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Asian Pacific Journal of Tropical Disease

journal homepage: www.elsevier.com/locate/apjtd



Infectious disease research

doi:10.1016/S2222-1808(15)61010-6

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Sensitivity of IgG ELISA for diagnosing cysticercosis in high risk group in and around Aligarh District of Uttar Pradesh, India

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ARTICLE INFO

Article history:

Received 14 May 2015

Received in revised form 22 May, 2nd

revised form 1 June 2015

Accepted 16 Oct 2015

Available online 11 Mar 2016

Keywords:

Cysticercosis

ELISA

Taenia solium

Seizures

High risk group

ABSTRACT

Objectives: To study the seroprevalence of cysticercosis and compare immunological, radiological and clinical features in patients of cysticercosis in high risk group of community.

Methods: The study was conducted in the Department of Microbiology and concerning departments of Jawaharlal Nehru Medical College Hospital, Aligarh from January 2012 to June 2013. The study population included 27 participants from high risk group in community like those involved in pig rearing, slaughtering of pigs and consumption of pork in and around Aligarh. The kit used to detect antibodies against *Taenia solium* (*T. solium*) was NovaTec *T. solium* IgG-ELISA.

Results: Majority of participants [12 (44.4%)] belonged to age-group 30–44 years. Majority of participants [25 (92.6%)] were males. Maximum number of participants [16 (59.3%)] belonged to socio-economic Class IV, followed by Class V. Only 2 (7.4%) participants showed positive for immunoglobulin G antibodies against *T. solium*.

Conclusions: Cysticercosis is a health problem in and around Aligarh with higher risk in males. Seroprevalence of cysticercosis in high risk community of Aligarh is 7.4%.

1. Introduction

Cysticercosis is the infection of various tissues caused by the larval stage of the tapeworm, *Taenia solium* (*T. solium*) which is acquired by the ingestion of eggs of the parasite released from taeniasis carriers. Taeniasis refers to the intestinal infection caused by the adult stage of the tapeworm. Cysticercosis is a health problem, particularly in the developing countries. High risk group for cysticercosis includes those involved in pig rearing, slaughtering of pigs and consumption of pork. Many factors which are present in this part of community are required for the completion of *T. solium* cycle like absence or scarcity

of adequate faeces disposal systems, open field defaecation, absence of adequate meat inspection and lack of adequate knowledge about the modes of transmission of the disease.

Contaminated food and water play important role in transmission of disease. After ingestion, the eggs pass from the lumen of the intestine into the tissues and migrate especially to the brain and muscles presenting as nodules in the muscles and seizures when the cysts are located in the brain. It is one of the important zoonotic diseases caused by cestodes worldwide, but it is endemic mainly in rural and remote areas of developing countries where people consume pork without inspection of meat[1,2]. It is also being increasingly reported in the developed countries due to migration of people with disease or *T. solium* carriers.

Industrialization and globalization has led to some cases in communities where pork eating is prohibited by religious law[3,4]. However, cysticercosis has also been reported in persons with no history of travel to endemic areas, most of whom get

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The study protocol was performed according to the Helsinki declaration and approved by Ethics Committee of the Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh. Informed written consent was obtained from all patients.

The journal implements double-blind peer review practiced by specially invited international editorial board members.

infected through a household contact harbouring the adult *T. solium* in the intestine[5].

Age and socioeconomic factors influence the prevalence of the disease. Majority of cases occur in the 20–50 years age-group. Males are more commonly affected as compared to females. A close relationship between incidence of cysticercosis and economic level and education level has been shown[6].

It is difficult to estimate the exact burden of the disease in a community study because: (I) the polymorphic presentation of the disease as some patients suffer only one or two seizures in the entire course of their illness while others get recurrent seizures; (II) in some patients, it remains silent throughout its infection; (III) some of the lesions might have disappeared or dissolved and (IV) social stigma associated with epilepsy prohibits the patients or their family member to come openly for medical assistance[7].

The present study was conducted to study the seroprevalence of cysticercosis and to compare immunological, radiological and clinical features in patients of cysticercosis in high risk group in and around Aligarh District.

2. Materials and methods

The present study was conducted in the Department of Microbiology and concerned departments of Jawaharlal Nehru Medical College Hospital, Aligarh for a period of one and a half years beginning from January, 2012. A total of 27 participants from high risk group (those involved in pig rearing, slaughtering of pigs and consumption of pork) in and around Aligarh were included in the study. Many factors favouring the completion of life cycle were present in this community, such as absence or scarcity of adequate faeces disposal systems, open field defecation, absence of adequate meat inspection and lack of adequate knowledge on the transmission mechanisms of the parasite. A total of 15 age and sex matched patients were also included in study as control group. All patients in control group had a normal brain scan and were otherwise healthy in all respect.

