

Radiographic Findings of Gastrointestinal Anisakiasis: Clinical and Pathologic Correlation¹

Tae Woong Chung, M.D., Heoung Keun Kang, M.D., Yong Yeon Jeong, M.D.,
Gwang Woo Jeong, Ph.D., Jeong Jin Seo, M.D., Yun Hyeon Kim, M.D., Jae Kyu Kim, M.D.,
Jin Gyoon Park, M.D., Seung Jin Park, Ph.D.², Jong Hoon Yoon, M.D.³

Purpose: To evaluate the radiographic findings of gastrointestinal anisakiasis with clinical and pathologic correlation.

Materials and Methods: In ten patients, findings were retrospectively analysed. There were two cases of the gastric variety of gastrointestinal anisakiasis and eight of the intestinal, and they were diagnosed during gastroscopy, by resection during surgery, and on the basis of typical clinical findings. All ten patients underwent both plain radiography and CT scanning of the abdomen. US was performed in five patients and an upper gastrointestinal series in one. Clinical data were evaluated with regard to a history of raw fish ingestion, time from ingestion of raw fish to onset of symptoms, location of abdominal pain, and laboratory data. Radiologic findings were analysed in terms of wall thickening and appearance, mesenteric infiltration, bowel dilatation proximal to lesion, and ascites.

Results: All patients had a history of recent ingestion of raw fish and complained of severe abdominal pain that occurred approximately 7 - 48 hours later. Pain occurred in the lower abdomen in five patients, the epigastrium in four, and the right lower abdomen in two. Laboratory test disclosed the leukocytosis in eight patients and eosinophilia in three. In all cases of intestinal anisakiasis, ileus was demonstrated on plain radiographs of the abdomen, while the upper gastrointestinal series showed mucosal thickening and multiple filling defects. US findings were bowel thickening and dilation, and on CT images, wall thickening revealed a target sign. Mesenteric infiltration and ascites were seen in seven patients. In four who underwent surgery, a cross-section through the lesion revealed submucosal eosinophilic granuloma with Anisakis larva.

Conclusion: Although the CT findings are non-specific, taken in conjunction with characteristic clinical findings, they may be helpful in the diagnosis of gastrointestinal anisakiasis.

Index words : Abdomen, CT
Gastrointestinal tract, inflammation
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¹Department of Diagnostic Radiology, Chonnam University Medical School

²Department of Biomedical Engineering, Chonnam University Hospital

³Department of Radiology, College of Medicine, Seonam University

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Address reprint requests to : Tae Woong Chung, M.D., Department of Diagnostic Radiology, Chonnam University Medical School, 8, Hakdong, Dongku, Kwangju 501-757, Korea.

Tel. 82-62-220-5882 Fax. 82-62-226-4380 E-mail: ctw744@cnuh.chonnam.ac.kr

Gastrointestinal anisakiasis is a disease caused by the accidental ingestion of larval nematodes in raw fish (1), and since this is a popular delicacy in Korea, the disease is not uncommon here (2). Many cases of gastrointestinal anisakiasis have been reported, though because the gastric form is easily diagnosed and patients with the intestinal variety undergo emergency surgery for acute abdominal pain, there have been few reports of the associated radiological findings. We reviewed cases in which CT had been performed and the findings reported.

Materials and Methods

Between April 1993 and September 1998, ten patients with gastrointestinal anisakiasis underwent CT imaging studies. There were eight males and two females, and they were aged 36 - 53 (mean, 42.5). Two had the gastric form of the disease and eight the intestinal form. All ten underwent both plain radiography and CT scanning of the abdomen. US was performed in five patients and an upper gastrointestinal series in one. In all patients with gastric form, the condition was diagnosed after the detection and removal of the larvae during gastroscopy.

