



Management of *Strongyloides stercoralis*: a puzzling parasite

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Strongyloides stercoralis is one of the common parasites in tropical areas. It can result in severe clinical syndromes, hyperinfection syndrome or disseminated strongyloidiasis in immunocompromised patients. The treatment of strongyloidiasis is a challenge for clinicians in clinical practice. Failure of treatment is due to autoinfection caused by the parasite life cycle and impairment of host immunity. Ivermectin currently is the treatment of choice. When compared with thiabendazole, it has shown a similar efficacy with better tolerability. However, there is neither consensus in duration of treatment nor in repetition of doses. The keys for management of this tough parasite include proper evaluation and prevention. Stool examination with high sensitivity techniques such as Baermann technique, filter-paper culture and agar-plate culture and specific IgG serology should be used in evaluation for 1 to 2 years. Screening, both stool examination and serology, before patients have immunosuppressive treatment is needed to prevent the severe form of strongyloidiasis.

Keywords: Albendazole, Ivermectin, *Strongyloides stercoralis*, Strongyloidiasis, Thiabendazole

Introduction

Strongyloides stercoralis can cause a wide spectrum of diseases such as acute strongyloidiasis, chronic strongyloidiasis, hyperinfection and disseminated infections depending on the host's immunity.¹ Most people with chronic strongyloidiasis are asymptomatic or have mild symptoms such as diarrhea, weight loss, urticaria and larva currens. Severe clinical manifestations such as pneumonia, meningitis and bacteremia leading to death occur in the severe forms of hyperinfection and disseminated infection in the immunocompromised due to high parasite load and migration of the parasite. Strongyloidiasis is still a problem in tropical areas, particularly South-East Asia, Sub-Saharan Africa and South America in both community and hospital settings, especially in immunocompromised patients.² This parasite also causes a problem in developed, non-tropical countries such as the United States of America or the United Kingdom especially among immigrants from endemic areas and travelers returning from endemic areas.^{3,4} In the United States, the prevalence from a community-based survey was 2.7% (95% CI: 2.4–3.0%) compared with a prevalence of 40.4% reported among refugees and immigrants.² Some certain areas in the United States such as Kentucky, Tennessee and West Virginia are endemic areas of strongyloidiasis.^{5,6}

Not only is strongyloidiasis difficult to diagnose due to the irregular shedding of the parasite,⁷ but it is also difficult to treat due to autoinfection and impaired host immunity. The gold standard tests are stool testing for agar plate culture and Baermann technique.^{7–9} Multiple specimens should be tested to improve

sensitivity of the tests. Apart from difficulty in curing this parasite, improper management has also been found. The study in the United States showed that delays or errors occurred more frequently when physicians were not familiar with travel medicine or immigrant health.³ Iatrogenic deaths caused by treatments have been reported.³ Treatment failure and relapse are not uncommon in strongyloidiasis. Theoretically, autoinfection of *S. stercoralis* takes 2–3 weeks. Therefore, antiparasitic agents should be given with repeated doses in the 2–3 week intervals for treating autoinfection to ensure the chronic strongyloidiasis is cured,⁸ or given until the parasite in hyperinfection or disseminated strongyloidiasis is cleared.¹

The emphasis of this review is the management of strongyloidiasis in adults divided into treatment of chronic strongyloidiasis, treatment of hyperinfection and disseminated infections, follow-up after treatment and prevention and patient education.

Methods

A literature search was performed by using Pubmed (Medline). The keywords were '*Strongyloides stercoralis* treatment', 'Strongyloidiasis treatment' and 'strongyloidiasis management'. Reviews, research studies, case reports and short communications with English abstracts from 1970 to October 2013 were included. The clinical trials and case reports were limited. Publications only involved adult cases. Standard text books, guidelines and article bibliographies were used as additional references.

Results

Treatment of chronic strongyloidiasis

For effective treatment in chronic strongyloidiasis, eradication of the parasites is recommended. Most antiparasitic agents cannot kill migrating larvae and eggs; therefore, autoinfection from the migrating larvae can cause relapse later. Effective treatment should be ensured by repeating the regimen 2–3 weeks apart.⁸ Thiabendazole, a benzimidazole compound antiparasitic agent, was used as the standard treatment for strongyloidiasis in the past. Ivermectin has high efficacy with better tolerance, so it has been the drug of choice for strongyloidiasis. The medications for treatment of chronic uncomplicated strongyloidiasis are reviewed below.