Detailed history was taken from all the participants. This study was undertaken after obtaining approval from Ethics Committee of the Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh. Informed consent was obtained from all patients. About 2–3 mL of venous blood was drawn in vacutainer tubes from all patients under aseptic conditions. After 30 min, the tubes were centrifuged at 2000 r/min for 5 min. The sera were stored at -20 °C in labelled vials.

The NovaTec *T. solium* immunoglobulin G (IgG)-ELISA was intended for the qualitative determination of antibodies against *T. solium* in human serum. Microtiter strip wells were pre-coated with *T. solium* antigens. Diluted patient serum samples were

added to the wells. IgG specific antibody, if present, bound to the *T. solium* antigen coated wells. All unbound material was washed away and the enzyme conjugate was added to bind to the antibody-antigen complex, if present. The immune complex formed by the bound conjugate was visualized by adding tetramethylbenzidine substrate. The intensity of the colored product was directly proportional to the amount of antibodies present in the specimen. Samples were considered positive if the absorbance value was higher than 10% over the cut-off. Samples with an absorbance value of 10% above or below the cut-off should not be considered as clearly positive or negative (grey zone). Samples were considered negative if the absorbance value was lower than 10% below the cut-off.

3. Results

In our study, maximum number of participants [12 (44.4%)] belonged to 30–44 years age group and least number of participants belonged to less than 15 years age group and 15–29 years comprising 4 (14.8%) each (Table 1). Majority of participants [25 (92.6%)] were males and the ratio of male to female was 12.5:1. Mean age of the participants was (36.63 ± 13.57) years. As per modified Prasad's classification[8], maximum number of participants [16 (59.3%)] belonged to socio-economic Class IV, followed by Class V with 8 (29.6%) participants. None of the participants belonged to Class I and Class II (Figure 1). Headache was the most common clinical feature noted in 7 (25.9%) participants followed by seizures which was observed in 3 (11.1%) and vision problem in 2 (7.4%).

Table 1
Age and gender distribution of participants.

Age (years)	Male (%)	Female (%)	Total (%)
< 15	4 (14.8)	0 (0.0)	4 (14.8)
15–29	3 (11.1)	1 (3.7)	4 (14.8)
30–44	11 (40.7)	1 (3.7)	12 (44.4)
≥ 45	7 (25.9)	0 (0.0)	7 (25.9)
Total	25 (92.6)	2 (7.4)	27 (100.0)

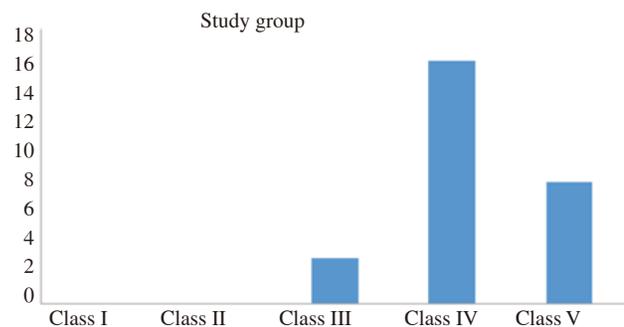


Figure 1. Distribution of patients according to socio-economic status.

Only 2 (7.4%) out of 27 participants showed positive for IgG antibodies and rest 25 (92.6%) were negative. Both the positive cases were males and were in 45 years and above age group.

Maximum number of participants who showed negative belonged to the 30–44 years age group with 11 males and 1 female (Table 2). Gender-wise distribution of IgG ELISA results with regard to different age groups was found to be insignificant.

Table 2

Gender-wise distribution of IgG ELISA results with age group ($n = 27$).

Age-groups (years)	Positive		Negative	
	Male	Female	Male	Female
< 15	0	0	4	0
15–29	0	0	3	1
30–44	0	0	11	1
> 45	2	0	5	0
Total	2	0	23	2

$\chi^2 = 6.17$; $df = 3$; $P = 0.104$

Out of 2 positive cases, 1 (50.0%) each belonged to Class IV and Class V. Out of 25 participants who tested negative, 15 (60.0%) belonged to Class IV followed by 7 (28.0%) participants in Class V. None of the participants belonged to Class I and Class II (Figure 2). Headache and seizures were present in both seropositive cases. Vision problem was noted in only 1 positive case (Table 3).

Table 3

Distribution of IgG ELISA results with clinical features.

Clinical features	IgG ELISA ($n = 27$)		
	Positive	Negative	Total
Headache	2	5	7
Seizures	2	1	3
Vision problem	1	1	2

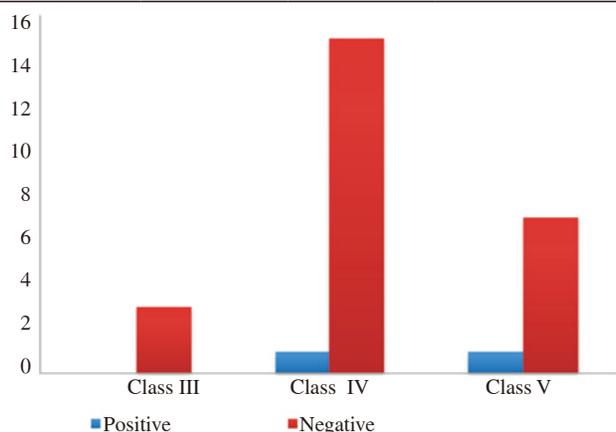


Figure 2. Distribution of IgG ELISA results with socio-economic status.