In four with intestinal form by resection during surgery, and in four on the basis of typical clinical findings. Histologic diagnosis depended on an eosinophilic granuloma and of a larva, while clinical diagnosis was based on the following criteria: a history of raw fish ingestion, abdominal pain, and elevated levels of specific antibodies to Anisakis larvae. All patients had a recent history of raw fish ingestion, complaining of severe abdominal pain that developed approximately 7 - 48 (mean, 18) hours later. Pain occurred in the lower abdomen in five patients, the epigastrium in four, and the right lower abdomen in two. Laboratory tests revealed

the presence of leukocytosis in eight patients (seven with intestinal anisakiasis, one with the gastric variety), and eosinophilia in three (two with intestinal anisakiasis, and one with the gastric form) (Table 1). A cross-section through the lesion revealed submucosal eosinophilic granuloma in four patients who underwent surgery, with Anisakis larvae in the necrotic center, and edema (Figs. 1C, D). In the four patients who underwent symptomatic treatment without surgery, clinical symptoms had almost disappeared 2 - 8 days after onset.

The CT findings included wall thickening, bowel dilatation proximal to the lesion, mesenteric infiltration, and ascites.

Results

In all eight cases of intestinal anisakiasis, plain radiographs of the abdomen revealed ileus in the form of dilated bowel loops and air-fluid levels (Figs. 1A, B). The upper gastrointestinal series showed mucosal thickening and multiple filling defects, about 3mm to 6mm in diameters, which were mucosal edema (Fig. 2A). US depicted bowel wall thickening, fluid-filled bowel dilatation, and ascites (Fig. 2B).

The CT findings are summarized in Table 2: wall thickening (4 - 8 mm) that revealed three concentric rings of high, low, and high density (target sign) was ob-

Table 2. CT Findings in 10 Patients with Gastrointestinal Anisakiasis

CT Findings	No. of Patients
Wall thickening with three rings	10
Proximal bowel dilatation	8
Mesenteric or omental fat infiltrations	7
Ascites	7

Table 1. Clinical Summary of 10 Patients with Gastrointestinal Anisakiasis

Case No.	Age(y)/Sex	Lesion Site	Location of Abdominal Pain	Time Interval(h)*	Lab. Data WBC(cell/mm ³)/Eosinophil(%)	Diagnosis
1	46/F	Stomach	Epigastrium	7	10,100/6/4	Gastroscopy
2	48/M	Stomach	Epigastrium	9	8,800/2.3	Gastroscopy
3	37/M	Small intestine	Lower abdomen	14	18,900/4.0	Surgery
4	53/M	Small intestine	Right lower abdomen	15	13,500/1.2	Surgery
5	38/M	Small intestine	Lower abdomen	10	11,100/3.4	Clinical Dx. +
6	42/F	Small intestine	Epigastrium	48	5,300/2.9	Clinical Dx. +
7	36/M	Small intestine	Right lower abdomen	13	8,200/13.5	Clinical Dx. +
8	42/M	Small intestine	Epigastrium	36	14,100/2.1	Surgery
9	46/M	Small intestine	Lower abdomen	17	17,100/1.5	Clinical Dx. +
10	37/M	Small intestine	Lower abdomen	10	12,000/3.0	Surgery

*time from ingestion of raw fish to onset of symptoms

+based on symptoms, imaging findings and elevation of the level of specific antibodies to the Anisakis larvae

