Three species of Leishmania infect humans in Saudi Arabia. In the southwest L. infantum Zymodeme LON 42 has its reservoir in Rattus rattus and causes kala-azar in infants and children. In the northern half of the country L. major, is transmitted by Phlebotomus papatasi from gerbils and merinos causing cutaneous (orienal sore) and oronasal leishmaniasis, while inland from the Red Sea coast L. tropica transmitted by Ph. sergenti causes oriental sore and leishmaniasis recidivans.

There was an increase in reported malaria cases in the early 1980s, but control programmes which were initiated as early as 1948 in the eastern part of the country have had an impact so that transmission is now confined to the western provinces. Plasmodium falciparum is the predominant species, but P. malariae and P. vivax have also been recorded. Vector mosquitoes include Anopheles arabiensis along the Red Sea coast, A. fluviatilis and A. stephensi in the eastern part of the country and A. sergenti and A. superpictus throughout. Chloroquine resistant P. falciparum has been
detected near the Yemen border. Apart from autochthonous malaria, imported cases in travellers and immigrant workers may become an increasing problem. Chloroquine remains the treatment of choice for malaria in the Middle East unless the infection has broken through chloroquine prophylaxis. The geographical origin of the infection could have been in a chloroquine resistant area or if the patient has clinical features of severe malaria. Patients with severe falciparum malaria should be treated with quinine by slow intravenous infusion starting with a loading dose of 20 mg of quinine dihydrochloride per kilogram body weight infused over 4 h.

Foci of Schistosoma haematobium infection exist in northwest, central and southwest Saudi Arabia, while S. mansoni infection occurs in larger areas in the western half of the country. Humans acquire these infections by bathing in or drinking water containing fork-tailed larvae (cercariae) released from intermediate snail hosts (Biomphalaria for S. mansoni, Bulinus for S. haematobium). Cercariae burrow into the skin, lose their tails and enter blood vessels. The resulting schistosomules migrate to the heart, lungs and liver. Adult male and female flukes move to their definitive homes in the veins of the perivesical plexus (S. haematobium) or inferior mesenteric plexus (S. mansoni). Some ova burrow through the wall of the bowel (S. mansoni) or bladder (S. haematobium) and if discharged in stools or urine into fresh water may infect snails and thence new human hosts. Damaging effects of schistosomiasis result from an inflammatory response to the ova which embolize through the bloodstream to the lungs, liver, central nervous system and elsewhere and which lodge in the wall of the bowel and bladder. Treatment has been revolutionized by the advent of praziquantel.

Leishmaniasis

During the last decade there has been a rapid increase in the understanding of leishmaniasis in the Kingdom of Saudi Arabia (KSA) as a result of studies by Peters, Killick-Kendrick, Al-Zahrani and their colleagues in the Ministry of Health.1,2 Cutaneous leishmaniasis is caused by two species of Leishmania. The anthropopotic L. tropica is transmitted by Phlebotomus sergenti in the 2000 m high plateau of the Asir Mountains in the southwestern part of the country,3 where it causes oriental sore and leishmaniasis recidivans.

Leishmania major is zoonotic in rodents such as gerbils and merions in desert and semi-arid areas of the Eastern Province, around Riyadh and in areas of oasis cultivation. It is transmitted by Ph. papatasi causing oriental sore and oronasal leishmaniasis in humans.

Leishmania infantum Zymodeme LON + 42 is enzootic in Rattus rattus from the western slopes of the Asir Range at 400 m down to Tihama on the Red Sea shore and southeast into Yemen.4 This organism which is also found on the Red Sea coast of Ethiopia causes visceral leishmaniasis. The sandfly vector is unknown.

Cutaneous leishmaniasis is seasonal in all age groups. Once the lesion has healed there is usually solid life-long immunity. Non-immune foreign immigrant workers, who comprise almost half the population of KSA, are commonly affected by cutaneous leishmaniasis. Cases of cutaneous and visceral leishmaniasis reported to the Ministry of Health increased from 3521 and 10 respectively in 1980 to 16,621 (150 cases/100,000 population/year) and 248 respectively in 1986.5 In 1986, a survey at Al Ahsa Oasis in the Eastern Province revealed that 2.8% of the population had lesions of cutaneous leishmaniasis.

