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CASE REPORT

A Case Report of *Taenia saginata* Infection and Literature Review

Luyao Liu[1,2,*], Yuanhao Ji[1,*], Lanlan Feng[1], Tao Wang[1], Xiaoning Li[2], Jinsun Yang[1]

[1]Department of Infectious Diseases, The First Affiliated Hospital of Wannan Medical College, Wuhu, Anhui, 241001, People's Republic of China; [2]Department of Clinical Laboratory, The First Affiliated Hospital of Wannan Medical College, Wuhu, Anhui, 241001, People's Republic of China

*These authors contributed equally to this work

Correspondence: Jinsun Yang, Email yangjinsun999999@163.com

Background: Despite the decreasing prevalence of parasitic infections, *Taenia saginata* infection remains a clinical concern in endemic regions. Humans acquire this infection by consuming raw or undercooked beef containing cysticerci. This study presents a case of *T. saginata* infection, reviews relevant literature, and underscores the importance of clinical awareness.

Case Presentation: We report the case of a 24-year-old female with diarrhea and white nodules in stool, with a history of travel to a *T. saginata*-endemic region. The patient was successfully treated with traditional Chinese deworming therapy comprising pumpkin seeds and betel nuts, resulting in complete symptom resolution. Diagnosis was confirmed by morphological examination of expelled tapeworms, histological staining of proglottids, and molecular analysis.

Literature Review: A PubMed search for "*Taenia saginata*" identified 92 articles, of which 8 with comprehensive clinical data were included. Eleven cases, including the present one, were analyzed for clinical presentation, treatment, and outcomes. Among the 11 patients, 10 had a history of consuming raw or undercooked beef. Primary symptoms included diarrhea, abdominal pain, and vomiting. When *T. saginata* affected the biliary system or duodenal papilla, patients had elevated ALT, AST, ALP, and TBL levels, with severe complications like gallbladder perforation requiring surgery. Treatment options included praziquantel, clonidine, albendazole, and traditional Chinese medicine, showing favorable efficacy. Surgery was required in severe cases with positive outcomes.

Conclusion: This study suggests *T. saginata* infection should be considered in differential diagnosis of patients with diarrhea and relevant travel history. When parasitizing the intestinal or biliary tract, it can induce corresponding symptoms. The patient responded well to appropriate medical treatment, including traditional Chinese medicine, with favorable outcomes. Surgical intervention was performed when necessary.

Keywords: *Taenia saginata*, case report, *cox1*, Chinese medicine, pumpkin seed and betel nut, literature review

Introduction

The global prevalence of parasitic infections has markedly declined with advancements in public health systems and improved hygiene practices.[1,2] However, *T. saginata* infection, a zoonotic disease, remains a significant concern, with an estimated 60 to 70 million carriers worldwide.[3] The parasite is endemic in Asia and highly prevalent in the Middle East and North Africa, where reported infection rates range from 0.2% to 8.6%, significantly exceeding those in Europe.[4,5]

T. saginata utilizes cattle as an intermediate host and humans as its definitive host.[6] Infection occurs through the consumption of raw or undercooked beef containing viable cysticerci or food contaminated with tapeworm eggs. Upon ingestion, larvae attach to the intestinal wall and mature into adult tapeworms within 2–3 months, subsequently producing eggs and gravid proglottids. In most cases, *T. saginata* parasitizes the human intestinal tract, leading to symptoms such as abdominal pain, diarrhea, and white nodules in the stool. In rare cases, it may cause severe complications including cholecystitis, pancreatitis, gallbladder perforation, and intestinal perforation.[7–9]

Although *T. saginata* infection has traditionally been considered geographically restricted, increased global travel and trade have heightened the risk of imported cases, potentially facilitating transmission from endemic to nonendemic

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regions. Although its prevalence has declined compared to the previous century, clinical cases continue to be reported.[10] Notably, *T. saginata* shares significant morphological similarities with *Taenia solium* and *Taenia asiatica*. While the latter two can cause cysticercosis, *T. saginata* is responsible only for taeniasis, making precise species identification crucial in clinical practice.[11] Given the morphological overlap, molecular biology techniques have emerged as the most reliable method for definitive diagnosis.[12]

