

## Differentiation of Tuboovarian Abscess from Endometriosis: CT Indicators<sup>1</sup>

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**Purpose:** To assess and compare CT findings of surgically confirmed cases of tuboovarian abscesses (TOA) and endometriosis in order to identify indicators which may be helpful in making correct preoperative diagnoses.

**Materials and Methods:** Of the 35 consecutive patients with surgically confirmed TOA, CT images were available for 11 of those patients. As a comparative group, 36 patients with surgically confirmed endometriosis with CT images were selected. CT images of TOA were compared with those of endometriosis. A retrospective analysis of the CT images of both groups was performed without knowledge of the pathologic diagnosis. The analysis compared the thickness and enhancement pattern of the cyst wall, attenuation of the cyst content, size and shape of the cyst, and paraaortic lymphadenopathy.

**Results:** Mean thickness of the cyst wall was  $6.2 \pm 2.0$  mm in TOA and  $4.5 \pm 2.4$  mm in endometriosis. Multilayered appearance in both diseases was seen on enhanced CT in 91% (10/11) of TOA cases and in 25% (9/36) of endometriosis cases. Hounsfield units of the cyst contents were  $20.0 \pm 5.5$  HU and  $24.7 \pm 10.0$  HU for TOA and endometriosis, respectively. Mean diameter of the cysts was  $7.5 \pm 1.7$  cm in TOA and  $7.9 \pm 3.1$  in endometriosis. Shape of the cyst was multilocular in 82% (9/11) of TOA cases and in 75% (27/36) of endometriosis cases. Paraaortic lymphadenopathy was present in 73% (8/11) and 44% (16/36) for TOA and endometriosis, respectively.

**Conclusion:** TOA should be suspected on CT when a multilocular cystic ovarian mass is observed, especially if the lesion has a thick wall and has a multilayered appearance, and is accompanied by paraaortic lymphadenopathy.

**Index words :** Fallopian tubes, abscess  
Ovary disease  
Ovary, CT  
Pelvis, CT

Tuboovarian abscesses (TOA) are a frequent cause of acute pelvic pain in women during their reproductive

years. When a patient presents with pelvic pain and a pregnancy test is negative, possible differential diagnoses of such pain include pelvic inflammatory disease (PID) (including TOA), endometriosis, ovarian torsion, hemorrhage and/or rupture of an ovarian cyst, appendicitis and ovarian neoplasm (1).

However, if PID is not suspected, clinical and radiologic diagnosis of TOA may be difficult. In particular,

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when there is an absence of internal gas bubbles, TOA is radiologically indistinguishable from pelvic endometriosis (endometriotic cyst) (2, 3). Endometriosis has distinctive magnetic resonance imaging (MRI) findings, but upon admission the first type of imaging performed is usually sonography or computed tomography (CT). Therefore, a differential diagnosis between TOA and endometriosis is important in CT imaging.

The purpose of this study was to assess and compare CT findings of surgically confirmed cases of TOA and endometriosis in order to identify indicators which may be helpful in making correct preoperative diagnoses.

### Materials and Methods

We retrospectively assessed 36 cases of surgically confirmed TOA during a 3 year period. CT images were available for 11 of the cases. The patients ranged in age from 19 to 73 (mean, 40).

As a comparative group, we retrospectively assessed 251 cases of surgically confirmed endometriosis during a 3 year period. CT images were available for 36 of the cases. The patients ranged in age from 19 to 45 (mean, 34).