Ivermectin

Ivermectin, a semisynthetic macrocyclic lactone, causes parasite paralysis by acting on the chloride channels.¹⁰ It acts upon many kinds of nematodes and ectoparasites such as onchocerciasis, intestinal helminthiasis, gnathostomiasis and scabiasis. Ivermectin is only available in oral preparation for humans. To improve the pharmacokinetic properties, it can be administered with food to increase bioavailability.¹⁰ The drug is mainly metabolized in the liver by cytochrome P450, CYP3A4 and is minimally excreted in urine.¹⁰

The parasite cure rates for ivermectin were 57–100% in normal hosts, as shown in Table 1.^{11–17} The efficacy is as high as thiabendazole, the previous drug of choice, with minimal side effects; therefore, ivermectin has become drug of choice to treat strongyloidiasis. The recommended dose is 200 µg/kg/day; however, no consensus has been reached whether it should be given for 2–3 consecutive days or given as repeated doses 1–2 weeks apart.^{8,10,18} The contraindication of ivermectin is concomitant *Loa loa* infection. The commonly reported side effects in treatment of uncomplicated strongyloidiasis were abnormal liver function tests, itching and neurological symptoms (Table 2). Despite its high efficacy and good tolerability, this drug has no effect on hookworm and low efficacy with *T. trichiura*, the intestinal parasite that commonly co-infests.¹⁹ Moreover, ivermectin is not available in some countries.

Benzimidazole compounds

The prototype of this group is thiabendazole while mebendazole and albendazole are benzimidazole carbamates.¹⁰ The proposed mechanism is inhibition of nematode microtubule formation by action on β-tubulin.

The cure rates in the treatment of strongyloidiasis by thiabendazole were 52.2 to 100% in normal hosts as shown in Table 1.^{13,15,16,20} A study among patients with hematologic malignancies in Brazil found that the three-day regimen of thiabendazole showed an 82% cure rate (15/18), a similar rate to that in immunocompetent hosts.²¹ The recommended dose is 25–50 mg/kg/day for three consecutive days with repeated treatments as required to eradicate the parasites. However, this drug has been discouraged because of significant adverse events, including nausea, vomiting, asthenia, anorexia, diarrhea, headache, and neurological effects such as dizziness, drowsiness and disorientation¹⁰ (Table 2). The

adverse events seem to be more frequent and severe in the elderly as found in Grove's study,²² and were reported to be as high as 95% by Gann et al.¹³ A transient abnormal smell in urine, like asparagus, was reported.²² Thiabendazole can cause hypersensitivity reactions such as angioneurotic edema and Stevens-Johnson syndrome; however, these severe reactions rarely occur.⁷

Although albendazole has shown lesser efficacy against chronic strongyloidiasis, it has been better tolerated than thiabendazole. The dose regimens and cure rates vary as shown in Table 1. The dosage of 400 mg for 3–5 days provided cure rates of 38–87%.¹⁷ The advantage of albendazole is activity against a broad range of intestinal nematodes including hookworm, *Ascaris lumbricoides* and *Trichuris trichiura*.¹⁹ In a short course regimen, the side effects included nausea, abdominal pain, loose stool, headache, dizziness and liver dysfunction as shown in Table 2.^{8,19}

Mebendazole is less effective for treating strongyloidiasis. The dosage of 100 mg twice daily for 3 days showed only a 50% cure rate.²³ The longer regimen, 28 days, showed a cure rate of 74% (17/23), but liver injury occurred.²⁴ In the dosage of 100 mg twice daily for 5 days repeated at 1, 3 and 4 weeks later, the cure rate was 100% in 46 patients with 48.9% liver injury.²⁴

Others

The other agents used to treat in strongyloidiasis were pyriminyl pamoate, levamisole and diethylcarbamazine.²⁵ However, the cure rate of pyriminyl pamoate was as low as 23–30%.^{14,26}

Treatment of hyperinfection and disseminated infections

Severe forms of strongyloidiasis, hyperinfection and disseminated infections, commonly occur in immunocompromised hosts such as patients with hematologic malignancy, human T cell lymphotropic virus (HTLV)-I infection, hypogammaglobulinemia, severe malnutrition, uremia, diabetes mellitus and patients given immunosuppressive agents especially corticosteroid.^{1,27} HIV infection does not seem to be a risk factor for *Strongyloides* hyperinfection and disseminated infections because Th2 mediated cytokine activity, which plays the main role in helminthic infections, remains normal.^{28,29} Strongyloidiasis can theoretically cause immune reconstitution inflammatory syndrome (IRIS), which presents as hyperinfection or disseminated infection after initiation of antiretroviral. However, only five possible cases have been reported and three of them had concomitant corticosteroid usage.^{30–34}

These forms of strongyloidiasis result in high mortality due to complications such as secondary bacterial infection. Thus, the treatment must include giving proper antiparasitic agents, improving host status and management of complications.