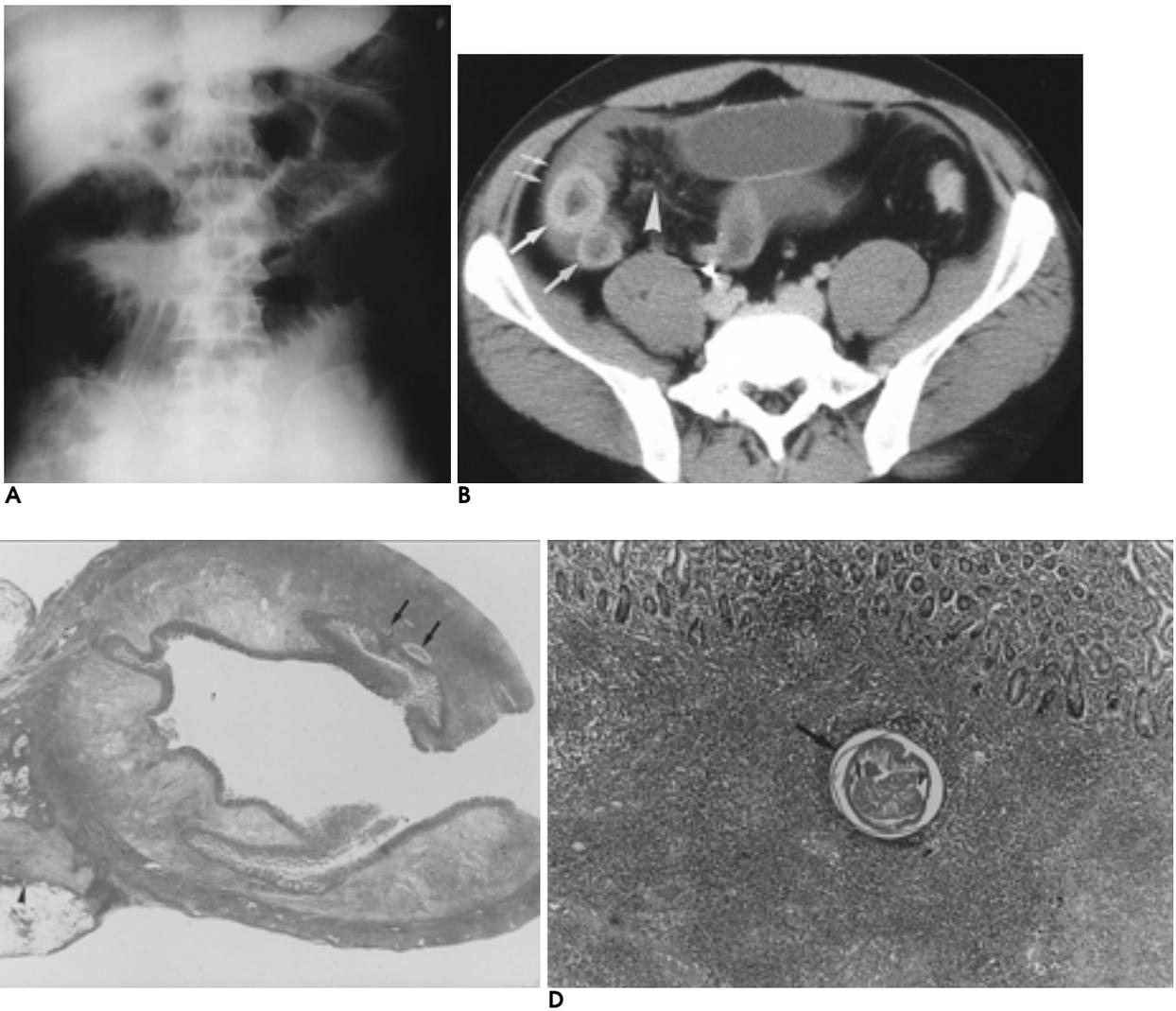


Fig. 1. Case 8.

A. Plain radiograph of the abdomen shows dilated bowel loops.

B. CT scan of the lower abdomen shows a thickened distal ileum with three rings, characterized by a soft tissue density inner ring, low-density central ring, and soft tissue density outer ring (large arrows), and surrounding ascites (small arrow). Increased attenuation and linear strands are evident in the adjacent mesenteric fat (small arrowhead). There are fluid-filled, dilated bowels proximal to involved intestine (large arrowheads).