Niclosamide and praziquantel are currently the most widely used anthelmintic agents in the treatment of taeniasis. Nonetheless, traditional remedies, particularly the combined use of pumpkin seeds and betel nut, have also demonstrated therapeutic potential. This regimen has been practiced in certain regions of China and has shown promising efficacy in managing infections caused by *Taenia asiatica* and *Taenia solium* across various parts of Asia.[13,14] Clinical observations have indicated that approximately 46.3% of patients treated with pumpkin seed–betel nut extracts may experience mild adverse effects, primarily nausea and dizziness.[15] However, these symptoms are typically transient and well tolerated, suggesting an acceptable safety profile for this traditional approach.[15]

Here, we report a case of *T. saginata* infection successfully treated with traditional Chinese medicine, which was confirmed by molecular analysis. Additionally, we reviewed previously reported cases to further elucidate their clinical characteristics, treatment strategies, and prognosis, thereby providing healthcare professionals with valuable insights into the diagnosis and management of this parasitic infection.

Case Report

A 24-year-old female art teacher from Wuhu City, Anhui Province, China presented to our hospital on December 9, 2024, complaining of diarrhea. The patient had 4–5 stools per day, which were thin and soft, with long white nodules. However, the patient denied experiencing abdominal pain, nausea, vomiting, or recent weight changes. Her mental status and sleep were unaffected and she had no history of consuming contaminated food. Upon further inquiry, she disclosed a recent travel history to Northwest China (Gansu Province) three months prior, where she had consumed undercooked beef, a known risk factor in *T. saginata* endemic regions. A physical examination revealed no abnormalities.

Laboratory tests showed a leukocyte count of 6.6×10^9/L with an elevated eosinophil ratio (9.1%). Immunoglobulin levels included IgE (374.54 IU/mL and IgG (20.02 g/mL. The serum electrolyte analysis revealed potassium (3.48 mmol/L and sodium (136.8 mmol/L. The liver function and urinalysis results were normal. Fecal microscopy confirmed the presence of tapeworm eggs (Figure 1). Oil immersion microscopy (1000× magnification) revealed oval eggs with thin shells, brownish-yellow coloration, thick embryonic membranes with characteristic radial striations, and visible six-hooked larvae, consistent with the morphology of *Taenia* spp. Cranial CT, ocular ultrasonography, and abdominal ultrasonography were unremarkable.

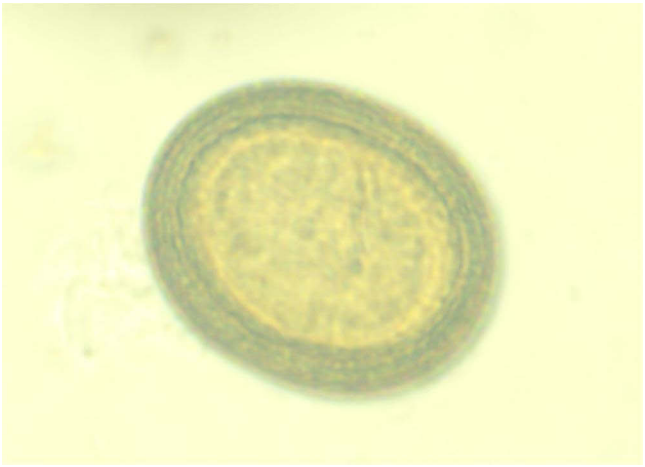

Figure 1 *Taenia saginata* eggs.

Figure 2 Discharged tapeworm bodies.

The patient underwent traditional Chinese medicine (TCM) deworming therapy using a pumpkin seed–betel nut regimen, resulting in successful expulsion of a 2.8-meter-long tapeworm without a cephalic segment was recovered (Figure 2). Morphological examination following genital pore injection with ink revealed approximately 17 lateral uterine branches per side, aligned with the morphological criteria of *T. saginata*, which typically exhibits 15–30 lateral branches (Figure 3).

