Successful treatment of niclosamide- and praziquantel-resistant beef tapeworm infection with nitazoxanide

Mohammad Lateef, Showkat Ali Zargar, Abdul Rashid Khan, Muzzaffar Nazir and At

Department of Zoology, University of Kashmir, Srinagar, India

Department of Gastroenterology, Sher-i-Kashmir Institute of Medical Sciences, Srinagar, India

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Summary

Background

Beef tapeworm (*Taenia saginata*) infection is acquired by eating inadequately cooked beef that contains the larvae or cysticerci of *T. saginata*. Niclosamide and praziquantel have proved effective for its treatment but treatment failures are well known. We report herein the results of nitazoxanide therapy.

Methods

A prospective study was conducted in 18 children and 34 adults to assess the efficacy and safety of nitazoxanide in the treatment of niclosamide- and praziquantel-resistant *T. saginata* infection. Nitazoxanide was administered twice daily for 3 days in 500-mg doses for those aged over 14 years and at 20 mg/kg body weight/day in children aged 5–14 years. Post-treatment follow-up was undertaken at 1, 2, 4, 8, and 12 weeks for fecal samples for proglottides, and to check the presence, number, and viability of *Taenia* eggs.

Results

Nitazoxanide cured 51 of 52 (98.1%) patients. Mild side effects occurred in seven patients, which resolved spontaneously. There were no abnormalities in laboratory parameters.

Conclusions

Nitazoxanide is a safe, effective, inexpensive, and well-tolerated drug for the
treatment of niclosamide- and praziquantel-resistant beef tapeworm infection.

Keywords: *Taenia saginata*; Prevalence; Niclosamide; Praziquantel; Drug resistance; Nitazoxanide

Corresponding author. Tel.: +91 194 2312092; fax: +91 194 2403470.

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Host Specificity of Helminth Parasites in Fishes of Kashmir: Phylogenetic Perspective

A. Hussain, A. R. Khan, and Fayaz Ahmad
PG Department of Zoology, University of Kashmir, Srinagar

The host specificity of a parasite is not merely a function of how many host species it can exploit, but also of how closely related these host species are to each other. A new host specificity index proposed by Poulin and Mouillot (2003) takes into account the average taxonomic or phylogenetic distance between pairs of host species used by a parasite. Using data on some helminth parasites of freshwater fish from Kashmir, the host specificity was studied and compared. Rhobodochona guptai and Allocreadium nemachilus were found to be highly specific. Pomphorhynchus kashmirensis showed least host specificity.

Key words: Freshwater fish, helminths, host specificity, Kashmir.

Epidemiological Survey of Taenia saginata Infection in Kashmir

A. R. Khan, S. A. Zargar*, M. Lateef, and Muzaffar Nazir
PG Department of Zoology, University of Kashmir
*Department of Gastroenterology, SKIMS, Srinagar

An epidemiological study of Taenia saginata infection was carried out in Kashmir to know the magnitude of this infection in free living human population. A total population of 8894 from all age groups were surveyed and interviewed for the passage of gravid proglottids, of them 201 (2.25%) persons were having history of passing these gravid segments in their faeces and were confirmed by stool examination for Taenia saginata infections.

Key words: Epidemiology, Taenia saginata, Kashmir.

Comparative Morphology of Oocysts of Eimeria in Domestic Rabbits of Kashmir Valley

A. R. Khan, Majidah Rasheed, Asiya-Magray and B. A. Pandit*
PG Department of Zoology, The University of Kashmir, Srinagar - 190006
*Division of vet. Parasitology, F V Sc & A H, Shuhama, Alustang, SKUAST-K

The present study was undertaken to identify and compare the morphology of unsporulated & sporulated oocysts of Eimeria in domestic rabbits of Kashmir Valley. In the five breeds of rabbits which included New Zealand white, California, Angora, soviet Chinchill and Grey-giant, a total of nine spp.s of Eimeria were found. The identification of the different species of Eimeria was done on the basis of the morphological characters of unsporulated and sporulated oocysts like shape, size, oocyst wall, presence or absence of microphyle, polar granule, stied body and residual body. The sporulation time was also recorded at the time of speciation. The spps
summer months had COHb levels > 2% as
compared to 76% during winter months
[p=0.001] and none of them had COHb level
greater than 5% during summer. Common
heating devices used included traditional fire
pot (kangri: 72%), gas heaters (44%), kerosene
heater stoves (36%), coal heating devices
(32%) with single person using multiple
appliances. Pulse oximetry was normal in all
patients and only CO-oximeter measured the
accurate blood levels of COHb. Thus, in cold
regions like Kashmir people using various
heating appliances, physicians coming across
unexplained winter headaches especially with
similar symptoms in cohabitants or coworkers
should suspect occult carbon monoxide
poisoning and should estimate venous COHb
levels in such patients by CO-oximetry.

Key Words: Carbon monoxide, carboxyhemoglobin, pulse.