For CT imaging, a Somatom plus-4 helical CT scanner (Siemens Medical System, Erlangen, Germany) was used. Contrast enhanced scans were obtained for all patients. In all cases scanning of contrast enhanced CT was initiated 60 seconds after an intravenous injection of 120 mL of contrast material containing 300 mg I/mL

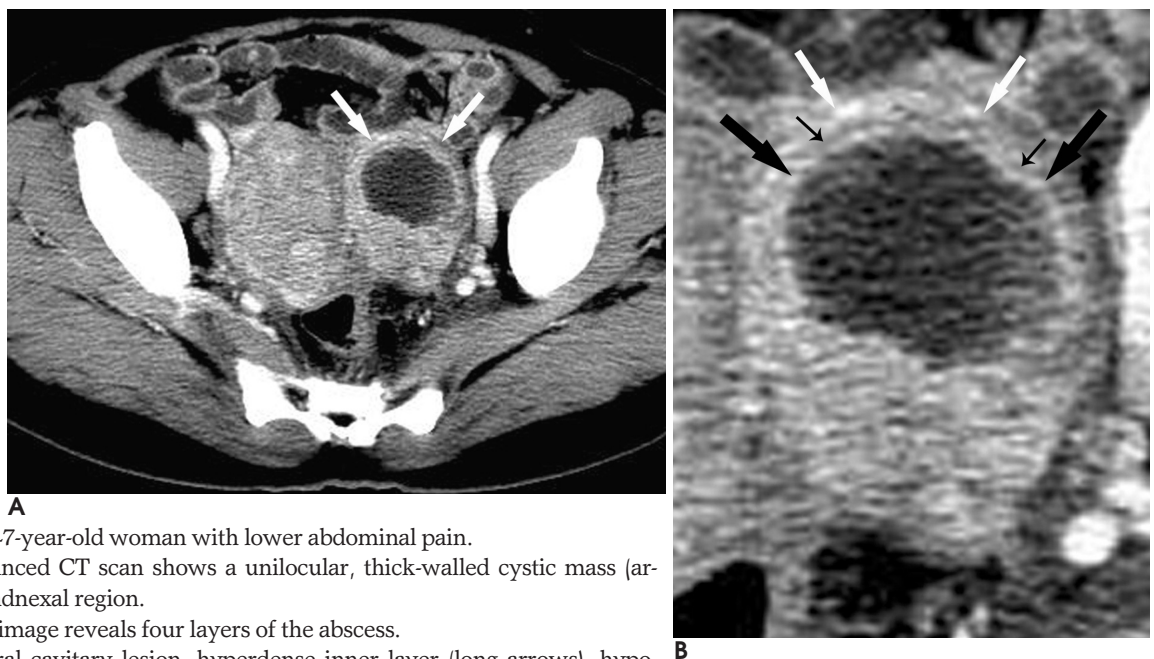
(Ultravist 370, Schering, Berlin, Germany) at a rate of 3mL/sec. The scanning parameters included 1:1 pitch, and 7 - 8 mm thickness.

Two radiologists reviewed the CT images retrospectively, and reached their conclusions by consensus. The radiologists focused on the thickness and enhancement pattern of the cyst wall, attenuation of the cyst content, size and shape of the cyst, and paraaortic lymphadenopathy. Evidence of paraaortic lymphadenopathy on CT scans was defined as three or more lymph nodes or nodes 1 cm or greater in diameter in the paraaortic location (4). If wall thickness was not uniform, the thickness of the cyst wall was measured at its thickest point.

Statistical analysis was performed to compare differences in CT findings. The T-test was used to assess differences in the mean values of wall thickness, attenuation of the cyst content, and size of the cyst. The differences between the two groups with regard to CT findings -specifically, enhancement pattern of the cyst wall, shape of the cyst, and paraaortic lymphadenopathy - were compared using Fisher's exact test. For all tests  $p < 0.05$  was considered to be statistically significant. All analyses were performed using SPSS program (SPSS version 10.0 software for Window; SPSS, Chicago, Ill).