Antiparasitic agents

Most of the clinical studies were conducted in chronic uncomplicated strongyloidiasis, therefore treatments of severe forms of strongyloidiasis were mainly published as case series or reviews. Fardet et al. reviewed severe strongyloidiasis among corticosteroid treated patients in 2006³⁵ and found that the most common treatment regimen (83.3% of report cases; 105/126) was thiabendazole at the dose of 25 mg/kg/day for 5–7 days.

Table 1. Clinical studies of chronic uncomplicated strongyloidiasis

Study, year published	Population	Study design	Follow-up period	Regimens	Cure/total n (%)	Remarks
Pungpak S et al. 1987 ⁵⁴	Thai adults without co-morbidity	Controlled trial, open label	15, 30 days	Albendazole 400 mg/day for 3 days Albendazole 400 mg/day for 3 days with repeated regimen 1 week later	8/11 (72) 19/19 (100)	
Archibald LK et al. 1993 ⁵⁵	British ex-Far East prisoners of World War II	Prospective cohort	6–9 months, using stool tests and/or serology	Albendazole 400 mg twice daily for 3 days	35/47 (75)	
Pittisuttithum P et al. 1995 ²⁰	Thai adults without co-morbidity	RCT, open label	3 weeks	Albendazole 400 mg twice daily for 5 days Thiabendazole 1 g twice daily for 5 days	18/23 (95 ^a) 12/12 (100)	NS
Shikiya K et al. 1994 ¹¹	Japanese patients	Prospective study	No data	Ivermectin 6 mg 2 doses, 2 weeks interval	108/125 (86.4)	
Datry A et al. 1994 ¹²	French adults without co-morbidity	RCT, open label	3 months	Ivermectin 150–200 µ/kg, single dose	24/29 (83)	P<0.01
Gann PH et al. 1994 ¹³	Southeast Asian refugees in the United States	RCT, open label	≥3 months	Albendazole 400 mg/day for 3 days Ivermectin 200 µ/kg, single dose Ivermectin 200 µ/kg, for 2 consecutive days Thiabendazole 50 mg/kg/day for 3 days	9/24 (38) 16/16 (100) 17/18 (94) 18/19 (95)	
Toma H et al. 2000 ¹⁴	Japanese adults, positive rate of HTLV-I infection was 29.4%	Controlled trial, open label	1 year	Pyriminium pamoate 5 mg/kg/day for 3 days Albendazole, 400 mg/day for 3 days	14/60 (23) 65/84 (77)	p<0.001; Pyriminium pamoate vs albendazole p<0.001; albendazole vs ivermectin significantly decreased cure rate in HTLV-I infection subjects
Igual-Adell R et al. 2004 ¹⁵	Spanish adults	Retrospective study	3 months	Ivermectin, 6 mg in a single dose Ivermectin 200 µ/kg, single dose Ivermectin 200 µ/kg, for 2 consecutive days Thiabendazole 50 mg/kg/day for 5 days	65/67 (97) 17/22 (77) 35/35 (100) 25/31 (78)	
Suputtamongkol Y et al. 2008 ⁵⁶	Thai adult patients with concomitant medical illness	RCT, open label	4 weeks	Veterinary (parenteral formulation) ivermectin 200 µ/kg, orally single dose	16/21 (76)	p=0.029
Bisoffi Z et al. 2011 ¹⁶	Adults without co-morbidity; Italian and immigrants	RCT, open label, phase III	3–6 months, Using both stool tests and serology (IFAT)	Albendazole 800 mg/day for 7 days Ivermectin 200 µ/kg, single dose Thiabendazole 50 mg/kg/day for 2 days	8/21 (38.) 60/106 (56.6) 48/92 (52)	NS
Suputtamongkol Y et al. 2011 ¹⁷	Thai adult patients with concomitant medical illness	RCT, open label	1 year	Ivermectin 200 µ/kg, single dose Ivermectin 200 µ/kg, two doses, given 2 weeks apart Albendazole 800 mg/day for 7 days	30/31 (97) 27/29 (93) 19/30 (63)	p=0.006; albendazole vs ivermectin

HTLV: human T cell lymphotropic virus; IFAT: immune fluorescent antibody assessment; NS: not significant; RCT: randomized controlled trial.

