenic abscesses showed ten separated abscesses scattering in both lobes of the liver.

CONCLUSION. Amoebic liver abscess was mostly in the right lobe and appeared as a solitary hypoattenuating mass with rim enhancement. The CT appearance of pyogenic liver abscesses were variable and mostly showed "cluster sign".

INTRODUCTION

Between January 2002 and January 2005, approximately 420 patients were discharged from Hatyai hospital with the diagnosis of liver abscess. Most of them were diagnosed by clinical, laboratory tests and ultrasonography. The big abscesses larger than 5 cm in size were mostly underwent percutaneous needle aspiration or catheter drainage under ultrasound guidance. Few cases were drained by open surgery. Only a small number of the patients were requested for CT scan. By CT appearance, liver abscesses were sometimes similar to hepatic tumors or cysts.

The purpose of this study is to compare CT appearance of amoebic and pyogenic liver abscesses with a review of CT findings of hepatic abscesses in the literatures.

MATERIAL AND METHODS

In a three-year period between January 2002 and January 2005, there were fifteen cases of proven liver abscesses, which underwent CT scan. There were 5 cases of amoebic liver abscesses, 9 cases of

[1] Division of Radiology Hatyai Hospital Songkhla Thailand 90110.

pyogenic liver abscesses, and one case of combined amoebic and pyogenic abscesses. They were 10-73 years of age (mean, 44.8), and 11 were men. All patients were HIV negative and had no underlying malignancy.

The diagnosis of amoebic liver abscess was confirmed by an elevated Entamoeba histolytica titer equal to or greater than 1: 1,280 in 3 cases. Blood for Entamoeba histolytica titer were not drawn in the remaining two cases. These two cases, one was treated by sonographically guided percutaneous aspiration with yielding of anchovy paste fluid. The trophozoites of Entamoeba histolytica were found in the stool of the other cases. All five cases had complete clinical response to antiamoebic therapy.

Proof of a pyogenic abscess was obtained by bacteriologic culture after percutaneous aspiration in 4 patients, and surgical drainage in 1 patient. There was one patient who had surgically confirmed of an appendiceal abscess with associated liver abscesses. One case had surgically confirmed of a diverticular abscess with associated liver abscesses. These two patients showed complete clinical response and complete healing of liver abscesses after antibiotic drugs given for appendiceal and diverticular abscesses. There was one female patient who had underlying disease of diabetes mellitus and presented with fever and right upper quadrant pain for 2 weeks. The CT appearance revealed innumerable miliary microabscesses scattered in the liver and multiple splenic abscesses. The indirect hemagglutination antibody test (IHA) for melioidosis was more than 1:320. The Widal and Weil-felix tests were negative. She had good clinical response after medical treatment as melioidosis. There was one patient which CT findings were suggestive of rupture of liver abscess. He was treated by open surgery and found that there was rupture of liver abscess with foul smell pus, mixed with blood. Pus culture and hemoculture were negative. Anaerobic bacteria were concluded to be the cause of liver abscess in this patient. He responded well with intravenous antibiotic therapy.

The microorganisms that were isolated from the abscess cavity were found to be mixed infection including both Staphylococcus coagulase positive, and coagulase negative, Klebsiella pneumoniae, Pseudomonas aeroginosa, Hemophilus influenza, and Burkhoderia pseudomallei.

All 15 patients had CT performed on a Hitachi W2000 with a scanning time of 1 second per slice, slices of 1 cm were done throughout the liver. Intravenous contrast material was used in all cases.

The CT appearance of liver abscesses were analyzed for number, location, size, shape, wall definition, central homogeneity, central attenuation coefficient, rim enhancement, peripheral low-attenuation rim, and the presence of perihepatic fluid collection and pleural effusion.

RESULTS

This series comprised of 5 cases of amoebic liver abscess, 9 cases of pyogenic liver abscess and one case of combined amebic and pyogenic abscesses.

Amoebic abscesses

There were five patients with proven amoebic liver abscess and all were men. The age range for the patients with amoebic liver abscesses were 24-63 years (mean, 40.2). The CT appearance of amoebic abscesses in all cases, was a solitary hypoattenuating mass. All amoebic abscesses were in the right hepatic lobe. Four abscesses were round or ovoid (Fig 1A, 1B) and one had multilobulated contour (Fig 2). The range for greatest axial dimension was 4-16 cm (mean, 8.8). Rim enhancement or enhancing wall, defined as a margin having higher density than either the surrounding normal liver or the abscess cavity, were found in all cases. The maximum and minimum thicknesses of the enhancing wall in each case were measured for calculation of the calculate average thickness. There were two cases that the

average thickness of rim enhancement was more than 10 mm. The rest three cases had an average rim enhancement of 3 mm to 5 mm. There were 4 cases (80%) that showed a "double target appearance".

This appearance consisted of a central hypodense area, intermediate ring-like enhancement, and an incomplete peripheral hypodense ring. There were two cases that 15 minute-delayed studies were also performed. The abscesses in the delayed images showed a central hypodense area and a relatively thick, dense ringlike enhancement of the intermediate and peripheral zones (Fig 1C).

