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Case Report

Successful Endoscopic Removal of *Anisakis* Larva that Deeply Invaded the Gastric Mucosa Using Jumbo Forceps

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Anisakis · Gastric anisakiasis · Jumbo forceps

Abstract
Anisakiasis is a parasitic disease caused by the ingestion of raw or uncooked seafood infected with third-stage larvae of anisakid nematodes. Generally, the larvae parasites live at the surface of the mucosa, but in this case, the larva deeply invaded its head into the gastric mucosa and was not removable with conventional biopsy forceps. In our case, we demonstrated the usefulness of jumbo forceps to remove the *Anisakis* larva in such a situation.

Introduction

Gastric anisakiasis is a parasitic disease acquired by ingesting raw or uncooked seafood that harbors third-stage larvae of nematodes belonging to the genus *Anisakis* or *Pseudoteranova* [1, 2]. Due to the traditional Japanese habit of eating raw seafood (sashimi and sushi), most cases of gastric anisakiasis have been reported in Japan. Although recently, with the popularization of raw seafood in other regions of the world, the number of gastric anisakiasis patients is increasing globally [1, 3, 4].

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Gastric anisakiasis is characterized by acute onset of epigastric pain at 1.4 ± 1.1 days after ingesting the contaminated food [1]. *Anisakis* larvae have been killed or weakened by exposure to some medications such as peppermint, creosote, and albendazole in vitro or in some animal models, but efficacy has not been established in humans [5, 6]. Currently, endoscopic removal of live larvae from the gastric mucosa has been reported to cure the disease clinically [1, 2]. Therefore, establishing methods for finding larvae quickly and removing them thoroughly is crucial. Anisakiasis larvae are small, that is, 20 mm in length, and they can infect not only the visually recognizable gastric surface but can hide between the wrinkles or invade into the mucosa. Removing the living larvae is sometimes challenging and requires more sophisticated methods. In this report, we discuss a case of gastric anisakiasis in which live larvae deeply invaded the mucosa and were successfully removed with a jumbo forceps.

Case Report

A 28-year-old Japanese male presented at a walk-in clinic complaining of epigastric pain and back pain. He reported eating raw salmon at home 17 h prior to the development of the epigastric pain. His vital signs at this visit were normal. Physical examination showed moderate abdominal tenderness without rebound or guarding in the epigastrium. Based on the clinical history and physical examination, gastric anisakiasis was suspected, and emergency endoscopy was performed. There were three *Anisakis* larvae; two of them were in the greater curvature of the stomach and were removed with endojaw biopsy forceps (Olympus Medical Systems, Japan), which are the conventional forceps that are generally used for gastric tissue biopsies. However, the third *Anisakis* larva deeply invaded the mucosa at the cardiac area of the stomach, and only its tail was visible. Accordingly, it was impossible to hold or remove the larva with the conventional biopsy forceps. The stomach pain continued due to the remaining larva, and the patient was therefore referred to our hospital for further treatment, including the option of an advanced endoscopic procedure or, if indicated, surgical treatment.

On arrival at our hospital, the patient first underwent computed tomography, which revealed fat stranding around the stomach but without ascites (Fig. 1a, b). Gastric perforation was not likely based on the findings, and accordingly, we decided to employ additional endoscopy before resorting to a surgical operation. The endoscopic observation showed that the entire larva penetrated the thickened mucosa of the cardiac part of the stomach except for the tail. There was no portion of the head or body to hold and pull out with a conventional biopsy forceps (Fig. 2a). Therefore, we decided to use a jumbo forceps that enables a large tissue biopsy to hold the larva with the mucosa.

After supplying sufficient air to keep a clear field of vision (Fig. 2b), we used a radial Jaw 4 cold polypectomy forceps (Boston Scientific Japan), i.e., a "jumbo forceps" to hold the mucosa and submucosa including the head and body of the larva and pulled out the larva as a whole (Fig. 2c, d). Bleeding was observed at the site of the larva's invasion after the procedure (Fig. 2e) but it stopped spontaneously. The absence of remnants of the larva in the stomach was verified, and the procedure was concluded (Fig. 2f). The gastric pain disappeared completely in about 30 min after the removal of the larva and the patient was discharged on the same day. Morphological microscopic examination revealed that all the larvae were in the third stage of *A. simplex* (Fig. 3a, b). Molecular analyses of the removed three specimens were carried out with DNA sequencing, and their species as *A. simplex sensu stricto* (s.s.) was confirmed.