**MED — 11**

**Nitazoxanide in treatment of Taenia saginata Infections in Kashmir**

S. A. Zargar*, A. R. Khan, M. Lateef and Muzaffar Nazir*

*Department of Gastroenterology, SKIMS, Soura
P.G. Department of Zoology, University of Kashmir, Srinagar

Nitazoxanide, a nitrothiazole derivative, was
administered orally in tablet form. A single dose
of 15-20 mg/kg body weight was given to 82
patients infected with *Taenia saginata*. Of them
81 (98.7%) were successfully treated while 1
patient (1.3%) did not respond to the
drug. Tolerance of the drug was good. 2 patients
(2.44%) had mild gastritis like symptoms.

Key word: *Taenia saginata*, nitazoxanide, tolerance, mild, gastric

**MED — 12**

**A Study of Prevalence of Stress Related Functional GI Disoders in Urban/Rural Population in Kashmir Valley**

Shameem I. Bhat, G. M. Malik, M. A. Kamili, Masood Tanvir and A. S. Shiekh

Post Graduate Department of Medicine, Govt Medical College, Srinagar

The study group comprised 3000 civilian
population with 500 from each district (1405
males & 1595 females) and 1000 paramilitary
personnel deployed in the valley in the age
group of 25-65 years. The prevalence of all the
functional gastrointestinal and non-
gastrointestinal symptoms was highest in the age
group 25 - 34 years at the time of survey
in both civilian and paramilitary population,
but higher in females. There has been a
considerable increase in the prevalence of
functional gastrointestinal and non-
gastrointestinal symptoms among the
inhabitants of the valley after the onset of
ongoing turmoil. Abdominal pain has
increased from 20.3% to 48.2%, excessive gas
/ bloating from 21.9% to 33.0%, > 3 bowel
movement per day from 7.8% to 20.4%, loose
watery stools from 5.7% to 9.4%, chronic
fatigue from 9.5% to 30.6%, joint pains from
4.2% to 11.4%, headache from 9.8% to 19.3% and
sleep disturbance from 5.7% to 16.6%
respectively. Kupwara showed a considerably
higher prevalence of all functional
gastrointestinal and non-gastrointestinal
symptoms compared to other districts and the
difference was statistically significant. The
paramilitary personnel deployed in the valley
The agent causing bovine cisticerciasis in cattle is *cysticercus bovis*, bovine larval stage of *Taenia saginata* (Goeze, 1782). Masse and Puge report that in a calf infected with mature segments of *Taenia saginata*, severe emaciation was observed after the appearance of clinical signs of cisticerciasis. In a calf, experimentally infected by Zurn, the following clinical signs were noted: temperature 40°C, accelerated pulse, abdominal distention, emaciation and difficulty in standing up. After the calf's death, Zurn found generalized cisticerciasis with particularly extensive involvement of the heart (according to Neumann, 1892).

Ershow (1933) described the clinical manifestations of acute cisticerciasis in experimentally infected calves and adult bulls. In all 10 experimental animals, fairly distinct clinical manifestations were observed during the first few days after infection, disappearing gradually towards the 8th - 12th day, and the animals recovered. In one case of 10, death of the calf occurred on the 8th day after its infection with 5 mature segments, containing the usual number of *Taenia ova*. In all infected calves and adult bulls, body temperature rose to 39.4 - 41.8°C on 2nd - 4th day of infection, and remained high until 6th - 7th day. The general condition of infected animals was impaired in case with severe infection, the animal lay moaning, appetite was poor, rumination absent, the proventriculus atonic, constipation present. In one case of very heavy infestation, profuse diarrhea was noted. Most calves heavily infected with cisticerciasis showed signs of myositis on 5th - 6th day the masseters and muscles of hip and limbs were chiefly affected.

The data of Ershow thus confirm the known experiments of Leukart and Zurn, who reported that bovine animals artificially infected with large number of *Taenia saginata* oncospheres become severely ill and die.

At present another trial has been made by authors to demonstrate the development of cisticercus larvae of the same parasite in the goat and sheep for this purpose a lamb and a nanny have been kept under controlled conditions to minimize the chances of other parasite infestation like Fascioliasis or Nematodiiasis. These animals have recently been inoculated with a dose of *T. saginata* 2 gravid segments in lamb and 1 gravid segment in nanny (goat) and certain changes such as slight increase in body temperature, dizziness and emaciation in both the experimental animals has been observed. The coprological examination of these animals has done after inoculation, few eggs of *T. saginata* were found in viable condition. But is yet to determine whether the development of cisticercus larvae has occurred or not as it is too early to diagnose the same and would be confirmed exactly after the slaughter of these animals.
AN OUTLINE OF "TAENIASIS" DUE TO TAENIA SAGINATA

A. R. Khan, M. A. Lateef, S. A. Zargar*
Post-Graduate Department of Zoology
The University of Kashmir, Srinagar - 190 006, Kashmir
* Dept. of Gastroenterology, SKIMS, Soura, Kashmir

Cestodes, or tapeworms, are segmented worms. The adults reside in the gastrointestinal tract, but the larvae can be found in almost any organ. Human tapeworm infections can be divided into two major clinical groups. In one group, humans are the definitive hosts, with the adult tapeworms living in the gastrointestinal tract (Taenia saginata, Diphyllobothrium, Hymenolepis, and Dipylidium caninum). In the other, humans are intermediate hosts, with larval stage parasites present in the tissues. Diseases in this category include echinococcosis, sparganosis and coenurosis. For Taenia solium, the humans may be either the definitive or the intermediate host.

