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Research Article

PATHOLOGICAL REACTIONS IN PORCINE MUSCLES DUE TO *CYSTICERCUS CELLULOSAE*

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ABSTRACT

Cysticercus cellulosae (*Taenia solium* metacestode) parasitizes the muscles of pigs leading to porcine cysticercosis. Total of 600 pigs were examined while slaughtering, among these 7 were found to be positive with an overall prevalence rate 1.16 percent with age wise, sex wise, breed wise, management wise and season wise prevalence being highest in 1 year (1.38 percent), male (1.36 percent), desi breed (2.67 percent), extensive system of management (2.42 percent) and post monsoon season (2.36 percent) for infection with *Cysticercus cellulosae*. Metacestode were isolated from gluteus medius, gluteus maximus, bicep femoris and vastus medialis of thigh region, and intercostal muscle from these 7 infected pig carcasses and were examined along with the adjacent tissue for disease manifestation in terms of cellular reactions. The study revealed that majority of the metacestodes showed degeneration of muscle fibers and were surrounded by fibrous connective tissue and inflammatory cells. Surrounding the cyst infiltration of inflammatory cells, primarily the lymphocyte, macrophages and scanty plasma cells were observed. An interesting finding was the presence of vasculitis characterized by perivascular fibrosis and marked congestion. The study concluded that the parasite is capable of manifesting disease in swine and the extent of lesions observed are directly pertinent to age of slaughtering and managmental .

Keywords: Swine, Histopathological, *Cysticercus cellulosae*, Infiltration and Vasculitis.

Porcine cysticercosis is caused by *Cysticercus cellulosae* (metacestodic stage of *Taenia solium*). The parasite is responsible for serious public health problem in addition to economic losses caused by it (Scitto *et al*., 1998; Chawan *et al*., 2015). Cysticercosis develops post ingestion of the food and water contaminated with *Taenia* eggs by humans as well as animals. The cysticerci take almost two months to mature in the human and porcine body and are usually localized in muscles in porcine and in nervous tissue in humans (Alvarez *et al*., 2002). The host immune system elicits various immune responses against the cysticerci. The infection in porcine is clinically covert, thus representing its benign nature (Flisser *et al*., 1989). Histopathological studies have shown that the cysticerci in hogs are found in various stages of degeneration ranging from slight infiltration of eosinophils and the mononuclear cells into the larval structures to intense granulomatous reaction surrounding the larvae with heavy eosinophil infiltration (Molinari *et al*., 1983). In contrast to pigs, infection in humans show varied response from being symptomless to presentation of grave clinical picture (Wayne *et al*., 1994). The prognosis of disease in porcine is guarded but the prognosis of disease in humans can be grave. The present study was conducted to observe cellular reactions encountered due to cysticercosis in porcine muscles.

MATERIAL AND METHOD

The study was conducted in and around Jammu region from May 2016 to April 2017. The area is located 332 meters above mean sea level, between 74º 50º east longitude and 30º 40º north latitude. The climate is hot, humid and subtropical. A total of 600 pork samples were examined for the presence of *Cysticercus cellulosae* for the present study. Monthly visits were made to the local slaughter shops for postmortem examination of pigs. The carcasses were examined visually, palpated and incised at the time of slaughtering (Thornton and Gracy, 1974). The distribution of samples collected with respect to different epidemiological variables – age (majority of animals being slaughtered in 8-12months of age), sex, breed, management and season is demonstrated in Table 1. Samples of muscles from suspected positive for *Cysticercus cellulosae* based on gross examination were brought immediately to the lab in a sterile polythene bag (Figure 1). The suspected samples were then examined microscopically for identification. Samples found to be positive tissue by staining and microscopic examination were further subjected to histological examination to determine the nature of interaction and pathology associated with it. Positive tissue samples were preserved in 10% formalin and processed by paraffin embedding (Luna, 1968). The paraffin embedded sections were then passed through sequential steps of deparaffinization by dipping in xylene followed by dehydration, achieved by passing the sections through descending grades of ethyl alcohal to tap water and stained by Hematoxylin and Eosin stain and finally mounted on canada balsam to prepare a permanent slide. The slides were then observed under microscope and pathological changes were recorded.