### Results

In the 11 cases of TOA, the mean wall thickness was



**Fig. 1.** TOA in a 47-year-old woman with lower abdominal pain.

**A.** Contrast-enhanced CT scan shows a unilocular, thick-walled cystic mass (arrows) in the left adnexal region.

**B.** Magnification image reveals four layers of the abscess.

Hypodense central cavity lesion, hyperdense inner layer (long arrows), hypodense middle layer (short arrows) and hyperdense outer layer (white arrows)

$6.2 \pm 2.0$  mm (1.8 - 10 mm). The cyst wall had a multilayered appearance in 91% (10/11) of the cases (Fig. 1). Mean Hounsfield unit (HU) of the cyst contents was  $20.0 \pm 5.5$  HU (range, 9 - 27 HU). Evaluation of HU was not possible in one case because there was no available DICOM file. The mean diameter of the cyst was 7.5 cm  $\pm$  1.7 cm (range 4.8 - 9.8 cm). The shape of cyst was multilocular in 82% (9/11) of the cases. Paraortic lymphadenopathy was present in 73% (8/11) of the cases (Fig. 2). Only one case displayed internal gas bubbles in the cavity.

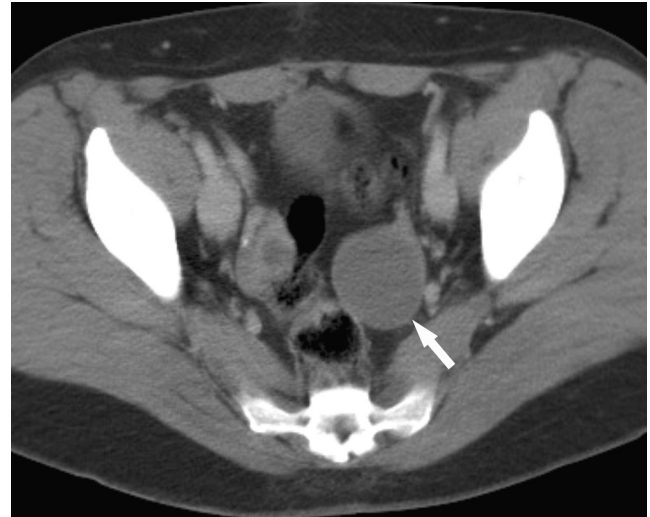
In the 36 cases of endometriosis, the mean wall thickness was 4.5 mm  $\pm$  2.4 mm (range, 1.0 - 10 mm) (Fig. 3). The cyst wall had a multilayered appearance in 25% (9/36) of the cases. Mean HU of the cyst contents was  $24.7 \pm 10.0$  HU (range, 5 - 43 HU). Evaluation of HU was not possible in 5 cases because there was no available DICOM file. The mean diameter of the cyst was 7.95 cm  $\pm$  3.1 cm (range 4.2 - 15.3 cm). The shape of cyst was multilocular in 75% (27/36) of the cases. Paraortic lymphadenopathy was present in 44% (16/36) of the cases.

Statistical analysis of the data revealed that the cyst wall of TOA was significantly thicker than that of endometriotic cysts ( $p=0.037$ ), and the diameter and HU of TOAs was equal to that of endometriotic cysts ( $p>0.05$ ). Multilayered appearance of the cyst wall had a sensitivity of 91% (10/11) and a specificity of 75%

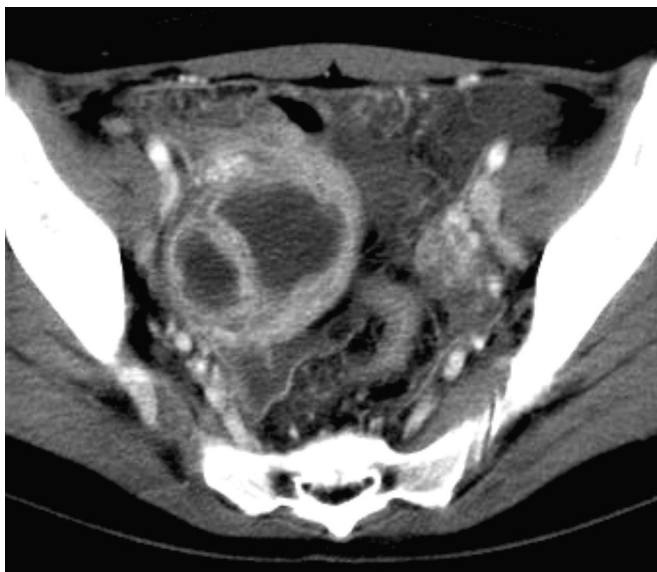
(27/36) in the differentiation of TOA from endometriotic cysts at CT. Paraortic lymphadenopathy had a sensitivity of 73% (8/11) and a specificity of 56% (20/36). There was a statistically significant difference in multilayered appearance, but the differences in paraortic lymphadenopathy were not statistically significant.