^a Per protocol analysis (outcomes of 4 patients were not evaluated).

Table 2. Adverse events of antiparasitic agents against strongyloidiasis

Antiparasitic agents	Adverse events
Thiabendazole ^{13,22,26}	Neuropsychiatric (23.0–89.5%), nausea (22.5–81.3%), fatigue (24.5–78.9%), liver dysfunction (33.8%), abnormal smell of urine (26.0%), anorexia (16.0–57.9%), dizziness (16.0–23.8%), headache (5.0–15.9%), abdominal pains (5.3–7.0%), vomiting (7.0%), flushed face (5.0%), pruritis (2.0%), paraesthesia (2.0%), sweating (2.0%), fluctuance (2.0%)
Albendazole ^{19,26,56}	Abnormal liver enzymes (26.3–33.3%), headache (7.4–10.6%), abdominal pain (0.6–14.8%), loose stools (1.8–10.0%), dizziness/vertigo (5.9%), cough (4.7%), fever (4.1%), nausea (3.5–3.7%), diffuse itching (3.5%)
Ivermectin ^{13,19,26,56}	Abnormal liver enzymes (13.6%), itching (1.8–11.8%), headache (8.8–10.6%), loose stools (1.2–9.8%), cough (6.7%), fever (6.3%), fatigue (0.8–5.9%), abdominal distension (4.3%), chest pain (4.3%), dizziness (2.4–3.0%), nausea (1.6–3.0%), constipation (2.9%)

However, the doses varied from 100 to 7000 mg per day and duration also ranged from 2 days to 1 month of treatment. The death rate in this study was 58.9% (89/151). A systematic review of case reports of severe strongyloidiasis by Bounfrate et al. showed that while 133 out of 244 patients received a single treatment, 42 patients did not receive treatment and the remainder were treated with a combination of drugs.²⁵ The death rates among single regimen treatments with ivermectin, thiabendazole and albendazole were 47% (18/38), 51% (28/55) and 73% (25/34), respectively.²⁵

Ivermectin has also become the drug of choice for treatment of severe forms of strongyloidiasis with various dosages, durations and routes of administration. Table 3 shows the available reports of ivermectin monotherapy regimens for treatment of these severe forms, parasite cure and patients' outcomes. However, the actual regimens in studies depended on the specific details of each case. In some cases, patients may have died within a short time, which would have made the regimen durations appear to be shorter than intended had the patients survived longer. Furthermore, the death rate in the severe form of *Strongyloides* infection is dependent on the patient's overall status, which is usually immunocompromised, and is not dependent on only the clearance of the parasite.

In severe cases that have absorption problems, such as gut obstruction, ileus and postoperation, the oral antiparasitic agents could not have had full efficacy as expected.^{36–41} The veterinary parenteral form of ivermectin was given subcutaneously with the patients' consent in many reports. The common dosage of parenteral ivermectin was 200 µ/kg/day (ranging from 75–200 µ/kg/day) given daily for 3–22 doses; the parasitological cure was 65% (11/17 cases).⁴¹ Although it was safe in treatment of chronic strongyloidiasis, severe neurotoxicity, such as encephalopathy and coma were reported in treatment of severe cases with parenteral ivermectin.^{37,41} The successful treatment of ivermectin retention enema was reported by Tarr et al.⁴² Multiple routes of administration for ivermectin also were given in severe cases.⁴³ Although no standard guideline for treatment of severe forms of strongyloidiasis exists, most reports have recommended the dosage of ivermectin giving 200 µ/kg/day until resolution of clinical syndromes and clearance of parasite detection in clinical specimens.^{1,10,44} Additionally, treatment and follow-up have been advised to be continued until fecal culture for *S. stercoralis* is negative for 2 weeks to eradicate autoinfection cycle.^{1,45}

Minimize immunocompromised status

One of the key issues in management of opportunistic infection is improving host immunity. Fardet et al. reported that the mean daily dosage of corticosteroid in severe strongyloidiasis patients was 52±42 (mean± SD) mg of prednisolone equivalent and the duration of corticosteroid usage ranged from 4 days to 20 years.³⁵ Hence, minimizing of immunosuppressive drugs should be performed in all cases.⁴⁵

Treatment of complications

The common complications of severe strongyloidiasis are pneumonia, gram negative bacteremia, meningitis, respiratory failure, gastrointestinal bleeding and hypoalbuminemia. Fardet et al. reported positive culture in the blood and cerebrospinal fluid in 29.1% (44/151) and 15.2% (23/151) of patients with severe strongyloidiasis.³⁵ The majority of identified organisms were enteric pathogens. Thus, the empirical treatment of complications, especially antibiotic, should be started as soon as diagnosis of severe strongyloidiasis has been made.

