

CT Findings of Small Bowel Anisakiasis:

Analysis of Four Cases¹

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Purpose: We wanted to describe the CT findings of small bowel anisakiasis with the pathologic correlation.

Materials and Methods: Four patients with surgically and pathologically proven small bowel anisakiasis were included in this retrospective study. They were three men and one woman and their ages ranged from 28 to 43 years (mean age: 38 years). We evaluated their clinical, CT and histological findings.

Results: All the patients had a history of ingesting raw fish within 24 hours from the time of symptom onset. They complained of abdominal pain ($n=4$), nausea ($n=4$), vomiting ($n=2$) and diarrhea ($n=1$). Physical examination revealed tenderness ($n=4$), rebound tenderness ($n=4$) and increased bowel sounds ($n=3$). Leukocytosis was noted in all the patients on the laboratory examination. None of the patients showed eosinophilia. The CT findings were segmental small bowel wall thickening with preserved layering ($n=4$), focal segmental luminal narrowing with proximal dilatation ($n=4$), peritoneal thickening ($n=3$), mesenteric or omental infiltration ($n=4$) and varying degrees of ascites ($n=4$). On the histopathologic examination, they revealed an infiltration of eosinophils ($n=4$) in all layers of the bowel wall with severe edema. The larvae were found on surgico-pathologic examination in all the cases.

Conclusion: The CT findings may be helpful to make the specific diagnosis of small bowel anisakiasis in a patient with the clinical findings of an acute abdomen and a history of eating raw fish.

Index words : Anisakiasis

Tomography, X-Ray Computed

Intestinal Diseases, Parasitic infection

Anisakiasis is a parasitic disease of the human body and it is caused by infestation with anisakis larvae. These larvae exist in raw or undercooked fish such as

mackerel, cod, pollack, herring, whiting, bonito and squid (1). Although the anisakis larvae can intrude into any part of the human body, the majority of cases are the gastric and intestinal forms (2). Especially, intestinal anisakiasis is the rarer form (3).

The known radiological findings of intestinal anisakiasis were mainly based on gastrointestinal contrast studies or ultrasonography (1, 4-6). To the best of our knowledge, the CT findings of intestinal anisakiasis are not

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well known. There have only been several case reports (5, 7–11) and one original research study on this (12). We experienced four cases of surgically proven intestinal anisakiasis. We analyzed their CT findings and clinical features with the pathologic correlation.

Material and Methods

From November 2004 to February 2008, we experienced four cases of intestinal anisakiasis. Our institutional review board approved this retrospective study and informed consent was waived.

These cases were proven surgically and pathologically via laparotomy. The patients were three men and one woman; their age range was 28 to 43 years old (mean age: 38 years). All of them were evaluated by abdominal CT. Through a review of the medical records, we evaluated their clinical manifestations and the CT findings, and this was all correlated with the histological findings.

The CT images were obtained using a 16-MDCT scanner (Somatom Sensation-16; Simens, Erlangen, Germany). Scanning was performed from the top of the liver to the symphysis pubis with 120 kVp, 140 mA, 16 × 1.5-mm collimation, a rotation speed of 0.5 seconds and a pitch of 0.75. From the raw data, the transverse section datasets were reconstructed with 5-mm thickness and the coronal sections were 3-mm thick. Intravenous nonionic contrast material (2 mL/kg; Ultravist 370; Schering, Berlin, Germany) was administered at a rate of 3 mL/s. Bolus-tracking software was used to trigger scanning 10 seconds after aortic enhancement reached a threshold of 150-HUs. In all patients, the three phased CT images were obtained, including the pre-, arterial- and portal phases.

The preoperative laboratory parameters that were examined were the complete blood cell count, including the eosinophil count, several indices through urine

analysis and other biochemical markers. We also inquired about each patient's clinical information such as the kinds of food they had eaten within the 3 previous days, the medical history, the operation history and the family history through a review of the medical records. All the patients underwent segmental resection of the small bowel.

Results

Clinical Features

All the patients had a history of ingesting raw fish within 24 hours before their symptoms. They complained of various gastrointestinal symptoms, including acute abdominal pain ($n=4$), nausea ($n=4$), vomiting ($n=2$) and diarrhea ($n=1$). On physical examination, they showed tenderness ($n=4$), rebound tenderness ($n=4$) and increased bowel sounds ($n=3$). That is, all the cases clinically showed the features of an acute surgical abdomen. Three of them showed leukocytosis ($n=3$). Eosinophilia was not found in any patients and the other laboratory indices were within the normal range (Table 1).

