Indian J Med Res 140, September 2014, pp 414-419

Clinical & biochemical profile of trichinellosis outbreak in north India

Rahul K. Sharma, N. Raghavendra, Smita Mohanty, Brijendra K. Tripathi, B. Gupta & Ankita Goel*

*Department of Medicine, Vardhman Mahavir Medical College & Safdarjung Hospital, *Department of Pediatrics, Lady Hardinge Medical College & Kalawati Saran Children Hospital, New Delhi, India*

Received January 1, 2013

***Background & objectives*: Trichinellosis is a parasitic infection caused by *Trichinella* nematodes, acquired from consumption of raw meat. However, data from Indian subcontinent are limited. The aim of this study was to investigate the clinical and biochemical profile of a suspected trichinellosis outbreak in a village in Tehri Garhwal district of Uttarakhand state in north India.**

***Methods*: Three index cases presenting as acute febrile myalgia syndrome with eosinophilia, after consumption of uncooked pork in a common feast, were confirmed as trichinellosis on muscle biopsy. A detailed epidemiological survey was carried out in the affected community and all the people who participated in the feast were investigated for clinical and biochemical profile.**

***Results*: A total of 54 patients were evaluated in the study. The type of pork consumed included uncooked in 24 per cent (n=13), open fire roasted in 39 per cent (n=21) and fried in 37 per cent (n=20). Clinical symptoms were found in those who consumed pork in uncooked or open fire roasted form (n=34). These included fever with chills and myalgia (100%), periorbital oedema (67%), dyspnoea (9%), and dysphagia (3%). Laboratory parameters studied in both symptomatic and asymptomatic patients showed eosinophilia in 90 per cent (n=41), raised ESR in 98 per cent (n=45), and an elevated creatinine phosphokinase (CPK) level in 85 per cent (n=39). All symptomatic patients were treated with a short course of oral steroids and albendazole therapy.**

***Conclusions*: *Trichinella* infection is not uncommon in India, and should be suspected in case of acute febrile myalgia especially in areas, where habits of consumption of raw meat is more prevalent.**

Key words Acute febrile myalgia - eosinophilia - parasitic infection - trichinellosis - raw meat - *Trichinella*

Trichinella infection is uncommon in humans in India with the diagnosis being difficult because of the non specific symptoms of the disease. Human trichinellosis occurs following the ingestion of raw or undercooked meat containing encysted *Trichinella* larvae[1]. A presumptive diagnosis of trichinellosis should be considered in patients with fever, myalgia, periorbital oedema, eosinophilia and recent consumption of poorly cooked meat, especially pork. Diagnosis is confirmed with serology (documenting a rise in the titre of antibody) or muscle biopsy showing *Trichinella* larvae[2].

An outbreak of this disease has not been reported from India making it a rarely thought cause of febrile

myalgia in this part of the world. We came across three patients, belonging to the same community, who presented with fever and generalized myalgia after consumption of pork in a community feast. A diagnosis of trichinellosis was suspected and confirmed by the muscle biopsy. Further enquiry revealed similar symptoms in many other people belonging to the same community who had participated in that feast. An outbreak was suspected and hence this survey was undertaken with the aim of evaluating the clinical and biochemical profile of trichinellosis outbreak in the community.

Material & Methods

This observational study was undertaken from April 6-8, 2011, in a remote village, Tola, in Tehri Garhwal district of Uttarakhand State in north India, following three index cases of the same community who presented in first week of March 2011 to the medicine ward of Vardhman Mahavir Medical College and Safdarjung Hospital, a tertiary healthcare hospital in New Delhi, India. The three cases had similar complaints of acute onset fever and generalized myalgia with eosinophilia, and a background history of pork ingestion in a community gathering (Table I). After being evaluated for eosinophilia myalgia syndrome, the diagnosis of trichinellosis was confirmed on the basis of demonstration of *Trichinella* larvae in the muscle biopsy specimens from vastus lateralis muscle in two patients (Figure). Though no parasite was seen in the muscle biopsy of the third patient, the evidence of myositis on background symptomatology, along with laboratory features confirmed the diagnosis.