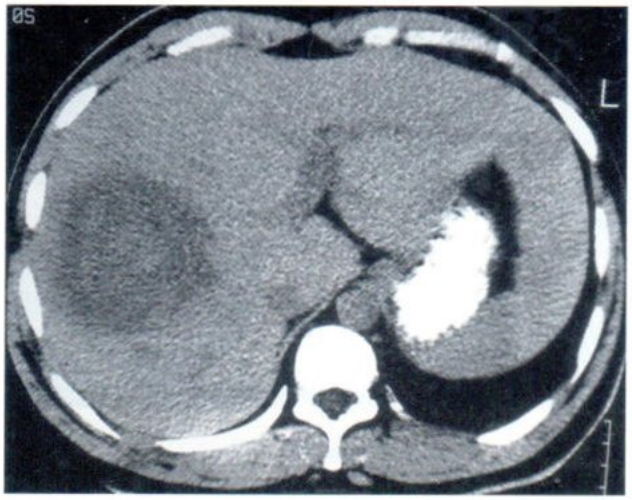

Fig.1A

Fig.1B

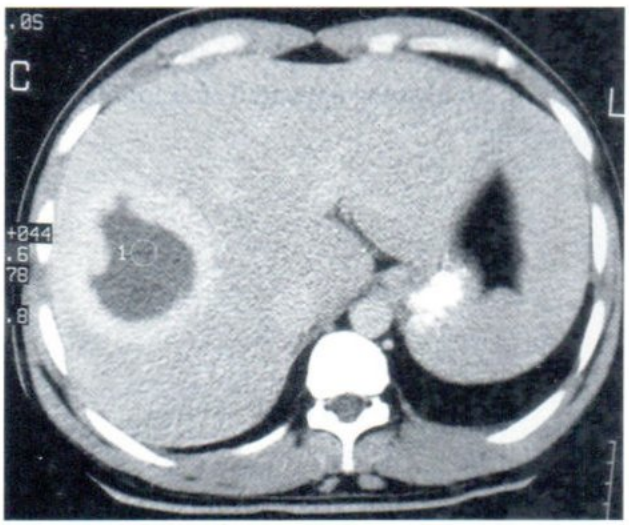

Fig.1C

Fig.1 An amoebic abscess in a 24 years-old man that proof by US-guided aspiration.
Fig.1A, Unenhanced CT scan showed a round hypodense mass in right lobe liver.
Fig.1B, Enhanced CT scan. An abscess showed a "double target appearance" (arrows).
Fig.1C, A 15 minute-delayed image showed a central hypodense area and a relatively thick, dense ringlike enhancement of the intermediate and peripheral zones.

The mean CT attenuation at the center of the abscesses after intravenous contrast media was 33 HU, ranging from 23 HU to 40 HU. There was no abscess that had gas or hematoma inside. There were two cases that showed internal septa (Fig 3). Right pleural effusion was noted in three cases. One of these cases had an abscess and consolidation in the right middle lobe due to rupture of amoebic liver abscess into right lung (Fig 4). Minimal perihepatic fluid collection was observed in one case. There was no patient that showed focal dilatation of the intrahepatic bile duct.

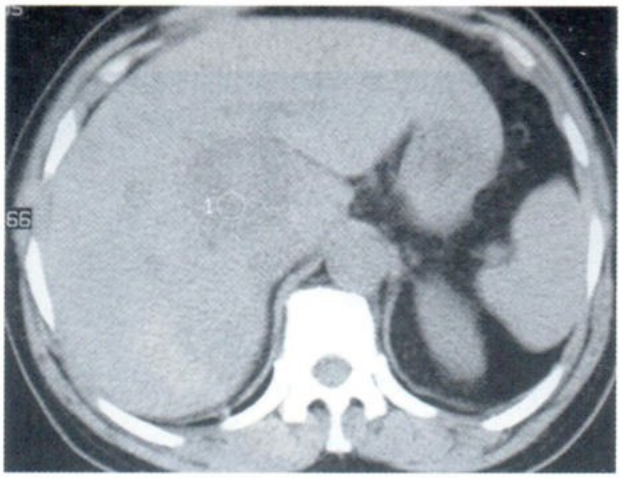

Fig.2A

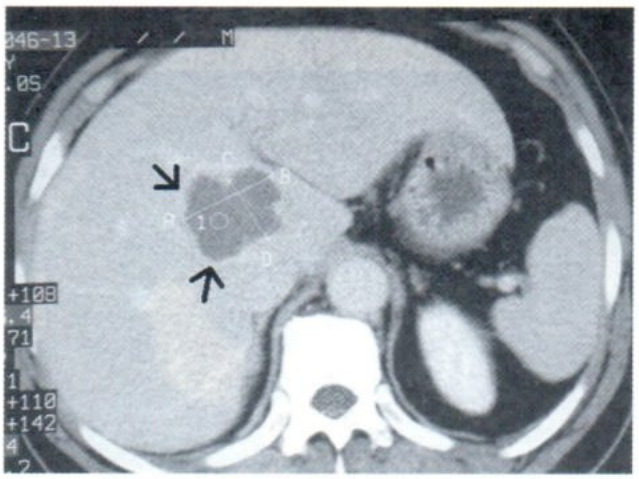

Fig.2B

Fig.2 A 63-years-old man with fever, right upper quadrant pain, and Entamoeba histolytica titer more than 1:1,280.

Fig.2A, Unenhanced CT scan showed a 4 cm hypoattenuating mass in anterior segment of right lobe of liver.

Fig.2B, Enhanced CT scan. An abscess appeared as a lobulated lesion with smooth, thin rim enhancement (arrows).

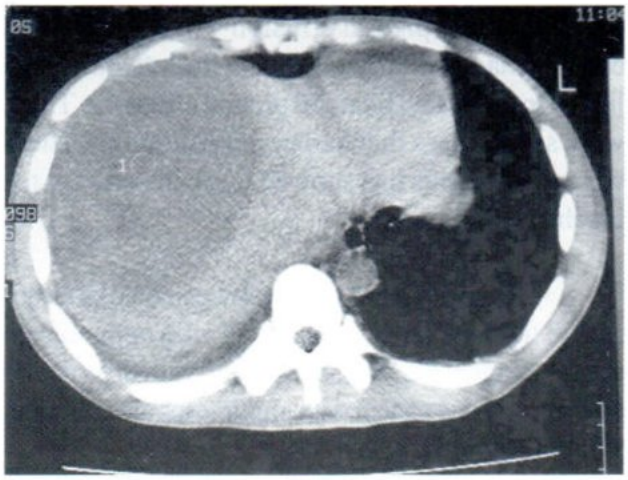

Fig. 3A

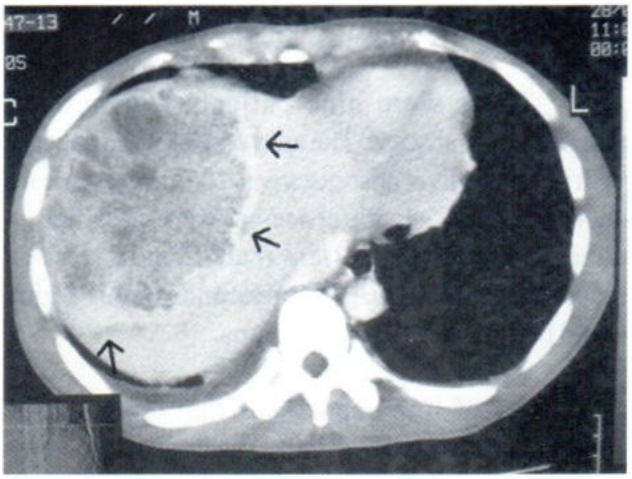

Fig. 3B

Fig.3 A 30-years-old man who had Entamoeba histolytica titer more than 1:1,280.

