

## Review Article

# Life-threatening complications of ascariasis in trauma patients: a review of the literature

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**BACKGROUND:** Ascariasis is one of the most common human parasitic infections worldwide. In some rare cases, ascariasis may cause serious consequences even sudden death. This study was undertaken to review the life-threatening complications of ascariasis in trauma patients reported in the literature.

**DATA SOURCES:** Relevant articles about ascariasis and trauma were searched from Pubmed, Google scholar, Scirus, and Wanfang databases.

**RESULTS:** Twenty-four patients with ascariasis were collected from 21 articles searched. Most of these patients were from tropical and subtropical countries. Of the 24 patients, 12 were children. Their major complications occurred in the airway passage and digestive tract. There were 3 fatal cases in these patients. Twelve of the 24 patients described in 10 articles were reported in the last 10 years.

**CONCLUSIONS:** Early diagnosis and prompt intervention are essential to minimize the high morbidity and mortality of these serious complications in trauma patients. Physicians should be aware of the possibility of *Ascaris* infection in a trauma patient from endemic area of ascariasis. History of *Ascaris* infection and routine examination of feces for *Ascaris* eggs may be helpful to make a correct diagnosis.

**KEY WORDS:** *Ascaris lumbricoides*; Ascariasis; Trauma; Emergency medicine; Surgery; Complications

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## INTRODUCTION

Ascariasis is one of the most common human parasitic infections worldwide, especially in developing countries. Ascariasis occurs frequently in tropical and subtropical regions, and in any areas with inadequate sanitation. Estimated 1.5 billion persons were infected with *Ascaris* in 2002. Children are infected more often than adults.<sup>[1]</sup> Severe *Ascaris* infections cause approximately 60 000 deaths per year worldwide, mainly in children.<sup>[2]</sup> Parasitic diseases are one of major public health problems, and ascariasis is common in China. Considerable progress in prevention and treatment of this infection has been made during the past decades. According to the data of the national survey carried out from June 2001 to 2004 compared with those of the national survey performed in 1990, the prevalence of

ascariasis was declined by 71.29%. However, there are still 85.93 million people infected with *Ascaris* in China.<sup>[3]</sup> Most patients infected with *Ascaris* have a chronic disease course and remain asymptomatic for years or present with only mild symptoms. In some rare cases, ascariasis may cause serious consequences, even sudden death.

Traumatic injuries are one of significant public health problems worldwide and may affect all age groups. About 5 million people worldwide died from injuries in 2000, and injuries accounted for 9% of the deaths in the world in 2000 and 12% of the world burden of diseases.<sup>[4]</sup> Complications are very common in trauma patients and contribute greatly to morbidity and mortality. Recently, Osler et al<sup>[5]</sup> have analyzed the data of 409 393 trauma patients and found a total of 175 299 complications in these patients. And 24% of the patients had at least one

complication. However, the presence and significance of *Ascaris* infection in trauma patients has rarely been reported. In fact, life-threatening complications of ascariasis may occur in trauma patients. This study was undertaken to review the literature on ascariasis, while emphasizing the awareness of *Ascaris* infection in some rare cases.

## DATA SOURCES

The data in articles were searched from Pubmed, Google scholar, Scirus, Chinese Wanfang databases with key words "Ascaris", "trauma" and variations of these terms.

## RESULTS

### Complications of ascariasis in the airway passage

#### *Ascaris* obstructing the larynx

Lapid et al<sup>[6]</sup> reported a ten-year-old girl hospitalized with burns to 45% of her body surface area, including the face. The girl was intubated upon admission and mechanically ventilated. Four days later, she was faring well enough to be extubated. But she was reintubated 15 minutes later for acute respiratory distress, inspiratory stridor and severe hypoxemia. Laryngoscopy disclosed an unidentified tubular object which obstructed the opening of the larynx. It was removed and identified as a 35-cm long *Ascaris* roundworm. It was estimated that 20–25 cm of the worm was located in the trachea and bronchi prior to removal. After the removal, her respiratory condition dramatically improved.

