Histological morphology and pathological changes in liver of rats naturally infected with larval stage *Cysticercus fasciolaris* of *Taeniae taeniaeformis*

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Received: 14/5/2014; Accepted: 15/5/2016

Summary

The aim of this study is to describe the morphology of *Cysticercus fasciolaris* by using light microscopy, and the pathological changes in the liver of rats naturally infected. A total of 50 liver specimens of local rats (Wister rats) were collected for examination. The gross lesions showed the presence of single or multiple cysts. Microscopic findings revealed the presence of larvae within the cysts which represent the larvae *Cysticercus fasciolaris* of the adult parasite *Taeniae taeniaeformis* which inhabited the small intestine of the domestic cats surrounded by fibrous connective tissue infiltrated with inflammatory cells (mononuclear cells and plasma cells). These lesions cause pressure atrophy to the adjacent hepatic parenchyma. In advanced hepatic infection there is a tendency to undergo neoplastic changes (fibroma). Other pathological lesions seen in the liver parenchyma were necrosis, apoptosis with infiltration of chronic inflammatory cells in the portal area, in addition; to formation of early granulomas with congestion of blood vessels which contain neutrophiles in their lumina with extensive area of hemorrhages in liver parenchyma. In conclusion the *C. fasciolaris* infction induce hepatic neoplasia in rat livers (fibroma) in advance cases of heavy infection, which could be developed to fibrosarcoma in future.

Keywords: *Cysticercus fasciolaris*, Fibroma, Rats.

Introduction

Taeniae taeniaeformis is a cestoda parasite of cats that uses rodents as intermediate host (1-3). There are some sporadic cases reported in human from Argentine, Czechoslovakia, Denmark and Taiwan (4 and 5). In an intermediate host, the *C. fasciolaris* were found in different structured forms and they could be recognized by multiple hepatic cysticercus (6). Histopathological observations in advances cases showed plenty of fibroblasts with neoplastic characterizations as a fibrosarcomas (٦ and ٧) with multiple metastases were present on the peritoneal surfaces of the other abdominal organs (8). Mature *C. fasciolaris* showed obvious scolex, long neck (strobila 3-4 cm) and pseudo-segmentation. Larva revealed armed rostellum characterized by double rows of hooks and four suckers which were clearly evident (9). There are no more documents yet about the histology of the C. *fasciolaris* in Iraq. Therefore, the aims of the present study to determine the histological morphology of C. *fasciolaris* in the liver of the rats by using light microscopy and seen the main hepatic lesions.

Materials and Methods

Specimens collecting and histopathological processing**:** Fifty liver specimens of local laboratory rats (Wister rats) were collected from the College of Veterinary Medicine, University of Baghdad. The rats were sacrificed then dissected and the internal organs were checked grossly for *fascolaris* cysticercus. Tissue specimens from infected livers with *C. fasciolaris* cysticercus were fixed overnight in 10% neutral buffered formalin. The specimens were embedded in paraffin, sectioned, and stained with hematoxylin and eosin stain according to (10). The slides were observed under the light microscope.

The cysticercus was opened and the viable larvae with white to opalescent fluid was obtained, long of the parasite was measured and examined under the dissecting microscope and preparing of glass slide according to (11).

Results and Discussion

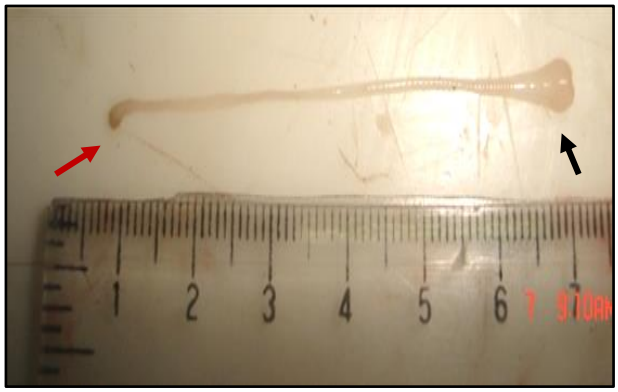
Gross pathological findings of *Cysticercus fasciolaris*: The gross lesions of infected livers showed visible solitary *Cysticercus* granuloma or multiple different sizes cystic structures

with 5-10 mm in diameter, imbedded or raised above the parietal and visceral surfaces of the liver (Fig. 1), when the cysticercus was opened by an incision in the wall a small white-yellow color larvae (2-35 cm) long appeared and had a rostellum and scolex with vesicle filled with fluid at the end of the larvae (Fig. 2). The cysticercus microscopically showed that the rostellum contained a scolex with two rows of taeniid shape hooks (Fig. 3). The scolex followed by a strobila which is already segmented without internal organs (Fig. 4).