Fig.3A, Unenhanced CT scan showed an 11 cms hypodense mass in superior segment of right lobe liver.

Fig.3B, Enhanced CT scan showed multiple septa within a large amebic abscess. Incomplete hypodensity surrounding the enhanced wall was noted (arrows). Right pleural effusion was shown.

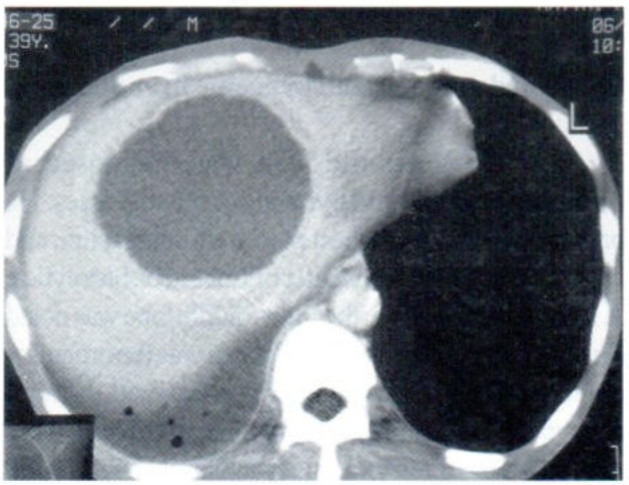

Fig. 4A

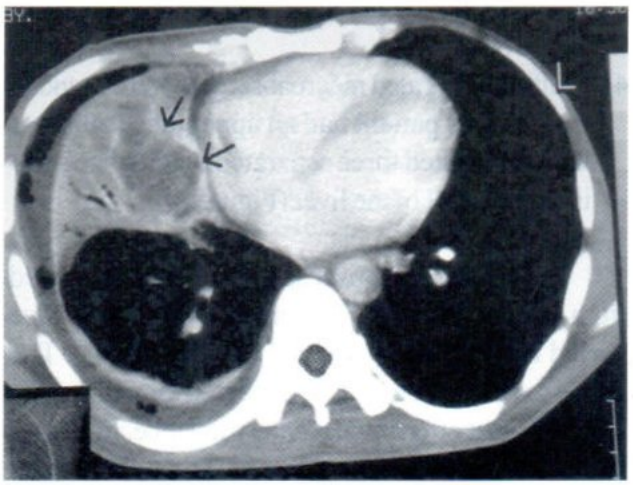

Fig. 4B

Fig.4 An abscess in a 39-years-old man who had trophozoites of Entamoeba histolytica in the stool.

Fig.4A, A large, thick-walled abscess was noted in right lobe. Right pleural effusion with small air bubbles was shown.

Fig.4B, An abscess and consolidation were noted in right middle lobe (arrows), representing rupture of abscess into right lung.

Pyogenic abscesses

There were nine patients with proven pyogenic liver abscess. The ages range for the patients with pyogenic liver abscesses was 10-73 years (mean, 46.4). Pyogenic hepatic abscesses were classified as either microabscesses (less than 2 cm in size) or macroabscesses. The CT appearance in this series could be subdivided into 4 groups.

1) Cluster of microabscesses that appeared to aggregate or coalesce into a macroabscess cavity or a macroabscess that had adjacent microabscesses. This appearance was found in 6 cases (Figure 5).
2) Diffuse miliary pattern of microabscesses, measuring few mm in size, each. This appearance was found in an old female 34 years of age who had diffuse hepatic microabscesses and multiple splenic abscesses due to disseminated melioidosis (Figure 6).
3) A solitary unilocular macroabscess was found in 1 case (Figure7).
4) Multiple separated macroabscesses were found in 1 case. This patient had an appendiceal abscess with associated three separated macroabscesses in segment VI of the liver (Figure8).

The biggest abscess in each patient varied from 4 to 10 cm (mean, 7.3) and the attenuation value varied from 20 HU to 30 HU (mean, 26 HU). The abscesses in all cases were distributed throughout the liver but most often involved the right lobe. In 2 cases the right lobe alone was affected. The right and left lobes were involved in 1 case. The right and caudate lobes were affected in 2 cases. There were 3 cases, which the abscesses were located in the right, the left and the caudate lobes. The left lobe was the only site of involvement in 1case.

Rim enhancement of pyogenic liver abscesses was mostly very thin or incomplete rim. There was no case that showed hypodensity surrounding the enhanced wall or "double target sign". Gas was not found in any abscess. Bleeding inside an abscess was noted in one case. Right pleural effusion was seen in two cases. Left pleural effusion was observed in a case that had a solitary abscess in the left lobe of the liver. One case had bilateral pleural effusions. There were seven cases that had perihepatic fluid. There were two patients that showed focal dilatation of the intrahepatic bile ducts.

Etiologic factors of liver abscess could be identified in three patients, one patient with appendiceal abscess (Figure 8A, 8B), one patient with diverticular abscess, and one patient with multiple intrahepatic duct stones (Figure 9).

Follow up CT of the abdomen was performed in two patients. One patient who had appendiceal abscess, the 14-month follow up study showed complete healing of liver abscesses (Figure 8C). The other patient who had multiple macroabscesses with adjacent microabscesses, the 26-month follow up CT scan showed calcified residues of liver abscesses (Figure 10).

Combined amoebic and pyogenic liver abscesses

A 53-years-old man was diagnosed as combined amoebic and pyogenic liver abscesses. He presented with fever, chest pain, abdominal pain, and cough. He had high serum titer of Entameba histolytica. A large lung abscess in the right middle lobe was noted (Figure 11A). Hemophilus influenza was the organism detected from the culture of pus derived through percutaneous drainage of lung abscess. There were various sizes of ten oval macroabscesses scattering around the right and left lobes of the liver (Figure 11B). All abscesses had thin rim enhancement, measuring less than 0.5 cm in thickness. The biggest abscess was in segment VIII, measuring about 6.4 cm in size. The attenuation value after intravenous contrast media at the central cavity of this abscess was 31 HU. No pleural effusion was shown. Percutaneous aspiration of the biggest abscess under US guidance was performed and anchovy paste fluid was obtained. Hemophilus influenzae was also detected from the culture of the liver abscess. The patient was undergone treatment with antiamoebic and antibiotic agents.