Finsnes<sup>[7]</sup> reported a 7-year-old girl who was severely wounded in an explosion incident. She was injured in the chest and had a penetrating wound to the right lung, diaphragm and liver. She had an abdominal surgery and stayed in the intensive care unit for 5 days, and made a remarkable physical recovery in the first week. The girl was given a general anesthetic for removal of a large number of stitches on her chest, back and abdomen. She slept in the recovery position for the following hour. At this point, she suddenly developed upper airway obstruction with falling SpO<sub>2</sub> from what appeared to be laryngospasm. A triple airway manoeuvre (head tilt, jaw thrust, and mouth opening) was performed, and then part of a worm protruded from her mouth. She quickly recovered after removal of a 30-cm long female *Ascaris* worm from her larynx. At last, she was successfully treated.

#### *Ascaris* in the trachea

Wu et al<sup>[8]</sup> described a 50-year-old woman with

tetanus due to wound of the left foot 5 days before her admission to the hospital. She had frequent dyspnea and convulsion. She underwent a tracheotomy and showed stable vital signs without any spasms. However, on the second day of her hospital stay, a 10-cm long *Ascaris* worm was aspirated from the pharynx. On the 6th day she had an attack of severe dyspnea, agitation, frequent convulsions and cyanosis. Drug intervention showed no effect, but all the symptoms were resolved after removal of a 10-cm long *Ascaris* worm from the trachea by aspiration. Similar events happened twice again 2 days and 4 days later, and both were resolved after removal of a 10-cm long *Ascaris* worm from the trachea. The patient received anti-helminth treatment and 40 *Ascaris* worms were expelled in the stools. She recovered well and was discharged after a 40-day stay in the hospital.

#### *Ascaris* obstructing the tracheal tube

Imbeloni<sup>[9]</sup> described a fatal case that a man admitted to the hospital after being struck by a car. He was comatose and developed respiratory failure. He was intubated and mechanically ventilated, with resultant improvement of blood gases and vital signs. After two days his orotracheal tube was changed because of the presence of thick secretions. Three hours later he developed acute respiratory failure and cardiac arrest and could not be resuscitated. Autopsy revealed a long *Ascaris* worm in the endotracheal tube.

Gan<sup>[10]</sup> described a 56-year-old man who was hit at his head by a dropping heavy object from a high place at 3 hours before his admission to the hospital. He underwent a repairing operation for the depressed skull fracture and had a tracheotomy. On the 10th day after surgery the comatose patient developed sudden dyspnea and cyanosis. Aspiration of sputum did not help at all, but the patient recovered promptly after removal of a 12-cm long live *Ascaris* worm which obstructed the tracheal tube.

Xuan<sup>[11]</sup> reported that a 12-year-old comatose boy was admitted to the emergency department. He had a depressed skull fracture and brain contusion. He underwent tracheotomy after admission to the hospital. On the third day of his hospital stay, he had sudden dyspnea. The respiration returned to normal as soon as a 15-cm long *Ascaris* worm was found and pulled out from the endotracheal tube during sputum suction. The boy was discharged after a 34-day stay in the hospital.

Bailey and Wainer<sup>[12]</sup> reported a 9-year-old boy who suffered a high-voltage electrical injury on the posterior scalp and right neck. On his second hospital day an *Ascaris* worm was removed from his oral cavity

during routine care. Thus, he received a treatment with mebendazole. An initial excision and temporally wound coverage were completed on hospital day 4. The boy remained stable postoperatively for 1–2 hours, and at that time he had a respiratory arrest which necessitated chest compressions and vasopressors. Fiber-optic bronchoscopy revealed a near-total occlusion at the end of the endotracheal tube by an *Ascaris* worm. A 22-cm long worm was removed. Finally the child received six additional reconstructive operations, recovered well, and was discharged after a 46-day stay in the hospital.

Noerdin et al<sup>[13]</sup> reported a 7-year-old boy with a head injury in a motor vehicle accident. He underwent a craniotomy and was stable for 48 hours. Then his condition progressively deteriorated. The patient showed dyspnea and hypoxemia was worsening despite giving pure oxygen. Manual ventilation was not helpful. Endotracheal tube was changed and no blockage with mucus plug was observed. Flexible bronchoscopy via the endotracheal tube revealed a yellowish tube like object at the lower end of the trachea, sitting on the carina and the ends snuggling into both the right and left main bronchi. The patient was then put under general anaesthesia to remove the foreign body with a rigid bronchoscope. It was identified to be an 8-cm long *Ascaris* roundworm. After the procedure, his ventilation and oxygenation markedly improved. The boy was eventually discharged home three weeks later.

