

Etiopathological study of multiple hepatic abscesses in a goat

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ABSTRACT

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Hepatic abscesses occur in all species, most commonly found in cattle, very less in sheep and rare in goats. The abscesses in liver constitute a major economic problem because of liver condemnation and reduced animal performance and carcass yield. During routine necropsy one interesting case of multiple hepatic abscess was encountered which was investigated for pathology and bacterial isolation. Lungs revealed 12-15 foci of abscess in different lobes similar to those observed in liver. Microscopic examination revealed thick and thin fibrous capsules around abscesses, containing basophilic and eosinophilic necrotic material infiltrated with numerous pus cells and some mononuclear cells. From the affected organs, *Corynebacterium pseudotuberculosis*, *Streptococcus sp.* and *Pseudomonas sp.* were isolated and confirmed by morphology, cultural, biochemical characteristics and molecular methods. In the present case the *C. pseudotuberculosis* could possibly have been a source of the systemic spread with the secondary infection of *Streptococcus* and *Pseudomonas sp.* The extensive damage to the liver caused by multiple foci of the abscesses could be the reason for emaciation and death.

Keywords: Etiopathology, goat, hepatic abscess

The liver is a vital organ of mammalian metabolism and has a wide range of functions, including detoxification of various metabolites, protein synthesis, and the production of biochemicals necessary for digestion. The liver supports almost every organ in the body and is vital for survival therefore any disturbance in this organ will reflect on the general health causing great economic losses in animal production¹.

Liver abscesses in feedlot animals, represent a major economic liability to producers, packers and ultimately consumers². The economic losses are due to reduced animal performance and carcass yield and condemnations of carcasses at abattoir¹. The bacteria such as *Fusobacterium necrophorum*, *Escherichia coli*, *Staphylococcus sp.*, *Pasteurella sp.*, *Streptococcus sp.*, *Corynebacterium sp.*, *Moraxella sp.*, *Pseudomonas sp.* and *Clostridium sp.* have been isolated by several workers from the hepatic abscesses of cattle, sheep and goats³⁻⁶. The association between the occurrence of hepatic lesions and ruminal infections has been reported previously⁷. In most cases; however, hepatic abscesses are incidental findings but rarely weight loss, anorexia, depression and reduction in production may occur and usually found in the liver at the time of slaughter or necropsy⁸. In cattle "rumenitis-liver abscess complex" has been established as the mechanism of hepatic abscesses, however, the cause of hepatitis with abscess formation in sheep and goats is poorly understood. The present case study was performed to evaluate pathological features and the identification of etiological agents associated with multiple abscesses in liver and lungs of an adult Sirohi goat.

A carcass of adult Sirohi male goat was received for necropsy with history of anorexia, emaciation and non response to the treatment. On necropsy, the carcass was carefully examined for gross pathological lesions in various organs. The tissues of liver and lungs affected with abscesses were collected for histopathological examination in 10% neutral buffer formalin. After proper fixation, the specimens were dehydrated in ascending grades of ethyl alcohol, cleared in xylene and embedded in paraffin wax. The sections were cut at 5 microns in thickness and stained with hematoxylin and eosin (H & E) stain for histological examination⁹. For bacterial isolation, a loopful of the pus was inoculated into nutrient agar, 5% sheep blood agar and MacConkey agar and incubated aerobically at 37°C for 24-48 hours. The isolates were identified according to the colony morphology, Gram's stain, as well as biochemical characters. For identification of *C. pseudotuberculosis* the isolates were further inoculated on cystine tellurite blood agar and incubated at 37°C for 48 h. The resultant black colonies were considered positive for *C. pseudotuberculosis*¹⁰. Colonies from the pure cultures of *C. pseudotuberculosis* from 72-h growth on blood agar plates were confirmed by polymerase chain reaction assay (PCR) of NADP oxidoreductase coenzyme F420-dependent gene of *C. pseudotuberculosis*¹¹.

The *Streptococcus sp.* and *Pseudomonas sp.* were identified by its colony characteristics on sheep blood agar and MacConkey agar and Gram's stain characteristics. For the molecular identification of these organisms sequencing of 16S rRNA was done with the primers of 27F (5'-AGA GTT TGA TCM TGG CTC AG-

