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## An Abattoir Study on Hepatic Tumors of Sheep

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**Abstract:** The aim of the present study was to assess the incidence and age distribution of hepatic tumors of sheep as well as study of their histopathologic characteristics. For this purpose, 3000 slaughtered sheep, consisting of 284 rams with approximate age of 7 to 20 months and 2716 ewes with approximate age of 3 to 7 years, were inspected during a routine postmortem examination. This study was conducted at Tabriz abattoir in the East Azerbaijan province of Iran, in a course of 8 months from March to November 2006. In this survey, two livers were encountered tumoral. Representative sections of the tumors were stained with hematoxylin and eosin. Gross and microscopic features of these tumors supported diagnosis of hepatocellular carcinoma and cholangiocellular carcinoma for a seven-years-old crossbreed ewe and a five-years-old native breed ewe respectively. In this survey, 0.074% of slaughtered ewes had hepatic neoplasia. That is, the prevalence of hepatocellular carcinoma and cholangiocellular carcinoma in aged ewes was equally 0.037% in this study.

**Key words:** Sheep, hepatic tumors, hepatocellular carcinoma, cholangiocellular carcinoma, histopathology, abattoir

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### INTRODUCTION

Hepatic neoplasms can be of epithelial or mesenchymal origin (Cullen and Popp, 2002). These tumors tend to occur in older animals, with an average age of 10 to 12 years (Thamm, 2001). Hepatic epithelial tumors may arise either from the hepatic cells or from the bile ducts. The former are called hepatomas or carcinoma hepatocellulare and the latter cholangiocellular adenomas or carcinoma cholangiocellulare (Sundarasiva, 2002). Hepatocellular carcinomas are uncommon in all domestic animals but occur more frequently in ruminants, particularly sheep (MacLachlan and Cullen, 2002; Sundarasiva, 2002). This tumor has been recorded in a Holstein cow (Jeong *et al.*, 2005). It also has been described in a heifer (Braun *et al.*, 1997). Cholangiocellular carcinoma is an uncommon neoplasm of sheep (Lofstedt *et al.*, 1988). However, hepatocholangioma and cholangiocellular carcinoma have been reported in sheep (Watt, 1970; Braun *et al.*, 1997; Lofstedt *et al.*, 1988). Cholangioma and cholangiocarcinoma also have been diagnosed in goats (Puette and Hafner, 1995; Rodriguez *et al.*, 1996). Besides, cholangioma, hepatic biliary cystadenoma, a relatively uncommon benign tumor,

has been identified in some domestic animals, including sheep, pigs, dogs and cats (Popp, 1990; Adler and Wilson, 1995; Nyland *et al.*, 1999). It also has been recorded in a 10-year-old horse as the first case in Equines (Salvaggio *et al.*, 2003). A Combined hepatocellular carcinoma and cholangiocarcinoma has been described in an 18-year-old Thoroughbred mare (Kato *et al.*, 1997). It has been revealed that hepatic and biliary neoplasms account for 10% of all neoplasms in cattle and 31% in sheep (Anderson and Sandison, 1967). Information from abattoir by these authors (Anderson and Sandison, 1967) indicates that hepatocellular and biliary neoplasms are 4 times more common in cattle than sheep. It also has been reported that 80% of hepatocellular tumors in cattle are carcinomas (Bettini and Marcato, 1992). Primary hepatic neoplasms are rarely seen in dogs, accounting for only 0.6 to 1.3% of all canine neoplasms (Magne and Withrow, 1985). Results from another study indicate that hepatocellular carcinomas are more common in dogs than cholangiocellular tumors (Patnaik *et al.*, 1980). A combined hepatocellular and cholangiocellular carcinoma has been diagnosed in a 12-year-old male Yorkshire terrier dog though; this primary hepatic tumor is extremely rare in dogs (Shiga *et al.*, 2001). It also has

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been revealed that hepatocellular carcinoma is a common cause of morbidity and mortality in captive prairie dogs (Garner *et al.*, 2004). Frequency of different types of hepatic neoplasms in cats varies from that seen in dogs and human beings, but the morphologic features are comparable (Patnaik, 1992). There are relatively few reports on bovine and sheep hepatic tumors at all (Kithier *et al.*, 1974). However, this abattoir study represents the incidence data of primary hepatic neoplasms in sheep. We also describe the gross and histopathologic findings of the tumors.