Clinical features

Cutaneous lesions of L. tropica and L. major develop days to months after infection at the site of sandfly bites on exposed parts of the body. Recurrent lesions (leishmaniasis recidivans) may develop particularly after L. tropica infection. Visceral leishmaniasis occurs in indigenous Saudi infants and young children and resembles Mediterranean infantile kala-azar. After an incubation of 2–8 months, there is persistent fever, wasting, hypersplenism, resulting in anaemia, leucopenia and thrombocytopenia, and hypergammaglobulinaemia. The fever characteristically shows a double spike each day, is accompanied by profuse nocturnal sweats and lasts for weeks with occasional afebrile intervals. Despite their progressive wasting and continuing high fever, the patients retain their appetite and remain active. The splenic enlargement, which is usually detectable after about a month, surges with each bout of fever until the spleen tip may reach the right iliac fossa. The liver is often enlarged. Chronic diarrhoea is attributable to infection of lymphoid tissue in the small and large bowels. Malnutrition,
leucopenia and immunoparesis predispose these patients to other infections, especially tuberculosis, pyogenic pneumonias and cancer of the oris. Hepatic cirrhosis may develop adding jaundice, ascites and oedema to the range of signs. Generalized oedema may also be due to malnutrition and to amyloid nephrotic syndrome.

Diagnosis

Diagnosis of cutaneous leishmaniasis is made by microscopic examination of dermal tissue scraped from a skin slit. Visceral leishmaniasis is diagnosed by examining splenic or bone marrow aspirate.

Treatment

Cutaneous lesions can be treated by local heat, cryotherapy, surgery, curettage or with a 3-week course of sodium stibogluconate (Pentostam) or meglumine antimoniate (Glucantime) (10–20 mg of antimony per kilogram per day).

Visceral leishmaniasis is treated with sodium stibogluconate or meglumine antimoniate, given in a dose of 20 mg of antimony per kg per day for 4 weeks.

Malaria

There was an increase in reported malaria cases in KSA in the early 1980s, but control programmes, initiated as early as 1948 in the Eastern Province, have had an impact. There is still transmission in all the western provinces of the country, except for the high altitude regions along the Yemen border in Asir province. Urban areas of Jeddah, Mecca, Riyadh, Medina and Taif are malaria-free. In 1987, 17,000 cases (94% Plasmodium falciparum) were reported; P. malariae and P. vivax have also been recorded.

Vector mosquitoes include Anopheles arabiensis along the Red Sea coast, A. fluviatilis and A. stephensi in the eastern part of the country and A. sergentii and A. superpictus throughout. Chloroquine resistant P. falciparum has been detected in the Tihama area towards the Yemen border.

Apart from autochthonous malaria, imported cases in travellers and immigrant workers may become an increasing problem.

Clinical features

Malaria must be considered in the differential diagnosis of all acute fevers. The minimum incubation period (interval between infecting mosquito bite and the onset of symptoms) is 7 days in the case of falciparum malaria. The diagnostic tertian fever (occurring every 48 h) is rarely seen and classical malarial paroxysms (with chill, hot phase and sweating defervescence) are uncommon. Fever usually starts abruptly and continues irregularly or with daily (quotidien) spikes. Headache, backache, myalgias, gastrointestinal symptoms (vomiting, abdominal pain and diarrhoea), postural syncope and prostration are common. Physical signs include fever, anaemia, jaundice, tender enlarged liver and spleen and the absence of lymphadenopathy, rash and localizing signs. In vivax malaria the periodicity is tertian (fever every 48 h) and with malariae malaria it is quartan (fever every 72 h). Falciparum malaria (malignant tertian malaria) is responsible for almost all the global mortality from malaria of two million per year. Severe life-threatening manifestations and complications of falciparum malaria include impaired consciousness (cerebral malaria), severe anaemia (especially in children in holoendemic areas), spontaneous bleeding, jaundice, hypoglycaemia, shock (‘algid malaria’), renal failure, lactic acidosis, pulmonary oedema and secondary bacterial infections. Strictly defined cerebral malaria carries a mortality of about 15% in children and 20% in adults.

Differential diagnosis

Malaria must be excluded in any febrile patient who has travelled to an endemic area, has received a blood transfusion or been exposed to even less common routes of infection. The differential diagnosis includes other infections which commonly cause chills and rigors (lobar pneumonia, ascending cholangitis, pyelonephritis and viral hepatitis), jaundice (viral hepatitis, leptospirosis and relapsing fevers), hyperpyrexia (heat stroke), gastrointestinal symptoms (traveller’s diarrhoea and typhoid) and encephalitis (viral, bacterial, fungal and protozoal infections).