## Discussion

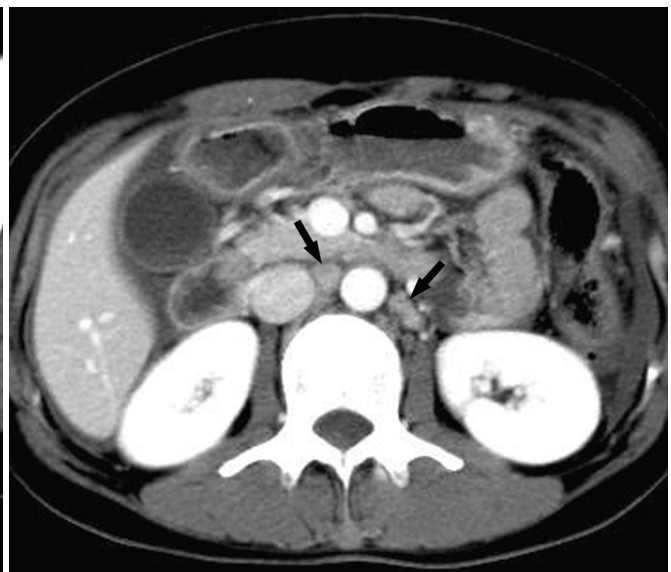
TOA is a well known complication of PID. It has been



**Fig. 3.** Endometriotic cyst in a 39-year-old woman with lower abdominal pain. Contrast-enhanced CT scan shows unilocular, thin-walled cystic mass (arrow) in the left adnexal region.



**A**  
**Fig. 2.** TOA in a 32-year-old woman with fever and abdominal pain.  
**A.** Contrast-enhanced CT scan shows multilocular, thick-walled cystic mass with multilayered appearance in the right adnexal region.  
**B.** Contrast-enhanced CT scan reveals multiple lymphadenopathy (arrows) in the paraaortic space.



reported to occur in as many as one third of patients hospitalized for acute salpingitis (5).

PID results from an ascending vaginal or cervical infection that progresses to endometritis and then followed by salpingitis. Inadequate treatment of PID may lead to infection of the ovary, with a resultant unilateral or bilateral TOA. Cultures usually reveal a polymicrobial infection with a preponderance of anaerobes (5).

Frequently, adhesions develop within the fallopian tubes, causing tubal obstruction and pyosalpinx. Although TOA generally remains localized to the ovary and fallopian tubes, rupture can result in a life-threatening generalized peritonitis (6).

Sonography is the imaging technique most frequently used to confirm a suspected diagnosis of TOA. Typically, sonograms reveal an adnexal or retrouterine mass that may be cystic, solid or complex (2).

CT is commonly used as an adjunct to sonography in atypical cases of TOA. Several CT findings suggest the diagnosis of TOA in proper clinical settings (7). Although nonspecific, the most frequent finding is a thick-walled, fluid density mass in an adnexal location (2).

Wilbur et al. described TOA on CT findings to be pelvic masses, anterior displacement of the mesosalpinx, thickening of uterosacral ligaments, rectosigmoid involvement, ureteral involvement and paraaortic lymphadenopathy. However, CT findings of endometriosis are similar and can mimic those of TOA. In the absence of internal gas bubbles, TOA is radiologically indistinguishable from pelvic endometriosis (2). However, this finding is rare and was found in only one case in this study.