Following the confirmation of diagnosis of *Trichinella* infection in these three index cases, the concerned local authority was contacted and a team of doctors along with paramedics provided by the local authority visited the affected community five weeks after the index cases were confirmed. Detailed proforma based clinical information was collected from all the people who had eaten the same pork preparation and relevant blood investigations were done after taking an informed consent. All the symptomatic patients were treated using albendazole therapy and a short course of oral steroids.

The data collected included demographic data (age, sex), presence of clinical symptoms and signs (like fever, myalgia, breathing difficulty, dysphagia, and periorbital oedema), and type of pork consumed (cooked or uncooked). Blood samples were taken on site for evaluation of various parameters like haemoglobin, erythrocyte sedimentation rate (ESR), absolute eosinophil count, creatinine phosphokinase (CPK) levels and liver function tests. Examination and laboratory findings were recorded and analyzed.

A clinical case of *Trichinella* was defined as a clinically compatible case (common signs and symptoms included eosinophilia, fever, myalgia and periorbital oedema) that is confirmed by laboratory criteria of either a positive serologic test for *Trichinella* or demonstration of *Trichinella* larvae in tissue obtained by muscle biopsy[3]. The outbreak was confirmed as defined by the Centres for Disease Control (CDC) and California Department of Public Health[3,4]. The study was approved by the Ethics Committee.

Results

Excluding three index cases, a total of 54 people took part in the community feast in the village and were eligible for the study. One death with similar clinical profile was reported. The clinical data were collected from all of them including the relatives of the patient who died due to similar illness. Seven people refused to give consent for blood sampling.

The study population included 18 males and 36 females. The age range of patients was from 5 to 87 yr with the mean age of 40 yr and four subjects under the age of 12 yr. The type of pork consumed included uncooked in 24 per cent (n=13), open fire roasted in 39 per cent (n=21) and fried in 37 per cent (n=20) (Table II).

Clinical symptoms were first noticed 2-3 wk after consumption of pork in 34 patients and subsided in 4-5 wk except for ten patients who had persistent myalgia at the time of the visit. The predominant symptoms observed were fever with chills and myalgia, documented in all 34 patients (100%) who consumed pork in uncooked or open fire roasted form. Periorbital oedema was found in 24 patients. Three patients also had difficulty in breathing, one person had difficulty in swallowing and one had itching all over the body. None of those 20 who consumed pork in fried form, suffered from, any form of clinical illness (Table II).

Of the 46 people who consented for blood investigations, 12 had consumed pork in uncooked form, 17 in open fire roasted form and 17 had consumed fried pork. Forty one people (89%) had

Table I. Clinical and biochemical profile of three index cases

Feature	Patient 1	Patient 2	Patient 3
Interval between exposure and admission to hospital, (days)	20	23	25
Age (yr)	50	54	24
Sex	Female	Male	Male
Fever with chills	Yes	Yes	Yes
Myalgia	Yes	Yes	Yes
Vomiting and diarrhoea	No	No	No
Abdominal pain	Yes	No	No
Shortness of breath	No	No	No
Generalized weakness	Yes	Yes	Yes
Difficulty in walking	Yes	No	Yes
Difficulty in swallowing	Yes	No	Yes
Periorbital oedema	Yes	Yes	Yes
Pedal oedema	Yes	Yes	Yes
Anaemia	No	No	Yes
Muscle tenderness	Yes	Yes	Yes
Haemoglobin (g/dl)	14.0	11.4	7.8
Total WBC count (cells/ml)	22930	9800	7600
Differential leukocyte count	N41 L9 M5 E45	N59 L26 M4 E7	N50 L32 M2 E16
CPK level, IU/l	2732	845	2247
AST/ALT level IU/l	208/341	-	117/142
ESR level	29	36	28
CRP levels	Positive	Positive	Positive
Absolute eosinophil count	10318	1050	1016
Muscle biopsy	multiple larvae forms of parasite *T. spiralis* with inflammatory reaction	features of parasite infection with larval form of *Trichinella* with giant cells	focal collection of lymphocytes and eosinophils along with occasional muscle fiber showing basophilic degeneration and giant cells