The ribbon-shaped tape worm attaches to the intestinal mucosa by means of sucking cups or hooks located on the scolex. Behind the scolex is a short, narrow neck from which proglottids (segments) form. As each proglottid matures, it is displaced further back from neck by the formation of new, less mature segments. The progressively elongating chain of attached proglottids, called the strobila, constitutes the bulk of the tapeworm. The length varies among species. In some, the tape worms may consist of more than 1000 proglottids and may be several meters long. The mature proglottids are hermaphroditic and produce eggs, which are intermittently released. Since eggs of the different Taenia species are morphologically identical, difference in the morphology of the scolex or proglottids provide the basis for diagnostic identification to species level. Most human tape worms require at least one intermediate host for complete larval development. After ingestion of the eggs or proglottids by an intermediate host, the larval oncospheres are activated, escape the egg, and penetrate the intestinal mucosa.

The oncosphere migrates to tissues and develops into an encysted form known as a cysticercus (single scolex), a coenurus (multiple scolexes), or a hydatid (cyst with daughter cysts, each containing several protoscolices). Ingestion by the definitive host of tissues containing a cyst enables a scolex to develop into a tape worm.

Taenia Saginata (Goeze, 1782)
Taenia saginata, the beef tape worm is the commonest large tapeworm causing intestinal taeniasis. The infection is acquired by ingesting beef infected with the larvae (cysticercus bovis) of the worm. Goeze in 1782 differentiated this tapeworm from that of taenia solium. The cattle was demonstrated to be an intermediate host of the parasite by I. cujut (1863).

Etiology and Pathogenesis
Humans are the only definitive host for the adult stage of taenia saginata. This tapeworm, which can reach 8-12m, even 15m in length, inhabits the upper jejunum and has a scolex with quadrilateral shape measuring less than 2 mm in diameter and bears four prominent suckers, which may be pigmented. The scolex is followed by a
short and fragile neck which is usually one half as broad as the head and several inches in length. The adult worm consist of 1,000-2,000 proglottids or segments. These are arranged as immature, mature and gravid segments in their linear sequence. Each gravid segment has 15-30 uterine branches (in contrast to 8-12 for Taenia solium and have 300-400 testes (twice the number in Taenia solium). The eggs are indistinguishable from those of Taenia solium; they measure 30-40 μm, contain the oncosphere, and have a thick brown striated shell. Eggs deposited on vegetation can live for months to years until they are ingested by cattle or other herbivores. The embryo released after ingestion invades the intestinal wall and is carried to striated muscle, where it transforms into the fluid filled bladder worm (cysticercus bovis) within 60-75 days. The cysticerci are commonly found in the skeletal and cardiac muscles, the fat, visceral organs and tongue. The cysticerci which are infectious to man are viable even upto 8 months in the muscles of the cattle after which they die and degenerate. When ingested in raw or undercooked beef, this form can infect humans. After the cysticercus is ingested, it takes ~ 2 months for the mature adult worm to develop.

Clinical Manifestations: Patients become aware of the infection most commonly by noting passage of proglottids in their faeces. The proglottids are often motile and may cause psychological distress in persons harbouring the parasite and also experience perianal discomfort. Mild abdominal pain, nausea, change in appetite, weakness, and weight loss can occur with Taenia saginata infection.

Diagnosis: The diagnosis is made by the detection of eggs or proglottids in the stool. Eggs may also be present in the perianal area, thus, if proglottids or eggs are not found in the stool, the perianal region should be examined with use of a cellophane - tape swab (as in pinworm infection). Distinguishing Taenia saginata from Taenia solium requires examination of mature proglottids or the scolex. Serological tests are not helpful diagnostically. Eosinophilia and elevated levels of serum IgE may be detected.

Treatment: A single dose of praziquantel (10 mg /kg) is effective. Niclosamide 2 gm oral dose is also effective. Moreover another drug Nitazoxanide has been proved to be much effective against Taeniasis. The recommended dosage of Nitazoxanide for 12-47 months, 4-11 years, 12 years and above are 100 mg, 200 mg and 500 mg, twice a day for 3 days respectively. However the exact drug efficacy of Nitazoxanide for Taeniasis is being recorded by the authors.

Prevention and Control: The major method of preventing infections is the adequate cooking of beef; Exposure to temperature as low as as 56°C for 5 minutes will destroy cysticerci. Refrigeration or salting for long periods or freezing at -10°C for 9 days also kills cysticerci in beef. General preventive measures include inspection of beef and proper disposal of human faeces.