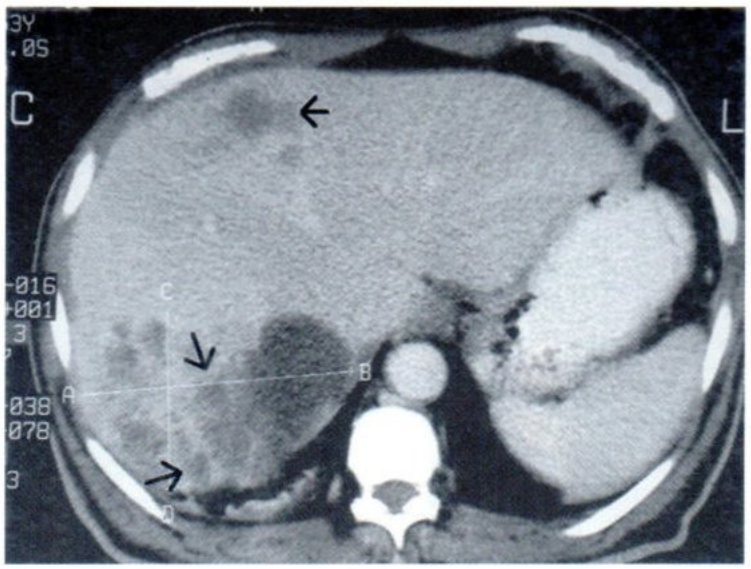

Fig.5 Multiple clusters of microabscesses that appeared to aggregate or coalesce into a macroabscess cavity (arrows) in a 52-years-old man with the diagnosis of melioidosis. US-guided aspiration of a liver abscess showed purulent fluid with positive for Burkholderia pseudomallei from pus culture.

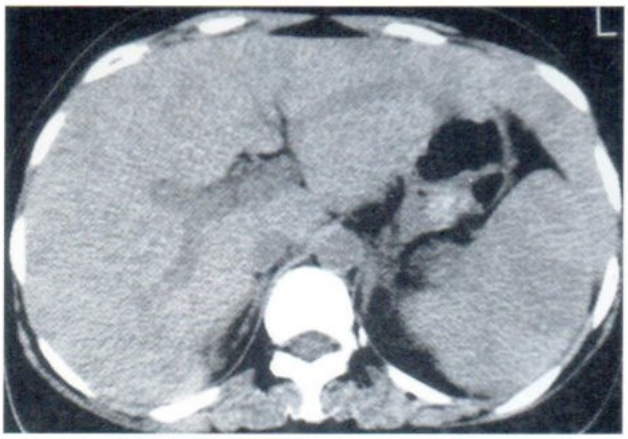

Fig.6A

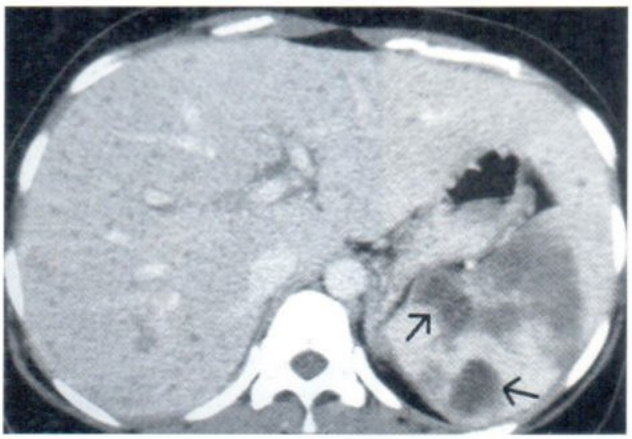

Fig.6B

Fig.6 A 34-years-old female who had underlying disease of diabetes mellitus and presenting with prolong fever that concluded to be due to disseminated melioidosis.

Fig.6A CT scan, pre contrast scan.

Fig.6B CT scan, post contrast scan showed innumerable miliary microabscesses in the liver and multiple splenic abscesses (arrows).

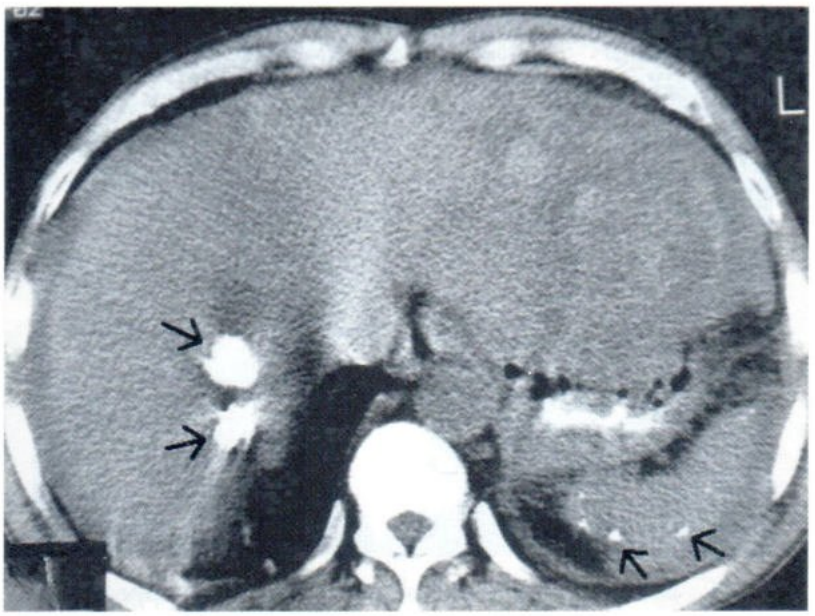

Fig.7A

Fig.7B

Fig.7 An abscess in left lobe of liver in a 60-years-old man who was undergone open surgery. Foul smell pus and blood were found in the abscess.

Fig.7A, CT scan, precontrast scan showed an ill-marginated hypodense area containing subtle hyperdensity in left lobe of liver. There were two calcifications in the right lobe and multiple tiny splenic calcifications (arrows). They were most likely old calcified granulomas.