CPK, creatinine phosphokinase; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein; AST, aspartate aminotransferase; ALT, alanine aminotransferase; N, neutrophils; L, lymphocytes; M, monocytes; E, eosinophils

high absolute eosinophil counts with normal count in two (11.7%) who consumed open fire roasted pork and in three (17.6%) who had it in fried form. A raised CPK level was seen in 39 (85%) patients suggestive of muscle involvement. Forty five (98%) patients had evidence of inflammation in form of raised ESR. Mild derangements of liver aminotransferases were noticed in three people with no icterus (Table III).

Discussion

T. spiralis, often found in domestic pigs, is the most common cause of human trichinellosis[5]. After

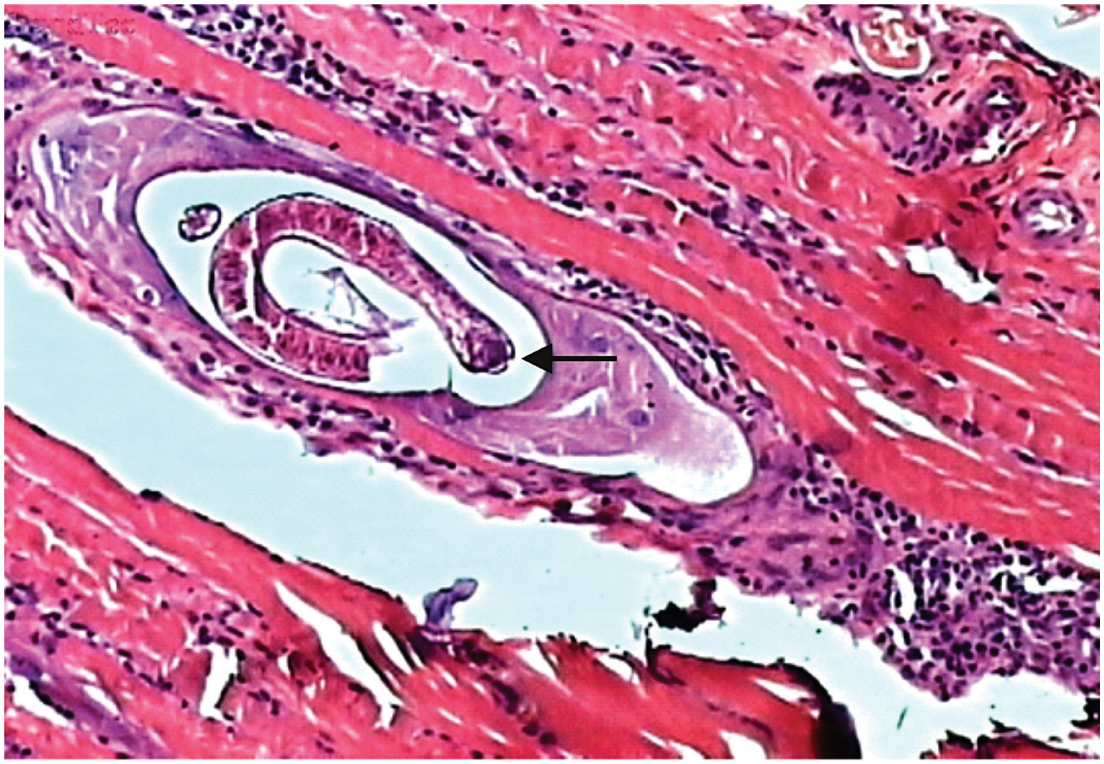

Fig. Histopathological slide of one index case of muscle biopsy specimen showing larvae (arrow) of *T. spiralis* with lymphocytic infiltrate surrounding the parasite (H & E ×500).