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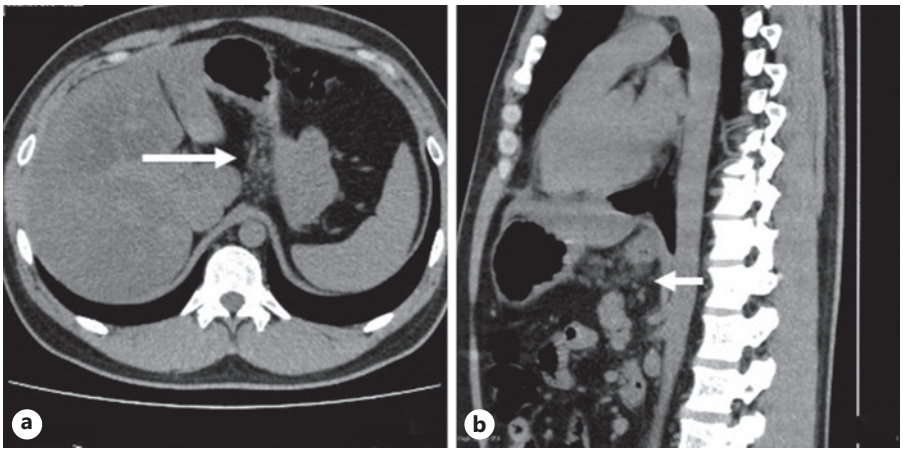

Fig. 1. Abdominal CT image of *A. simplex*. Axial (**a**) and sagittal (**b**) views of computed tomography images show fat stranding around the cardiac and fundic muscle lesions of the stomach.

Discussion

In the current case, the *Anisakis* larva that deeply invaded the mucosa was successfully removed as a whole with a jumbo forceps by grasping the mucosa and a part of the submucosa with the head and most of the body, which was not possible with the conventional biopsy forceps. The jumbo forceps had a relatively large jaw outer diameter of 2.8 mm, a maximum opening of 8.8 mm, and a cup volume of 12.4 mm^3, which is a larger volume than that of conventional biopsy forceps (7.22 mm^3). Accordingly, polypectomies of colorectal polyps are performed with jumbo forceps [7].

We chose to perform an additional endoscopic technique instead of using medical treatment. Some literature reports have described the use of conservative therapies such as corticosteroids for intestinal anisakiasis [5]. However, conservative treatments are controversial. Ito et al. [8] reported that penetration of the *Anisakis* larva through the gastric mucosa presumably causes the formation of an abscess within the muscular layer, with subsequent rupture of the abscess leading to transient perforation. Indeed, there are case reports of gastric perforation caused by gastric anisakiasis [9–11]. Kawashima et al. [9] reported an intestinal bleeding case, which developed hypovolemic shock and underwent surgery. Kang et al. [10] reported a case of chronic anisakiasis that presented as an ulcerated submucosal tumor, which resulted in bleeding. Thus, the complete removal of larvae is important to cure anisakiasis and prevent complications. Hence, the endoscopic procedure was chosen in the current case.

It is noted that there is a pathogenic difference between the two species causing anisakiasis, *Anisakis simplex*. s.s. and *A. pegreffii*, which are the dominant causative species in human anisakiasis [1]. Arizono et al. [12] reported that *A. simplex* s.s. larvae from chub mackerel tolerated artificial gastric juice better than *A. pegreffii*, with 50% mortality in 2.6 and 1.4 days, respectively. In addition, *A. simplex* s.s. penetrated the agar at significantly higher rates than A. *pegreffii* in vitro. These results showed the pathogenic difference between the two species. In our case, all three larvae were *A. simplex* s. s. despite one larva penetrating deeper than the other two. Our speculation for the different pathogenic presentation among the same species was that the cardia is a physiologically constricted site, and accordingly, the *Anisakis* larva that landed in the cardia stagnated there and was able to penetrate deep into the membrane.