4. Discussion

Maximum (44.4%) participants were found in the age group of 30–44 years. Participants mean age was (36.63 ± 13.57) years. Similar age profile was noted by Mwanjali *et al.* while assessing the prevalence and risk factors associated with human *T. solium* infections in Mbozi District of Tanzania and by Mwape *et al.* in a community-based longitudinal study in the Eastern Province of Zambia[9,10]. Mwang'onde *et al.* in a serological survey for human cysticercosis prevalence in Mbulu District, Tanzania found that the mean age of participants was (34.49 ± 18.44) years[11]. In our study, majority (92.6%) of participants were males and 7.4% were

females leading to male to female ratio of 12.5:1. Mwanjali *et al.* also found more males (57.4%) as compared to females (42.6%)[9]. Mwang'onde *et al.* also noted more males as compared to females though the male to female ratio was 1.56:1 which was lower than the present study[11]. Goel *et al.* assessing neurocysticercosis (NCC) in Indian community noted 53% males and 47% females[12]. However, Mwape *et al.* reported differently with males comprising 41.3% and females comprising 58.7% of participants[10]. Both the positive cases in present study were males and were in age group of 45 years and above. However, the difference in seropositivity was insignificant. The differences in seropositivity rates between gender and age group possibly reflect level of exposure by gender to risk factors. The seroprevalence of antibodies (IgG) to *T. solium* among pig rearers in Nigeria noted the highest prevalence in subjects above the age of 56 years[13]. Similarly, Mwanjali *et al.* noted the risk for seropositivity increased with age and maximum cases were observed in 36–60 years age group[9]. Seropositivity was found to increase with age and the male participants (75%) were more seropositive for human cysticercosis than female participants[11]. O'Neal *et al.* observed significant increase in seroprevalence with age[14].

About 88.9% of participants were from lower socioeconomic strata. Both seropositive cases belonged to lower class. This group comprised of participants indulged in pig rearing, slaughtering and consumption of pork which is commonly observed in this class. Human cysticercosis is man to man transmission acquired faeco-orally usually in areas with deficient sanitation and improper faeces disposal. Open field defaecation and insanitary disposal of faeces predisposes to cysticercosis.

Headache was the most common clinical feature noted in 25.9% of participants followed by seizures which was observed in 11.1%. Mwanjali *et al.* noted that 52.0% of participants had chronic headache and 14.8% acknowledged a history of epileptic seizures[9]. Gomes *et al.* found that 2.2% of people had history of seizures[15]. Carrique-Mas *et al.* reported that 8.9% of participants had seizures and 61.3% reported dizziness or severe headaches while 29.8% reported no symptoms suggestive of NCC[16]. Both the seropositive cases in high risk group had history of seizures and headache both.

Nguekam *et al.* in a seroepidemiological study of human cysticercosis in West Cameroon found that 2.5% of those having seizures were seropositive[17]. In another study, the seroprevalence in participants having seizures was 44.7% and was significantly associated with risk of NCC[16]. Furthermore, these results indicated a strong association between epileptic seizures and cysticercosis. About 7.4% participants tested positive for IgG antibodies. In a study in rural community in Zambia, seroprevalence of 5.8% has been recorded[18]. Anticysticercal antibodies for human cysticercosis were found in 16.3% of community members from

Mbulu, a District in the northern zone of Tanzania[11]. Jayaraman *et al.* assessing the relative seroprevalence of cysticercus antigens and antibodies in a population sample in South India noted cysticercus IgG antibodies among 15.9% of participants[19]. Ishida *et al.* in a seroepidemiological study of human cysticercosis noted the seropositivity of 3.4%[20]. However, higher seropositivity was also noted in few studies[9,10,21,22].

Infection with cestode *T. solium* is becoming a health problem in and around Aligarh with predisposition to males. Seroprevalence of cysticercosis in high risk community of Aligarh is 7.4%. The inconclusive evidence also states that the risk of NCC increases with age. NCC is predominantly a disease of lower socioeconomic strata. Absence of sanitary facilities together with unavailability of safe drinking water along with consumption of raw/uncooked vegetables in poor hygienic conditions plays a substantial role in inflicting the poor through faeco-oral route. Seizures and headache are the most common clinical presentation of this infection.

Conflict of interest statement

We declare that we have no conflict of interest.

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