Diagnosis

Examination of thick and thin blood films taken frequently during the first 12–24 h of admission remains the best way of confirming a diagnosis of malaria. Ideally, the film should be made at the bedside (avoiding storage of blood in anti-coagulants) and stained immediately with a Romanovsky stain such as Wright’s, Field’s, Leishman’s or Giemsa stains. A simple technique
employs Field's stain for both thick and thin films. A thin film is first fixed in anhydrous methanol and the thick film is dried rapidly using a small hair dryer.

**Treatment**

Vivax, ovale and malariae malaria are still effectively treated with chloroquine. Relapses of vivax and ovale should be prevented by eliminating liver hypnozoites with a course of primquine. Although chloroquine-resistant strains of *P. falciparum* are beginning to emerge in the Middle East, chloroquine is still an effective first line treatment for uncomplicated falciparum infection. However, in patients whose infection has broken through chloroquine prophylaxis, in whom the geographical origin of the infection is uncertain or could have been a chloroquine resistant area out of the country and in patients with clinical features of severe malaria, pyrimethamine-sulphadoxine ('Fansidar') or mefloquine (Lariam) can be used. Patients with severe falciparum malaria need parenteral treatment. Quinine is the drug of choice given by slow intravenous infusion. Treatment is started with a loading dose of 20 mg of quinine dihydrochloride per kg body weight infused over 4 h. This is followed by maintenance doses of 10 mg/kg body weight given every 8 h until the patient is fit to swallow tablets. Quinine is safe in pregnant women and in patients with renal and hepatic impairment, but the maintenance dose should be halved if the plasma quinine concentration exceeds 15 μg/litre at any stage or if parenteral treatment is needed for more than 48–72 h. An initial loading dose should not be used if the patient has started quinine, quinidine or mefloquine within the previous 24 h. Quinine dihydrochloride can be given by intramuscular injection in dispensaries or clinics where intravenous therapy is not possible. In conscious patients, quinine produces a number of unpleasant side-effects (nausea, dizziness, tinnitus etc.) which reduce patient compliance. Its most serious toxic effect is hypoglycaemia resulting from hyperinsulinaemia.

**Prevention of malaria**

Mosquito vectors of malaria usually bite between dusk and dawn. They should be excluded from sleeping quarters by insect proofing, permethrin-impregnated nets and insecticides. Those exposed to bites out of doors should apply repellants containing N,N-diethyl-m-toluamide and wear long sleeves and long trousers. A safe chemoprophylactic regimen for KSA is proguanil (adults 200 mg per day) and chloroquine (adults 300 mg of base once a week). An alternative is pyrimethamine (Maloprim) and dapsone.

**Schistosomiasis**

Schistosomiasis is one of the world's most important and prevalent infectious diseases. In tropical countries between latitudes 36°N and 34°S, 500–600 million people are thought to be exposed and more than 200 million infected in some 79 countries. Schistosomes are digenetic dioecious trematodes (flukes). This discussion will be restricted to the two species (*Schistosoma mansoni* and *S. haematobium*) endemic in KSA; *S. mansoni* is prevalent in many parts of the western region, but *S. haematobium* is found only in the Giza district in the southwest, along the Red Sea coast, north of Medina and around Mecca. In 1981 12 634 cases were reported, and in 1982, 18 329 were reported.

**Life cycle**

Humans are infected when skin or mucous membranes are in contact with fresh water from muddy lakes or slow-flowing streams containing infective larval schistosomes (cercariae). The fork-tailed cercariae, which are 400–600 microns (μm) in length, are released from intermediate snail hosts. They penetrate the skin where they change into schistosomules which migrate into blood vessels and hence to the heart, lungs and liver where they mature to adult worms and mate within 1–4 weeks of infection. The adults are 12–26 mm x 0.3–0.6 mm in size. The female lies in the male's gynecophoral canal. The paired worms migrate into venules of the inferior mesenteric plexus (*S. mansoni*) or vesical plexus (*S. haematobium*). There they may live for several years. The female produces several hundred eggs a day, some of which burrow through the tissues and are shed into the large bowel (*S. mansoni*) or urinary tract (*S. haematobium*). These ova are viable for up to 3 weeks in moist conditions. In fresh water, flagellate larval miracidia 160 μm long hatch out and infect certain species of Planorbis snail—*Bulinus* for *S. haematobium*, *Biomphalaria* for *S. mansoni*. Asexual multiplication occurs in the snail and cercariae are then released which can infect a new human host.

