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Research Article

Histopathology of *Cysticercu sfasciolaris* Batsch, 1786 (Cyclophyllidae: Taeniidae) extrinsic parasite of liver in infected rat (*Rattus rattus*) from Hyderabad, Sindh, Pakistan

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Abstract

The aim of study was to examine pathology of tissues caused by *Cysticercus fasciolaris* (Cyclophyllidae: Taeniidae) a larval stage of a helminth parasite *Taenia taeniformis* in the infected liver of rats *Rattus rattus*. The study was carried out at the advance laboratory of Parasitology of the Department of Zoology, University of Sindh Jamshoro during the year from August 2018 to November 2019. A total of 08 brown rats *Rattus rattus* were entrapped from various localities of Hyderabad and were brought to the laboratory for examination of their helminthes parasites. A total of 08 rats were dissected and only 05 were found infected with *Cysticercus fasciolaris* on liver in the form of cysts. The samples of tissues from infected parts of the liver were obtained and fixed in bouin's solution. The series of sections were made by microtome technique and were finally mounted in Canada balsam. In the histopathological findings, the infected liver of rats revealed presence of mononuclear cells such as lymphocytes, macrophages, eosinophilic cells, plasma cells, and polynuclear cellular infiltration in the necrotic area, fatty disintegration and development of coagulation areas and necrosis of the hepatic cells. The infected liver had congested blood vessels and congested sinusoids were observed and investigated.

Keyword: Histopathology; *Cysticercus fasciolaris*; Cestode; Endoparasite; Rats; Hyderabad

Introduction

Rats *Rattus rattus* represents most successful and one of a major group of mammals worldwide. They are cosmopolitan in distribution and have high rate of reproductive and adaptive capacity in a wide variety of habitats **[1]**. Their voracious and non- voracious behavior has a distinct impact on human economy. The majorityare significant vectors of man and domestic animal diseases worldwide **[2, 3]**. There are more than 20 diseases of man are directly transmitted by rats **[4]**. Rats *Rattus rattus* act as definitive or intermediate hosts of many endoparasites which are usually found in domestic animals and human beings.

Cysticercus fasciolaris is the larval stage of the cestode, a helminth parasite, *Taenia taeniformis* there definitive hosts are mostly cats [5]. This larval stage uses a wide variety of small rodents, and intermittently birds and humans as intermediate hosts. The eggs of parasites are passed out in rats droppings in fields, grain stores and amongst foodstuffs in houses, and are responsible for spreading of diseases [4]. The rats have close association with humans and their livestock as well as with blood-sucking arthropods like beetles and cockroaches. Life cycle of parasite is started by the ingestion of the infectious eggs. Inside the alimentary canal metamorphosis occurred and eggs are developed into *Cysticercus fasciolaris* larva. The larva moves through the intestinal wall and reached to the liver with portal circulation and developed cysticercus cyst [6]. The metacestode *Cysticercus fasciolaris* is commonly found in the tissues of infected liver of cotton rat, black rat, mice, rat, and other wild and domestic rodents [7]. The larvae rarely migrate to other organs such as spleen and lung [8]. It primarily causes structural changes and misfunctioning of liver cells [9]. It was also observed fibroplasia and progressive inflammation in the liver parenchyma that may progress to hepatic fibrosarcoma [10]. The larval stage of cestode parasite *Cysticercus fasciolaris* is largely connected with the pathology of fibrosarcomas and can also have major hepatic destruction and gastroenteropathy in the intermediate host [11]. The development of the larvae parasite *Cysticercus fasciolaris* in rats is more successful [12]. The infection in rats is measured asymptomatic by means of unusual complications [13]. The main idea of the present research is to find out complete gross histopathology caused by a cestode *Taenia taeniformis* in the infected liver of rats *Rattus rattus* and to estimate the possibility of presence of hepatic fibrosarcoma by these parasitic larvae in the infected liver.