To confirm species identity, a segment of the expelled worm was subjected to molecular analysis. Genomic DNA was extracted using a blood/tissue genomic DNA extraction kit (TIANGEN, DP304) and stored at −20°C. *cox1* gene, using

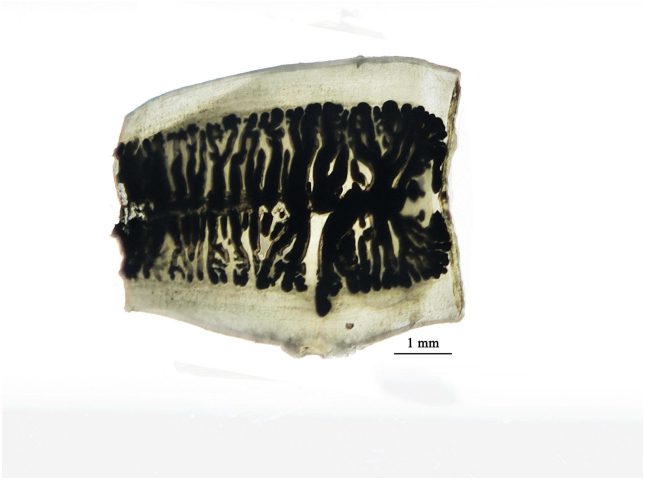

Figure 3 Ink-stained gravid proglottids of *Taenia saginata*.

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primers[10] COX-F (5'-TTT TTT GGG CAT CCT GAG GTT TAT-3') and COX-R (5'-TAA AGA AAG AAC ATA ATA ATG AAA ATG-3'), yielding a 389-bp product. The PCR system (50 μL) included 1 μL of the DNA template, 2 μL of each primer, 25 μL of 2× Taq enzyme mix, and 20 μL of distilled water. The thermal cycling conditions were as follows: initial denaturation at 95°C for 3 min; 35 cycles of denaturation at 95°C for 10s, annealing at 49°C for 15s, and extension at 72°C for 1 min; and final extension at 72°C for 5 min. The PCR products were sequenced using Sanger sequencing (Shanghai Sangon Biotech Co.) and sequence comparisons were conducted using the NCBI database. Phylogenetic analysis was performed using the Maximum Likelihood (ML) method in the MEGA X software, with 5000 bootstrap replicates and 2000 iterations.

Gel electrophoresis confirmed the presence of a distinct 389 bp *cox1* fragment under UV light (Figure 4). Sequence analysis revealed a 97.16% homology with the Chinese isolate (AB066495) of *T. saginata* (Figure 5). By integrating morphological and molecular evidence, the patient was definitively diagnosed with *T. saginata* infection.

At the one-week follow-up, eosinophil counts normalized, diarrhea completely resolved, and all laboratory markers returned to baseline. At the three-month follow-up, the stool examination for eggs and proglottids was negative, and the patient remained in good overall health.

Literature Review

A comprehensive search of the PubMed database was conducted for literature published up to March 2025, using "*Taenia saginata*" as the keyword. The inclusion criteria were as follows: (1) patients diagnosed with *T. saginata* infection during a medical consultation; (2) Comprehensive clinical data and well-documented treatment plans. The exclusion criteria were as follows: (1) studies involving infections caused by other parasitic species; (2) articles related to *T. saginata* that did not report clinical cases but focused solely on epidemiology, morphology, or systematics; (3) duplicate publications.

The search retrieved 92 relevant articles, of which 8 met the inclusion criteria, yielding 10 case reports. Eleven cases were analyzed, including the present case, a total of 11 cases were analyzed. The demographic and clinical characteristics of the patients are summarized in Table 1.

All the patients were from developing countries or regions. Of the 11 patients, 4 (36.36%) were male and 7 (63.64%) were female, with a mean age of 34.64 ± 15.66 years. Notably, 10 patients had a history of consuming raw or undercooked meat prior to the infection. The most commonly reported symptoms were abdominal pain (8/11; 72.73%), vomiting (5/11; 45.45%), nausea (3/11; 27.27%), diarrhea (2/11; 18.18%), and jaundice (2/11; 18.18%).