Because this condition occurs in immunocompromised hosts, co-infections such as other intestinal parasites, aspergillosis and nocardiasis are not uncommon. Clinicians should be aware of this and promptly treat them.

Follow-up after treatment

In all cases, treatment success in terms of clinical improvement should be assessed by both clinical and laboratory evaluations including stool examination and serology.^{8,16} Among various stool examinations, agar plate culture or Baermann technique are recommended in evaluation of treatment outcome.^{16,25} However, direct examinations with stool samples can cause false negatives due to low parasite load and irregular shedding, especially after treatment. From the study of Bisffi et al, the cure rate of ivermectin and thiabendazole groups were 56.6% and 52.2%, respectively, when using both stool examination and serology criteria of cure, but the cure rates were 85.7% and 94.6%, respectively, when using negative stool tests only.¹⁶ Eosinophilia and serology by IgG titer with ELISA method decrease by time after treatment.^{9,46,47} Serology was used in evaluation of outcome

Table 3. Treatment of severe forms of Strongyloidiasis infection with ivermectin

Reference	Age, sex	Risk factors	Clinical Syndrome	Clinical presentations	Diagnostic specimen of <i>Strongyloides stercoralis</i>	Ivermectin dosage (daily)	Duration	Parasite cure	Outcome
Oral ivermectin									
Orem J et al. 2003 ⁵⁷	32, M	AIDS	SHS	No data	Sputum Stool	200 µg/kg/d	Single dose	No, recurrence 4 months later	Survived
Das P et al. 2007 ⁵⁸	50, M	Received corticosteroid	SHS	Chronic diarrhea	Duodenal biopsy	200 µg/kg/d 200 µg/kg/d	3 days Single dose	Yes No data	Survived
Rose CE et al. 2009 ⁵⁹	59, F	CLL, received alemtuzemab, hypoalbuminemia	DS	Pneumonia Ileus	Sputum Stool	147 µg/kg (15 gm) on 1st day then 293 µg/kg (30 gm)	22 days	Yes	Died
Roxby AC et al. 2009 ⁴⁴	63, M	Post heart transplantation	SHS	ARDS	Sputum	200 µg/kg/d	36 hours	Not evaluated	Died
Murali A et al. 2010 ⁶⁰	58, M	Poorly controlled diabetes mellitus, postsurgery laryngeal cancer	DS	Chronic pericardial effusion	Pericardial fluid	200 µg/kg/d	2 days	Not evaluated (resolution of pericardial effusion)	Survived
Tsai M-J et al. 2011 ⁶¹	72, M	COPD, chronic kidney disease	SHS	ARDS Ileus Bacteremia	BAL Colon biopsy	200 µg/kg/d	2 days	Not evaluated	Died
Hamilton KW et al. 2011 ^{a,43}	53, F	Post renal transplantation	SHS	Gastro-intestinal bleeding	Gastric aspiration Sputum	200 µg/kg/d	Weekly for 5 cycles, followed by 7 consecutive days	Yes	Survived
Hsu CN et al. 2013 ⁶²	17, F	Post intestinal transplantation	SHS	No symptom	Stool	200 µg/kg/d	2 days and repeated 2 weeks later	Yes	Survived
Subcutaneously veterinary parenteral ivermectin									
Donadello K et al. 2013 ⁴¹	56, M	Post renal transplantation	DS	Pancreatitis Respiratory distress	Stool Sputum Abdominal fluid	75 µg/kg/d initially then 200 µg/kg/d at 5th day	9 days	Yes	Died
Multiple route of administration									
Marty FM et al. 2005 ³⁸	54, M	Multiple myeloma received immunosuppressive agents, HTLV-I	DS	Diarrhea Pneumonia	Stool Sputum Urine	200 µg/kg/d, nasogastric feeding x 1 day 400 µg/kg/d in 40% ethanol solution, nasogastric feeding x 2 day 200 µg/kg/d, subcutaneously x3 days. 200 µg/kg/d, orally x 1 day		Yes	Survived