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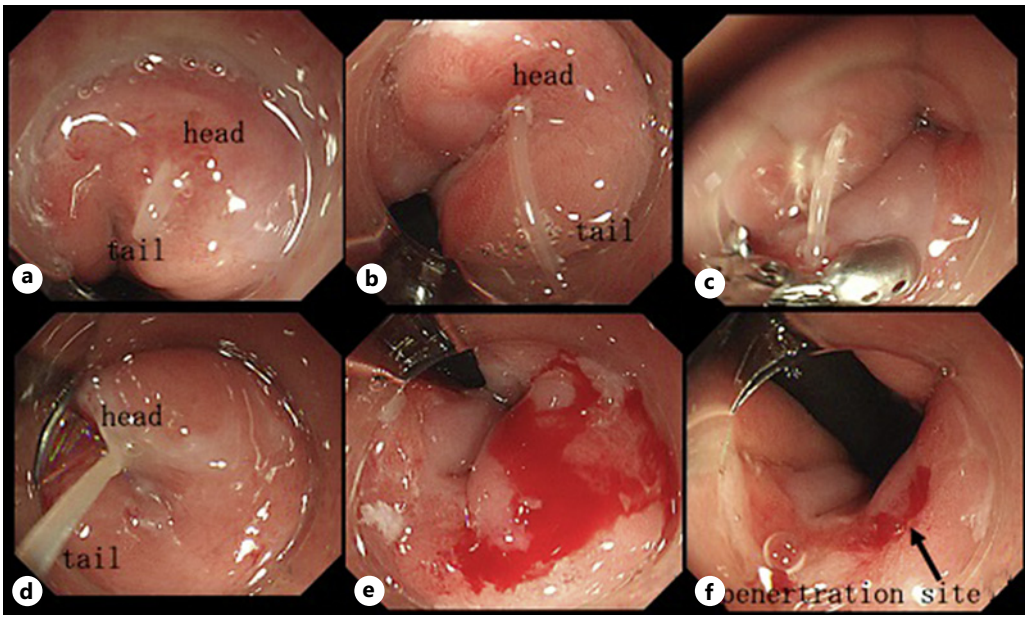

Fig. 2. Endoscopic image of the *Anisakis simplex* larvae. **a** Endoscopic image of the stomach displaying the larvae with white light imaging. There was no part of the head or body to hold and pull out with conventional biopsy forceps. **b** After supplying sufficient air, a better field of vision was achieved. **c**, **d** Radial Jaw 4 cold polypectomy forceps (Boston Scientific Japan), i.e., "jumbo forceps," hold the mucosa covering the larvae and pulled out the larvae as a whole. **e** Bleeding was observed at the site of the larvae's invading area after the procedure. **f** The absence of remnants of the larvae in the stomach was verified, and the procedure was concluded.

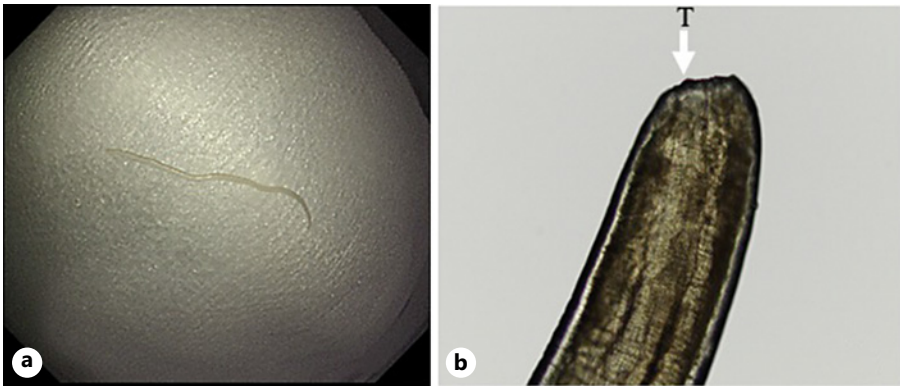

Fig. 3. Morphological image of *A. simplex*. **a** ~15 mm white worms are consistent with *A. simplex* larvae. **b** The morphological examination with a magnification power of 40 revealed the head portion of the larvae, anterior, and a boring tooth (T), and the entire larvae was covered with a rigid cuticle, consistent with *A. simplex* in the third-stage.

In conclusion, we demonstrated the usefulness of jumbo forceps for removing the *Anisakis* larvae that deeply invade the gastric mucosa. Complete removal of larvae is necessary to cure anisakiasis and prevent complications. The CARE checklist has been completed by the authors for this case report and is attached as online supplementary material (for all online suppl. material, see https://doi.org/10.1159/000533808).

Case Rep Gastroenterol 2023;17:321–326
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Statement of Ethics

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. Ethical approval was not required for this study in accordance with local and national guidelines.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Funding Sources

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Author Contributions

Toshio Arai, Takehito Kunogi, and Yasuhiro Nakano analyzed and interpreted the patient data and had direct contact with the patient. Takahiro Kinebuchi made the pathological diagnosis. Nisikawa Koji assisted in the editing and revision process. Hiromu Sugiyama participated in the genetic analysis and critically reviewed the manuscript. All authors read and approved the final manuscript.

Data Availability Statement

All data generated or analyzed during this review are included in this article and its online supplementary material files. Further inquiries can be directed to the corresponding author.

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Case Rep Gastroenterol 2023;17:321–326
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