CT Findings

The affected segments of the small bowel were the jejunum in two patients and the ileum in two. All the patients mostly showed common CT features; segmental small bowel wall thickening (range: 7–17 cm in length [mean: 13 cm]) (Table 2), preserved layering of the intestinal wall in the affected segments with mucosal enhancement, and irregular and segmental luminal narrowing in the involved segments with proximal dilatation. In addition, there was peritoneal thickening ($n=3$), mesenteric infiltration ($n=4$) and various degree of ascites ($n=4$) (Table 2) (Fig. 1).

Table 1. Clinical Features of the Small Bowel Anisakiasis Patients

Case Number	Gender/ Age	Raw Fish Ingestion	Symptoms	Signs	Laboratory Findings	
					White Blood Cell Count (/mm ³)	Eosinophil Count
1	M/28	< 12hr	Cramping abdominal pain, Nausea, Vomiting	Td (+)/RTd (+)	15000	1.6%
2	M/43	< 24hr	Colicky abdominal pain, Nausea, Vomiting	Td (+)/RTd (+), increased bowel sounds	13700	1.0%
3	F/40	< 24hr	Intermittent abdominal pain, Diarrhea, Nausea	Td (+)/RTd (+), Increased bowel sounds	9000	4.0%
4	M/40	< 12hr	Colicky abdominal pain, Nausea	Td (+)/RTd (+), Increased bowel sounds	14800	1.9%

Note.— Td = tenderness, RTd = rebound tenderness

Table 2. CT Findings of the Small Bowel Anisakiasis Patients

Case Number	Involved Site and Length	Segmental Luminal Narrowing	Pattern of Wall Thickening	Ascites
1	Jejunum, 15 cm	+	Target appearance, Circumferentially preserved layering, Mucosal enhancement Mesenteric infiltration	+
2	Jejunum, 13 cm	+	Target appearance, Circumferentially preserved layering, Mucosal enhancement Peritoneal thickening, Mesenteric infiltration	+
3	Ileum, 7 cm	+	Target appearance, Circumferentially preserved layering, Mucosal enhancement Peritoneal thickening, Mesenteric infiltration	+
4	Ileum, 17 cm	+	Target appearance, Circumferentially preserved layering, Mucosal enhancement Peritoneal thickening, Mesenteric infiltration	+