Fig.7B, After I.V. contrast, the abscesses were round shape and had well-marginated contour. Large amount of perihepatic fluid collection, due to rupture liver abscesses were also noted.

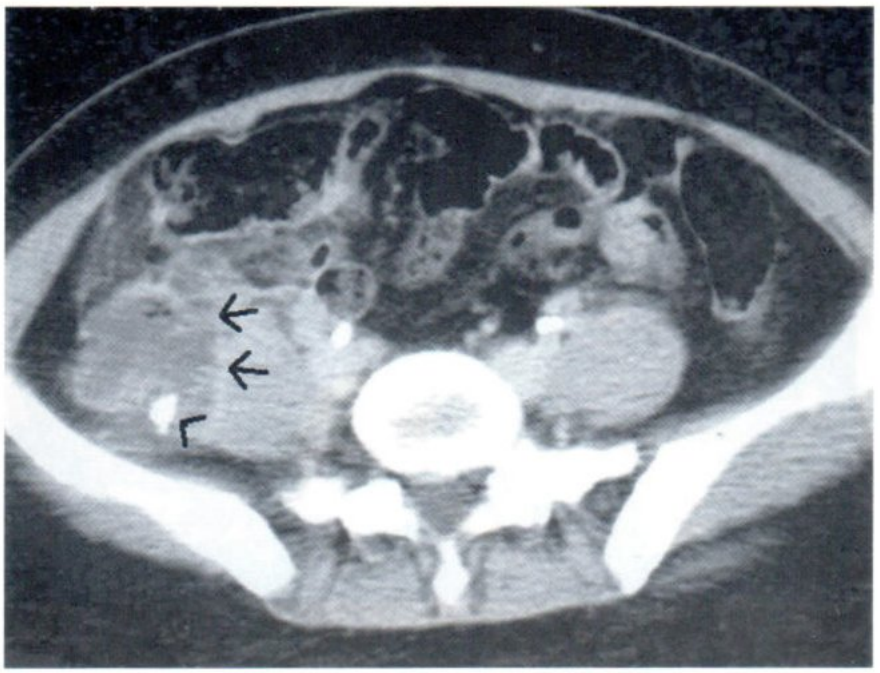

Fig.8A

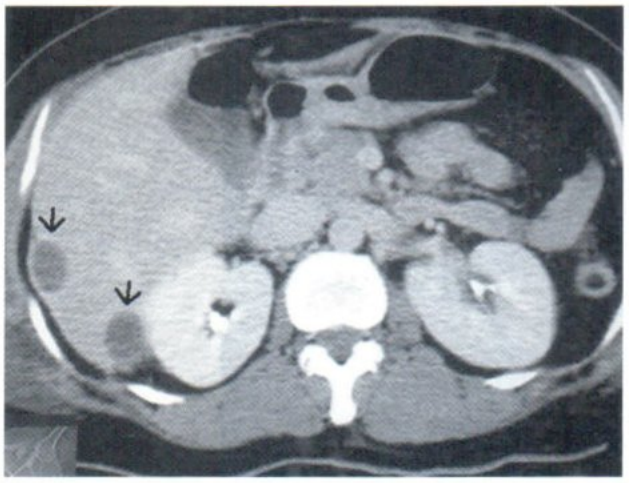

Fig.8B

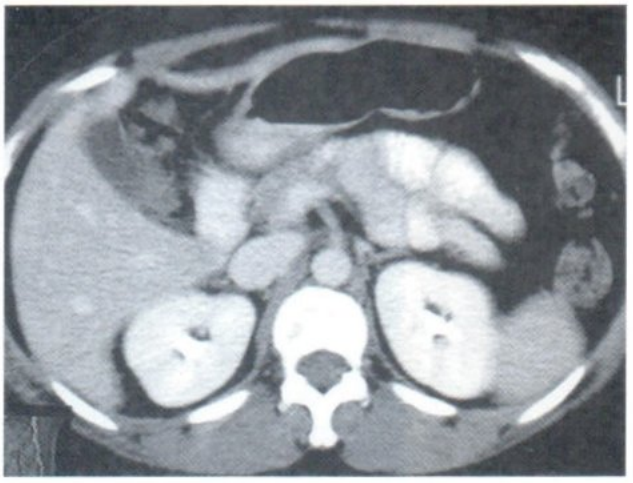

Fig.8C

Fig.8 A 35-years-old female presented with fever and abdominal pain.
Fig.8A, CT scan of abdomen showed an appendiceal abscess (arrows) with an appendicolith (arrowhead).
Fig.8B, There were separated macroabscesses in segment VI of the liver.
Fig.8C, The 14-months follow up CT scan showed disappearance of hepatic abscesses.

