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Parasitic Appendicitis

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1. Introduction

The etiologic factors and the incidence of appendicitis differ from country to country.(Francis et al, 1992; Jones et al, 1985) In this chapter, we discuss parasitic appendicitis. Enterobious vermicularis and Tenia sp are frequently found in the appendectomy specimens in Izmir, Turkey. Other parasites include: Trichuris trichiura, Schistosoma haematobium, Schistosoma mansoni, Ascaris lumbricoides, Entamoeba histolytica which are reported in different city and countries. (Okolie et al, 2008; Pasupati et al, 2008; Terada et al, 2009) .

It is important to understand about parasitic appendicitis for both local populations at risk and for travelers.

This chapter asks if the incidence of parasitic appendicitis be reduced with preventive medicine?

Whenever parasites are found at an appendicectomy antiparasitic treatments are necessary and the rest of the immediate family should be treated. Education about hand washing, hygiene, cooking and animal management may be required.

2. Histology

Appendix wall has four layers from out to in that serosa, muscular layer, submucosa and mucosa respectively. Muscular layer contains circular and longitudinal muscles. Appendix has intestinal structure but there is not villus in the mucosa. Lamina propria and submucosal layers have got large amounts of lymphoid tissue. (Erbengi, 1985; lab.anhb.uwa.edu.au, 2011; Skandalakis et al, 2004)

3. Clinical features

The clinical features of appendicitis in the context of parasitic infections are varied.

Etiology of parasitic appendicitis:

Appendicitis is more common in males than females (1.4:1) and can be seen at any age but it is more commonly seen in older children and in young adults. Obstruction of the appendiceal lumen can occur with parasites and their eggs. If the lumen is obstructed, continued secretion and proliferation of bacteria or the parasites may cause an increase in the intraluminal pressure. Increased pressure impairs the circulation of the appendix wall and mucosal damage may cause bacterial invasion, inflammation, sepsis and finally necrosis

and perforation. If the lumen is obstructed, pain can be partially or exclusively reported at the umbilicus, and can be difficult to localize. (Bilgin, 2004; Engin O et al, 2010,2011; Lally et al, 2004; Smink et al, 2007; Turhan et al, 2009)

Taenia

Taenia saginata, is a parasite of both cattle and humans, causing taeniasis in humans and is frequently seen in Turkey, Africa, Southeast Asia, other parts of Eastern Europe and in Latin America where cattle are managed by infected humans who have poor hygiene. Preventative measures include better education, proper disposal of faeces and rigorous meat inspection programs and the thorough cooking of beef. The organisms are killed if meat is heated to 75^0C for 5 minutes or until no longer pink or cooled to -10^0C for 5 days.

T. saginata can grow to over 10 m in length. The worm is divided into an anterior scolex, a short neck and a long body called the strobila. The worm has four strong suckers to anchor it in the intestine where it can live for over 20 years passing out gravid segments containing eggs. These segments dry up and release eggs which can infect cattle. Inside the bovine duodenum the eggs hatch and gain entry to the circulation and then the connective tissues over muscle where they develop into infective cysticercoid cysticerci.

The most commonly infected muscles are the masticatory muscles, heart, tongue, thorax and diaphragm. If meat containing adult Ciysticerci bovis are eaten undercooked or raw, scolexs adhere to the human small intestine and the rings begin to develop. After 10 weeks, adult rings are passes from the anus.

The life cycle of T. saginata is human-cow-human. Oral intake may follow from the unclean hands of workers handling infected meats in slaughterhouses. It is impotant to note that an infected person may have no clinical symptoms.

The diagnosis is made on seeing the falling rings. If eggs are seen in the stool, it can not be easily determined to which tenia the eggs belong.

Treatment for tenia infection is the drug praziquantel which opens calcium channels causing paralysis of the worm, aiding expulsion of the parasite through peristalsis. Albendazole is also effective.

Taenia solium lives in the human small intestine and their cysticercus cellulosa live in the pig which is the intermediate host. The life cycle is human-pig-human. Infection occurs in humans eating undercooked pork. The diagnosis is made on find rings or scolex of T.solium. For prevention the contact of human stool with pigs should be avoided and undercooked pork should not be eaten.(Cetin et al, 1983; Gonzales et al, 2002; Sartorelli et al, 2005; Unat et al, 1982)

Appendicitis and tapeworms

Though infected individuals may be asymptomatic tape worms can cause non-specific symptoms such as abdominal pain, diarrhea and a decreased appetite with nausea. There may be abdominal swelling and on investigation a leucocytosis. Confusion with appendicitis is easily understood. However, distinguishing features may include an increased appetite and eosinophila which are seen with tape worms and not with appendicitis. Protoglottids of the adult tapeworms may be found in the lumen of the appendix but if they casue the appendicitis or not is unclear.