Regarding complications, four patients (36.36%) developed biliary inflammation, while one patient each (9.09%) presented with acute biliary pancreatitis, intra-abdominal inflammation with jejunal perforation, gastric perforation, and mesenteric vascular dysplasia. Three patients (27.27%) experienced no complications. In terms of parasitic localization, *T. saginata* was found in the gallbladder (2/11, 18.18%), duodenal papilla (3/11, 27.27%), jejunum (1/11, 9.09%), and stomach (1/11, 9.09%), while in three cases, the exact site of infection was undetermined.

Laboratory findings revealed that seven patients (63.63%) exhibited mild leukocytosis, while eosinophilia was noted in 4 four of six cases tested (66.67%). Elevated levels of total bilirubin (TBL) (2/10, 18.18%), alanine aminotransferase (ALT) (4/10, 40.0%), aspartate aminotransferase (AST) (4/10, 40.0%), and alkaline phosphatase (ALP) (4/10, 40.0%) were observed in a subset of cases.

The treatment strategies varied, with most patients receiving medical therapy, including pumpkin-seed-betel nut deworming therapy (3/11, 27.27%), clonidine (3/11, 27.27%), albendazole (2/11, 18.18%), and praziquantel (1/11, 9.09%). Surgical intervention was required in one case (9.09%), while another patient expelled the tapeworm naturally after surgical repair of gastric perforation. In addition, two other patients did not receive any antiparasitic drugs after surgery. All patients achieved full recovery after treatment.

Discussion

T. saginata infection, a typical zoonotic disease, is primarily acquired through the accidental ingestion of raw or undercooked meat containing cysticerci. In this study, we report a case of *T. saginata* infection in which the patient presented with diarrhea and expelled white tapeworm segments in the feces. Notably, indiscriminate deworming without identifying specific tapeworm species can be hazardous, as certain tapeworm larvae can invade vital organs such as the