C. Photomicrographs (original magnification, X5; H-E stain) of a cut surface of the resected ileum shows two *Anisakis* larvae (arrows) in submucosa, which reveals edematous and inflammatory changes, and extensive inflammatory and hemorrhagic reaction in mesenteric fat (arrowheads).

D. Low-power photomicrograph (original magnification, X40; H-E stain) shows a submucosal parasitic granuloma with *Anisakis* larva (arrow) in necrotic center. Surrounding inflammatory reaction contains eosinophils and lymphocytes.

served in all patients, and in all eight intestinal cases, proximal bowel dilatation was seen. Mesenteric or omental infiltrations was present in one of two gastric cases and six of eight intestinal. Varying amounts of ascites around abnormal bowel loops were seen in seven patients (one gastric case and six intestinal) (Fig. 1B, 2C).

Discussion

The life cycles of an *Anisakis* has not been completely described, but ecological surveys and laboratory experiments suggest that it involves three hosts. Eggs from adult *Anisakis* species exit the body in the feces of marine mammals. A larva hatches, and is eaten by microcrustaceans such as krill, and by feeding on infected

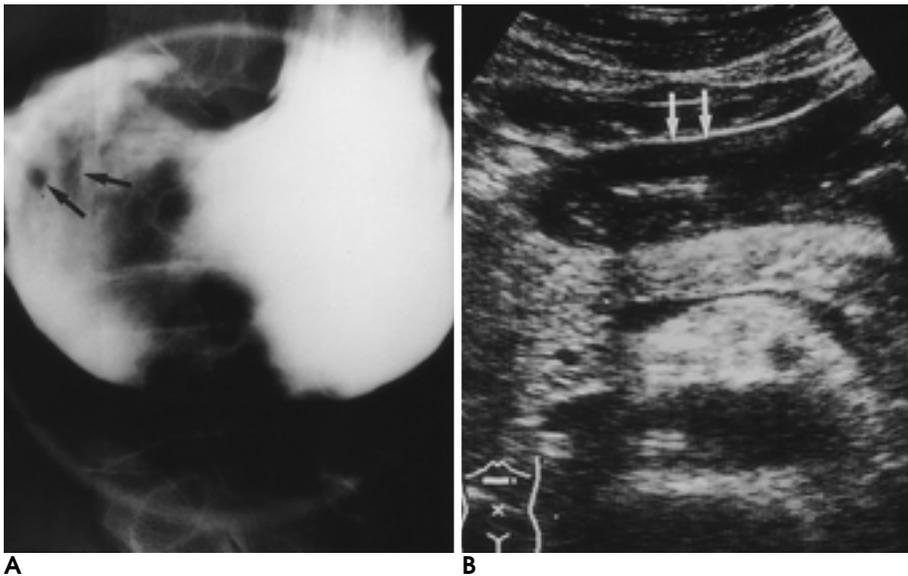
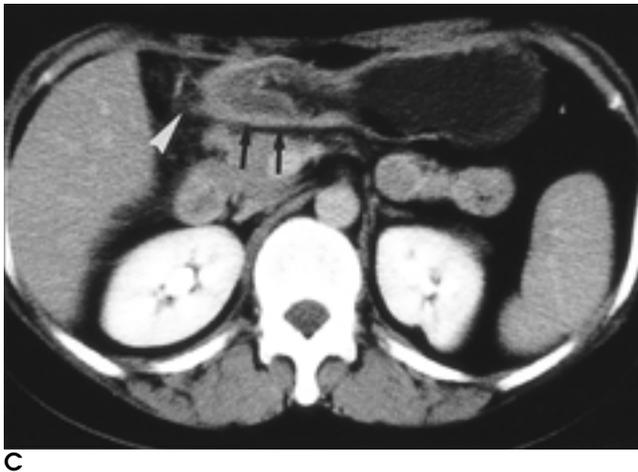


Fig. 2. Case 2.