Materials and Methods

The study was conducted in the urban areas of various localities of Hyderabad, Sindh, Pakistan. The study was conducted during the year of August 2018 to November 2019. The brown rats *Rattus rattus* were entrapped in different areas of Hyderabad, including food streets and grocery stores of Latifabad, Qasimabad, Tando Jam and Tando Alhyar. Live traps were baited with tomato, bread and cucumbers, were brought to the Advanced Parasitological Laboratory, of Department of Zoology, University of Sindh, Jamshoro, for dissection and inspection of helminthes parasites of liver. The infected livers were checked under the microscope for cysts. The location, size and numbers of cysts were observed. The infected tissue of liver samples was fixed in fixation (Bouin's solution) for 24 hours, then the tissue was dehydrated with the process of dehydration in an increasing degree of alcohol, for example 70%, 80%, 90%, and 100% each step for one hours, then the tissue was cleared in benzene for few minutes. The tissue becomes puffy. The process of infiltration was started when tissue was kept in molten paraffin wax in cavity blocks in an oven at 60 ^{o}C. The blocks were later trimmed and sectioned at 5 microns. Then, the sections were de-paraffinized in xylene, taken to water and consequently stained with eosin and hematoxiline and examined under a light microscope with magnification of 40X [14].

Results and Discussion

The present research work was comprising only one type of larval stage *Cysticercus fasciolaris* of cestode parasite *Taenia taeniformes* Batsch, 1786 (Cyclophyllidae: Taeniidae) which was found in the liver tissues of infected rats *Rattus rattus* (Rodentia: Muridae) as a new host and new locality record from the study area (Table 1). In present research work 08 brown rats were dissected for investigating of liver parasites *Cysticercus fasciolaris*. There are 05 rats

were found infected with *Taenia taeniformes* cestodes parasites. The prevalence of parasites was recorded 62.5% and rate of infection was observed with 2.5. (Table 1& 2).

Histopathological findings of the *cysticercus fasciolaris*a metacestodein the tissues of infected liver of rats *Rattus rattus* revealed infiltration of mononuclear cells formation, (Fig. 1) which mainly comprised of lymphocytes, macrophages and occasional eosinophils with active development of fibroplasia. A complete microscopic study on liver sections showed the construction of fibrous connective tissue capsule with extensive zone of inflammatory cells infiltration comprising of lymphocytes, plasma cells, macrophages, eosinophils and fibrous connective tissue metaplasia (Fig. 1A-B). The lesions were varied in severity with some areas still having healthy hepatocytes adjacent to affected areas surrounding the cysts while hepatocytes in some of the affected areas were vacuolated (Fig. 2A-B). The blood vessels around the areas were congested and there was also proliferation of new blood capillaries within the zone of fibroplasias (Fig. 3A-B). The parasites migration in the alimentary canal have major capacity to produce enteropathological changes and may be immune T cell determined (Fig. 4 &5) **[9]**. The process of development of sarcomas in infected rats *Rattus rattus* caused by *Taenia taeniformis* is leading to the formation of chronic inflammatory reaction of the capsule and increases of nonspecific responses against foreign body which is not an effect specially caused by this parasite **[5]**. In Iran, a prevalence of 4.34% was reported in rats *Rattus rattus* of Kermanshah **[15]**, 0.5% in *Ratus norvegicus* rats of Mazandaran province **[16]**, 3.3% and 1.3% in the *Apodemus sylvaticus* and *Mus musculus* of Hamadan province, respectively**[17]**, and 18.2% in wild rats *Ratus norvegicus* of Tehran **[18]**.

