Visceral Larva Migrans Associated With Earthworm Ingestion: Clinical Evolution in an Adolescent Patient

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ABSTRACT

A 16-year-old girl developed a cough, hypereosinophilia (absolute eosinophil count: 32 000/mm³), hypergammaglobulinemia, and multiple noncavitary pulmonary nodules 1 month after having ingested an earthworm on a dare. Spirometry revealed moderate restriction and reduced gas diffusion. Parabronchial biopsy demonstrated eosinophilic organizing pneumonitis with multiple eosinophilic microabscesses, and *Toxocara* titers were elevated (>1:4096). Ophthalmologic examination ruled out ocular larva migrans. The patient received a 10-day course of albendazole (400 mg orally twice daily) and demonstrated significant clinical improvement with resolution of cough and pulmonary function abnormalities. Her white blood cell count and hypergammaglobulinemia normalized within 20 days, yet eosinophils (absolute eosinophil count: 1780/mm³) and *Toxocara* serologies (>1:4096) remained elevated 3½ months after completing antihelminthic therapy. In this instance, the ingested earthworm served as the paratenic carrier of *Toxocara* larvae from the soil to the patient. This case highlights the clinical evolution of pulmonary visceral larva migrans infection caused by *Toxocara* spp. associated with a discrete ingestion in an adolescent patient. In addition, it provides a rare opportunity to define the incubation period of visceral larva migrans and emphasizes the importance of education regarding sources of *Toxocara* infection.

CASE REPORT

A 16-YEAR-OLD WHITE female with a history of asthma, urticaria, and bipolar disorder presented for evaluation to the allergy program of our hospital in mid-September 2004 with a 2-week history of progressively increasing eosinophilia associated with moderate cough, wheezing, and 5-lb weight loss. Two weeks before presentation, she had experienced nausea, a temperature to 101°F, and swelling around her eyes, cheeks, and lips and near the thenar eminence of the palm. All symptoms spontaneously resolved in 2 to 3 days.

On physical examination diffuse wheezes with moderately diminished air entry were noted on lung auscultation. Otherwise, the patient had a soft, nontender abdomen without organomegaly, no lymphadenopathy, rashes, or ocular symptoms, and a normal mental-status examination. Spirometry revealed moderate restriction (forced vital capacity [FVC]: 2.78 L at 54% of predicted [reference range: 80–100%]; forced expiratory volume in 1 second [FEV_1]: 2.22 L at 58% of predicted [reference range: 80–100%]; FEV_1/FVC: 107% [reference range: 80–100%]; forced expiratory flow rate between 25% and 75% of the forced vital capacity [$FEF_{25–75}$]: 2.07 L/second at 55% of predicted [reference range: 70–100%]) and reduced gas diffusion (diffusion capacity of 14.63 at 58% of predicted [reference range: 80–100%]). Laboratory evaluation revealed leukocytosis, a white blood cell (WBC) count of 47 800/mm³ with 67% eosinophils (absolute eosinophil count: 32 000/mm³), elevated platelet count (445 000/mm³), and normal hematocrit. Hypergammaglobulinemia, with increased levels of immunoglobulin (Ig)G (1870 mg/L [reference range: 639–1344 mg/L]), IgM (962 mg/L [reference range: 40–240 mg/L]), and IgE (1570 ng/L [reference range: 0–200 ng/L]), was also noted.

Key Words: visceral larva migrans, Toxocara, pediatric, eosinophilia, pulmonary

Abbreviations: FVC, forced vital capacity; FEV_1, forced expiratory volume in 1 second; $FEF_{25–75}$, forced expiratory flow rate between 25% and 75% of the forced vital capacity; WBC, white blood cell; Ig, immunoglobulin; VLM, visceral larva migrans

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The erythrocyte sedimentation rate, C-reactive protein, antineutrophil cytoplasmic antibody, IgA hepatic transaminase, serum urea nitrogen, and creatinine levels were within normal limits. An echocardiogram and electrocardiogram were normal.

The patient denied any history of travel. She smokes half a pack of cigarettes per day and had been taking ibuprofen once or twice daily for occasional headaches for 2 weeks before evaluation. She had a cat and guinea pig at home. She denied pica but stated that she had eaten an earthworm on a dare at the beginning of August 2004. This event occurred in a friend's backyard in which a dog and puppy frequently played. She also denied ingestion of any undercooked or raw meat or liver.