A. The upper gastrointestinal series shows multiple nodular and linear filling defects (arrows) in gastric antrum.

B. US shows gastric wall thickening (arrows).

C. CT of the stomach shows a gastric wall thickening with submucosal edema (arrows) and omental infiltrations (arrowhead).



krill, squid and fish in turn become infected. Humans are accidental hosts and become infected by ingesting raw or improperly cooked seafood dishes. The life cycle is completed when marine mammals eat squid and fish infected with *Anisakis* larvae (3).

Anisakiasis of the gastrointestinal tract has been reported to affect the stomach in 75% of cases and the intestine in 25% (4). The site of penetration by larvae determines which of two clinical forms of gastrointestinal anisakiasis will occur. The first type, acute gastric anisakiasis, is manifested as cramping abdominal pain 4 - 6 hours after the ingestion of raw or poorly cooked fresh fish, and is frequently diagnosed gastroscopically. The symptoms are secondary to acute ulceration of the gastric mucosa caused by the worm as it attempts to penetrate the stomach wall (6). Intestinal anisakiasis, on the other hand, usually occurs within seven days of ingestion with severe symptoms such as diffuse abdominal tenderness or

colicky abdominal pain and sometimes even intestinal obstruction. Though the worm is usually found in the submucosa, it may penetrate the intestinal wall. The syndrome is often incorrectly diagnosed as acute appendicitis or regional ileitis prior to surgery (7).

Nakata et al. (8) reported the radiographic findings of acute gastric anisakiasis: coarse, broad gastric folds due to mucosal edema and threadlike filling defects about 3 cm in length, showing an *Anisakis* larva itself; all cases were radiologically positive. Anisakiasis is diagnosed by gastroscopy, which allows removal of the worms and cures the patient.