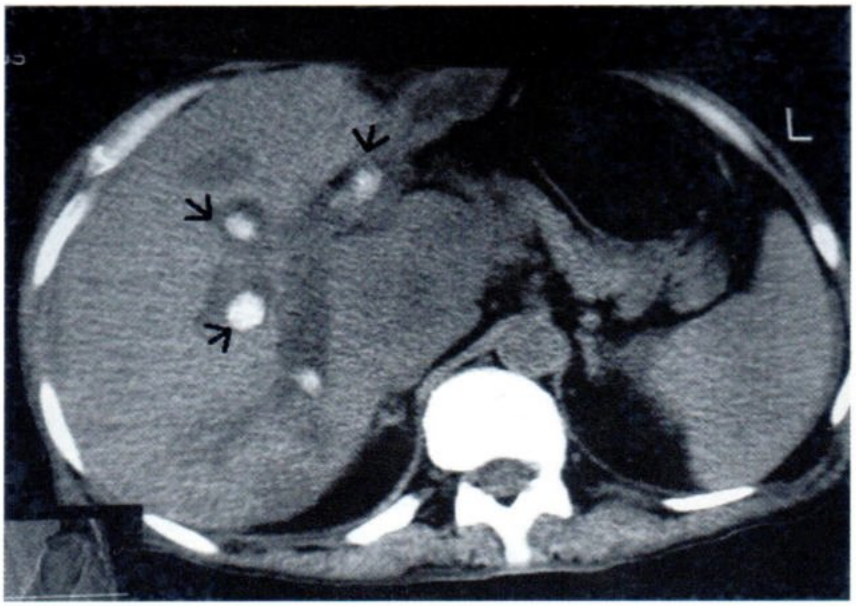

Fig.9A

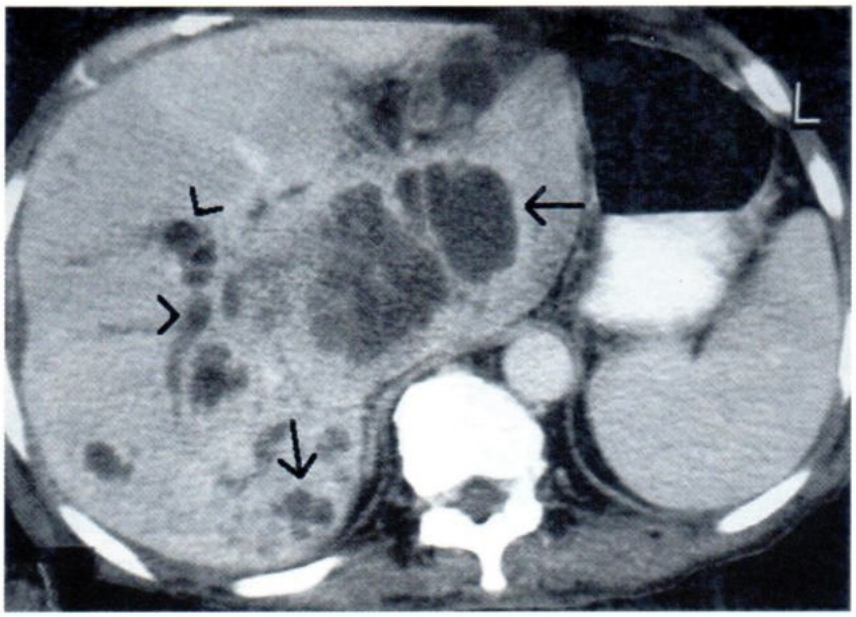

Fig.9B

Fig.9 A 71-years-old man who had undergone cholecystectomy due to gallstones for many years. This time he came with fever, jaundice, and right upper quadrant pain.

Fig.9A, CT scan pre I.V. contrast showed multiple intrahepatic duct stones in dilated intrahepatic ducts (arrows).

Fig.9B, CT after I.V. contrast showed cluster of microabscesses that appeared to coalesce into a macroabscess cavity (arrows). Pseudomonas aeroginosa was cultured from liver abscess.

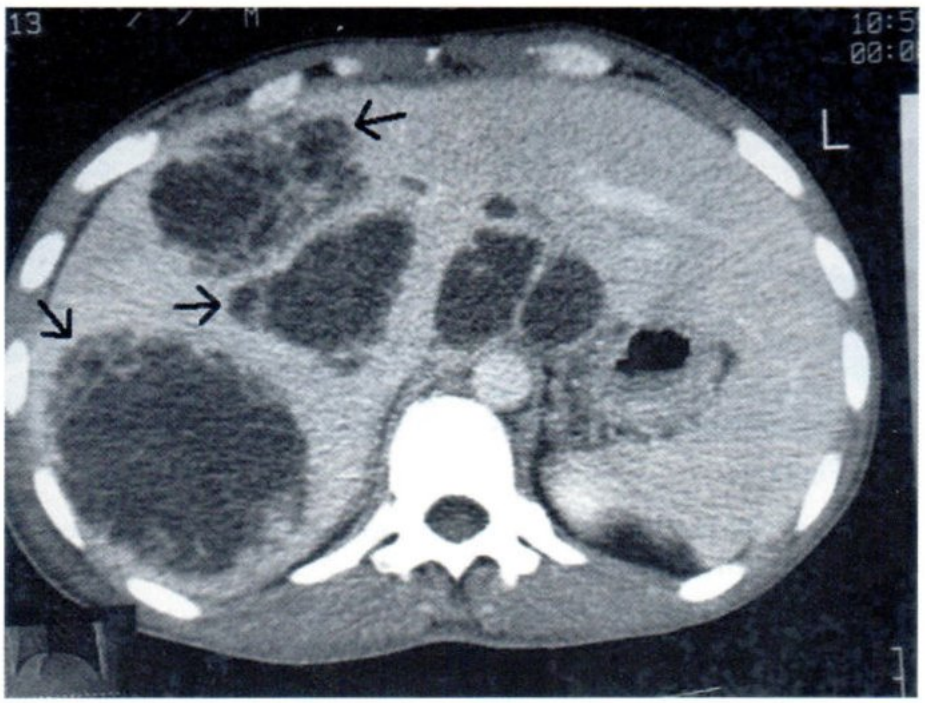

Fig.10A

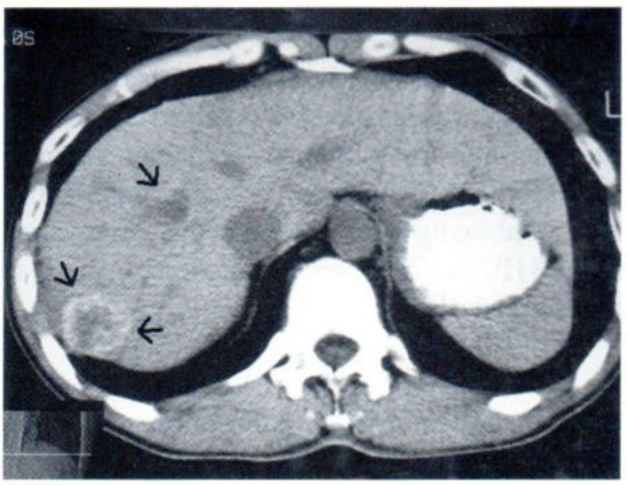

Fig.10B

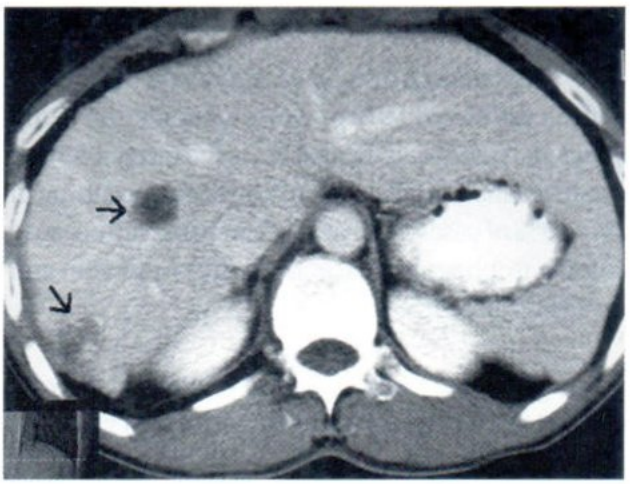

Fig.10C

Fig.10 A 43-years-old man who had E. histolytica titer less than 1:80. Purulent content was obtained from US-guided aspiration of a hepatic abscess.