Non–contrast-enhanced chest computed tomography images demonstrated small (5-mm), noncavitary bilateral nodular opacities that were predominantly peripheral in location; several were associated with a hazy ground-glass appearance (Fig 1). Small bilateral pleural effusions were noted also. There was no evidence of pulmonary consolidation or hilar, parabronchial, or mediastinal lymphadenopathy. In addition, there was no imaging evidence of hepatic or splenic involvement or abdominal lymph node enlargement. Bronchoalveolar-lavage cultures were negative for viruses and bacteria. A parabronchial biopsy demonstrated an eosinophilic organizing pneumonitis with multiple eosinophilic microabscesses (Fig 2). No vasculitis, granulomas, or parasites were seen on biopsy. Because of concern for a malignant process, specifically acute lymphoblastic leukemia, the patient underwent a bone marrow biopsy that revealed a 70% cellular marrow, normocellular for age, with an increase in eosinophilic forms, estimated to be 50% to 60% (Fig 3).

Additional testing revealed that the patient was purified protein derivative–negative and had negative stool ova and parasite examinations. Serological testing for *Trichinella spiralis* and *Strongyloides stercoralis* were negative. *Toxocara* titers returned positive with values of >1:4096 (reference: <1:32). Ophthalmologic examination ruled out ocular larva migrans.

The patient received a 10-day course of albendazole (400 mg orally twice daily) and demonstrated significant clinical improvement with resolution of cough and pulmonary function abnormalities within several days into the course of therapy (FVC: 3.70 L at 102% of predicted [reference range: 80–100%]; FEV_1: 3.25 L at 101% of predicted [reference range: 80–100%]; FEV_1/FVC: 100% [reference range: 80–100%]; $FEF_{25–75}$: 3.92 L/second at 100% of predicted [reference range: 70–100%]) and normal gas diffusion (diffusion capacity of 22.04 at 88% of predicted [reference range: 80–100%]). Her WBC count and hypergammaglobulinemia normal-

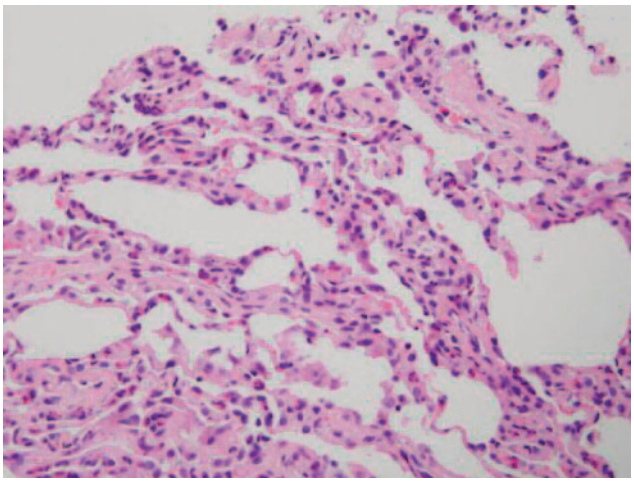

FIGURE 2
Hematoxylin-eosin stain of transbronchial biopsy that demonstrates organizing eosinophilic pneumonitis.

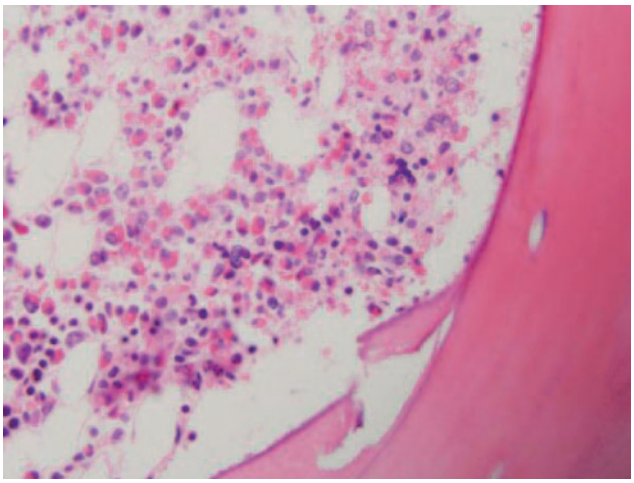

FIGURE 3
Bone marrow biopsy, with 50% to 60% eosinophils.

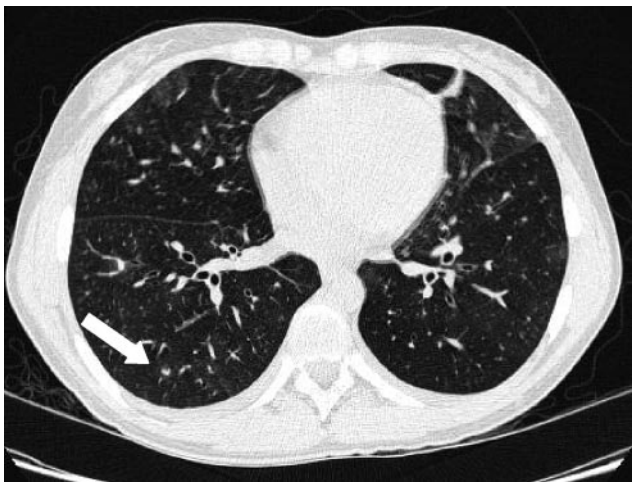

FIGURE 1
Non–contrast-enhanced axial computed tomography image of the lungs at presentation with multifocal noncavitary pulmonary nodules (the arrow indicates 1 nodule).

ized within 20 days. Nevertheless, despite marked clinical improvement, eosinophils (WBC count: 9350 with 19% eosinophils; absolute eosinophil count: 1780/mm^3) and *Toxocara* serologies (>1:4096) remained elevated 3½ months after completing antihelminthic therapy.

