CASE#5

Slide: Case 1

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Signalment: macaque (*Macaca fascicularis*), male, adult

Clinical History
The animal was part of a private collection. It was lethargic for several days. Radiographs revealed multiple nodules in the lung.

Gross Pathology
Multiple grayish nodular masses were visible in the liver (diameter up to 2 cm). The cut surface revealed a sponge like structures with multiple cysts which were filled with mucoid grayish fluid.
Cystic masses as described in the liver were also present in the pancreas and the lung.

Diagnosis:
Liver: hepatitis, severe, multifocal granulomatous, with infiltrating metacestodes of *Echinococcus mulfilocularis*; hepatitis, chronic active, multifocal, severe.

Discussion:
Histologically multiple large cysts are found in the hepatic parenchyma. The cysts are lined by an inner layer of flattened cells and a homogeneous eosinophilic thick outer layer. Inside these cysts, numerous scoleces are visible. The cysts are surrounded by a ring of granulomatous reaction, including multinucleated giant cells, lymphocytes, few eosinophilic granulocytes, and fibrous tissue. On multiple locations the tissue directly surrounding the cysts is necrotic and mainly infiltrated by neutrophilic granulocytes.

In the adjacent hepatic parenchyma is a severe multifocal to coalescing fibrosis. Furthermore there is a severe mixed cellular inflammatory infiltrate consisting of histiocytes, lymphocytes, plasma cells, and neutrophilic granulocytes.

The parasites present in the liver are consistent with the hydatid stadium of *Echinococcus mulfilocularis*. This was also proven by a PCR specific for E. *multilocularis*.
We consider the the chronic active hepatitis in the adjacent parenchyma as a consequence of the infiltrative growth of echinococcal hydatids into the surrounding tissue. In the histological section of the liver numerous bacterial colonies are visible. As the inflammatory infiltrate does not seem to be related to these bacteria we considered this finding as postmortal overgrowth.

(Case #5 continued)

Echinococcus mulfilocularis is a small tapeworm that predimonantly infects red and arctic foxes as definitive hosts. The hermaphroditic adults reach sexual maturity in the small intestine of their hosts in about 28 days, and the subsequent egg production starts at about the same time.
The ovoid E. *multilocularis* egg contains a fully differentiated oncosphere. When ingested by a suitable intermediate host (eg. small mammals such as microtine and arvicolid rodents, occasionally muskrats and others), digestive processes in the host gut result in release and activation of the oncosphere. Humans or other mammals may become intermediate hosts after intake of infectious eggs. The oncosphere penetrates the epithelial border and enters venous and lymphatic vessels, followed by distribution to other anatomical sites.
Most of the oncospheres vesicularize in the liver, but some may also reach the lungs and other organs. Inside the organs the parasite continues to develop by asexual metacestode proliferation. For completion of the life cycle, definitive hosts must ingest mature infective metacestodes.
inside the intermediate host the metacestode progressively invades the surrounding host tissue. Protrusions from the germinal layer are formed, which will start to protect themselves by the continuous synthesis of an outer laminated layer. This results in mass expansion and metastasis formation.

Macroscopically, a resulting hepatic lesion usually appears as a dispersed tissue consisting of scattered small cysts and vesicles not well delineated the adjacent parenchyma. The lesions may contain zones of calcification and necrosis. Histologically, numerous irregular small vesicles embedded in a dense stroma of connective tissue are found. The vesicles are lined with a thin inner germinal layer and a prominent outer PAS-positive laminated layer. Intraluminal multiple scoleces bud off.

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