Table 1. *Cysticercus fasciolaris, Taenia taeniformes* of brown rats *Rattus rattus*, collected during the present work from Hyderabad district, Sindh, Pakistan

Name of animal host	Name species of parasites	No. of host species	No. of infected sample	Abundance of helminthes on each host	Prevalence	Rate of infection	Total No. of parasites recovered
Brown rat *Rattus rattus*	*Cysticercus fasciolaris, Taenia taeniformes*	08	05	04	62.5	2.5	20
	Total	08	05	04	62.5	2.5	20

Table 2. *Cysticercus fasciolaris* collected during present study from brown rats *Rattus rattus* with their classification

Order	Family	Genera	Species
Cyclophyllidae	Taeniidae	*Taenia*	*Cysticercus fasciolaris, Taenia taeniformes* Batsch, 1786

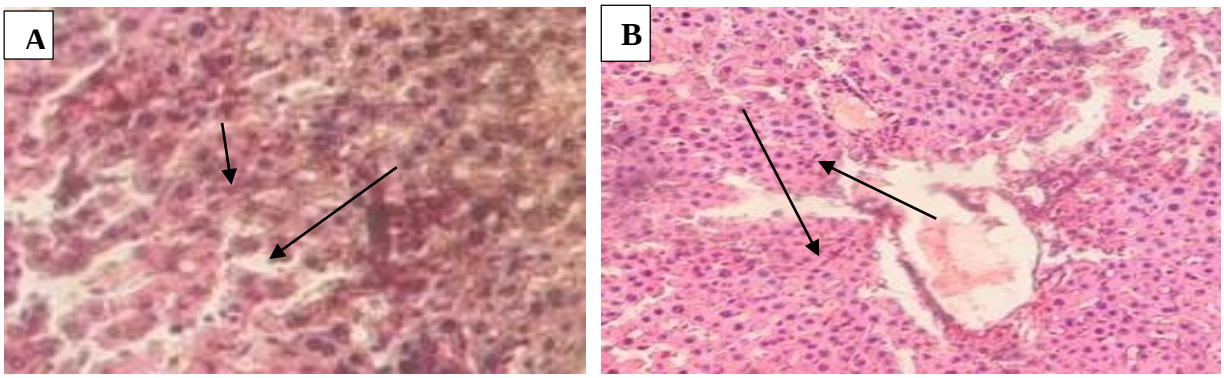

Figure 1. Histopathology of cystic liver shows the presence of fibrous connective tissue capsule and widespread zone of inflammatory cells infiltration comprising lymphocytes, plasma cells, macrophages and eosinophils. (A-B X 40)

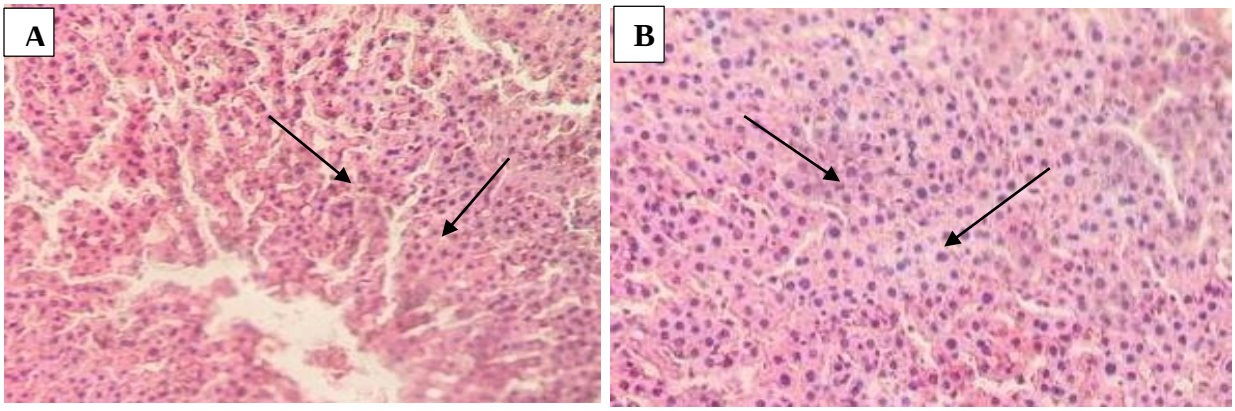

Figure 2. Photomicrograph of infected liver shows the presence of polynuclear cellular infiltration and fatty degeneration in the necrotic area. (A-B X 40)