DISCUSSION

To our knowledge, this is the first case report that describes the clinical course of pulmonary visceral larva migrans (VLM) caused by *Toxocara* spp. associated with a discrete ingestion in an adolescent patient. The majority of *Toxocara* infections occur in young children, 1 to 4 years of age, for whom ingestion of contaminated soil is the obvious means of infection.[1] Nevertheless, among helminth infections affecting humans in developed countries, *Toxocara* ranks second only to pinworm infection in frequency.[2]

In this case, the ingested earthworm served as the paratenic carrier of *Toxocara* larvae from the soil to the patient. Researchers have demonstrated that *Toxocara* larvae are distributed in the tissues of earthworms exposed to infective *Toxocara* eggs and can be transmitted to animal hosts when they are fed earthworms.[3] In addition, this known single-point source ingestion, in contrast to multiple instances of soil ingestion that is seen more commonly in young children, provides a rare opportunity to define the incubation period of VLM (~4 weeks between ingestion and symptom onset in this case).

Although infection is most often clinically asymptomatic[4] and self-resolving, pulmonary involvement can cause cough, wheeze, dyspnea, and infiltrates and may mimic bronchitis, pneumonia, or asthma. Adults with *Toxocara* spp. pulmonary infection have presented with respiratory failure,[5,6] eosinophilic pleural effusions,[7,8] pulmonary nodules, and acute and chronic eosinophilic pneumonia.[9,10] Previous reports in the pediatric literature have demonstrated varied presentations of VLM in children including chronic hypereosinophilia,[11] hepatic granulomas and abdominal lymph node enlargement,[12] central nervous system toxocariasis (ie, eosinophilic meningoencephalitis, cerebritis, myelitis),[13–16] pulmonary involvement including wheezing, coughing, respiratory distress, and pulmonary infiltration,[17] myocarditis,[18,19] and, more recently, thrombocytosis.[20] VLM has been associated also with pyogenic liver abscesses in children.[14,21] In addition, *Toxocara* infection has caused pericardial tamponade[22] and has also been shown to mimic lymphoma.[23]

Our patient demonstrated the classic clinical findings seen with pulmonary toxocariasis, including fever, wheezing, coughing, pulmonary nodules, and eosinophilic pneumonia. In young children, fever and hepatomegaly have been shown to be common clinical signs, and abdominal ultrasound examination findings in children with *Toxocara* spp. infection include hepatosplenomegaly, hepatic granulomas, and abdominal lymph node enlargement.[12] Nevertheless, it has been noted that hepatic nodules in VLM may not be very numerous or well defined, suggesting that such lesions might be overlooked.[12] The hypergammaglobulinemia noted on laboratory evaluation suggests hepatic migration of larvae in this patient, although no clinical or radiologic hepatic abnormalities were seen. In addition, our patient demonstrated thrombocytosis on initial presentation and for 2½ weeks during her illness; a laboratory manifestation of VLM that has been reported only recently.[20] Because of the findings of hypereosinophilia in association with multiple pulmonary nodules, our patient underwent bone marrow biopsy to rule out a malignant process. A normocellular marrow with striking eosinophilic predominance was noted, which suggested a reactive process, as seen with a parasitic infection.

Although the definitive diagnosis of toxocariasis requires detecting *Toxocara* larvae in the tissues, larvae are found only rarely on pathologic examination. Alternatively, the detection of specific antibodies for *Toxocara* larval antigens, in the context of marked hypereosinophilia (range: 17–85%; mean: 38%),[24] hypergammaglobulinemia, and negative serological results for other parasitic diseases, strongly supports the diagnosis of acute *Toxocara* infection. Specifically, the remarkably high enzyme-linked immunosorbent assay titer (>1:4096) using *Toxocara* spp. excretory/secretory antigen from second-stage (L2) larvae in this patient who had ingested dirt while eating an earthworm, a known paratenic carrier of *Toxocara* larvae, in an area in which dogs and puppies had played and likely defecated, were strongly suggestive of acute infection. Antibody to the excretory-secretory *Toxocara* spp. antigen via the enzyme-linked immunosorbent assay method has a sensitivity of 78% and specificity of 92% at a titer of 1:32 for VLM.[25] The quantity of the infecting dose and frequency of reinfection affects the distribution and survival of *Toxocara* spp. larvae and contributes to the marked eosinophilia and hypergammaglobulinemia seen with VLM. Infection with *Toxocara* spp. can produce a profound inflammatory response, not unlike atopy, and perhaps contributed to our patient's initial symptoms of swelling around the eyes, lips, and cheeks. Eosinophilia, leukocytosis,[1] and *Toxocara* serological response[16] may take months to years to resolve even when all clinical symptomatology has normalized. Given the extent of pulmonary findings in our patient associated with strongly elevated *Toxocara* titers, we postulate that this patient ingested a large inoculum of larvae and had a pronounced allergic and inflammatory reaction to the parasite, notwithstanding the history of an isolated ingestion of contaminated soil associated with eating an earthworm.