### MATERIALS AND METHODS

For determining the incidence and age distribution of hepatic tumors of sheep as well as study of their histopathologic characteristics, 3000 slaughtered sheep, consisting of 284 rams with approximate age of 7 to 20 months and 2716 ewes with approximate age of 3 to 7 years, were inspected during a routine postmortem examination at Tabriz abattoir in the East Azerbaijan province of Iran, in a course of 8 months from March to November 2006. The age and sex of these animals were recorded simultaneously. Among these slaughtered animals, grossly, on external and cut surface observations, two livers were encountered tumoral. For identification of these tumors histopathologically, representative sections of the tumors were fixed immediately in 10% neutral buffered formalin, processed routinely and embedded in paraffin. Tissue sections were cut to 4  $\mu$ m thickness and stained with hematoxylin and eosin (Lee and Luna, 1968).

### RESULTS

One of these livers belonged to a seven-years-old crossbreed ewe. The sheep was of normal appearance at the time of slaughter, without any preexisting medical conditions. At postmortem examination, a single well-demarcated large neoplasm that had involved contiguous liver lobes was encountered. Its diameter was recorded (D1: 23 and D2: 45 mm). On cut surface tumor mass had been subdivided into lobules by multiple fibrous bands and the general appearance of neoplastic mass was light tan to yellow with dark red areas of hemorrhage (Fig. 1). Hepatic lymph node was enlarged and hemorrhagic, with a white-gray nodule on its surface. The lungs and other tissue and organs at the vicinity of the affected liver, appeared grossly normal. In the affected liver, microscopically, aggregates of neoplastic cells were seen as crude acini with scant connective tissue stroma between them. Invasion of malignant cells at the margin of the compressed normal hepatocytes was indicator of malignancy (Fig. 2). In higher magnification, pleomorphic



Fig. 1: Massive hepatocellular carcinoma, sheep. Tumor mass is well demarcated and has been subdivided into lobules by multiple fibrous bands

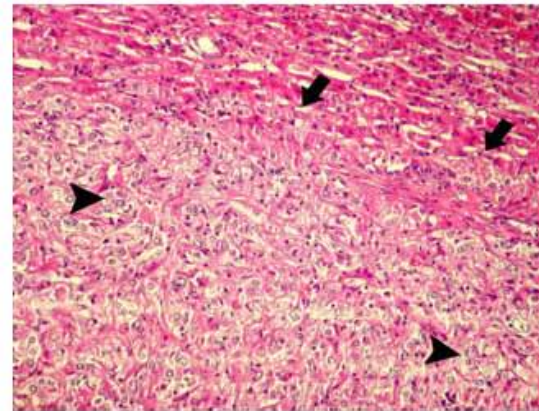


Fig. 2: Low power magnification of hepatocellular carcinoma, sheep. Aggregates of neoplastic cells are seen as crude acini (arrowheads). Invasion of malignant cells at the margin of the compressed normal hepatocytes (arrows) is present (H and Ex60)

cells, mitotic figures and bizarre forms were more often (Fig. 3). Besides, macroscopic and microscopic characteristics of the lesion in the hepatic lymph node were in agreement with metastasis to it. These findings suggest a poorly differentiated adenoid hepatocellular carcinoma in the ewe.

Another case belonged to a five-year-old native breed slaughtered ewe so, with the signs of unthriftiness and cachexia. Postmortem inspection of the carcasses revealed rounded shaped, multiple firm often umbilicated pale grayish colored small-sized (8 mm in greatest diameter) nodules which scattered randomly throughout the liver (Fig. 4). Infrequently masses of coalescing small



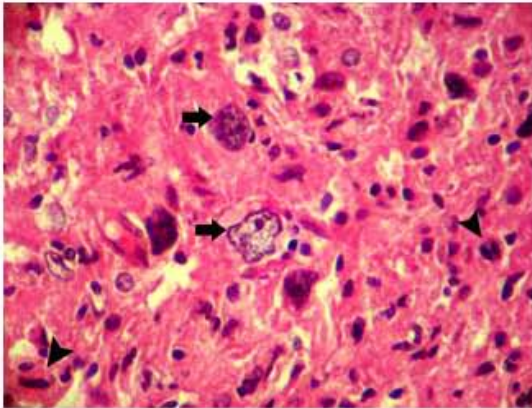


Fig. 3: High power magnification of hepatocellular carcinoma; sheep. Atypical hepatocytes and bizarre forms (arrows) are seen. Mitotic figures (arrowheads) are numerous (H and E x400)