human consumption of trichinous meat; encysted larvae are liberated by digestive acid and pepsin and invade the small-bowel mucosa to mature into adult worms[4]. This enteral phase, lasting for 1-8 wk, is usually asymptomatic, but diarrhoea, abdominal pain, nausea, and vomiting may occur. After about one week, female worms release newborn larvae that migrate via the circulation to striated muscle and lodge as cysts. Clinical symptoms of trichinellosis arise from the successive phases of parasite enteric invasion, larval migration, and muscle encystment[2].

The migrating *Trichinella* larvae provoke a marked local and systemic hypersensitivity reaction, with fever and hypereosinophilia. Periorbital and facial oedema is common. A maculopapular rash, headache, cough, dyspnoea, or dysphagia may be seen. After onset of larval encystment in muscle 2-3 wk after infection, symptoms of myositis with myalgias, muscle oedema, and weakness develop, usually overlapping with the inflammatory reactions to migrating larvae. The most commonly involved muscle groups include the extra ocular muscles; the biceps, the muscles of the jaw, neck, lower back, and diaphragm. Peaking around

Table II. Clinical profile of study population

Sign/symptom	Uncooked pork (n=13)	Open fire roasted (n=21)	Fried pork (n=20)
Fever with chills	13	21	0
Myalgia	13	21	0
Periorbital oedema	13	11	0
Shortness of breath	2	1	0
Difficulty in swallowing	1	0	0
Itchy rash	0	0	1

Table III. Biochemical profile of study population

Parameter	Uncooked pork (n=12)	Open fire roasted (n=17)	Fried pork (n=17)
Raised ESR	12	17	16
Eosinophilia	12	15	14
Raised CPK	10	14	15
Deranged liver enzymes	2	1	0

three weeks after infection, symptoms subside only gradually during a prolonged convalescence over the next few weeks[2].

Although most infections are mild and asymptomatic, heavy infections can cause severe cardiovascular or neurological complications, enteritis, periorbital oedema, myositis, and rarely death. Diagnosis of this disease is confirmed by documenting a rise in the titre of antibodies on serology or demonstration of larvae in the muscle biopsy specimen taken usually from biceps or vastus lateralis.

The duration of the incubation period is related to the number of larvae ingested, which, usually determines the severity of disease. The incubation period varies from a few days to two months and is generally shorter when the disease follows a more severe course following a high infective larval load. In our study, the duration of incubation period ranged from 2-3 wk. The average incubation period noted in a recent case series from Vietnam was 3-9 days with previous studies suggesting an average period of 7-14 days (mean 8.6 days)[1].

In the present study, incidence of fever and myalgia was found to be almost 100 per cent in all patients who had consumed pork in raw form. This conforms to the findings in previous studies on *Trichinella* outbreaks in Vietnam and other studies where these two are the predominant findings seen in 90-100 per cent of the cases[1,6-9]. Periorbital oedema, though thought to be an important symptom seen in up to 80-95 per cent cases[1,9] in the previous studies, was seen in less number of cases (67%) in our study, possibly due to milder infection in most of the patients.

The outcome and duration of symptoms vary greatly along with the severity of the disease depending upon host immunity, age, sex, and general health of the infected individual as well as the infective larval load and the infecting species of *Trichinella*. In mild infection resulting from the ingestion of low numbers of larvae in muscle, symptoms related to the migratory and parenteral phases are usually the first to be clinically detected since these patients experience no symptoms during the enteral phase. In our study, none of the affected patients developed abdominal symptoms. This may be possibly due to low larval load thereby developing systemic symptoms directly.

In our study, three patients were diagnosed to be the index cases with marked symptoms suggesting the diagnosis. In majority of the patient population in village, symptoms subsided before the visit of our team. Only a few people with prolonged myalgia were noted, which has been shown to persist in upto 98 per cent of patients at two years and in 25 per cent of patients at ten years in a retrospective study[10].