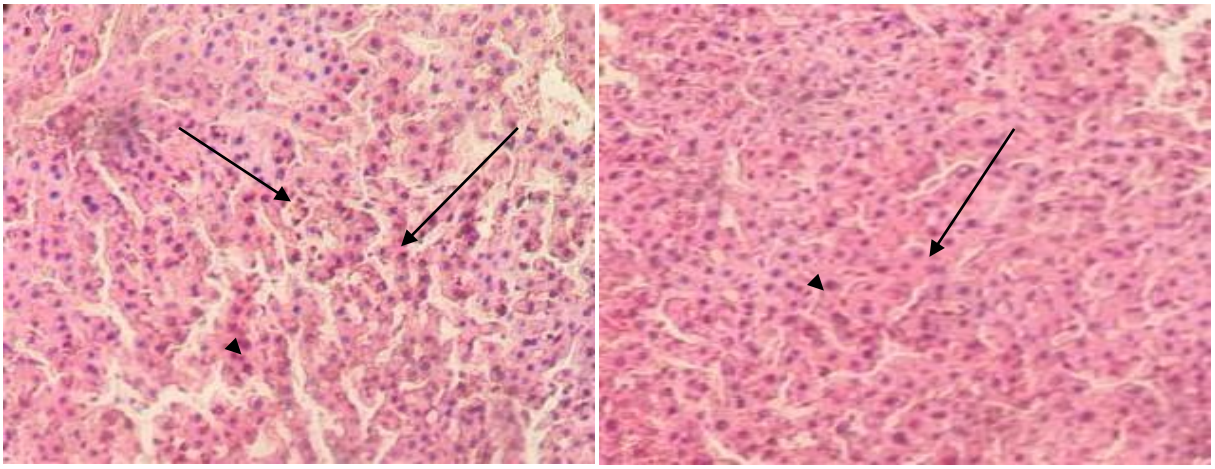

Figure 3. Sections of infected liver shows the area of coagulation, necrosis of hepatic cells, congested blood vessels and congested sinusoids. (A and B X 40)

Figure 4. Shows dissection and collection of liver parasites

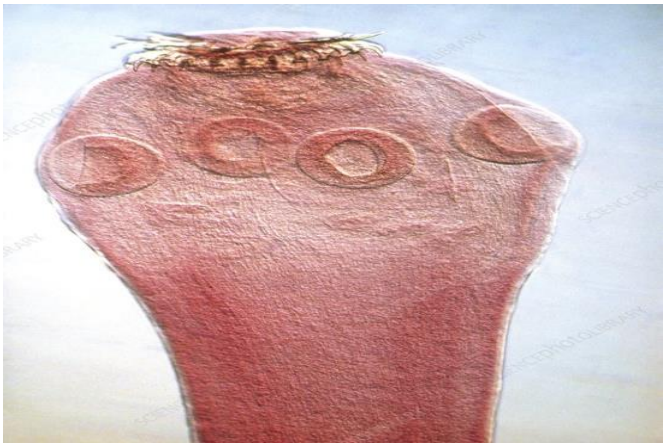

Figure 5. Showing scolex of *Cysticercus fasciolaris*

Conclusion

The reason of the present study was to find out the incidence of parasites and the histopathology of liver of brown rats *Rattus rattus* which was naturally infected with *cysticercus fasciolaris* an endoparasite. The parasite is a bladder worm and lives inside the cysts. This larval stage of the parasites slowly and gradually degraded the function of liver like development of fibrosarcoma and increased number of cysts formation was examined. Disintegration of fats of hepatocytes and gastroenteropathy were also observed. The increased pathology may cause the death of the host.

Author's contributions

Conceived and designed the experiments: F Shaikh & NA Birmani, Performed the experiments: F Shaikh & S Naz, Analyzed the data: S Naz & F Shaikh Contributed materials/ analysis/ tools: S Naz & NA Birmani, Wrote the paper: F Shaikh & S Naz.

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