

Parasitic Diseases of Urinary Tract

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Abstract

Urinary tract infections are among frequent health problems, but parasitic infections are taken no notice. Of urinary system diseases, parasitic diseases such as schistosomiasis (bilharziasis) and trichomoniasis effect lots of people and often give rise to renal and lower urinary tract diseases. Echinococcosis and filariasis rarely effect urinary system. Schistosomiasis gives rise to the disease by finding its way into bladder veins in human who is final host. It leads to unintended consequences such as permanent urogenital problems, renal failure and malignancy because of its chronicity and tissue damage in the part of body it locates. Symptomatic involvement in urogenital system is more common in females compared to males. Trichomoniasis is the most frequent parasitic disease in the world which occurs because of *Trichomonas vaginalis* trophozoites' involvement in urogenital system sexually. This disease underlies vaginitis which is frequent in females, but it gives rise to urethritis and prostatitis in male. Echinococcosis is known as an endemic zoonotic parasitic disease which infects to humans from animals and grows up in humans evolved in agriculture and stock rising and it may involve in kidney sporadically. Filariasis involves lymphatic system. Obstruction give rise to elephantiasis which may involve in stratum and legs. In this review was presented general information about morphological, biological characteristics of urinary system parasites, diseases they give rise to, clinical symptoms and their prevalence in Turkey. Therefore, helpful information for diagnosis and treatment in humans has been presented by reviewing information in literature about *S. haematobium*, *E. granulosus*, *T. vaginalis*, *W. bancrofti*, urogenital myiasis and scabies which are among urogenital system parasites.

Key words: Urogenital parasites, human, Turkey..

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Introduction

Parasitic diseases as schistosomiasis (bilharziasis), trichomoniasis, echinococcosis, and filariasis (*Wuchereria bancrofti*) affect lots of people, and they cause urinary tract diseases. Echinococcosis and filariasis affect the urinary tract disease less than other parasites (Unat et al., 1995; Özcel, 2007; Yazar et al., 2016). In this review, the general information about the biological, morphological features, and clinical symptoms of significant helminths, protozoons, and arthtoparasides which locate in urinary system, and the prevalence of diseases in Turkey were reported. We aimed to present the recent information of literature in this topic.

Schistosomiasis (Bilharziasis)

Schistosomiasis is an endemic disease in tropical, and subtropical areas. The urinary schistosomiasis caused by *Schistosoma haematobium* (Bilharz, 1852) is common in 75 countries in South America, Africa, and The Middle East region. More than 200 million people are infected, and it is estimated that more than 800 million people are under the risk of infection (WHO Information, 2010). It was reported that *Bulinus*, the intermediate host worm, was seen in our country in Nusaybin and Suruç region (Özcel, 2007b). The frequency of this parasite is unknown in Turkey. Most of the reported cases have originated abroad (Alver et al., 2004; Yazar, 2008; Özvatan, 2011).

Morphology

Females are generally longer and slimmer than males, and they exist in ducts called as 'canalis gynecophrus' which are located in the ventral part of the male body. Female *Schistosoma* leave their males while just laying eggs, go into the capillary veins and then turn back to ducts of the males after releasing their eggs. Males are 10-15x0.7-1 mm, and females are 15-20x0.25 mm in size. There are oral suckers surrounding the oral cavity and the ventral sucker just under it in the front part of the body. In the digestive system, oral cavity, pharynx, oesophagus and intestinal canal are available respectively. Two intestinal canals end at the posterior part of the body by combining with each other. The eggs of *Schistosoma* species which are classified in trematodes don't have valves, miracidium (larva) exist in *Schistosoma* eggs as in many other trematod classes. The sizes of the eggs vary according to the species of *Schistosoma* and there is an apophysis spinal in various parts of the egg. *Schistosoma haematobium* eggs are oval and 100–160 x 40–60 µm in size. They have a spina on one of its margins (Yazar, et. al., 2016; Özcel, 2007b).