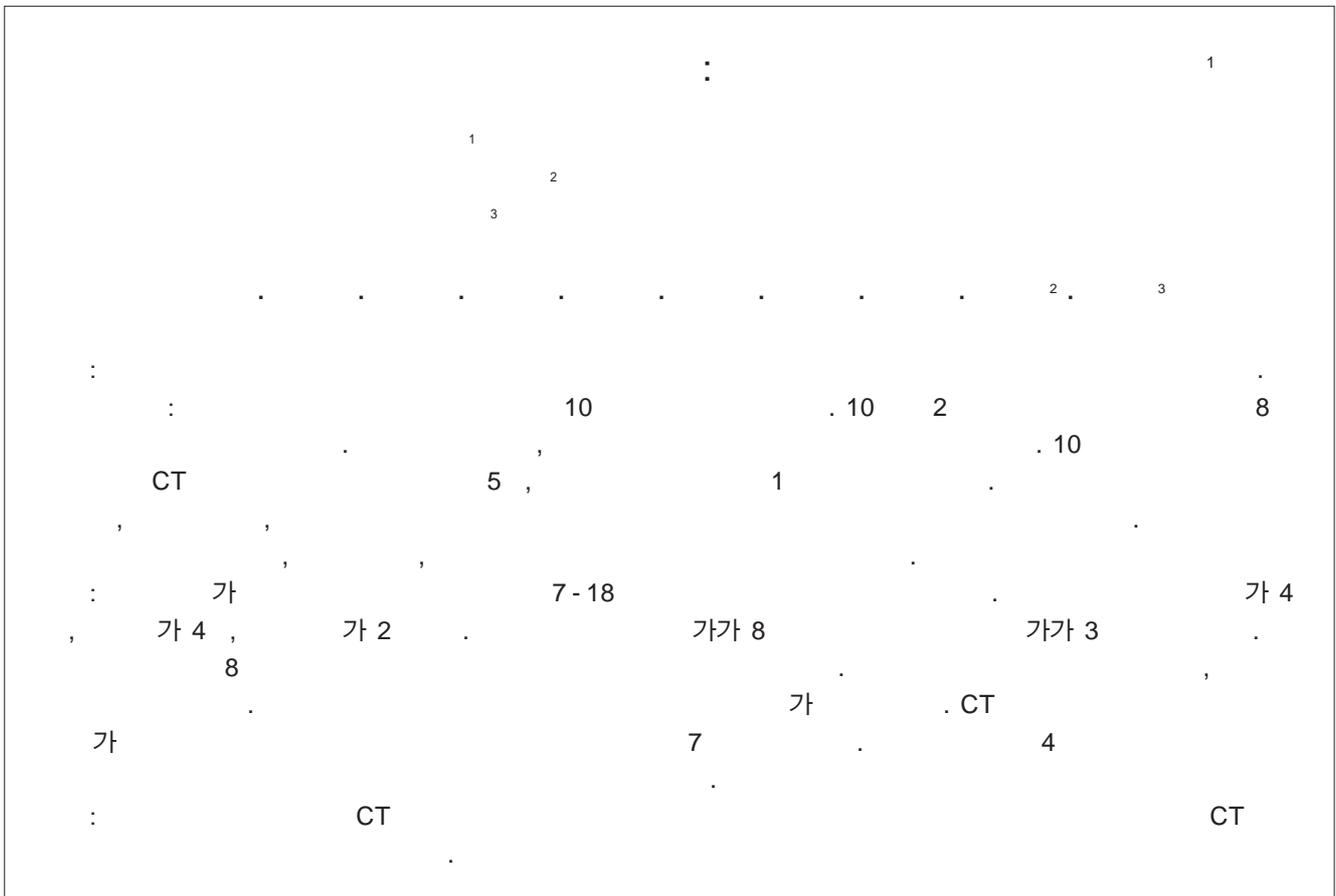
The radiographic features of intestinal anisakiasis are irregular wall thickening of the jejunum, ileum, or colon, with mucosal edema and luminal narrowing, and dilatation of the proximal intestine. These findings accurately reflect the changes revealed by pathologic examination: marked edema, eosinophilic infiltration, and granuloma formation. In rare cases, careful barium studies demonstrate thread-like radiolucencies, which is the most common diagnostic sign of anisakiasis. Thickening of the bowel wall of the small intestine may also be seen in cases of eosinophilic enteritis, Crohn's disease, ischemia, tuberculosis, and neoplasm, however, and correct diagnosis may thus be difficult, requiring an appropriate clinical history and immunoserological examination (7, 9 - 11).

To the best of our knowledge, the CT findings of gastrointestinal anisakiasis have not previously been reported; our CT findings of the disease were similar to the US findings previously reported by Shirahama et al. (12). There included wall thickening, fluid-filled lumen proximal to the involved section of intestine, with ascitic fluid

around it, and decreased peristalsis, as revealed by real-time US. These US features, however, are also nonspecific. In our study, CT findings of gastrointestinal anisakiasis revealed modest circumferential and symmetric wall thickening associated with inflammatory change in the adjacent mesentery, varying amounts of peritoneal fluid collection around the involved intestine, and ileus. The involved loops have a target appearance characterized by a soft tissue density inner ring, low-density central ring, and soft tissue density outer ring. These density differences are due to mucosal hyperemia, degree of contrast, submucosal edema, inflammation, and fat deposition. Like the US features, these CT findings of anisakiasis also appear to be somewhat nonspecific. They may occur in ischemic, infectious, or radiation enteritis, eosinophilic gastroenteritis, and Crohn's disease. We believe, however, that CT examination is a more useful alternative diagnostic method which in patients with ileus more easily detects a thickened bowel loop than does US. In conclusion, although the CT findings are non-specific, taken in conjunction with characteristic clinical findings, they may help diagnose gastrointestinal anisakiasis.

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 : 2000 5 31
 E - mail : office@radiology.or.kr
 : 121 - 8 () 137 - 130
 : (82 - 2) 578 - 8003, : (82 - 2) 529 - 7113
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