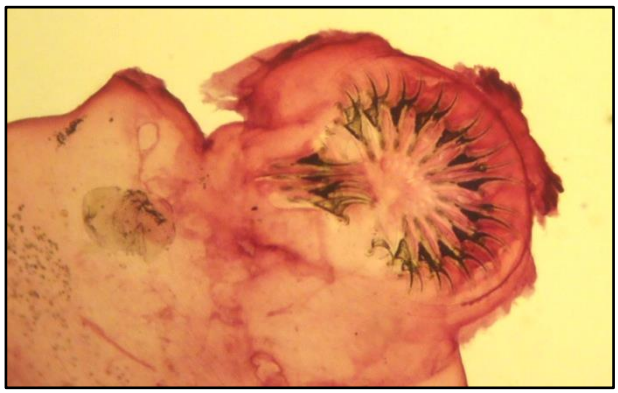
The post-mortem findings of the laboratory rat livers showed single or multiple hepatic cysticercus, the size of the cysticercus depends on the age of infection and the development of scolex, hooks and suckers. That agreed with (12 and 13) who explained that these structures will be developed when the larvae will be adult as *T. taeniaeformis* in cats intestine as a definitive host. These suckers and hooks play roles of fixation of the young *T. taeniaeformis* in the host's intestinal mucosa. The larval stage of the parasite was diagnosed according to the presence of the characteristic taeniidean hocks, which was confirmed as double rows of hocks. This metacestoda was corresponding to *Cysticercus fasciolaris* of the adult cestode *Taenia tainaeformis*, which inhabit the small intestine of the domestic cats (6 and 14).

The histopathologic examination showed multiple tracts and parasitic cysts which contained numerous larvae that consisted of several immature segments surrounded by integument. These cysticercus were pressure atrophy to the adjacent hepatic parenchyma and are surrounded by thick fibrous connective tissue infiltrated with neutrophiles, mononuclear cells and plasma cells (Fig. 5). The histopathologic findings were consistent with fibroma which was represented as whorls and interlacing bundles of fibroblasts and collagen fibers. The tumor cells are fusiform, stellate in shape and have large, pale ovoid to elongated nuclei, mitotic figures are rare (Fig. 6 and 7). Hepatic parenchyma undergo necrosis and apoptosis with extensive areas of hemorrhages (Fig. 8 and 9), and congestion of blood vessels and sinusoids which contain neutrophiles in their Lumina. Infiltration of mononuclear and plasma cells in portal area were also seen. Many section showed formations of early granulomas (Fig. 10).

Figure, 1: The gross lesion liver of rat shows two visible *Cysticercus granuloma* cystic structures, raised above the parietal (→) and visceral (→) surfaces of the liver.



Figure, 2: Liver shows a small white-yellow color tape worm (6 cm) long appeared which has a rostellum and scolex (→) with vesicle filled with fluid at the end of the worm (→).

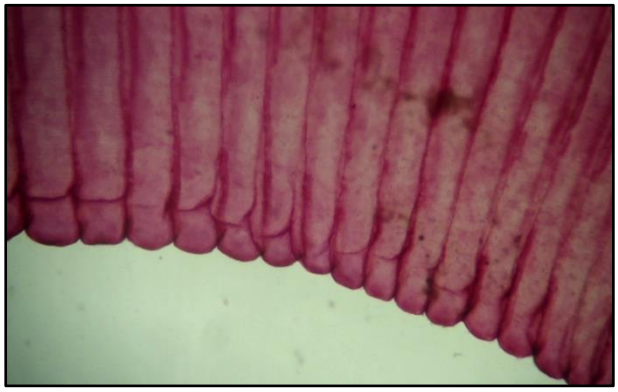


Figure, 3: Microscopic view of the larval stage (cysticercus) shows that the rostellum contained a scolex with two rows of taeniid shape.

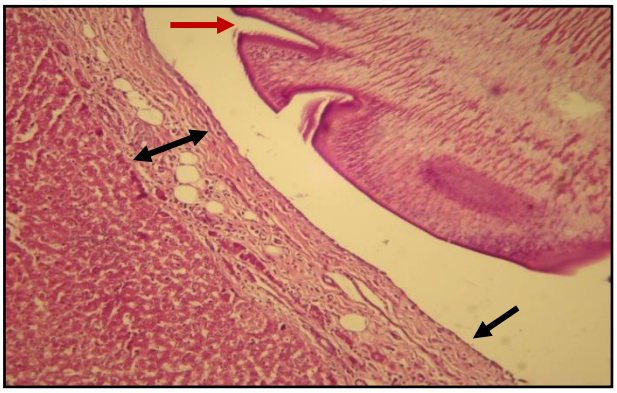
The microscopic findings were consistent of fibroma and are similar to previously reports that *Taenia*- induced hepatic tumor (6, 7, 9 and 15). Other studies monitored that in advance cases where the hepatic cysts are more than three month old, and the long standing larvae may induce tumor in the liver

tissue (fibroma and fibroscarcoma) (8, 16 and 17). The rough surface of *C. fasciolaris* might cause irritation of the hepatic tissue, which surrounded the cyst. The irritation might stimulate and promote the hepatic cells around the cyst to develop carcinogensis behavior and the chemical reactions between the larvale and hepatic tissue may induce the cellular changes which finally develop into fibroma.