Enterobius vermicularis

Enterobius vermicularis or Occiyur vermicularis, is a small white nematod. The length of the male parasite is 3-6mm, and the width is 0.1-0.25mm. The dimensions in the female parasite

are 8-13mm and 0.3-1.3mm respectively. The host of the parasite is the human. The female parasite leaves the bowel and goes out from anus where it spawns on the perianal region at night and then dies. Male enterobious may be rarely found in the perianal area. Perianal pruritus may occur when the parasite is there. The parasitic embryo becomes an adult in 6-7 hours in the presence of the appropriate heat and humidity. The adult egg is infectious for humans and when the adult egg enters the human gastrointestinal tract, it changes into the to adult parasite. After 15-43 days from oral intake the adult eggs are changed into the spawning adult parasites. The life cycle of the parasite is thus human-human-human. The parasite generally stays in the caecum taking nourishment from the bowel wall where it takes blood, epithelial cells and organic mater

Clinical symptoms caused by the parasite include perianal pruritus, macroscopic and microscopic blood in the stool, appetite disorders, abdominal pain, diarrhoea, weight loss, nasal itching, teeth grinding, dizziness, a singing in the ears and on investigation anemia, and eosinophilia.

Female parasite may go out from the anus and come in to the vagina or urethra and so cause urogenital symptoms. The diagnosis is made on finding the parasite and its eggs on the perianal area, in stool, or under the nails of patient's.

The parasite may infect humans in different ways. The eggs may be taken in through the digestive system. Eggs found in powders may go into foods or be inhaled and after that swallowed. The patient may contaminate others. If contaminated underwear and bed linen are shaken, infection can be transmitted to others. Sometimes, hatched parasites from the matured eggs in the perianal region may enter the bowel retrogradely.

For prevent of infection the vectors must be treated and beds should not be shared and nails should be cut short. Hands must be washed well before cooking and eating. Children must not scratch their perianal regions and rooms should be well ventilated. (Cetin et al, 1983; Chang et al, 2009; Fukushima et al, 2010; Ok et al, 1999; Unat, 1982)

Enterobius vermicularis has been reported in 1.4% of 1549 appendicectomies in the USA (Arcaet al 2004) and is not much higher in many other series.

Trichuriasis

Trichuriasis is a world wide parasite from infected vegetables, fruits, drinking water and dirty fingers. The eggs hatch in the small intestine and the larvae become adults on their way to the caecum and large bowel. Adult worms are 3-4 cm in length and they feeds on food residue and blood. Female parasite spawns in the bowel and the eggs go out with the stool. Embryo grows in appropriate conditions. From egg to spawning adult parasite takes 12-14 weeks from orally intake. (Ok et al, 2009; Unat, 1982; Vavricka et al, 2009) The worms can be asymptomatic but can be visible in the stools and they can cause rectal prolapse and appendicitis. Diagnosis is on seeing the eggs or worms in the stools and treatment is with Flubendazole.

Schistosoma haematobium and S. mansoni

S.hematobium and S.mansoni are the most commonly seen Scistosomia types in humans. The male's length is 10-15mm and female's length is 20mm. They live in the venous system and feed on blood and the final host is the human. After the male and female parasite mate the eggs pass through the urinary bladder and bowel. The parasite is expelled from in the urine or stools and on contact with fresh water they hatch. and infect the intermediate host which is a mollusc. Bulinus truncatus, Bulinus africanus, Bulinus globus are the important intermediate host molluscs. Hundreds of larvae (cercariae) ar released back into the water

after 5-6 weeks from the onset of invasion of the molluscs. The cercariae enter the human through softened skin and migrate to the lungs and the liver. The life cycle of the parasite is human-molluscs (e.g. Bulinus truncatus)-human. To prevent the spread of Scistosomiasis human's urine and stool should be treated before entering rivers. In endemic region, gloves and boots are important because transmission occurs in water. (Cetin et al, 1983; Djuikwo-Teukeng et al, 2011; Keiser et al, 2010; Kosinski et al, 2011)

After appendicectomy eggs have been found in the lumen of the appendix together with transmural inflammation granulomatous reactions and purulent exudates. Sometimes the fibrosis that follows a schistosomal infection causes a luminal obstruction and later secondary bacterial appendicitis.