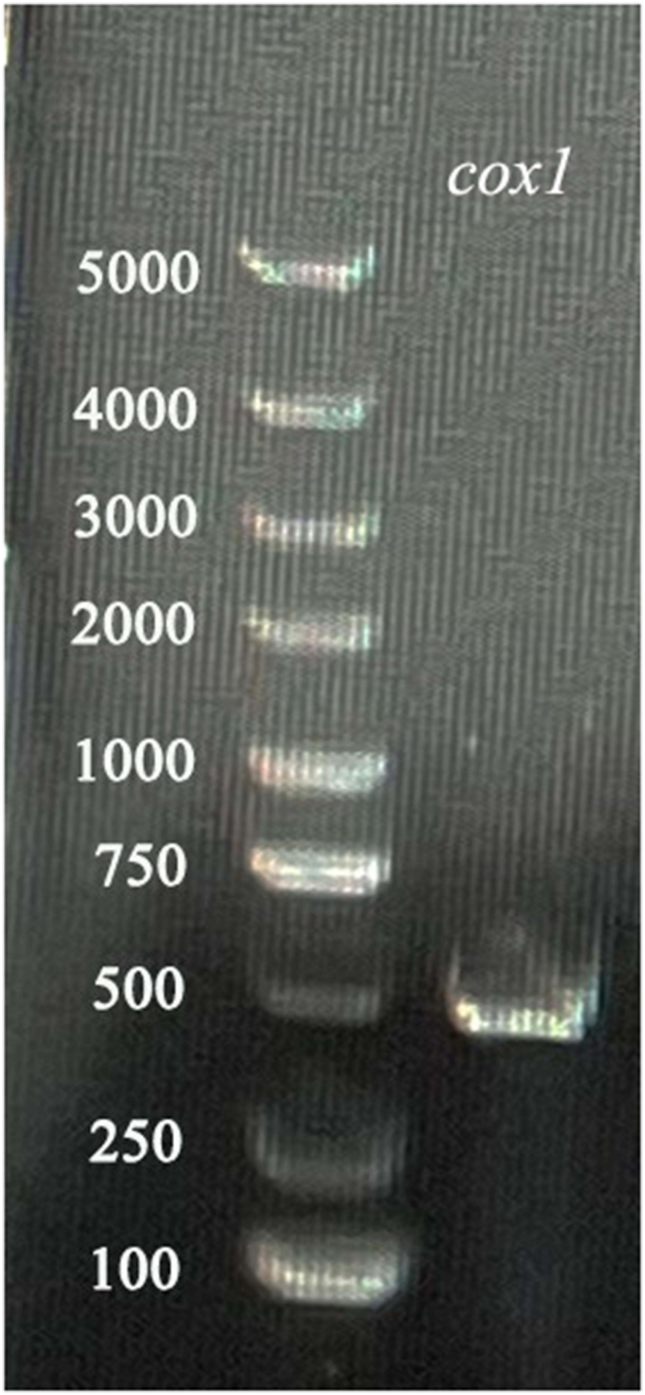

Figure 4 *Cox1* gene amplification bands.

brain and eyes, leading to severe complications. Therefore, prior to antiparasitic therapy, the patient underwent cranial CT and ophthalmic ultrasonography to rule out organ invasion. After confirmation, the tapeworm was successfully expelled using a traditional Chinese medicine regimen of betel nuts and pumpkin seeds. The diagnosis of *T. saginata* infection was confirmed using molecular analysis. A distinctive feature of this case was that diarrhea was the sole specific symptom, apart from the presence of white tapeworm segments in the feces. Additionally, the patient resided in a non-endemic area but had a history of travel to regions with a high prevalence of tapeworm infection and known consumption

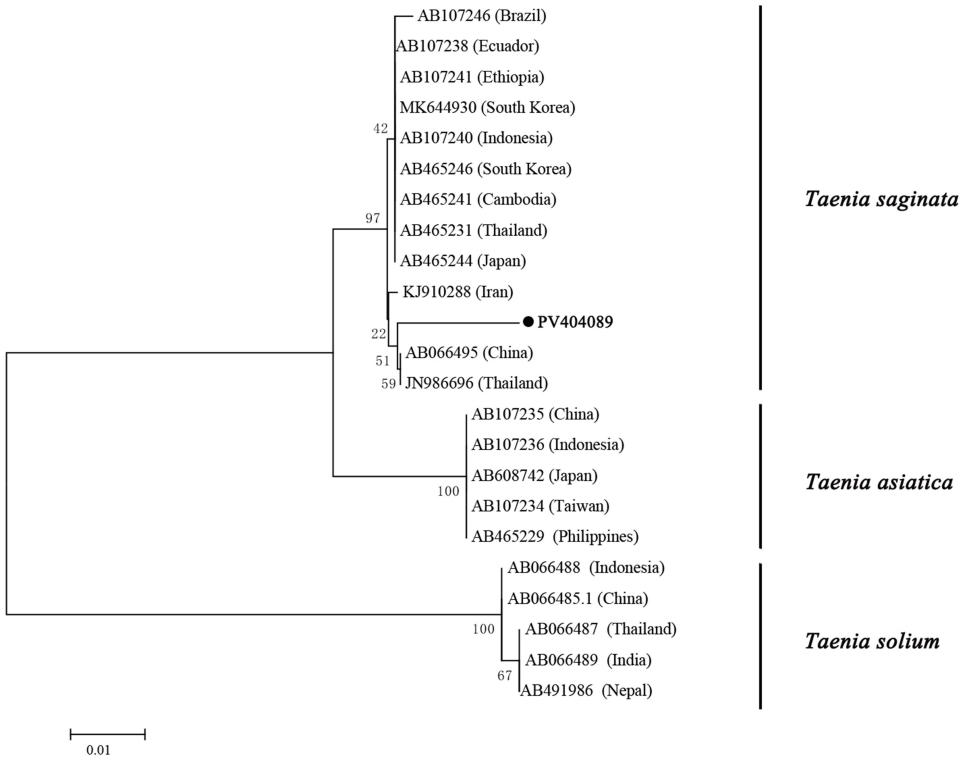

Figure 5 Phylogenetic tree constructed based on *Taenia saginata cox1* sequences. ●, *cox1* gene amplified in this study.

of raw meat. *T. saginata* infections typically have a long incubation period, with symptoms emerging months after the exposure.