Although CT features of TOA have been reported, there have been no studies investigating its differentiation from endometriosis. In this study, when CT images revealed a thick-walled, multilocular cystic mass in adnexa it was suggestive of a TOA. The mean diameter of the cyst was  $7.5 \pm 1.7$  cm in TOA and  $7.9 \pm 3.1$  cm in endometriotic cyst, and mean HU of the cyst contents was 20.0 HU and 24.7 HU, respectively. There was no statistical difference in diameter and HU of endometriosis and TOA ( $p > 0.05$ ). However, the mean thickness of the cyst wall was  $6.2 \pm 2.0$  mm and  $4.5 \pm 2.4$  mm in TOA and endometriosis, respectively, which was a statistically significant difference ( $p = 0.037$ ).

Other findings such as multilayered appearance of the cyst wall and paraaortic lymphadenopathy may help in the diagnosis of TOA. Multilayered appearance had a

sensitivity of 91%, a specificity of 75%, and p-value of less than 0.05. Although p-value was greater than 0.05, paraaortic lymphadenopathy had a sensitivity of 73% and a specificity of 56%.

The multilayered appearance of the cyst wall may correspond to inflammatory process around the abscess. This finding is similar to the "double target sign" for liver abscesses. Liver abscesses include four layer; hypodense central cavity lesion (central necrosis), hyperdense granulation layer, hypodense abscess wall, and hyperdense compensatory hypervascular area (8 - 10). These findings can be used to explain the multilayered appearance of TOA.

There were some limitations in this study. First, there was no pathological correlation of TOA cases. Most pathologic gross specimens were spoiled during operation. Second, there was a small number of cases.

Although this study assessed only 11 cases, the findings suggest that TOA should be suspected on CT when a multilocular cystic ovarian mass is observed, especially if the lesion has a thick wall and has a multilayered appearance, and is accompanied by paraaortic lymphadenopathy.

## References

1. Choi HJ, Kim SH, Kim SH, Kim HC, Park CM, Lee HJ, et al. Ruptured corpus luteal cyst: CT findings. *Korean J Radiol* 2003;4: 42-45
2. Wilbur AC, Aizenstein RI, Napp TE. CT findings in tuboovarian abscess. *AJR Am J Reontgenol* 1992;158:575-579
3. Mitchell DG, Mintz MC, Spritzer CE, Gussman D, Arger PH, Coleman BG, et al. Adnexal masses; MR imaging observations at 1.5T, with US and CT correlation. *Radiology* 1987;162:319-324
4. Outwater E, Kaplan MM, Bankoff MS. Lymphadenopathy in primary biliary cirrhosis: CT Observations. *Radiology* 1989;171:731-733
5. Lauder DV, Sweet RL. Current trends in the diagnosis and treatment of tuboovarian abscess. *Am J Obstet Gynecol* 1985;151:1098-1101
6. Berek JS, Adashi EY, Hillard PA. *Novak's gynecology*, 12th edition. Baltimore: Williams & Wilkins: 1996:405
7. Wilbur A. Computed tomography of tuboovarian abscesses. *J Comput Assist Tomogr* 1990;14:625-628
8. Mathieu D, Vasile N, Fagniez PL, Segui S, Grably D, Larde D. Dynamic CT features of hepatic abscess. *Radiology* 1985;154:749-752
9. Halvorsen RA, Korobkin M, Foster WL, Silverman PM, Thompson WM. The variable CT appearance of hepatic abscesses. *AJR Am J Reontgenol* 1984;141:941-946
10. Cho HC, Chang JC, Koh JK. Vascular nature of liver abscess examined with computed tomography: separated identification of the four layers and difference according to the various factors of abscess. *J Korean Radiol Soc* 1994;31:321-326



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 $6.2 \pm 2.0 \text{ mm}$  $4.5 \pm 2.4$  mm

CT	(Multilayered appearance)		91% (10/11)	25% (9/36)	.
Hounsfield unit	20.0 ± 5.5 HU	24.7 ± 10.0 HU	,	7.5 ± 1.7 cm	7.9 ± 3.1 cm
.	82% (9/11)	75% (27/36)	,		73% (8/11)
44% (16/36)	.				
: CT	,	(multilayered appearance)			가