In the laboratory parameters, eosinophilia is the earliest and most characteristic finding of trichinellosis. It has been reported to occur as early as the first week and is almost universal in all patients, the incidence reported close to 88 per cent in an outbreak from Turkey[11]. In our study eosinophilia was found to be present in 90 per cent of the patient population including both symptomatic and asymptomatic patients. This eosinophilia was present despite the subsidence of symptoms in most of the affected people.

Another positive laboratory finding is an elevation in circulating levels of muscle enzymes [*e.g*. CPK, 1, 6-diphosphofructoaldolase, lactate dehydrogenase (LDH), aldolases, and aminotransferases]. These may be elevated in 35 to 100 per cent of infected individuals and are present in the serum due to the destruction of muscle tissue by migrating newborn larvae[12]. In a few studies the presence of elevated CPK and LDH levels has been shown to be as high as 70-90 per cent[9,11]. However, their levels do not correlate with the severity of the disease. In our study, 85 per cent patients had raised CPK.

The confirmatory diagnosis of *Trichinella* is done by either serology or demonstration of parasite by muscle biopsy. Antibody detection tests are useful adjuncts to diagnosis starting after 12th day of infection. The sensitivity of the IgG-ELISA reaches 100 per cent on day 50. The test remains positive for more than 2 years in 88 per cent of infected people[13]. However, in regions where other helminthic infections are common, cross-reactions could give rise to false positive results[14]. An earlier report has demonstrated cross-reactivity between *Trichinella* and *Schistosoma mansoni* using anti-gp50 monoclonal antibodies[15].

Many asymptomatic patients in our study demonstrated eosinophilia and raised CPK levels. A few case reports in the past have shown similar result where a clinically implicated meat was consumed and no clinical symptoms were observed though they fulfilled the laboratory criteria for diagnosis[16]. In a study comparing acute trichinellosis in children with adults, the incubation period was found to be similar, but myalgia (66 versus 96%), facial and/or eyelid

oedema (57 versus 86%), eosinophilia (52 versus 96%) and increased serum CPK (38 versus 79%) were less common in children than in adults[17]. In our study, the number of children affected were only four and all were asymptomatic.

Trichinellosis is cosmopolitan, ranging from the Arctic to the tropics[18]. Human trichinellosis has been documented in 55 countries around the world[19].

In conclusion, *Trichinella* infection is not uncommon in India but usually remains undiagnosed due to lack of awareness about the disease. In cases of Acute febrile myalgia especially in areas where habit of consumption of raw meat is prevalent, *Trichinella* infection should be suspected. Public awareness and food hygiene are important components of prevention.

Acknowledgment

Authors thank Dr A.K. Aggarwal, Chief Medical Officer, Tehri Garhwal district, Uttarakhand, and his technical staff for their co-operation and for providing the necessary facilities and support in the field and laboratory work.