Fig.10A, CT scan post I.V. contrast showed multiple macroabscesses that had adjacent microabscesses (arrows).

Fig.10B, Pre I.V. contrast CT scan 26 months later showed calcified residues of hepatic abscesses (arrows).

Fig.10C, Post I.V. contrast CT scan 26 months later showed no enhancement of calcified residues of hepatic abscesses (arrows).

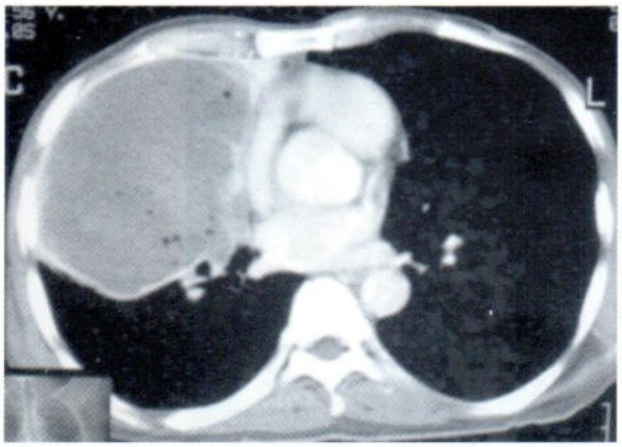

Fig.11A

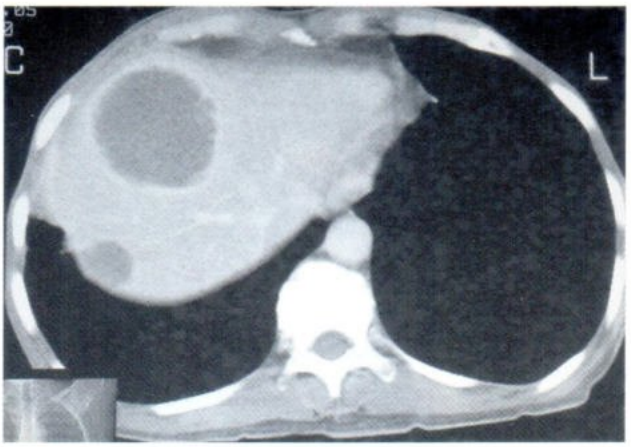

Fig.11B

Fig.11 A 53-year-old man who had 10 separated liver abscesses and a large lung abscess. He had combined amoebic and pyogenic liver abscesses.
Fig.11A, CT scan showed a large abscess in the right lung.
Fig.11B, CT scan post I.V. contrast showed two separated macroabscesses in the right lobe of liver.

DISCUSSION

Amoebic liver abscess

Entamoeba histolytica is endemic worldwide, with an estimated 10% of world's population being infected. Amoebic liver abscess is the most common extraintestinal complication of amebiasis, occurring in 3% to 9% of cases.[1] Hepatic infection occurs because colonic trophozoites ascend via the portal vein and invade the parenchyma.[2,3]

Base on clinical features alone, it may be difficult to distinguish an amoebic from pyogenic liver abscess. Somewhat surprisingly, patients with amoebic abscess are usually more acutely ill than patients with pyogenic abscess.[4,5] Serum antibodies to Entamoeba species are present in more than 90% of case.[3] However, serologic findings may be negative in acute disease (but positive at repeated testing performed within 7-10 days) and may be positive if the patient had amebiasis in the past.[4]

A combination of clinical, epidemiologic, and image findings usually establishes the diagnosis of an amoebic liver abscess, in conjunction with positive amoebic titers, may suggest the diagnosis.[5]

At contrast-enhanced CT, amoebic abscesses usually appear as rounded, well-defined lesions with attenuation values that indicative the presence of complex fluid (10-20 HU).[6] The attenuation value at the central cavity of the abscess in this series varies from 23 HU to 40 HU, which is higher than that was reported in the literature.

An enhancing wall 3-15 mm in thickness and a thin outer rim of lower attenuation around the abscess are common and somewhat characteristic for this lesion.[4] A thin outer rim of lower attenuation, defines the outer limit of the inflammatory wall or localized zone of edema, giving the lesion as a "double target sign".[6-8] However, a hypodense rim at the periphery of an enhancing lesion does not specific for liver abscess, it can be found in hepatic tumor such as metastasis.[9]

The appearance of the central abscess cavity is quite variable. There may be multiple septa or fluid-debris levels. Rarely, gas bubbles or areas of

hemorrhage are identified within the abscess cavity. Although the presence of gas within an amoebic liver abscess might result from superinfection with a gas-forming organism, this finding coupled with a history of expectoration, vomiting or evacuation per rectum of material resembling anchovy sauce is more likely indicative of a hepatobronchial or hepatoenteric fistula .[6]

Approximately three quarters of hepatic amoebic abscesses occur in, the right lobe, a phenomenon that may be explained by the preferential right -sided streaming via the portal vein of seeded blood from the superior mesenteric vein, which drains the right colon.[10]

Extrahepatic abnormalities are common and include pleural effusion, pericardial extension, perihepatic fluid collection, gastric or colonic involvement, and retroperitoneal extension.[4,6] The most common extrahepatic abnormality was right pleural effusion, representing either reactive serous fluid or amoebic empyema.[6]

In this series, all cases had a solitary amoebic abscess of round, ovoid, or lobulated hypoattenuating mass with an enhancing wall. A peripheral zone of edema around the abscess was noted in 80% of cases. The delayed dense enhancement of the intermediate and peripheral zones of the amoebic abscess has not been well described in the literature. This finding was found in all two cases of amoebic abscess that being performed 15 minute-delayed scan.