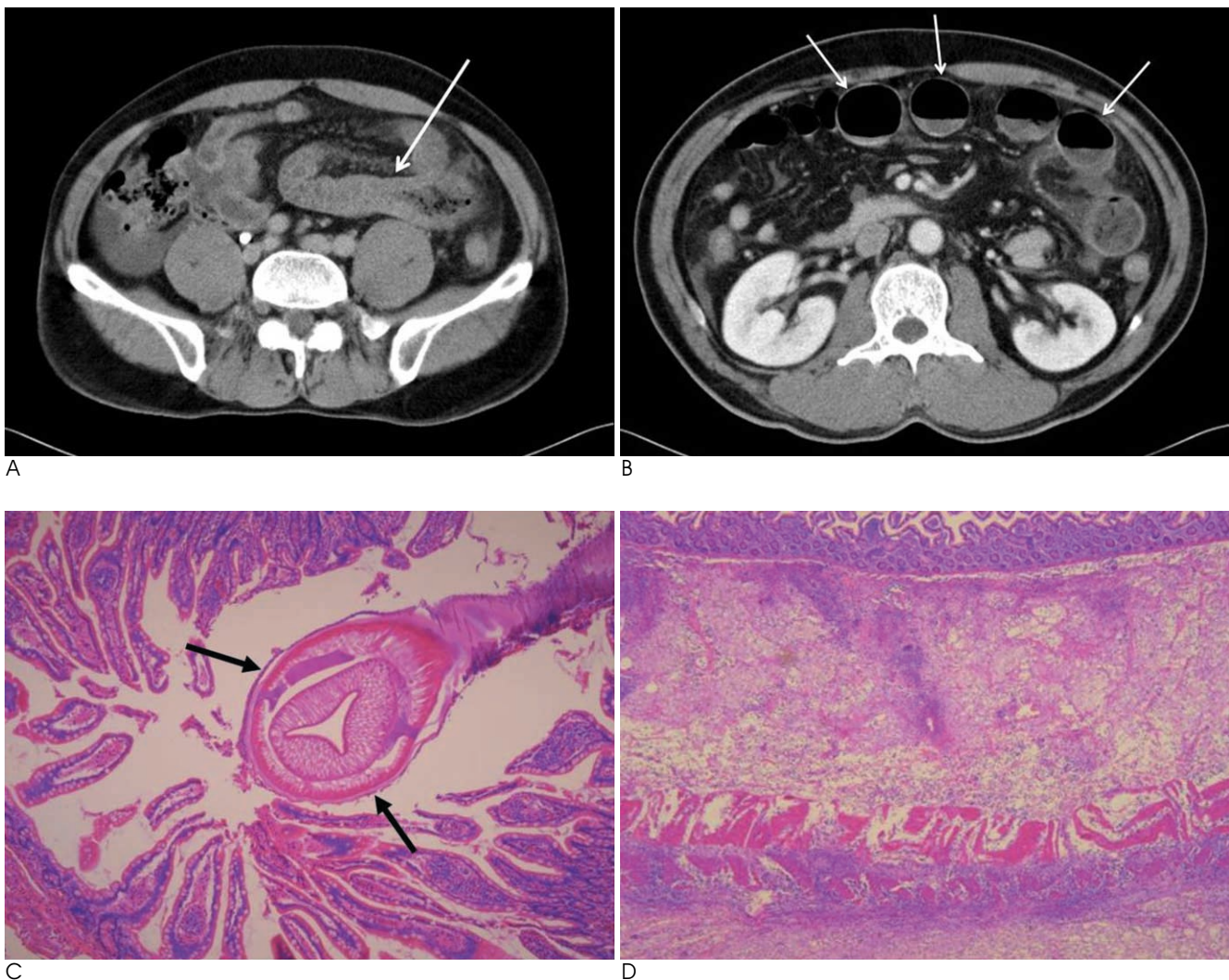


Fig. 1. A 43-year-old male patient with small bowel anisakiasis (Case 2). The CT findings (A and B): The axial scan of abdominal CT at the level of the iliac crest (A) shows circumferential wall thickening or edema of a long segment of the jejunum with peritoneal thickening and mesenteric infiltration. Proximal luminal dilatation from the transition zone is also noted (arrow). There is ascites at the right gutter. The axial scan at the level of the kidney (B) shows dilated proximal bowel loops that mimic obstructive ileus (arrows). The pathologic features (C and D): Photomicroscopy (C) show a helminthic larva (arrows) penetrating the bowel mucosa (H & E, $\times 40$). There is a dense infiltration of eosinophils with other inflammatory cells in all the layers of the small bowel (H & E, $\times 20$) (D).

Pathologic Features

Four patients underwent surgical resection of the small bowel. The pathologic examination showed the infiltration of eosinophils and other inflammatory cells, including neutrophils, in all the layers of the bowel along with severe transmural edema (Fig. 1D). In all the cases, there were larvae penetrating the intestinal mucosa (Fig. 1C).

Discussion

Gastrointestinal anisakiasis is a rare parasitic disease in human beings and it is caused by penetration of a nematode larva. Its incidence has considerably increased in the last few years in many countries (13). The major inflicted species are *Anisakis simplex* and *Pseudoterranova decipiens* and the final hosts are marine mammals such as whale and dolphin (6, 14). It is known as these larvae can involve any part of the human body, including the colon and the extraintestinal organs such as the peritoneum, lungs, lymph nodes, ovaries, liver, pancreas and spleen. However, its major forms are the gastric and intestinal types (2, 7). Gastrointestinal anisakiasis is classified into the luminal and invasive forms, and most of the gastric and intestinal types belong to the invasive form, which causes clinical problems (8).

The clinical presentations of gastrointestinal anisakiasis in the previous reports were acute abdominal pain of varying severity, nausea, vomiting, urticaria, chills and diarrhea within a few hours after ingestion of raw fish (1, 2, 7, 8, 14, 15). All our cases also had similar clinical manifestations and a history of eating raw fish. Leukocytosis is a common laboratory finding of gastrointestinal anisakiasis. Peripheral eosinophilia is frequently presented in cases of the gastric form of anisakiasis. However, peripheral eosinophilia is known to be an uncommon finding in cases of intestinal anisakiasis (1, 4, 8). Intestinal anisakiasis can be classified as two types; one is the mild initial infection type and the other is the fulminant reinfection type. The fulminant reinfection type shows featured of allergic reactions by the Arthus-type and these reactions can be clinically problematic. Therefore, when sensitized patients are reinfected by *Anisakis* larvae, enteric anisakiasis reveals focal enteritis accompanied with an infiltration of inflammatory cells, and mainly eosinophils, around the sites penetrated by larvae (7, 16). The clinico-pathologic manifestations of our cases could be explained by this mechanism.