Differentiating *T. saginata* from other *Taenia* species using conventional microscopy can be challenging because tapeworm eggs share similar morphological characteristics. Although features such as proglottid structure, head morphology, and uterine lateral branches can assist in species identification, expelled tapeworms are often incomplete, which limits the reliability of morphological diagnostics. In contrast, molecular methods, particularly mitochondrial genome sequencing, offer a high specificity for identifying *T. saginata*. Genes, such as *cox1* and *cytb*, serve as precise molecular markers. For instance, Taehee et al[21] successfully confirmed *T. saginata* infection by PCR amplification and sequencing of the *cox1* and *elp* genes. In this case, *cox1* sequencing revealed 97.16% homology with a Chinese isolate (AB066495), providing definitive molecular confirmation of *T. saginata* infection.

Traveler diarrhea (TD) is one of the most common illnesses affecting international travelers.[22] It is defined as the occurrence of ≥3 unformed bowel movements within 24 hours, accompanied by at least one additional symptom—such as nausea, vomiting, abdominal cramps, fever, hematochezia, mucus in stools, or urgency—either during travel or upon return.[23] Bacterial pathogens are responsible for up to 90% of TD cases, followed by viral and protozoal infections, whereas helminthic infections remain relatively rare.[23] However, parasitic infections should not be overlooked as potential causes of TD. Unlike bacterial or protozoal infections, helminthic infections often have a prolonged incubation period, with symptoms such as diarrhea or abdominal pain manifesting months after initial exposure.[24] This pattern has also been observed in other helminthic infections. For instance, a 62-year-old male patient developed symptoms of neurocysticercosis due to *T. solium* after a trip to Mexico.[25] Similarly, a Japanese traveler returning from Thailand and Laos presented with intermittent watery diarrhea, later diagnosed as Ceylon hookworm infection.[26] Given the delayed onset of symptoms, clinical diagnosis is often challenging. Both patients and physicians may fail to associate current symptoms with prior travel history, potentially leading to misdiagnosis or delayed treatment. Therefore, in individuals with chronic or unexplained gastrointestinal symptoms, travel history should be sought, especially travel to endemic areas, and parasitic infections, including *T. saginata*, should be considered in the differential diagnosis.