References

1. Taylor WR, Tran GV, Nguyen TQ, Dang DV, Nguyen VK, Nguyen LT, *et al*. Acute febrile myalgia in Vietnam due to Trichinellosis following the consumption of raw pork. *Clin Infect Dis* 2009; *49* : e79-83.
2. Weller PF, Trichinella and other tissue nematodes. In : Fauci AS, Braunwald E, Kasper DL, Hauser SL, Longo DL, Jameson JL, *et al*, editors. *Harrison's principles of internal medicine*. 17th ed. New York: The McGraw-Hill Company; 2008. p. 1316-9.
3. California Department of Public Health. Trichinosis Case report. Available from: *http://www.cdph.ca.gov/pubsforms/forms/CtrldForms/cdph8606.pdf*, accessed on December 12, 2012.
4. Centres for Disease Control and Prevention certified. Trichinellosis 1996 Case Definition [updated 2011 February 11]. Available from: *www.cdc.gov/osels/ph_surveillance/nndss/casedef/trichinosis_current.htm*, accessed on December 12, 2012.
5. Pozio E, Gomez Morales MA, Dupouy-Camet J. Clinical aspects, diagnosis and treatment of trichinellosis. *Expert Rev Anti Infect Ther* 2003; *1* : 471-82.
6. Murrell D, Bruschi F. Clinical trichinellosis. In: Tsien Sun, editor. *Progress in clinical parasitology.* Boca Raton: CRC Press; 1994. p. 117-50.
7. Olaison L, Ljungstrom I. An outbreak of trichinosis in Lebanon. *Trans R Soc Trop Med Hyg* 1992; *86* : 658-60.
8. Pawlowski ZS. Clinical aspects in man. In: Campbell WC, editor. *Trichinella and Trichinosis.* New York : Plenum Press; 1983. p. 367-402.
9. Tolan RW, Garekar S, Asmar B, Steele RW. Pediatric Trichinosis. Available from: *emedicine.medscape.com/article/1000156-overview*, accessed on December 10, 2012.
10. Cabie A, Bouchaud O, Houze S, Khuong MA, Ruggeri C, Ancelle T, *et al*. Albendazole versus thiabendazole as therapy for trichinosis: a retrospective study. *Clin Infect Dis* 1996; *22* : 1033-5.
11. Turk M, Kaptan F, Turker N, Korkmaz M, El S, Ozkaya D, *et al*. Clinical and laboratory aspects of a trichinellosis outbreak in Izmir, Turkey. *Parasite* 2006; *13* : 65-70.
12. Capo V, Despommier DD. Clinical aspects of infection with *Trichinella* spp. *Clin Microbiol Rev* 1996; *9* : 47-54.
13. Morakote N, Sukhavat K, Khamboonruang C, Siriprasert V, Suphawitayanukul S, Thamasonthi W. Persistence of IgG, IgM and IgE antibodies in human trichinosis. *Trop Med Parasitol* 1992; *43* : 167-9.
14. Gamble HR, Pozio E, Bruschi F, Nockler K, Kapel CM, Gajadhar AA. International Commission on Trichinellosis: recommendations on the use of serological tests for the Detection of *Trichinella* infection in animals and man. *Parasite* 2004; *11* : 3-13.
15. Linder E, Thors C, Lundin L, Liungstrom I, Farah S, Hagi H, *et al*. Schistosome antigen gp50 is responsible for serological cross-reactivity with *Trichinella spiralis. J Parasitol* 1992; *78* : 999-1005.
16. Clausen MR, Meyer CN, Krantz T, Moser C, Gomme G, Kayser L, *et al. Trichinella* infection and clinical disease. *QJ M* 1996; *89* : 631-6.
17. Ozdemir D, Ozkan H, Akkoc N, Onen F, Gurler O, Sari I, *et al*. Acute trichinellosis in children compared with adults. *Pediatr Infect Dis J* 2005; *24* : 897-900.
18. Stehr-Green JK, Schantz PM. Trichinosis in Southeast Asian refugees in the United States. *Am J Public Health* 1986; *76* : 1238-9.
19. Pozio E. World distribution of *Trichinella* spp. infections in animals and humans. *Vet Parasitol* 2007; *149* : 3-21.
20. Alipuria S, Sangha HK, Singh G, Pandhi S. Trichinosis - a case report. *Indian J Pathol Microbiol* 1996; *39* : 231-2.
21. Mohan H, Aggarwal R, Nada R, Punia R, Ahluwalia M. Trichinosis of Psoas Muscle. *J Assoc Physicians India* 2002; *50* : 729-30.
22. Handa R, Aggarwal P, Sarkar C, Vijayaraghavan M, Mattewal A, Arya V, *et al*. A patient with muscle weakness. *J Indian Rheum Assoc* 2000; *8* : 85-7.

Reprint requests: Dr Rahul Kumar Sharma, H. No.407-k Street no. 2, Mandawali Fazalpur, Delhi 110 092, India
e-mail: dr.rahulk05@gmail.com