The CT differential diagnosis of amoebic liver abscess in the adult includes simple hepatic cyst, infected or hemorrhagic cyst, pyogenic liver abscess, echinococcal cyst, hematoma, biloma, cystic or necrotic metastasis, undifferentiated embryonal sarcoma, and biliary cystadenoma.[6]

Pyogenic liver abscess

Liver abscesses can be resulted from infection by five different routes: (a) biliary tree, due to ascending cholangitis from benign or malignant obstruction; (b) portal vein or superior meseneteric vein phlebitis related to appendicitis, diverticulitis, pancreatitis, or other gastrointestinal infectious source; (c) arterial septicemia as a result of endocarditis, pneumonitis, or osteomyelitis; (d) local extension, due to suppuration involving neighboring tissue such as perforated ulcer, pneumonia, or pyelonephritis; and (e) traumatic cause, due to blunt or penetrating injuries.[7-9] A solitary hepatic abscess is often cryptogenic and has no clear-cut predisposing cause.[5,11]

The clinical manifestations of pyogenic abscess are highly variable. Patients may present with high fever, rigors, and severe right-sided abdominal pain or may have clinical occult abscesses that manifest only as weight loss and vague abdominal pain.[4]

Pyogenic liver abscesses may be classified as either microabscess (<2 cm) or macroabscess (≥2 cm). Pyogenic microabscesses may appear as multiple widely scattered miliary lesions or as a cluster of microabscesses that appears to coalesce focally.[9,12] The major differential diagnosis of diffuse miliary pattern of hepatic lesions might have included bacterial microabscesses, fungal microabscesses, tuberculosis, metastasis, lymphoma, steatosis, sarcoidosis, biliary hamartoma, and fibropolycystic liver disease.[9,13,14]

At CT scan, the pyogenic hepatic macroabscessses appear as low attenuation, rounded masses on both noncontrast and contrast-enhanced scans.[13] At contrast-enhanced CT, large pyogenic abscesses are generally well defined and hypoattenuating; that may be unilocular with smooth margins or complex with internal septa and an irregular contour.[4] The attenuation ranges between 0 and 45 HU overlaps with that of other lesions such as cysts, bilomas, and neoplasms. However, most abscesses have an enhancing peripheral rim or capsule.[7] The "cluster sign" may also be seen, with small, less than 2-cm diameter lesions clustering together with apparent coalescence into a large abscess.[12] Gas bubbles or air-fluid level are specific signs but are present in less than 20% of

cases.[13] The presence of gas in the hypodense central area may also represent a cystic fistula of the biliary tract associated with gas or a tumor with secondary infection.[8] There is no case in this series that contains air bubble in abscess cavity. This because whenever air is identified by ultrasonography, liver abscess is highly suggestive and there is no need to do CT scan.

In this series, pyogenic hepatic abscess has variable CT appearance. The most common CT finding is cluster of microabscesses that appeared to aggregate or coalesce into a macroabscess cavity or a macroabscess that has adjacent microabscesses. However, single macroabscess, separated discreate multiple macroabscesses, and miliary microabscesses are also found.

CONCLUSION

Amoenic and pyogenic liver abscesses have variable CT appearances. Amoebic liver abscess is mostly in the right lobe and appears as a solitary hypoattenuating mass with wall enhancement and peripheral hypodense rim. Pyogenic liver abscesses mostly appear as a cluster of microabscesses or a macroabscess that has adjacent microabscesses.

Awareness of the spectrum of CT findings in liver abscess may aid in diagnosis and prompt institution of treatment without additional costly and invasive procedure.

REFERENCES

1. VanSonnenburg E, Mueller PR, SchiffmanHR, et al. Intrahepatic amoebic abscesses: indications for and results of percutaneous catheter drainage. Radiology 1985; 156: 631-635.
2. Samuelson J, Von Lichtenberg F. Infectious disease. In: Cotran RS, Kumar V, Robbins SL, eds. Pathologic basis of disease. 5th ed. Philadelphia, Pa: Saunders, 1994; 305-377.
3. Eckburg PB, Montoya JG. Hepatobiliary infection. IN: Wilson WR, Sande MA, eds. Diagnosis and treatment in infectious disease: Lange current series. New York, NY: McGraw-Hill, 2001; 269-286.
4. Mortele KJ, Segatto E, Ros PR. The infected liver: Radiologic-pathologic correlation. Radiographic 2004; 24(4): 937-955.
5. Ralls PW. Focal inflammatory disease of the liver. Radiologic clinics of North America 1998; 36(2): 377-389.
6. Radin DR, Ralls PW, Colletti PM, Halls JM. CT of amoebic liver abscess. AJR Am J Roentgenol 1988;150:1297-1301.
7. Hagga JR, Lanzieri CF, Sartoris DJ, Zerhouni EA. CT and MRI of the whole body, 3rd ed. St.Louis, Missouri: Mosby, 1994; 896-944.
8. Mathieu D, Vasile N, Fagniez PL, Segui S, Grably D, Larde D. Dynamic CT features of hepatic abscesses. Radiology 1985; 154:749-752.
9. Lee JKT, Sagel SS, Stanley RJ, Heiken JP. Computed body tomography with MRI correlation. 3rd ed. Philadelphia: Lippincott-Raven, 1998; 701-777.
10. Pitt HA. Liver abscess. In:Turcotte JG, ed. Shackelford's surgery of the alimentary tract, 3rd ed. Philadelphia: WB Saunders, 1991; 443-465.
11. Land MA, Moinuden M, Biano AL. Pyogenic abscess: changing epidemiology and prognosis. South Med J 1985;78: 1426-1430.
12. Jeffrey RB Jr, Tolentino CS, Chang FC, Fedrle MP. CT of pyogenic hepatic microabscesses: The cluster sign. AJR Am J Roentgenol 1988; 151; 487-489.
13. Halvorsen RA, Korobkin M, Foster WL, et al. The variable CT appearance of hepatic abscesses. AJR Am J Roentgenol 1984; 141: 941-946.
14. Moretele KJ, Ros PR. Cystic focal liver lesions in the adults : Differential CT and MR imaging features. Radiographic 2001; 21: 895-910.
15. Brancatelli G, Federle MP, Vilgrain V, Vullierme MP, Marin D, Lagalla R. Fibropolycystic liver disease: CT and MR imaging findings. Radiographic 2005; 25: 659-670.