Table 1 List of Clinical Data of 11 Cases of *Taenia Saginata* Infection

Year	Country	Age	Sex	History of Eating Raw Meat	Complications	Symptoms	Parasitic Site	WBC ($\times 10^9$/L) 4.0–10.0	EOS (%) 0.5-6	TBL (μmol/L) 3.0–22.0	ALT (U/L) 0–35.0	AST (U/L) 14.0–36.0	ALP (U/L) 40-150	Treatment	Prognosis
2024 (this example)	China	24	Female	Raw beef	None	Diarrhea	/	6.6	9.1	19.21	12	16	/	Pumpkin seeds (150g), areca nut (150g)	Recovery
1998[16]	Kashmir	23	Female	Eat raw meat	Mesenteric vascular dysplasia, hemorrhage	Headache, anemia	/	10.8	/	Normal	Normal	Normal	Normal	Niclosamide	Recovery
2003[16]	Thailand	32	Female	Eat raw beef	Acute intra-abdominal inflammation, jejunal perforation	Epigastric pain, nausea, diarrhea	Jejunum	17.2	32	Normal	Normal	Normal	Normal	2 g of niclosamide	Recovery
2008[17]	Kashmir	26	Female	/	Acute cholecystitis	Epigastric pain, vomiting	Gallbladder and common bile duct	12.7	3	32	/	/	410	Surgically removed	Recovery
2012[18]	India	32	Male	Eat raw beef	Cholecystitis, gallbladder perforation	Epigastric pain, vomiting, fever	Gallbladder	13.5	1	12.7	42	68	197	15 mg/kg orally of praziquantel	Recovery
2016[19]	Turkey	56	Female	Eat beef	Cholangitis	Right upper abdominal pain, nausea, vomiting, jaundice	Sphincter of Oddi (duodenal papilla)	12.36	/	11.48	104	328	696	2 g of niclosamide	Recovery
2021[7]	Lebanon	27	Male	Eat raw beef	Gastric perforation	Severe abdominal pain, nausea, vomiting	Stomach	12.6	/	Normal	250	240	Normal	Surgical repair of gastric perforation, spontaneous vomiting expelled *Taenia saginata*	Recovery
2023[8]	China	31	Female	Eat raw beef	Acute biliary pancreatitis	Abdominal pain, bloating	Duodenal papilla	10.53	/	25.88	8.72	15.36	56.29	First 3 days: Areca nut (80 g/day), pumpkin seeds (125 g/day), and mirabilite (25 g/day); Next 3 days: Albendazole (8 mg/kg/day)	Recovery
2023[8]	China	73	Male	Eat raw beef	Acute cholangitis	Abdominal pain, jaundice	Duodenal papilla	7.92	/	33.24	117.86	60.16	646.87	First 3 days: Areca nut (80 g/day), pumpkin seeds (125 g/day), and mirabilite (25 g/day); Next 3 days: Albendazole (8 mg/kg/day)	Recovery
2024[20]	Ramallah	33	Female	Eat raw beef	None	Weight loss, abdominal pain, vomiting	/	Normal	Increased	Normal	Normal	Normal	Normal	400mg of albendazole	Recovery
2024[20]	Hebron	24	Male	Eat raw beef	None	Weight loss, abdominal pain, general fatigue	/	Normal	Increased	Normal	Normal	Normal	Normal	400mg of albendazole	Recovery

Note: / missing data.

Abbreviations: WBC, white blood cell count; EOS, Eosinophil; TBL, bilirubin; ALT, alanine transaminase; AST, aspartate aminotransferase; ALP, alkaline phosphatase.

The prevalence of *T. saginata* infection is geographically specific, with cases predominantly reported in Asia and the Middle East, which are regions that are largely composed of developing countries. This distribution aligns with the higher prevalence of *T. saginata* in underdeveloped areas, likely due to dietary habits favoring raw or undercooked meat, lower hygiene awareness, and inadequate meat inspection protocols.[27,28] Among the 11 cases analyzed, the mean patient age was 34.64 ± 15.66 years, with the majority falling into the young adult demographic (approximately 20 to 40 years of age). Eosinophilia is a well-established marker of parasitic infections, and in this study, 4 four of six patients (66.67%) exhibited elevated eosinophil percentages. Notably, eosinophilia is not exclusive to *T. saginata* infections. For instance, Nekrasova et al[29] reported a male patient with *T. solium* cysticercosis, whose eosinophil percentage increased to 8% following infection. Therefore, in clinical practice, unexplained eosinophilia should raise the suspicion of parasitic infections, including *T. saginata* and other tapeworm species.

T. saginata infection can result in a diverse spectrum of clinical manifestations, with symptom severity closely related to parasite localization. Statistical analysis indicated that abdominal pain was the predominant symptom, observed in 72.72% of cases, whereas diarrhea was reported in only two patients—likely reflecting intestinal colonization. Adult tapeworms typically inhabit the small intestine after infection; however, they may occasionally invade the jejunum, resulting in perforation. Parasites may migrate to other anatomical regions in suboptimal host environments. Although the stomach's highly acidic milieu generally inhibits parasitic survival, a case involving the long-term use of a proton pump inhibitor demonstrated that reduced gastric acidity can permit retrograde migration of the tapeworm. Moreover, *T. saginata* can colonize the duodenal papilla and confluence of the common bile duct and main pancreatic duct, where its presence may induce inflammation and injury to the pancreas, bile duct, and gallbladder, as evidenced by elevated levels of ALT, AST, ALP, and TBL. In rare instances, retrograde entry into the gallbladder may precipitate gallbladder perforation.