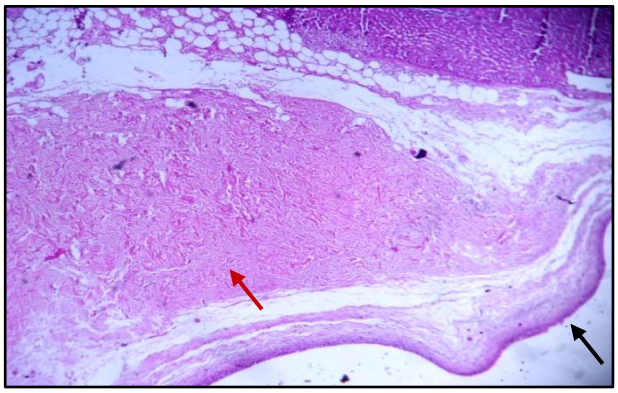
Hepatic tumors in rats are believed to arise from the host capsule that forms around the encysted larvae (6 and 8). Furthermore, the encysted larvae and associated sarcomas rarely occur in other anatomical locations (18). Although other rodents are susceptible to infection with *Taenia taeniaeformis*, tumors are exceedingly rare in other infected rodents, suggesting that susceptibility to oncogensis is partly dependent on the host species (1 and 19). The mass of the liver extended to the stomach, spleen and diaphragm with multiple small metastases were found throughout the mesenteric fat and on the peritoneal surface of the kidney, small intestine, pancreas and seminal vesicles (8). The pathological effects exerted by the cyst lodgment in the liver parenchyma showed atrophied and compressed hepatocytes and that was due to space occupying cyst (20). The tissue reaction around which composed of fibrous connective tissue layer, represented cysticercus defence mechanism to limit the enlargement of the cyst, and such encapsulation promote the initiation of tumor growth (21).



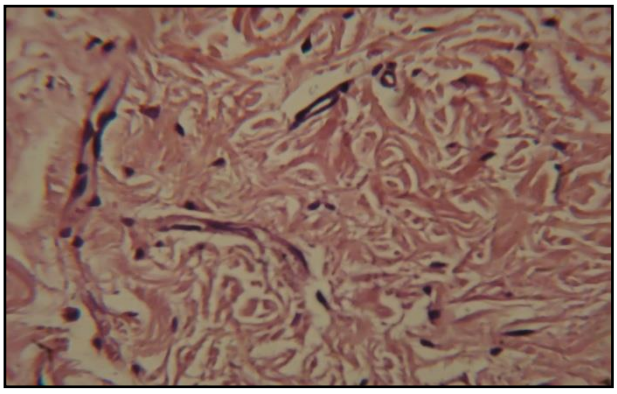
Figure, 4: Microscopic view of the larval stage (cysticercus shows the segmented parts without internal organs (Carmin stain x400).



Figure, 5: Histopathological section shows parasite (⟶) inside its cyst (⟶) caused pressure atrophy to the adjacent hepatic parenchyma and are surrounded by thick fibrous connective tissue infiltrated with neutrophiles, mononuclear cells and plasma cells (⟷) (H&E x100).



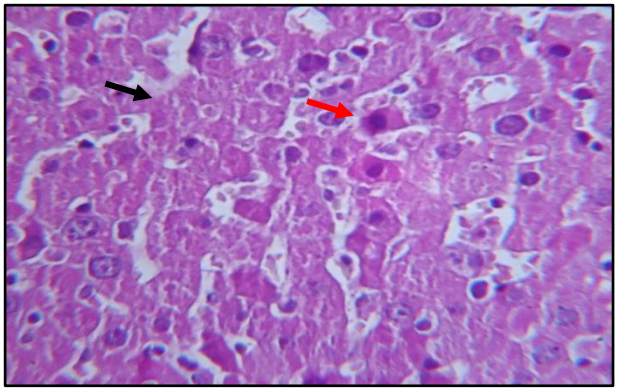
Figure, 6: Histopathological section shows parasitic cyst (⟶) in the hepatic parenchyma induced fibroma (⟶) which consisting of whorls and interlacing bundles of fibroblasts and collagen fibers (H and E x100).