Bharati et al<sup>[14]</sup> described a 28-year-old man, a polytraumatized victim, was presented in the emergency room with signs of respiratory distress. He had a compressed fracture of the dorsal vertebrae (D1-D2), right femur and right tibia and fibula, and multiple rib fractures with flail segment of the chest and pneumothorax. A bilateral chest tube was inserted into the pneumothorax. The patient was electively intubated in the emergency room and shifted to the ICU for further management. On the second day of his ICU stay, he suddenly became restless and started to be desaturated. It was noticed that the movement of the chest wall was asymmetrical. As the suction catheter was removed from the endotracheal tube, a 15-cm long *Ascaris lumbricoides* was suctioned out. Later, the conditions of the patient were improved and the patient settled down. He received anti-helminthic treatment and was operated upon for the bone fractures. The rest of his course in the hospital was uneventful.

#### ***Ascaris* worm in the intercostal drainage bag**

Mohite et al<sup>[15]</sup> reported a middle age man with a recent blunt trauma over the left chest, and had a left

pneumothorax with a collapsed lung. An emergency intercostal drainage tube was inserted and fixed. Next morning, the left lung was well expanded and there was no air under the diaphragm. In the afternoon, an *Ascaris* worm was noticed in the intercostal drainage bag along with 50 mL of blood mixed with bile. During the laparotomy, the intercostal drainage tube was found to perforate the left dome of the diaphragm with the tip entering the loop of the jejunum. The chest tube was removed on the second day of operation and the patient made a quick recovery.

#### ***Ascaris* pneumonitis**

Lastra et al<sup>[16]</sup> reported a 25-year-old man, who was injured with loss of consciousness in a motorcycle accident. He had a fracture of the left frontal bone and orbit, a fracture of the anterior cranial fossa and left frontal cerebral contusion. Chest radiography identified alveolar infiltrates in both lung fields, and blood test revealed leukocytosis and eosinophilia. Numerous *Ascaris* larvae were found in the left bronchus by fiber-bronchoscopy and identified pathologically. Unfortunately, the patient died of brain death caused by severe trauma.

Heggens et al<sup>[17]</sup> reported *Ascaris* infection in three children thermally injured in the same fire. One child without smoke inhalation did not develop *Ascaris* pneumonitis even with positive stool samples and was discharged with no complications. Whereas the other two children had a complication of smoke inhalation, that induced severe pneumonitis. One of them was placed on extracorporeal membrane oxygenation (ECMO) and did not complete the treatment with vermox. This child died of adult respiratory distress syndrome (ARDS) after several weeks of ECMO treatment. Histological lung sections revealed *Ascaris* larval infestation. Another child also developed a pneumonitis, but received the full course of treatment with vermox, slowly recovered, and discharged home. The authors concluded that a heavy infestation of *Ascaris* could further exacerbate the smoke-induced lung injury.

#### **Complications of ascariasis in the gastrointestinal tract**

##### ***Roundworm in the intestinal lumen***

Podgorny<sup>[18]</sup> reported a 3-year-old boy who was injured by a pistol shot had a wound in the chest and abdomen. Exploratory laparotomy revealed, in addition to the gunshot penetrating injuries of the lung, liver, stomach, gall bladder and colon, most unexpectedly, a

massive *Ascaris* infection throughout the entire length of the small intestine, one *Ascaris* worm lodged in the appendix, and another worm was found while examining the perforation of the transverse colon. The two worms were removed and the perforations in the colon were repaired. After the operation the child improved rapidly and eventually was discharged home.

Pratt and Blachar<sup>[19]</sup> reported a 17-year-old girl who was involved in a bomb explosion with multiple injuries in the chest, abdomen and pelvis. A CT scan of the abdomen revealed an incidental finding of multiple curvilinear tubular and cylindrical filling defects in the intestinal lumen, suspicious for an intra-luminal intestinal infection with roundworm. It was confirmed at emergency abdominal operation performed for the traumatic intestinal perforation.