Continued

Table 3. Continued

Reference	Age, sex	Risk factors	Clinical Syndrome	Clinical presentations	Diagnostic specimen of <i>Strongyloides stercoralis</i>	Ivermectin dosage (daily)	Duration	Parasite cure	Outcome
Hauber HP et al. 2005 ⁶³	77, M	Received cyclophosphamide and corticosteroid	SHS	Bloody diarrhea Pneumonitis	GI mucosal biopsy Bronchial lavage Stool	170 µg/kg/d	Orally x3 days Subcutaneously x7 days	Yes	Died
Salluh JIF et al. 2005 ⁶⁴	56, M	Lung cancer with brain metastasis, received corticosteroid	DS	Acute abdominal pain Peri-umbilical purpuric lesion	Gastric aspiration Stool	12 mg	Subcutaneously x3 days together with nasoenteral feeding x 16 days	Yes	Survived
Leung V et al. 2008 ³⁹	67, M	Cranio-pharyngioma post-radiation, received corticosteroid	SHS	Bacterial meningitis Bacteremia Gut obstruction	Nasogastric aspiration Tracheal aspiration Bowel resection	200 µg/kg/d	Nasoenteral feeding x 2 days Subcutaneously x 8 days	No	Died
Fusco D et al. 2010 ⁶⁵	76, F (Patient 3)	Received corticosteroid	SHS	Colitis Pneumonia Bacteremia	BAL Stool	200 µg/kg/d	Nasoenteral feeding x 10 days Subcutaneously every 72 hours x 3 doses	Yes	Died
Hamilton KW et al. 2011 ^{a,43}	39, F	Post renal transplantation	DS	Periumbilical purpuric patch Diarrhea	Skin biopsy Stool	200 µg/kg/d	Nasoenteral feeding x 5 days Enema x 1 day Subcutaneously every other day x 11 days Orally 14 days	Yes	Survived

ARDS: Adult respiratory distress syndrome, BAL: Bronchioalveolar lavage, CLL: Chronic lymphocytic leukemia, COPD: Chronic obstructive pulmonary disease, DS: Disseminated strongyloidiasis, SHS: *Strongyloides stercoralis* hyperinfection syndrome.

^a Recipients of donor-derived *S. stercoralis* for same donor.

of treatment by significant decreasing in titer or conversion to negative in both endemic and non endemic areas.^{9,47} While the eosinophilia resolved quickly within 1 month after treatment,¹³ serology took longer to decrease. Thus, patients need serological evaluation every 3–6 months for up to 2 years to see the response.⁹ The limitations of follow-up by using serology are the longer time taken to decrease, the limited availability and the lack of well established recommendations.

The HTLV-I infection was found to be associated with treatment failure in both Japan and Peru, which are endemic for both HTLV-I and *S. stercoralis*.^{14,48} Terashima et al. recommended that patients with uncomplicated strongyloidiasis which has failed to respond to standard treatment should be investigated for HTLV-I infection.⁴⁸

Prevention and patient education

The immunocompromised patients who live in, or have history of travel to, an endemic area of strongyloidiasis should be screened for *Strongyloides* infection with stool examination, stool culture technique and serology.^{1,49,50} The best practice is screening before patients undergo transplantation, chemotherapy or take immunosuppressive agents. There is limited data on prophylactic treatment in immunocompromised patients.^{51,52} The randomized, placebo-controlled trial in Brazil showed that prophylactic treatment with thiabendazole was not superior to placebo in decreasing the rate of *Strongyloides* infection in hematologic malignancy ($p=0.36$).⁵¹ In contrast, albendazole 400 mg twice daily for 5 days showed reducing odds of having strongyloidiasis in comparison with a once daily regimen in nephrotic syndrome patients taking corticosteroid.⁵² However, the limitation of both studies was inadequate power. Control programs performed in schools should use albendazole to eradicate both *S. stercoralis* and other intestinal parasites.¹⁹ Albendazole, for both 3 days and 5 days, and single dose ivermectin both showed similar cost-effectiveness in model analysis among immigrants with a more than 2% prevalence of strongyloidiasis.⁵³

Education emphasizing personal hygiene including using latrines and wearing shoes in endemic area should be given to patients, persons at risk and the ordinary population. Contact isolation should be applied in all strongyloidiasis cases to prevent secondary transmission and all family members should be screened for transmitted infection.¹

Conclusions

The management of strongyloidiasis should be adjusted to suit to individual patients based on clinical syndrome and host immunity. Not only an effective regimen of antiparasitic agents but also the proper evaluation is also needed to ensure the curative treatment. The complications of severe forms of strongyloidiasis have to be promptly evaluated and treated. In all cases, patients should receive education.

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