Ascaris lumbricoides: A round worm

The male parasite's length is 15-20 cm and in female parasites the length is 20-30 cm. The life cycle is human-human-human and infection follows with the oral in take of eggs containing live larvae. Larvaes exit from the egg in the bowel lumen and enter the venous system through bowel wall. They then go to liver, lung, trachea, pharynx, esophagus, stomach, and small bowel. They become adults in 2-3 months. Different clinical symptoms may be found during the 2-3 month period. Clinical symptoms include pain located in the right upper quadrant, nasal itching and intestinal obstruction and discomfort in the chest with a cough producing sputum which may contain parasites. Investigations may show an eosinophilia and icterus due to bile duct obstruction,. The diagnosis is made on finding the parasites and eggs in the stool. Eggs are not found in the stool if there are only male parasites or no adult female parasites in the bowel. The eggs are taken in orally with foods and drinks contaminated with human stool. (Bailey et al, 2010; Cetin et al, 1983; Gupta et al, 2009 ;Unat, 1982)

Treatment is with albendazole or mebendazole. Appendicitis due to ascriasis has been made on Ultrasound and CT scanning showing long filling defects in the right iliac fossa.

Entamoeba histolytica

The main host of the parasite is the human were it stays in the lumen or wall of the large bowel. The parasite may stay in the appendix, small intestine, liver, lung, brain or testis. Spread is via fecal-oral contamination of food and drinks. Clinical symptoms include abdominal pain, diarrhoea and bloody stools. (Ali et al, 2008; Biller et al, 2009; Tan et al, 2010)

Cryptosporidium parvum

This is an intestinal parasite. It is mainly affects the ileum of humans.(Borowsi et al, 2010) Clinical symptoms are diarrhea, nausea, vomiting, fever and abdominal pain. Oocysts are found in the stools of infected humans. The diagnosis is made on finding cysts in the stools or on showing torfozoits in intestinal biopsy specimens. The diagnosis of pulmonary and tracheal cryptosporisidiasis is made by biopsy and staining. The disease is transmitted by the fecal-oral route. (Hannahs et al, 2011; www.fda.gov/Food/FoodSafety/, accessed:16 April 2011))

Microsporidia

This is a mandatory intracellular parasite. It causes a small intestinal infection. Other than this, the parasite may cause biliary tractus, oculary, pulmonary and renal infections. Granulomatous lesions may occur. The most common species of parasite infections are Enterocytozoon bieneusi and Encephalitozoon intestinalis. Enteritis, cholangitis. The diagnosis is made by microscopic examination of biopsy specimens, stools, urine, bile, or

from bronco-alveolar-nasal lavage fluid. Transmission of the disease is: fecal-oral, oral-oral, aerosol inhalation, or eating contaminated foods. (Sancak et al, 2005; Turk et al, 2009)

Blastocystis hominis

B. hominis infection is seen all over the World especially in tropical and subtropical areas. Orally ingested cysts cause an intestinal infection leading to diarrhea, abdominal pain, abdominal distention, weight loss, rectal hemorrhage and pruritus. (Dogruman et al, 2007; Ertug et al, 2009)

Isospora belli

This parasite lives in epithelial cells of the small intestine. The disease is transmitted by contaminated foods and drinks. The symptoms include anorexia, abdominal pain, nausea, diarrhea and fever. The diagnosis is made by identification of oocysts in the host feces. (Nagamani et al, 2008; Walther et al, 2009)

4. Discussion

Though parasites may be found in appendicectomy specimens it does not follow that they always cause the appendicitis. It is well know that an appendicolith may be asymptomatic so to may be parasitic infections in the appendix..(Huwart et al, 2006)

Turan at al. reported a retrospective study that consisted of 56 patients who underwent surgery for gynecologic pathologies. Incidental appendectomy materials were examined microscopically. The appendices were abnormal in 31 cases (55.36%), as follows: acute appendicitis in 3 cases, lymphoid hyperplasia in 21 cases, fibrotic obliteration in 6 cases, and endometriotic implants in one case. Thus lymphoid hyperplasia does not equate to acute appendicitis. (Turan et al, 1994). Likewise some minor degree of lymphoid hyperplasia may follow parasitic infection and not always cause symptoms.

Nonetheless obstruction of the appendicular lumen may start acute appendicitis. Pieper at al.'s experimental model in which the rabbit's appendix was obstructed with a balloon showed a role for obstruction in the pathogenesis of acute appendicitis. (Pieper et al, 1982)

Parasitic appendicitis is reported all over the World but, it is more frequently seen in some areas than another.