The management of *T. saginata* infection typically involves pharmacological interventions such as clonidine, praziquantel, and albendazole. In the present series of 11 cases, three patients received clonidine, three were treated with albendazole, and three Chinese patients, including the current case, were administered a traditional Chinese regimen comprising pumpkin seed and betel nut. Two additional patients underwent surgical intervention. Albendazole and praziquantel, both mentioned in this study, are widely used generic anthelmintics. Regardless of the treatment modality, patient outcomes were uniformly favorable. Combination therapy with pumpkin seeds and betel nuts represents a traditional Chinese anthelmintic approach that leverages the natural properties of these botanicals, providing a gentle and well-tolerated treatment alternative. Betel nut is rich in betulin, a cholinergic receptor agonist that induces sustained muscular excitation in *T. saginata*, ultimately leading to exhaustion and detachment.[30] Concurrently, pumpkin seeds disrupt the parasite's metabolic processes, resulting in an energy deficit. The synergistic action of these agents on the nervous system of *T. saginata* induces generalized paralysis, while the dietary fiber in pumpkin seeds enhances intestinal peristalsis to expedite worm expulsion.[15] Studies indicate that this combination can achieve a deworming rate exceeding 90%, which may facilitate the expulsion of intact worms more effectively than praziquantel.[15] In addition to its demonstrated efficacy, this regimen offers several practical advantages. First, pumpkin seeds and betel nuts are widely available and inexpensive in many regions, making them accessible in both clinical and non-clinical settings. Second, the therapy is associated with a low incidence of adverse effects, making it particularly suitable for children and patients with compromised health. In particular, for pediatric patients, the pumpkin seed–betel nut combination serves as a milder alternative that may help mitigate the potential side effects associated with chemical anthelmintics. Third, compared to synthetic drugs, patients are often more psychologically receptive to natural therapies, which may enhance compliance and reduce anxiety associated with treatment. Although most cases respond well to conservative pharmacological treatment, in cases of severe complications, such as jejunal or gallbladder perforation, pharmacotherapy alone may be insufficient, necessitating surgical repair. Overall, both pharmacological and surgical interventions have yielded favorable treatment outcomes for *T. saginata* infections.

Our study has several limitations. First, the cephalic segment of the tapeworm, which is crucial for morphological identification, is small and prone to detachment; indeed, head segments were identified in only one of the 10 reviewed cases and were absent in our patient. Second, some literature sources lack complete blood test data, particularly regarding eosinophil count. Consequently, several studies on *T. saginata* infection were excluded from our review because of

missing clinical information, which may have introduced a bias into our analysis. Moreover, as with most literature reviews, the tendency to report atypical or severe cases may have led to an overrepresentation of uncommon clinical features. Finally, our analysis was limited to sequencing the *cox1* gene, a marker suitable for species identification, but insufficient for elucidating host-parasite genomic interactions. Genomic studies on *T. saginata* are still in their infancy, making it challenging to investigate the adaptive evolution and immune evasion mechanisms of this parasite. In contrast, the genome of *Taenia hydatigena*, a related cestode, has been more comprehensively characterized.[12]

In summary, increased global travel may facilitate the spread of *T. saginata* from endemic to non-endemic regions, underscoring the importance of maintaining good dietary hygiene for prevention and control. In patients with a history of travel to endemic areas and diarrhea, *T. saginata* infection should be considered as a differential diagnosis. When the parasite colonizes the intestinal or biliary tract, it causes a range of clinical symptoms. The traditional Chinese medicine regimen of pumpkin seed–betel nuts offers a mild and non-irritating treatment option that warrants wider clinical application. Overall, patients systematically treated for *T. saginata* infections exhibited favorable prognoses, with few fatal cases reported.

Ethics Approval and Consent to Participate

As a case report, this study did not require any referral from our institutional clinical ethics committee.

Consent for Publication

Written informed consent was obtained from the patient for publication of this report and accompanying images.

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Disclosure

The authors declare that they have no competing interests in this work.

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