Biology

Adult male and female parasites live together in big veins. The males stay in the big veins after copulation and females leave the males nearly every day and mainly go into the veins surrounding the urogenital system (urinary bladder veins) by proceeding into small veins and lay their eggs there. These eggs attach to the blood vessels via blood flow velocity and spinas on their walls and reach into the urinary bladder space by penetrating into

the vein wall. These eggs which are passed with urine need fresh water or saline water with a density of less than 0.7% to be alive. Miracidium leaves the egg in fresh water, and moves by the help of cillias and penetrate into the fresh water snail *Bulinus*. Then it loses the cillias and sporocyst phase is progressed and female sporocysts take its place without redi phase. Double-tailed cercariae evolve out of sporocysts and these are called furcocariae. Furcocariae scatter to snail's tissues and body cavity by destroying the sporocyst. In certain circumstances, they move in the fresh water very fast by leaving the snail (Altıntaş, 2002; Yazar et. al., 2016). There is no metacercaria phase, which is an infective form in other areas, for them. The furcocercariae is the infective form of *S. haematobium*. The infection of the last host occurs due to furcocercariae' burrowing the skin or contaminates by the freshwater. The furcocercariae that goes into the organism from the skin, travels to the mezentery vein via the lymphatic vessels, then lung and systemic circulation, and finally comes to bladder vein. The furcocercariae that penetrated into the oral epithelia travels to lung via blood stream and then migrates to the bladder from the left heart. The prepatent period is six weeks. *Schistosoma* is a trematode, which has a long lifetime, and they can be alive during the host life if a treatment is not given (Altıntaş, 2002; Ross et. al., 2002; Özcel, 2007b; Avcioğlu, 2007).

Clinical Symptoms, Diagnosis and Treatment

The erythema, papule and itchiness (Swimmer'sitch) can be seen on the host skin because of the host reaction (Altıntaş, 2002; Şahin et. al., 2009). The classic signs of urinary schistosomiasis are associated with accumulating the eggs in the kidney and the kidney damage. Adult females lay eggs at bladder veins, then migrate to the urinary bladder submucosa and granulomas occur because of cell infiltration and inflammation (Hams et. al., 2013). The accumulation of eggs under mucosa causes mucosal hyperemia and hematuria. The eggs which penetrate into the mucosa and migrate into the urinary bladder are excreted through bleeding the urine. The inflammation causes different levels of cystitis in urinary bladder mucosa. The little erythema and ulcerative lesions on bladder mucosa can be seen under cystoscopic evaluation. Ulcerative lesions induce scar tissue, the bladder wall becomes thicker and loses its elasticity. The

eggs create pseudo tubercles on the bladder mucosa and then nodules and polypoid masses develop (Gryseels, 2012). Schistosomiasis is also known as a predisposing factor for adenocarcinoma of the bladder. It is one of the most important reasons of urinary bladder carcinoma especially in Africa and The Middle East, although the cancer pathogenesis, and molecular mechanisms are still not known well (Koonrunsesomboon, 2015).

It is more common in females than males (Remoue et. al., 2002; Özcel, 2007b; Avcioglu, 2007). While vesicula seminalis, prostate, urethra, vas deferences and rarely testes and ureters are affected in males, ovary, fallopian tubes, uterus, and vagina are involved for females (Özcel, 2007). In addition tiredness, exhaustion, sweating, headache and subfebrile fever (Katayama fever) are seen in local symptoms (Avcioglu, 2007).

The parasite is diagnosed by the detection of Schistosoma eggs in the urine through stool and biopsy materials. The most appropriate method to detect the eggs in the urine is by examining the last part of the urine which passed in the afternoon after being centrifuged. It is recommended that the eggs examined for at least five different days microscopically if the urine sample is negative taken from clinically suspicious conditions. Additionally, antigen and antibody detection tests can be used alternatively in suspicious conditions (Özcel, 2007b; Şahin et. al., 2009).

The control of the disease is based on large-scale treatment of risky population, access to safe water, improved sanitation and hygiene education. The disease should be kept in mind if the visitors from the endemic countries have symptoms of infection (Inobaya et. al., 2014).

The most effective treatment modality is using Praziquantel (single dose, orally, 40 miligrams per kilogram) (Altıntaş, 2002).

Cystic Echinococcosis

Cystic echinococcosis (CE) is a helminthzoonotic disease and common in the world especially our country. The prevalence of disease in our country varies according to the region, it is mostly common in Eastern, South-East, and Central Anatolia (Unat et. al., 1995). The prevalence of disease is 50-400/100.000, and the incidence is 3,4/100.000 in Turkey (Doğru, 2008). The reported case with CE in Turkey is mainly located in the liver and lungs (Altıntaş et. al., 2004). Renal cyst hydatid commonly occurs with systemic diseases

and the isolated form is very rare (Vargas-Serrano et. al., 1997; Zmerli et. al., 2001; Bozdağ et. al., 2012; Merdin et. al., 2014).