Cabrera and Garcia<sup>[20]</sup> reported a 26-year-old soldier who was shot in the right upper back abdomen. A surgical diagnosis was made of open abdominal trauma involving the right kidney, ascending colon, and a 2-cm duodenal perforation. After right nephrectomy and hemicolectomy, an adult female *Ascaris* worm emerged from the small intestinal wound and moved into the surrounding peritoneal cavity. The patient did well after the operation and was later discharged in good condition.

### **Roundworm in the intestinal lumen and peritoneal cavity**

Masumbuko and Hawkes<sup>[21]</sup> reported a 12-year-old girl presented with gunshot wounds on the anterior abdominal wall, involving the left shoulder and the thumb of the left hand. She underwent an urgent exploratory laparotomy. In addition to the surgical treatment of gunshot injuries of many abdominal organs, an unexpected finding was that a total of 22 ascarids (seven had been fragmented by the bullet) were extracted through the traumatic enterotomy wound and from the peritoneal cavity. Fortunately, the patient recovered well without complication.

### **Roundworm in the peritoneal cavity**

Huang et al<sup>[22]</sup> reported 2 cases of traumatic rupture of the small intestine (the exact nature of trauma was not specified) who underwent intestinal anastomosis. The patients developed acute abdominal colicky pain and rebound tenderness at 5 and 11 days after the operation, respectively, and were suspected of intestinal fistula and peritonitis. In both patients the second laparotomy revealed the rupture of intestinal anastomosis and the

presence of several *Ascaris* worms in the peritoneal cavity. Both patients recovered well after the second operation and were discharged from the hospital.

Alfonso and Carrigan<sup>[23]</sup> reported a 45-year-old man admitted to the hospital with a right tibia fracture. Three days later he developed acute inflammation of the abdomen. At laparotomy it was discovered that there was a perforation of the ileum with hundreds of *Ascaris* worms lying freely in the peritoneal cavity. The patient was treated and uneventfully recovered.

### **Ascaris in the nasogastric tube**

Perry et al<sup>[24]</sup> reported a 39-year-old woman who was wounded in a motor vehicle crash. She had multiple bone fractures and tendon injury. The patient received broad spectrum antibiotics, analgesia, and was admitted to the ward. A nasogastric tube was inserted for nausea the following day after admission. Her tendon injuries were repaired operatively. Postoperatively the nasogastric tube was extracted while a large, red, pointed, writhing *Ascaris* worm was found. The patient was treated with mebendazole and recovered uneventfully.

### **Roundworm passing from the mouth**

Scherbenske and Norman<sup>[25]</sup> reported a 23-year-old man injured by beating. He had a scalp laceration and a left radius and ulna fracture, and an open left metacarpal fracture. The patient was operated upon for the wound of the left forearm. He was anesthetized and an endotracheal tube was inserted orally via direct laryngoscopy. The 5-hour operation was well tolerated by the patient. While being fully awaking, the patient was extubated and given oxygen via a face mask. After moving the patient to a gurney for transportation to the surgical intensive care unit, he regurgitated a 15-cm adult female *Ascaris lumbricoides*. The infestation was undiagnosed until after extubation. He was treated with mebendazole, recovered well, and was discharged 7 days after admission.

Margery and Niang<sup>[26]</sup> reported a 36-year-old man admitted to the emergency room after being hit by a bus. He had an orbital hematoma and rib fractures. During an overnight observation, a female adult *Ascaris* worm was observed to exit from the mouth. Finally, the patient recovered well and was discharged.

## **DISCUSSION**

In this study, we collected 24 cases reported in 21 articles. There were 13 males and 6 females (other 5

cases were not specified). The overwhelming majority of the patients were from tropical and subtropical countries. Although ascariasis occurs at all ages, it is most common in children. In this article, 12 of the 24 cases were children. The most frequent causes were traffic accidents in 5 cases, firearm wounds in 5, and burn injuries in 4. There were 3 fatal cases in this group of patients. Ascariasis is one of the 17 neglected tropical diseases in the world,<sup>[27]</sup> and still constitute a significant burden in many developing countries. We noticed that 11 cases, almost half of the 24 cases described in 10 articles were reported in the last decade; among them, 8 cases in 8 articles were reported in recent 4 years. These facts highlight the actual significance of this finding.