Pathological effects of schistosomiasis result from an inflammatory granulomatous reaction to
ova lodged in the walls of the bladder and ureters (S. haematobium) or large bowel (S. mansoni) and to ova which embolize to the liver, lungs, central nervous system and elsewhere.

**Clinical features**

Penetration of the skin by cercariae can cause intense pruritis (‘Swimmer’s itch’) and an erythematous papular rash (schistosomal dermatitis) especially when there has been presensitization. This may develop within minutes or hours of exposure by bathing or washing in infected water and lasts for 2–3 days. It may occur with pathogenic schistosomes but is more commonly caused by the cercariae of birds and small mammals (e.g. Trichobilharzia and Bilharziella) which die after reaching the dermis.

**Katayama fever**

At the time when the adult females begin to produce eggs, 18–58 days after infection, patients with S. mansoni infection may develop sudden fever, rigors, arthralgia, gastrointestinal symptoms, tender hepatomegaly, lymphadenopathy and urticaria associated with blood eosinophilia and increased serum IgE with specific IgM. This serum sickness-like syndrome which may last 4–12 weeks is attributed to immune complex formation.

**Chronic urinary schistosomiasis**

Chronic urinary schistosomiasis (S. haematobium) presents with painless haematuria, seen initially only in the last few drops, but progressing in some cases to massive haematuria resulting in iron deficiency anaemia. Associated symptoms include dysuria, frequency, nocturia, urgency and suprapubic and perianal discomfort. The incidence of severe morbidity varies in different geographical areas. Reaction to the ova lodged in the bladder and the distal third of the ureters results in fibrosis, calcification, ‘sandy patches’, hydroureters, hydropnephrosis and obstructive nephropathy complicated by recurrent pyelonephritis and septicaemia. Squamous cell carcinoma of the bladder may develop.

**Chronic gastrointestinal schistosomiasis**

Chronic gastrointestinal schistosomiasis (S. mansoni) may present 3 to 12 months after infection. There is abdominal pain and diarrhoea with passage of blood, pus and mucus. Reaction to ova lodged in the wall of the distal colon and rectum leads to submucosal nodules, ulceration and polyp formation. Ova embolized into the portal circulation cause portal fibrosis and portal hypertension with splenomegaly, oesophageal varices, ascites and eventually hepatocellular failure; S. haematobium infection may also cause mild periportal fibrosis.

**Schistosomal cor pulmonale**

This may complicate S. mansoni or S. haematobium infections.

**Schistosomiasis of the central nervous system**

Ova of S. mansoni and S. haematobium which reach the central nervous system may give rise, on rare occasions, to acute encephalomyelitis or granulomatous space-occupying lesions of the brain or, more commonly, to spinal cord lesions. Three types of spinal involvement have been described: myelitis, intrathecal granulomata and radiculitis resulting from lesions in the corda equina and conus medullaris. The most common neurological presentation, which may start a few weeks after exposure to infection, is acute flaccid paraplegia with sphincter dysfunction and a sensory level.

**Diagnosis**

Diagnosis of schistosomiasis is confirmed by finding characteristic ova or by serology (enzyme immunoassay). Ova of S. haematobium, which have a terminal spine, are most often found in urine voided around midday or in bladder wall biopsies taken at cystoscopy. Ova of S. mansoni have a lateral spine and are found in the blood/mucus coating stools or in rectal or colonic biopsies.

**Treatment**

Treatment has been revolutionised by praziquantel which, in a single dose of 40 mg/kg body weight, cures 70–95% of cases of S. mansoni and S. haematobium infection. Transient gastrointestinal symptoms are the only serious side-effects. Although some praziquantel is excreted in the milk, this treatment is not contraindicated in lactating women. Oxamniquine is a cheaper alternative treatment for S. mansoni in a single dose of 15–20 mg/kg. Fever, drowsiness, dizziness and rarely seizures are reported side-effects.
References