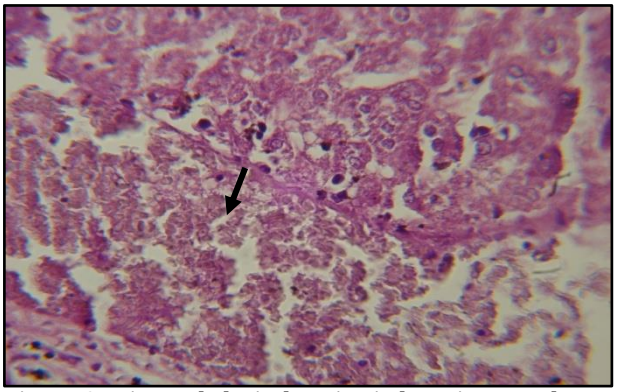
Figure, 7: Histopathological section in fibroma of (Fig. 6) at high magnification shows The tumor cells are fusiform, stellate in shape and have large, pale ovoid to elongated nuclei, mitotic figures are rare (H and E x400).

Apoptosis of hepatocytes seen in tissue section revealed that apoptosis is an active and highly regulated form of cells death responsible for the cellular default demise of the hepatocytes. This process is thus in charge of tissue homeostasis and maintains of vital function of the liver (22). Disregulation of

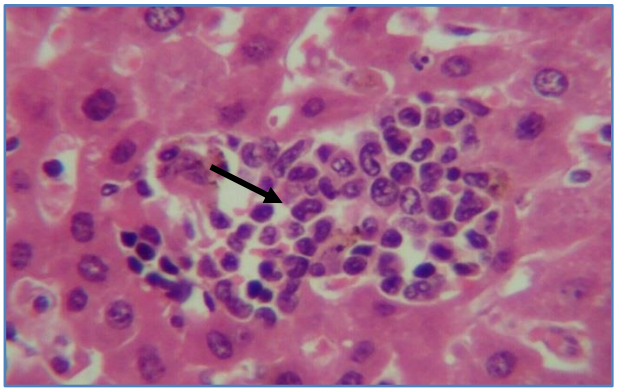
apoptosis might underlying several pathophysiological disturbances of the liver, like hepatitis of viral or autoimmune origin, alcoholic hepatitis acute inflammatory liver failure, primary biliary cirrhosis and toxic liver injury (23).



Figure, 8: Histopathological section in hepatic parenchyma shows coagulative necrosis (⟶) and apoptosis (⟶) (H and E x400).



Figure, 9: Histopathological section in hepatic parenchyma shows extensive area of haemorrhage (⟶) (H and E x400).



Figure, 10: Histopathological section in hepatic parenchyma shows formations of early granulomas (⟶) (H and E x400).

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دراسة نسجية، شكلية ومرضية لتغيرات الكبد المصابة بالطور اليرقي *Cysticercus fasciolaris* في الجرذان المختبرية المصابة طبيعياً

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الخلاصة

هدفت هذه الدراسة الوصف الشكلي للكيس المذنبة للـ *Cysticercus fasciolaris* للديدان الشريطية البالغة المسماة *Taeniae taeniaeformis* باستعمال المجهر الضوئي مصحوبه بالتغيرات المرضية النسجيه لأكباد الجرذان المصابة طبيعياً بالطفيلي. حيث فُحِصَت 50 عينة كبد خمجة بالكيسة المذنبة والتي ظهرت عيانيا إما بشكل منفرد أو متعدد. اما نسجيا فقد أظهر الكبد وجود الكيسة المذنبة تحتوي على اليرقات محاطة بنسيج ضام مرتشح بالخلايا الالتهابية (خلايا وحيدة النواة وخلايا البلازمة) ادت الى حدوث ضمور في متن الكبد المجاور. أدت الإصابة المتقدمة في بعض الحالات إلى حدوث الورم الليفي. أما الآفات الأخرى فقد تميزت بالنخر الكبدي والموت الخلوي المبرمج مع ارتشاح الخلايا الالتهابية المزمنة في الباحات البابية، فضلاً عن تكون الأورام الحبيبية واحتقان الأوعية الدموية المحتوية على خلايا العدلات مع نزوفات واسعة في المتن الكبدي. نستنتج من الدراسة بأن يرقة *Cysticercus fasciolaris* يمكن أنّ تؤدي إلى حدوث اورام ليفية في الكبد في الحالات المتقدمة من الإصابة، والتي يمكن أنّ تتطور محدثة الغرن الليفي الخبيث مستقبلاً.

الكلمات المفتاحية: *Cysticercus fasciolaris*، الورم الليفي، الجرذان.