Izmir is the third biggest city in Turkey with a population of 3.6million. Two retrospective clinical studies were made in Izmir. The first study was made by Dicle et al between 1990-1996. The second study was made by Engin et al between 2002-2009. The two investigations were made in different two hospitals close to each other in the city center. The numbers of patients attending the emergency departments were similar in the two hospitals.

Dicle et al investigated retrospectively 2473 cases operated between 1990-1996 years and found 45 (1.8%) cases of parasitic appendicitis. The female/male ratio was 30/15. There were 5 Tenia, 34 E.vermicularis, and 6 undetermined parasites in 45 cases. Investigators reported histopathologic changes from mucosal hemorrhage to ulceration in some of the excised appendices: mucosal hemorrhage in 12 cases, eosinophilia in 18 cases, neutrophil infiltration in 6 cases.(Dicle et al, 1997)

Engin et al investigated parasitic appendicitis operated between 2000-2009 years in Izmir, Turkey. In this study, there were 1969 cases of acute appendicitis and 9 parasitic cases (0.45%). These parasites were E.vermicularis and Tenia. Tenia in 2 cases and E.vermicularis in 7 cases. The female/male ratio was 8/1. Fecaliths with parasites were found in two cases and parasites alone in 7 cases.

If Dicle and Engin et al's studies are compared, parasitic appendicitis fell from 1.8% to 0.45%. During this time the literacy ratio rose form 87.13% in 1990 to 95,3% in 2009. (http://ekutup.dpt.gov.tr/bolgesel/gosterge ; http://www.yeniasir.com.tr)

Let us consider another geographic region. The literacy ratio is lower in Adana than some cities in Turkey and parasitic appendicitis is high in Adana. It has been argued that if the literacy ratio is increased to 88% or higher then the parasitic appendicitis ratio may decreased. (Engin et al, 2010)

However, it should be noted that the incidence of parasitic appendicitis was in the early study similar to that found in the USA and the most recent study has one of the lowest incidences reported anywhere in the world.

Hazir et al had made a study in Ankara, Turkey. In this investigation, Screening for E.vermicularis was explored in different districts of Ankara. The following were determined: the student's age, sex, and socioeconomic status of their families, and knowledge about E.vermicularis infection. Significant gender-related differences were not found. Infections declined with increased educational level of the family. The mothers are usually the primary carers of children in Turkey, and for this reason, the mother's educational level affects her child's. In this study, 86.4% of Mothers of children with parasitosis had been graduated from primary school, and only 4,5% of the mothers had graduated from university. This shows that a mother's educational level affects her child's health.(Hazir et al, 2009)

5. Antiparasitic therapy should be given after finding parasitic appendicitis

Antiparasitic therapy must be given to confirmed cases of parasitic infection. Close friends and family members may be examined for parasitic infection and carrier state. Additionally education about hygiene and sanitation must be given.

Community health programs and individual training are important to prevent parasitic infections. People working in the food industry must be appropriately educated and trained. Wastewater treatment plants should be sufficient for the population.

If parasitic infestations are prevented, the rate of appendicitis caused by parasites will also decrease.(Kazemzadeh et al, 2008; Okolie et al, 2008)

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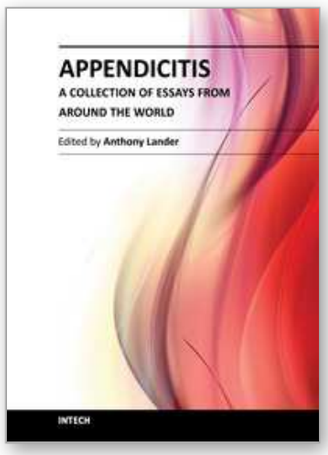

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This book is a collection of essays and papers from around the world, written by surgeons who look after patients of all ages with abdominal pain, many of whom have appendicitis. All general surgeons maintain a fascination with this important condition because it is so common and yet so easy to miss. All surgeons have a view on the literature and any gathering of surgeons embraces a spectrum of opinion on management options. Many aspects of the disease and its presentation and management remain controversial. This book does not answer those controversies, but should prove food for thought. The reflections of these surgeons are presented in many cases with novel data. The chapters encourage us to consider new epidemiological views and explore clinical scoring systems and the literature on imaging. Appendicitis is discussed in patients of all ages and in all manner of presentations.

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