The intestinal type is a rarer form of gastrointestinal

anisakiasis than the gastric type. Therefore, relatively few studies have reported on the radiologic features of intestinal anisakiasis (5). To recapitulate the brief radiologic findings that had been described in several studies, edema of the intestinal wall and luminal narrowing along a long segment of intestine with an adjacent peritoneal fluid collection are the fundamental features regardless of what modalities were used (1, 4, 5, 7–10, 17, 18). The CT findings of intestinal anisakiasis have been described in some studies (5, 7–12). Previous studies have revealed a relatively long segment of circumferential and symmetric thickening of the bowel wall, luminal narrowing and diffuse mucosal enhancement with the target sign suggesting 'edema' in the involved segment. Our cases also showed similar findings. Based on the results of the previous studies and our study, small bowel anisakiasis shows constant CT findings.

These radiologic findings of intestinal anisakiasis reflect pathologic changes such as marked edema or congestion by a diffuse eosinophilic infiltration, and granuloma formation (4). Sometimes, well-preserved helminthic larvae that have penetrated the bowel wall, which was surrounded by a thick cuff of acute inflammatory cells with numerous eosinophils, may be microscopically seen to be present in the involved small bowel (2, 6, 8).

Gastric or colonic anisakiasis can be diagnosed by endoscopy and that's why rapid diagnosis and treatment are possible (1, 11, 14, 17). According to the previous reports and our study, the clinical symptoms and signs of intestinal anisakiasis mimicked an acute abdomen requiring surgery and its diagnosis is difficult (5, 7–10, 15). However, intestinal anisakiasis can be highly suggested if a patient has a history of raw fish ingestion with the characteristic radiologic findings. Because most patients with anisakiasis have a self-limiting course or they need only medical treatment (13), the differential diagnosis from various conditions that cause true intestinal obstruction or strangulation may be important to avoid unnecessary laparotomy.

Although our study has a small sample size and this can be regarded as a limitation, all the patients showed common clinical and CT findings, which could be a clue for making the correct diagnosis. In conclusion, intestinal anisakiasis should be considered when there are favorable CT findings in a patient with a history of recently ingesting raw or undercooked fish.

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소장 아니사키스증의 CT 소견: 네 증례를 통한 분석¹

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목적: 소장 아니사키스증의 CT 소견을 기술하고 병리학적 소견과 연계성을 알아보려고 하였다.

대상과 방법: 수술 후 병리소견으로 확진된 4예의 소장 아니사키스증을 대상으로 하였다. 환자는 3명의 남자와 1명의 여자 환자를 포함하였고 평균 38세로 28-43세의 연령범위에 분포한 환자군을 대상으로 CT 소견과 임상 소견 및 조직학적 소견을 평가하였다.

결과: 모든 환자가 증상이 시작된 시점으로부터 24시간 내에 날생선 섭취력이 있었고 모든 예에서 복부 통증과 오심을 호소하였으며, 구토는 2예에서, 설사는 1예에서 각각 나타났다. 이학적 검사에서 복부 압통과 반동 압통이 4명에서, 장음의 증가는 3명에서 있었다. 검사 소견으로는 백혈구 증가증이 모든 예에서 있었으나 호산구 증가증은 없었다. CT 소견은 4명의 환자 모두에서 장충이 유지되었고 분절성의 장벽 비후와 국소 분절의 협부가 있었으며, 협부 상부의 소장은 내장 확장 소견을 보였다. 복막 두께의 증가는 3증례에서, 장간막 또는 장막 침윤은 모든 예에서 있었고, 동반된 다양한 양의 복수가 모든 예에서 있었다. 유충은 모든 증례에서 확인되었으며, 병리적으로 모든 층의 호산구 침윤과 장벽의 부종 소견이 모든 예의 소장 조직에서 관찰되었다.

결론: 급성 복증과 유사한 임상 증상과 날생선 섭취의 과거력이 있는 환자들에서 CT 소견은 소장 아니사키스증의 특정 진단에 도움이 될 것이다.