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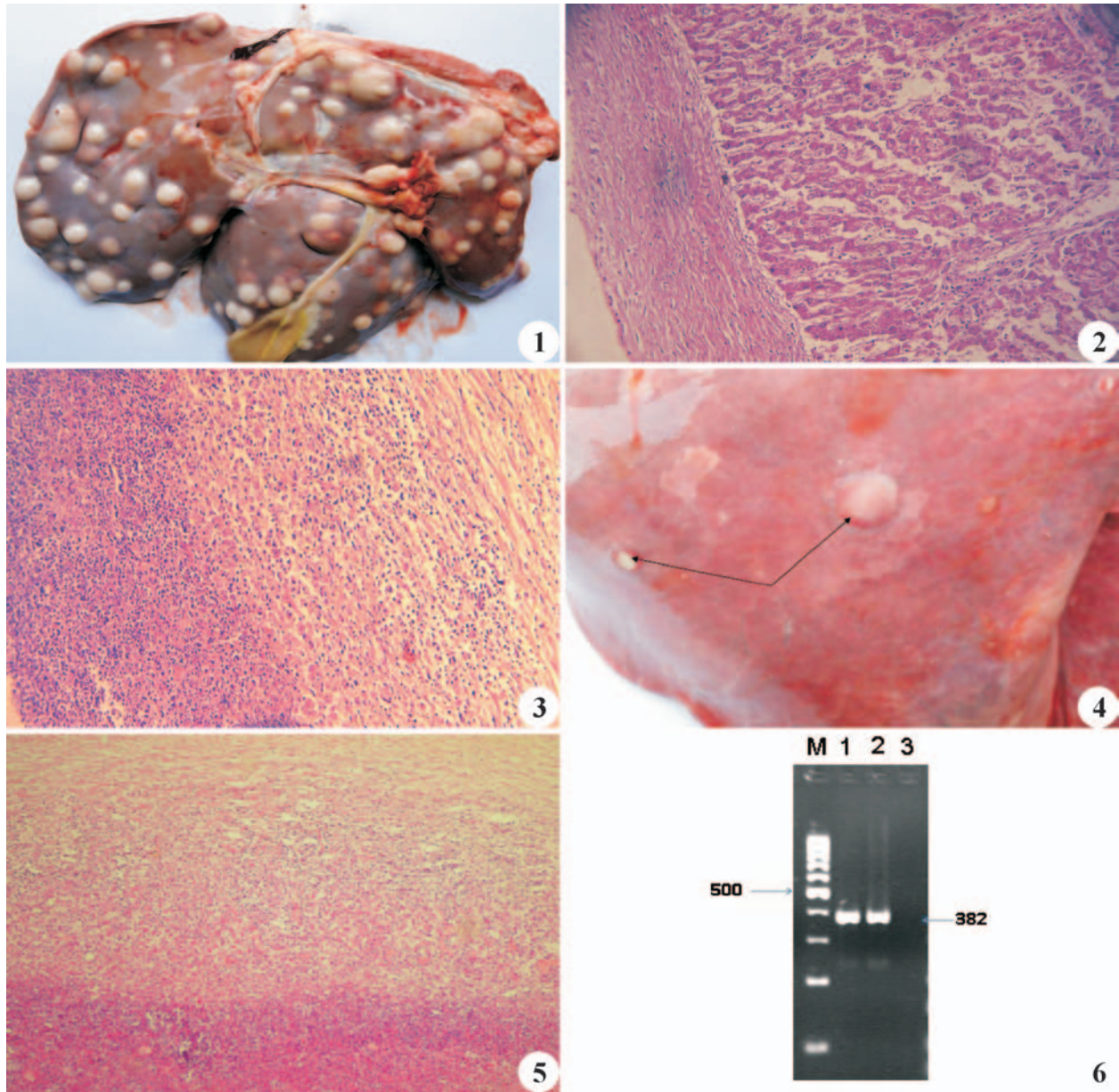


Fig.1. Multiple foci of abscesses in dorsal and ventral surface of the liver in goat; **Fig.2.** Liver of goat showing thickened capsule with individualization of the hepatocytes. H&Ex100; **Fig.3.** Hepatic abscess characterized by finely granular eosinophilic and basophilic substance infiltrated with neutrophils and surrounded by fibrous capsule. H&Ex100; **Fig.4.** A discrete multiple foci of abscesses in the lungs of goat; **Fig.5.** Lung abscess characterized by finely granular eosinophilic and basophilic substance infiltrated with neutrophils and mononuclear cells and surrounded by fibrous capsule. H&E x100; **Fig.6.** PCR amplification of *C. pseudotuberculosis* isolate. Lane M-marker (sm#0323 Fermentas); Lane 1-382 bp product of NADP oxidoreductase coenzyme F420-dependent from *C. pseudotuberculosis* isolate positive control; lane 2-382 bp product of NADP oxidoreductase coenzyme F420-dependent from *C. pseudotuberculosis* isolate; lane 3-Negative control.

3') and 1492R (5'-CGG TTA CCT TGT TAC GACT T-3')¹². After the PCR amplification and agarose gel electrophoresis, specific sized bands were excised from gel under UV light and were subsequently purified using mini elute gel extraction kit (Qiagen). The purified products were sequenced by Xcelris genomics, India and compared with sequence available in the NCBI database.