Morphology

The adult form of *Echinococcus granulosus* (*E. granulosus*) is 2-11 mm in height and 0.6 mm in width. The body of the parasite is formed of 3 or 4 cingulars. It is composed of scolex, neck, immature, mature, and gravid cingulars. The scolex is typically small, and has four brawny suckers, rostellum, and 28-50 distichous coronoids. The body (strobila) is generally composed of 3 cingulars, but rarely 4- cingular striae are encountered. The last cingular, proglottid is gravid and it is nearly half of the body. The uterus extends across the cingular and there may be 200-800 eggs in it. The eggs are round and slightly oval, 28-36 µm in size, thick-walled, dark brown, radial lineal and contain 6-coronoid embryo (the oncosphere) . The eggs of *E. granulosus* can not be differentiated under light microscope from the other species of *Echinococcus* and *Taenia* (Altıntaş et. al., 2004; Özbilgin & Kilimcioğlu, 2007).

The cause of the disease is the larva form of *E. granulosus* called as hydatid cyst. The cysts are usually filled with clear fluid called rock water, which is secreted from germinal layer. The fluid is alcali (base) with 7.2-7.4 Ph, 1007-1015 density, and also it has antigenic features (Özbilgin & Kilimcioğlu, 2007).

Biology

The adult form is located in the small intestine of dogs or other canidae as a definitive host, the larva form is located in internal organs of sheep, cow, pig or human as intermediate host. The eggs of parasite excreted by the definitive host constitute disease by ingestion and rarely inhalation by intermediate hosts. The oncosphere that releases from the eggs in the small intestine penetrates into the intestine wall and enters into the portal system. Oncosphere invades the liver previously and develops with fluid-filled cysts. Oncospheres rarely pass over the sinusoids and enter to systemic circulation, and can migrate to all internal organs (Altıntaş et. al., 2004; Eckert & Deplazes, 2004).

Clinical Symptoms, Diagnosis and Treatment

Isolated renal disease is rare, and reported as 2-4% of all cases (Adayener et. al., 2008). The other involved organs in the genitourinary system are urinary bladder, prostate, testes, and seminal

vesicles. Renal cystic echinococcosis is usually a single and cortical located lesion. The disease can be asymptomatic for several years, and some symptoms occur when the cyst enlarges. The most common symptoms are palpable mass, hematuria, pain, and hydaturia which occur with the connection of cyst and collector system (Göğüş et. al., 2003). Hydaturia is specific to disease (Angulo et. al., 1997; Göğüş et. al., 2003).

The renal cystic echinococcosis is diagnosed with radiologic methods, direct diagnostic microbiologic tests, serologic and molecular tests. Ultrasonography, computed tomography, and magnetic resonance are used for radiologic imaging. Imaging technics are useful to see the calcification of cyst wall. The suspicious cases can be checked by using serologic tests as indirect hemagglutination test, indirect fluorescent antibody test, and Enzyme-linked immunosorbent assay (Pawlowski et. al., 2001; Filippou et. al., 2007; Yılmaz&Babür, 2007).

The renal cystic echinococcosis can be treated with different methods as medical, surgical, and PAIR (puncture, aspiration, injection, respiration) (McManus et. al., 2003; Köksal et. al., 2004). Surgery is the first line treatment modality, and complete resection of the cyst is recommended. There are several different surgical approaches as cystectomy, pericystectomy, partial cystectomy, partial and simple nephrectomy as well. The most serious complication during the surgery is fatal anaphylaxis due to a rupture of the cyst and dissemination of the infection. Benzimidazol family such as Albendazol, Mabendazol, and Praziquantel are the options for the medical treatment. The purpose of Albendazol and Mabendazol treatment, which is done before and after surgery, is sterilisation of the cyst, preventing the anaphlaxy and the recurrence (Pawlowski et. al., 2001; Filippou et. al., 2007). The recommended treatment period is 3-6 months. The most common adverse effect of medical treatment is dysfunction of the liver (Köksal et. al., 2004).

Trichomoniasis

The flagellated parasite *Trichomonas vaginalis* (*T. vaginalis*) is the aetiologic agent of trichomoniasis, which was firstly described by Donne in 1836. It is a sexually transmitted infection, and a common parasite in the world (Safi et. al., 2000; Özcel &Zeyrek, 2007). It affects the urogenital system and it is fed by cells, bacteria, and sperm cells via fagositing (Unat et. al., 1995).