Previous publications have reported that VLM is a benign and self-limited illness and that treatment of mild

cases is rarely necessary.[4,5] Nevertheless, severe pulmonary, myocardial, or central nervous system involvement may warrant therapy. Recommended antihelminthics, for adults and children, include albendazole 400 mg twice a day for 5 days or mebendazole 100 to 200 mg twice a day for 5 days, although the optimal duration of therapy is not known.[26] Treatment with antihelminthics, particularly in cases of recent *Toxocara* infection, will aid in limiting additional migration of *Toxocara* larvae and may decrease the possibility of even a single larva migrating into the eye and causing ocular damage. There is no consensus concerning the utility of corticosteroids in the treatment of VLM, although steroids have been felt to be beneficial in cases of severe respiratory or myocardial involvement.

This case also highlights the high prevalence of *Toxocara* eggs in the soil environment. Numerous studies have demonstrated *Toxocara* eggs in substantial proportions in environmental soil samples from public parks, playgrounds, and backyards worldwide.[27–29] Eating earthworms, which ingest soil and are covered in soil, is certainly a risk for infection with *Toxocara*.

Although most pediatric patients with clinically evident VLM present with fever and hepatomegaly, this case, an adolescent patient with hypereosinophilia and nodular pulmonary disease, demonstrates the variations in clinical symptomatology in pediatric patients. Clinical recovery from pulmonary VLM may be rapid despite continued eosinophilia and consistently elevated *Toxocara* titers. Public education about the sources of *Toxocara* infection is a priority.

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An error appeared in the article by Cianferoni et al, titled "Visceral Larva Migrans Associated With Earthworm Ingestion: Clinical Evolution in an Adolescent Patient" published in the February 2006 issue of *Pediatrics Electronic Pages* (doi: 10.1542/peds.2005-1596). On page e337, the legend for Figure 2 reads: "Hematoxylin-eosin stain of transbronchial biopsy that demonstrates organizing eosinophilic pneumonitis." It should read as follows: "Hematoxylin-eosin stain of transbronchial biopsy demonstrating increased numbers of intracapillary circulating eosinophilis." The authors would also like to acknowledge Dr Sara O. Vargas from the Division of Pathology at Children's Hospital Boston for providing the photomicrographs for Figures 2 and 3.

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Shattuck PT. The Contribution of Diagnostic Substitution to the Growing Administrative Prevalence of Autism in US Special Education. PEDIATRICS 2006;117:1028–1037.

Errors appeared in the article by Shattuck titled "The Contribution of Diagnostic Substitution to the Growing Administrative Prevalence of Autism in US Special Education" that was published in the April 2006 issue of *Pediatrics* (doi:10.1542/peds.2005-1516). On page 1029, lines 8 through 11 in the first paragraph, the author wrote: "In the California Developmental Disabilities Service system, the number of clients with an autism diagnosis as a percentage of all clients rose from 4.9% to 9.4% during the 1994–2003 period.[1]" It should have read as follows: "In the California Developmental Disabilities Service system, the number of clients with an autism diagnosis as a percentage of all clients rose from 4.9% to 9.4% during the 1987–1998 period.[1]"

On page 1031, the last sentence of the first paragraph of the Results section, the author wrote: "Of the 2, the higher prevalence estimate from New Jersey was closest to other recent epidemiological surveys yielding estimates of 61.3 per 1000[38] and 57.9 per 1000.[39]" It should have read as follows: "Of the 2, the higher prevalence estimate from New Jersey was closest to other recent epidemiological surveys yielding estimates of 6.26 per 1000[38] and 5.87 per 1000.[39]"

On page 1037, Reference number 39 reads: Baird G, Charman T, Baron-Cohen S, et al. A screening instrument for autism at 18 months of age: A 6-year follow-up study. *J Am Acad Child Adolesc Psychiatry.* 2000;39:694–702.

Reference 39 should be: Chakrabarti S, Fombonne E. Pervasive developmental disorders in preschool children: Confirmation of high prevalence. *Am J Psychiatry.* 2005;162:1133–1141.

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