Liver damage occurred by any primary or secondary disease process may disturb metabolic processes that are vital for normal health and optimum productivity¹³. The hepatic system is particularly susceptible to abscesses because it receives blood from various sources, encompassing the hepatic artery, the portal system and the umbilical vein in fetus and neonate. Entry via portal

vein is most common route². In the present report, the prominent gross lesions were observed in hepato-biliary system. More than 300 multiple white nodules containing pus were present in all the lobes of liver dorsally and ventrally. Liver parenchyma was studded with multiple grayish-white purulent nodules of variable size (2 mm to 2 cm in diameter), which coalesced to become larger (Fig. 1). The gall bladder and bile ducts were distended with dark brown, thick bile. Wall of the bile ducts was thickened and hard to cut. Microscopic examination of liver sections revealed thickened capsule of the liver with fibrous connective tissue proliferation. Hepatic parenchyma showed disorganization and distortion of the hepatic cords with degenerative changes and necrosis in the hepatocytes (Fig. 2). The necrotic cells were characterized by eosinophilic cytoplasm with karyorrhexis and karyolysis of the nuclei. The sinusoidal space was found widened and at some places infiltrated with mononuclear cells. The liver parenchyma revealed multiple small and large abscesses surrounded by thick and thin fibrous capsules. Centrally, the capsules contained finely granular eosinophilic and basophilic substance infiltrated with pus cells and mononuclear cells. The infiltration of mononuclear cells was also evident in the fibrous connective tissue layer of the capsule (Fig. 3). In some abscesses central areas revealed calcified material. The bile ducts were constricted with thickened wall due to the proliferation of fibrous connective tissue and hyperplasia of the biliary epithelial cells. The similar gross and microscopic findings in liver abscesses have been reported in cattle and buffalo^{14,15}, sheep 4-6 and rarely in goats^{16,17}.

Lungs revealed 12-15 multiple discrete foci of abscess in different lobes similar to those observed in liver. The abscesses encompassed thick or thin fibrous capsule, with central areas containing a purulent yellowish white or yellow and mucoid suppurative contents, with 0.5-2 cm in mean diameter (Fig. 4). Microscopically, lungs revealed similar abscesses as observed in liver, the capsule of these nodules was found infiltrated with macrophages and with some mononuclear cells (Fig. 5). The alveolar epithelium was proliferated and lumen of the alveoli contained pinkish exudates at some places. The extension of hepatic abscesses in other organs such as lungs observed in the present study has been rarely reported in domestic animals¹⁶.

Liver abscesses can be seen in any species but are more prevalent in ruminants especially Cattle. In the USA about 3% of the sheep slaughtered annually have liver abscesses and in another study, about 16.4% has been declared in Texas. In South West of Iran, about 8.6% of slaughtered sheep revealed liver abscesses⁵. A recent study in Herrik sheep from Iran reported 4.6% prevalence of hepatic abscesses⁶. The incidence of hepatic abscess

was found very low, in a retrospective study from Brazil revealed only 2.5% incidence of hepatic abscesses in goats¹⁶. The study on microorganisms associated with abscesses in sheep and goats in Iran, reported that out of a total of 120 abscesses, six hepatic abscesses were found in sheep and only one in a goat¹⁷. In the present study bacteria such as *C. pseudotuberculosis* isolated and confirmed by specific PCR (Fig. 6) from the liver and lungs and the *Streptococcus* spp. and *Pseudomonas* spp. were isolated and identified from the same tissues. Involvement of these organisms in the causation of hepatic abscesses have been previously reported in sheep and goats^{4,16,17}. The other organisms such as *Staphylococcus aureus*, *Fusobacterium necroforum.*, *Escherichia coli*, *Clostridium perfringens*, *Protreus vulgaris*, *Pasteurella* spp. *Corynebacterium* sp. have been reported as etiological agents for hepatic abscesses in cattle, sheep and goats^{2,4,6,16-18}.

The pathogenesis of liver abscess is not clearly understood, it is believed that in feedlot animals rumenitis can cause liver abscess. Eating excessive levels of carbohydrates such as grain can change the rumen bacteria and drop the pH of the rumen. The lowered pH can damage the rumen wall and allows bacteria to pass into the bloodstream and enter the liver, where they can cause abscesses^{1,2,4}. This was not found to be the case in the present study. Looking back to the history of case, the general body condition of the goat was poor. Previous history of this farm revealed that the farm is endemic for the Caseous lymphadenitis and the causative agent *C. pseudotuberculosis* has been successfully isolated and identified from the skin abscesses of sheep and goats^{10,11}. The microscopic features of the abscesses observed in liver and lungs in the present case are similar to the abscesses of *C. pseudotuberculosis* as reported by previous workers^{6,16}, in their study they considered *C. pseudotuberculosis* is the most prevalent bacterium incriminated for hepatic abscesses in sheep and goats.

The present study concludes that the *C. pseudotuberculosis* could possibly have been a source of the systemic spread with the secondary infection of *Streptococcus* and *Pseudomonas* spp. The extensive damage to the liver caused by multiple foci of the abscesses and systemic spread of the infection in internal organs could be the reason for emaciation and death of the goat under study.

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