It is worth noting that among the 24 cases, *Ascaris* infestation was diagnosed only in 5 cases before surgery, in 6 cases during abdominal surgery or respiratory intubation, in 2 cases after operation, but postoperatively in 11 cases and 2 cases at autopsy. This indicates that physicians need to pay more attention to the possibility of *Ascaris* infection in trauma patients.

It is also worthy of noting that the dangerous consequence to the patient is not necessarily correlated with the number of infected *Ascaris* worms. Among the reported cases, massive *Ascaris* infection in the intestine<sup>[18]</sup> or in the peritoneal cavity<sup>[21,23]</sup> was successfully treated. However, the single *Ascaris* worm obstructing the tracheal tube,<sup>[10]</sup> endotracheal tube,<sup>[11,12,14]</sup> larynx<sup>[6]</sup> or trachea,<sup>[8,13]</sup> caused sudden life-threatening dyspnea and necessitated immediate intervention. A single roundworm obstructing the endotracheal tube even caused acute respiratory failure and death of a patient.<sup>[9]</sup> These data demonstrate that the presence of even a single *Ascaris* worm in the airway tract is extremely dangerous, and physicians should be vigilant on this issue.

It is understandable that almost all complications of ascariasis in trauma patients so far reported were found in the digestive and airway tracts. It is closely related to the unique life cycle of *Ascaris lumbricoides*. *Ascaris* infection is taken place by ingestion of eggs in the fecal-contaminated drinking water and foods. Eggs containing infective larvae hatch in the duodenum. The larvae penetrate the intestinal mucosa and enter the circulatory system, via the venous system to the liver and then to the lung. The larvae molt twice in the lungs, and eventually rupture from the pulmonary capillaries to enter the alveoli. Subsequently they move up to the respiratory tree and trachea to the epiglottis to be coughed up, swallowed, and passed again to the small intestine, where they complete the final molt and develop to sexual maturity.<sup>[28]</sup>

*Ascaris* worms have the ability to probe and force their way into various ectopic locations. Probably they are prone to try to escape unfavorable conditions. Thus, various abnormal conditions such as fever, diseases, surgical operation, drugs, anesthesia, traumatic injuries, spicy foods, fasting, etc., may cause them to migrate to other less hostile regions, finally to diverse complications such as intestinal perforation,<sup>[22,23,29]</sup> volvulus,<sup>[30,31,32]</sup> intussusceptions,<sup>[33]</sup> and gangrene.<sup>[34]</sup> *Ascaris* may penetrate through the intestinal perforation into the peritoneal cavity and cause acute peritonitis.<sup>[21,22,23,35]</sup> When larvae migrate through the lungs, they may cause eosinophilic pneumonitis (Löffler's syndrome).<sup>[16,17, 36]</sup> *Ascaris* worms in the airway passage can cause sudden obstruction and dyspnea,<sup>[8-13,37]</sup> or cough with *Ascaris* worm from the nose or mouth.<sup>[26,38,39]</sup> Understanding the characteristic behavior of *Ascaris* worms may be helpful in our diagnosis and treatment.

Although ascariasis is more prevalent in tropical and subtropical developing countries, physicians should be vigilant of related complications. At the present time, the intensive immigration and freedom of travel between various parts of the world may increase the incidence of this disease.

The diagnosis of *Ascaris* infection is usually not difficult. Especially, many powerful diagnostic techniques such as ultrasound, CT, MRI and endoscopy are widely applied at present. However, the most important thing is that physicians should be aware of the possibility of *Ascaris* infection in a trauma patient. From a practical point of view, a careful collection of previous history of *Ascaris* infection such as roundworm in vomitus or passing in stools and a routine examination of feces for *Ascaris* eggs may provide valuable information that is useful to make a correct diagnosis. This test is simple to perform, non-invasive and cheap in cost, and it can be done everywhere, even in a rural ambulance service. Therefore, it is worth taking a routine stool examination in every urgent trauma patient coming from an endemic area of ascariasis. Since a delay in its management may have a fatal outcome, early diagnosis and prompt intervention are essential to minimize the high morbidity and mortality of these life-threatening complications in trauma patients.

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data collection and wrote the manuscript. All authors contributed to the design and interpretation of the study, and approved the final manuscript.

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