T. vaginalis is mostly common in patients of ages between 20-40. It is reported that *T. vaginalis* is detected between 4% and 73% of women with vaginal discharge in our country (Suay et. al., 1995; Tamer et. al., 2008; Değerli et. al., 2011), and it is reported by 2,8% among men with urethritis (Çulha et. al., 2008), while founded that between 0,8% and 12% among men with nongonococcal urethritis (Özbilgin et. al., 1992; Ay et. al., 1999).

Morphology

Trichomonas vaginalis has only one form as a trophozoite. The trophozoite is oval and pear shaped, 10-25 x 5-15 µm in size. It has a nucleus, four anterior flagella, and a flagella called ‘‘wavy membrane’’ dangling down along the membrane of a parasite. *T. vaginalis* is a protozoon which turns around its own axis continually. It feeds by phagocytosing cell, bacteria and sperm in its location (Unat et. al., 1995; Özcel &Zeyrek, 2007).

Biology

It is a monoxenous parasite, and human is the single host for it. The throphozoite is in infective form since there isn't a cyst form of it. The trophozoite form is not very resistant to external factors; it can be alive for 1 hour in water, and 24 hours in urine. *Trichomonas* is sexually transmitted from infected female or male, but rarely contaminated from soiled towels, baths, swimming pools, toilet paper, and toilet seats (Unat et. al., 1995; Yazar et. al., 2016).

Clinical Symptoms, Diagnosis and Treatment

The mean incubation period is 6-10 days. The symptoms of disease vary according to organ and gender. Vaginal discharge occurs during the acute period of the disease. Frothy, greenish, malodorous vaginal discharge is characteristic of the disease. Disuria and pollacuria are common with erythema, tanning, and itchness of the vulva and vagina. The chronic disease can be commonly present with semptomatic vaginal discharge or can be asymptomatic. The symptoms have decreased over time, and disease becomes in latency (Kuman &Altıntaş, 1996).

Most infected men are asymptomatic, and it is hard to detect the disease. Male patients are generally presented with urethritis, prostatitis, and rarely epididymitis and cystitis. Occasionally, white and fuzzy urethral discharge can be seen (Kuman &Altıntaş, 1996; Skerk et. al., 2002).

The disease is diagnosed with immediate

microscopic evaluation of the vaginal, and urethral discharge, prostatic secretion, and urine sediment. Another method of diagnosis is via overnight culture. The suspicious cases can be checked by using serologic and molecular tests. More than one method can be combined to diagnose (Özcel & Zeyrek, 2007).

Infection is treated with oral or local use of metranidazole (250 miligrams per kilogram, three times a day, a week period). The drug is contraindicated in the first 3 months of pregnancy. Secnidazole has taken the place of metronidazole because of its adverse effects and long treatment period of this drug. Secnidazole has better results than other nitroimidazole family (2 grams, single dose, orally). Tinidazole can be useful in case of resistant disease. Partners have to be treated all together (Kuman & Altıntaş, 1996; Özcel & Zeyrek, 2007).

Filariasis

Filariasis is a parasitic infection in tropical and subtropical areas with high morbidity but low mortality (Chandy et. al., 2011). There are 7 species of filariasis parasites which cause disease in humans, but typically *Wuchereria bancrofti*, *Brugia malayi*, and *Brugia timori* are known as factors for filariasis (Melrose, 2002; Palumbo, 2008). The intermediate host is mosquitos as *Aedes*, *Anopheles* and *Culex* species. The disease is transmitted to humans through the bite of an infected mosquito. The disease has a long latency period, and sometimes, it can also be asymptomatic. This situation generally damages the lymphatic system and kidneys (Kuman, 2007).

Wuchereria bancrofti

Almost 1 billion people are under the risk of lymphedema disease known as *Wuchereria bancrofti* (*W. bancrofti*). It is estimated that roughly 120 million people are infected with *W. bancrofti* in developing countries. Lymphedema is common in Uganda, Tanzania, Kenya, Rwanda, Burundi, Sudan and Ethiopia. Filariasis cases are very rare in our country, because of this reason there is no information about its frequency in Turkey. It is detected sporadically in Alanya, Elazığ, Çubuk and Samsun region in Turkey (Unat et. al., 1995; Kuman, 2007).