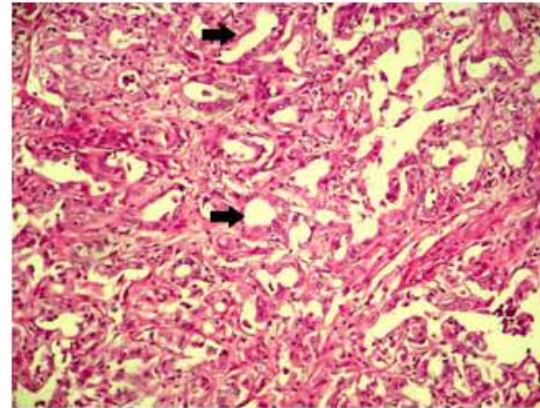


Fig. 5: Low power magnification of cholangiocellular carcinoma; sheep. Neoplastic cells have been organized into a tubular or acinar arrangement (arrows) and retained a resemblance to biliary epithelium (H and E x100)



Fig. 4: Cholangiocellular carcinoma; sheep. Multiple raised pale gray nodules with a central depression are present within the liver

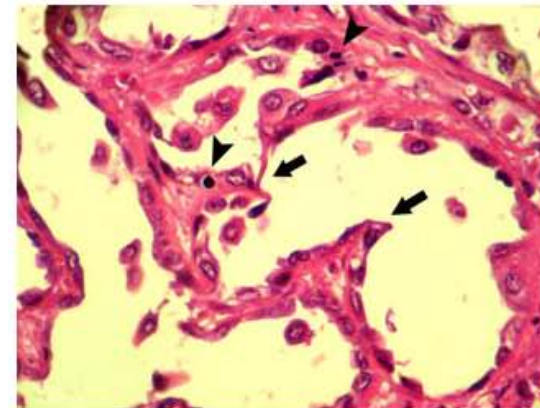


Fig. 6: Cholangiocellular carcinoma; sheep. Higher magnification shows papillary projections (arrows). Mitotic figures (arrowheads) are numerous (H and E x400)

nodules were observed. The same nodules were confirmed in the lungs, also. Inspection of other tissue and organs were grossly normal. Microscopic examinations of the liver and lungs revealed unencapsulated well-differentiated carcinoma in which neoplastic cells had been arranged in an acinar and tubular pattern and retained a resemblance to biliary epithelium. Scanty connective tissue stroma existed between acini (Fig. 5). Higher magnification showed acini lined by tall cuboidal epithelium with infrequent papillary projections. The nuclear crowding and occasional nests of epithelial cells in the stroma were seen. Mitotic figures were numerous (Fig. 6). Pathologic gross and microscopic features of this neoplasia support a diagnosis of cholangiocellular carcinoma.

## DISCUSSION

In this limited study the incidence data, macroscopic and then microscopic features of the hepatocellular carcinoma and cholangiocellular carcinoma as the most important hepatic tumors in sheep, was described. The histological appearance of hepatocellular carcinomas varies considerably, depending on the degree of differentiation of the individual hepatocytes and the histological arrangement of the cells. The three major diagnostic categories of hepatocellular carcinomas are trabecular, adenoid, and solid (Cullen and Popp, 2002). Althothe trabecular pattern is the most common

histological form of the tumor in domestic animals (Patnaik *et al.*, 1981) adenoid pattern has been recognized in this survey. Based on this abattoir survey, we propose that the primary hepatic neoplasms can be found occasionally in sheep, although they are comparatively rare and relatively common in old females (0.037% for each of them). In the fact, the precise incidence of these hepatic tumors is unclear because the incidence data reported are, based on a selected population specially, from a small geographic area. Comparison of the incidence of these neoplasms in this study is unreliable for similar reasons. Since, the data from this study have been derived from an abattoir survey and relatively few animals at the earlier stages of their life expectancy have been studied, creates another challenge in estimating the real tumors incidences. Because of failure in getting a precise history of the affected animals, it is not known if the incidence of these tumors depends on some predisposing factors. In any way, the results of this study may be in contradictory with other information, but it seems that the incidences of neoplastic diseases are alarming on the rise. Although, these tumors do not have a recognized cause in domestic animals, however, various chemical carcinogens, naturally occurring carcinogens and chronic viral, bacterial and parasitic infections may play a role in liver cancer in domestic animals (Cullen and Popp, 2002). Therefore, it is strongly recommended that to perform other comprehensive studies in this connection.

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