RESULTS AND DISCUSSION

Out of 600 pork samples examined at different meat shops in Jammu, 7 pork samples were found positive for the presence of *Cysticercus cellulosae* with an overall prevalence rate of 1.16 percent with age wise, sex wise, breed wise, management wise and season wise prevalence being highest in 1 year (1.38 percent), male (1.36 percent), desi breed (2.67 percent), extensive system of management (2.42 percent) and post monsoon season (2.36 percent). The present findings were in concordance

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Table 1
Details of meat samples collected from slaughter houses

Age group	
<1yr	383
>1yr	217
Sex	
Male	367
Female	233
Breed	
Desi	187
Crossbreed	413
Management system	
Extensive	206
Semi intensive	394
Season	
Summer	138
Monsoon	164
Post monsoon	127
Winter	171

with the result shown by Chawhan *et al*. (2015), however Borkataki *et al*. (2011); Sharma *et al*. (2004) observed varied result with respect to present findings.

In the present study, the histopathological section displayed an intact cyst with a bladder wall and scolex. Insides of the cyst were characterized by presence of spiral canal, hooklets and well preserved vesicular membrane. The parenchymatous portion of the cyst could be seen along with extensive fold of spiral canal (Figure 2). The pathological changes observed surrounding the cyst the skeletal tissue showed lymphocytic infiltration and fibrosis in muscle connected to the core of the cyst. An interesting finding was the presence of vasculitis characterized by perivascular fibrosis and congestion (Figure 3). Perivascular fibrosis was more pronounced in blood vessels present adjacent to the cyst. Vasculitis is primarily caused by massive leukocyte migration which ultimately damages the blood vessel causing inflammatory changes. Degenerated cysts showed fibrosis of outer membrane and presence of inflammatory cells surrounding the outer covering as well as inside the larvae, with lymphocyte population being the highest followed by macrophages and scanty plasma cells.

In the present study most of the cystcerci were in second stage of degeneration and the findings were in harmony with works of Fleury *et al*. (2015); Aluja and Vargas (1988); Molinari *et al*. (1983) as they also reported prominent inflammatory reaction in the parenchymatous region and in and around scolex of the parasite as shown in Figure 4. A pronounced cellular reaction consisting mainly of lymphocytes, macrophages and a few plasma cells were seen which is in concord with finding of Willms and Merchant (1980) and Blazek *et al*. (1981). In the present study, cyst showed degeneration characterized by fibrosis of outer membrane and presence of inflammatory cells and no granuloma formation was observed. The degenerative changes encountered were not much pronounced owing to the reason that most of the pigs screened for present study were slaughtered early in life, thereby the immune system of the infected animal did not had enough time to further regress the infective larvae leading to granuloma formation. Another important finding of the study was presence of fiberosis and congestion in bloodvessal adjacent or in surroundings of cyst, the probable explanation of this finding is that it occurred as an inflammatory response to infection wherein massive migration of lymphocytes had lead to development. Hence it is concluded that extent of degenerative changes encountered depend upon the age of slaughtering and managmental technique.

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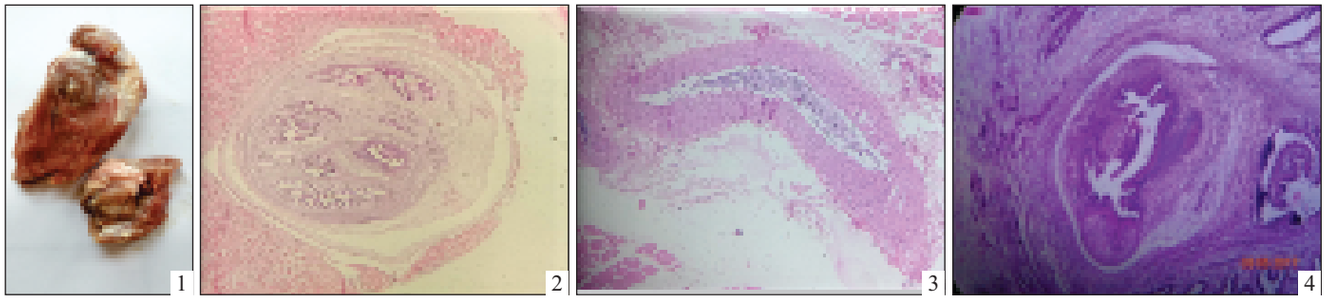

Figs. 1-4. 1. Cysticerci adhered to the surface of porcine muscle. **2.** Tissue section showing intact cysticerci embedded in muscle showing vesicular membrane, sucker and spiral canal at 10X with H&E. **3.** Tissue section showing vasiculitis at 40X with H&E stain. **4.** Tissue section showing Cell infilteration and Fiberosis in and around Cysticerci at 40X with H&E stain.

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