Morphology

The adult forms are cylinder-shaped. They don't have lips, and oral cavity is not developed, and it is fistular going on with oesophagus. The male is 30-40 mm x 0,1 mm in size, and it has 15 pairs of postnatal papillas. The female is 50-100 mm x 0,25 mm in size, and transparent, but eggs in the uterus can be seen. Females are viviparous, and their larvas are named as microfilariae which are 300x8 micron in size. After the infection, microfilariae can be seen in blood within 6-8 months (Unat et. al., 1995; Kuman, 2007).

Biology

Human beings serve as the definitive host and mosquitoes as their intermediate hosts. The major vectors of *W. bancrofti* are mosquitoes of the genus *Culex* (in urban and semi-urban areas), *Anopheles* (in rural areas of Africa and elsewhere) and *Aedes* (in islands of the Pacific). In Turkey, the most common vector is *Culex fatigans*. Larvae known as microfilariae may live for a few years until they are transferred by an insect vector (Culicidae; mosquitos) which is an intermediate host in the blood. When microfilariae are transferred together with blood by a suitable vector, L1 larvae develops in the digestive tract of the vector. L1 larvae migrate to thoracic muscles of vector mosquito from midgut wall. It molts here twice in 3 weeks and L3 larvae develop within 3 weeks after metamorphosis (infective filariform). Infective L3 larvae come to the proboscis of the vector and it goes into the circulator system of the host while sucking blood. A larva molts twice in humans and it becomes adult with metamorphosis while migrating to certain infected regions. Microfilariae are detected in the blood after almost 6 months (Unat et. al., 1995; Kuman, 2007; Yazar et. al., 2016).

Clinical Symptoms, Diagnosis and Treatment

Recurrent lymphadenitis, lymphangitis, and fever can be seen in mild disease, and these cause swelling especially in the legs and feet. Inflammation in epididymis, testes, scrotum, and spermatic cord is not very rare, and also hydrocele is common. In severe disease, obstruction of major lymphatic vessels may cause to chyluria and elephantiasis (Melrose, 2002; Kuman, 2007; Chandy et. al., 2011).

The final diagnosis for filariasis is established from a blood sample which is taken during the night by microscopic examination if microfilariae

are seen in blood samples (Melrose, 2002). Urine and hydrocele fluid may also be seen as factors. The lower parts of the legs, edema and painful swelling began in the reproductive organs and feet should be considered of filarial acute attack. Finger-causing fossa while pressing over swelling is the diagnostic sign of the disease. Over time, skin thickens and changes colour. It resembles an elephant's skin. Apart from swelling, cough and mild temperature are some indications of the disease. In elephantiasis cases, the diagnosis is established clinically because microfilaria can not be detected in blood (Simonsen et. al., 2002; Mendoza et. al., 2009).

The first choice for treatment is diethylcarbamazine (DEC), despite having some toxic side effects. DEC should be given orally three times a day in dose of 2 mg per kg during 12 days. This medicine does not make an end of adult larvae but effective on microfilariae. The most important advantage of Ivermectin which was investigated recently is using a single dose a day. The effectiveness of both medicines on adult parasites is not enough. Long term DEC treatment is useful to prevent the spread of new adult parasites. Physiotherapy is run together with surgical treatment. The legs should be jacked for detumescence in legs and compression socks should be put on to prevent the obstruction of lymphatic liquide (Stolk et. al., 2005).

Urogenital Myiasis

Urogenital myiasis is an infestation of humans and vertebrates, which is a member of the diptera family known as flies larva, and also lives on live cells or dead tissue. Pathophysiology of infestation varies on humans, with the location of larva and the species of it. Urogenital myiasis usually limits itself, but rarely patients are presented with urinary tract obstruction, and genital lesions. Urogenital myiasis cases were rarely reported in our country with the species of *Eristalis tenax* (Mumcuoğlu et. al., 2005), *Lucilia sericata* (Dinçer et. al., 1995), and *Psychoda albipennis* (Taylan-Özkan et. al., 2004; Güven et. al., 2008).

The symptoms of the infestation are commonly itchiness, dysuria, pollacuria, infravesical obstruction, anuria and hematuria. These symptoms occur with habitation and development of larva's into the lower urinary system (Zumpt, 1965; Dinçer, 1997; Güven et. al., 2008).

Scabies

Scabies called as *Sarcoptes scabiei* are the other infestations located on genital organs (Yazar et. al., 2016).

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