Macroscopical and microscopical studies of the common bile duct in reindeer (*Rangifer tarandus tarandus* L)

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Summary: The histological structure and secretory function of the common bile duct (*ductus hepaticus communis*) has not been previously described in reindeer. Macroscopical studies were thus performed in 25 reindeer to reveal the morphology and topography of the *ductus hepaticus communis* and adjoining organs. Histologic structure of the common bile duct was investigated in 20 animals. Our studies showed that the *ductus hepaticus communis* and pancreaticus join about 2 cm before the duodenal opening to form the common duct.

The common bile duct is an elastic tube about 3 to 5 cm long and 2 to 3 mm thick partly surrounded by fat and pancreatic tissues. The wall of the duct, being about 1 mm thick by light microscopy, consisted of folded mucosa surrounded by connective tissue fibres and a serosal layer. Distally, also muscular bands were seen. In some areas separate leucocytes and even lymphatic nodules were present. Surprisingly pancreatic acini occurred in certain areas of the wall, even in close contact to subepithelial tissues. Mucosal epithelium consisted of surface and glandular epithelial cells with mucous secretion. Numerous intraepithelial globule leucocytes were identifiable within the lamina epithelialis.

Key words: anatomy, histology, ductus pancreaticus, globule leucocyte, mast cell.

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Rahko, T. ja **Nikander, S.** 1990. Tutkimus yhteisen sappikäytävän rakenteesta porolla.

Yhteenveto: Yhteisen sappikäytävän (*ductus hepaticus communis*) histologista rakennetta ja eritystoimintaa ei ole aikaisemmin kuvattu porolla. Makroskooppisia tutkimuksia suoritettiin 25 porolla yhteisen sappikäytävän rakenteen ja topografian selvittämiseksi. Seinämän histologinen rakenne selvitettiin 20 porolla. Tutkimukset osoittivat, että porolla *ductus hepaticus communis* ja *ductus pancreaticus* yhtyvät noin 2 cm ennen ohutsuolta muodostaakseen yhteisen tiehyeen.

Ductus hepaticus communis on noin 3–5 cm pitkä ja 2–3 mm:n läpimittainen käytävä. Se on elastinen ja osittain rasva- ja haimakudoksen ympäröimä. Seinämä on mikroskooppisesti noin 1 mm paksu. Sisäosan muodostaa poimuuntunut limakalvo. Limakalvoa ympäröivät sidekudossäikeet ja serosa, sappikäytävän loppuosassa myös lihassäikeistö. Seinämässä havaittiin yksittäisiä valkosoluja ja imusolukasautumia. Poikkeuksellisena anatomisena piirteenä voidaan pitää haimasaarekkeiden esiintymistä sappikäytäväseinämän kudoksissa jopa läheisessä kosketuksessa pintaepiteeliin. Limakalvon epiteelikudos on sekä pinta- että rauhassolukkoa, joka erittää limaa. Epiteelissä tunnistettiin lukuisia kerässoluja huolimatta siitä, että poroille oli suoritettu loishäätö edellisenä syksynä.

Rangifer, 10 (1): 3—8

Rahko, T. och **Nikander, S.** 1990. Studier av gallgången (*ductus hepaticus communis*) hos ren.

Sammandrag: Den gemensamma gallgångens histologi och sekretoriska funktion hos renen har inte tidigare beskrivits. För att klarlägga den makroskopiska byggnaden och topografin av den gemensamma gallgången (*ductus hepaticus communis*) undersöktes dessa i 25 renar. Väggen i 20 gallgånger granskades histologiskt. Undersökningarna visade att *ductus pancreaticus* mynnar ut i ductus hepaticus communis bildande en gemensam utförselgång till duodenum. *Ductus hepaticus communis* är c. 2–3 mm i diameter och 3–5 cm lång. Den elastiska gångens vägg är c. 1 mm tjock delvis omgiven av fett- och pankreasvävnad. Gångens vägg består av serosa, bindvävsfibrer och nära mynningen ses muskelfibrer. Insidan av gången är beklädd med en veckad slemhinna. Lymfatisk vävnad och enstaka lymfocyter observeras. Anmärkningsvärt är att pankreasvävnad förekommer i gallgångens vägg och under slemhinnan. Slemhinnans epitel består av yt- och körtelepitel som avsöndrar slem. De globulära leukocyterna var talrika i epitelet trots att renarna avmaskats på hösten.

Rangifer, 10 (1): 3—8

Introduction

The anatomy of the liver and main bile ducts varies among different animal species (Schache, 1907, Bevandic & al., 1967, Elias & Sherric, 1969, Dellman and Brown, 1976). The reindeer belongs to the family Cervidae, which do not possess a gall bladder. In the reindeer, bile secreted by the liver is thus directly conducted to the duodenum through the ductus hepaticus communis, the common bile duct (Akaevskij, 1939). The secretory function of the duct bile wall is not yet known.

In bovines, on the other hand, bile is stored in a gall bladder, the wall of which is rich in serous and mucous glands (Dellman and Brown, 1976). In cattle the original bile is thus concentrated and mixed by mucous fluids of the gall bladder and the wall of main bile duct is profoundly glandular (Rahko, 1971, 1973).

This paper describes the structure of the wall of the common bile duct in reindeer.

Materials and methods

Macroscopical studies were performed in 24 reindeer. One animal was selected for more thorough dissection of the inner organs to reveal the topography of the liver, pancreas and adjoining organs.

The tissue specimens of *ductus hepaticus communis* used in the light microscopical studies originate from 20 reindeer. Eight animals were slaughtered at the Reindeer Research Institute in Kaamanen outdoors at -30°C. 12 reindeer were slaughtered in a slaughterhouse located in Savukoski in eastern Lappland.

Approximately 5–10 mm long specimens of *ductus hepaticus communis*, surrounded by fat and pancreatic tissues, were cut into small tissue blocks, which were soon transferred into the different fixatives. Care was taken to prevent freezing of the tissue specimens.

Six specimens were fixed in diluted formaldehyde solution (25 %) buffered at pH 7 by phosphate buffer (fixation time 4 days). Additional six specimens were fixed in Bouin's solution for one day, then transferred into 70 % alcohol. Furthermore, 14 specimens were fixed during 1 to 4 months in 4 % paraformaldehyde in 0.1 M phosphate buffer containing 0.1 % sodium azide (NaN_3) and 0.05–0.1 % glutaraldehyde.

The material was embedded in paraffin in the usual manner, sectioned at 4 microns and routinely stained with haematoxylin and eosin (HE).

Results

Macroscopical studies

The common bile duct appeared as a 2–3 mm thick elastic tube between the liver and oral part of the duodenum. It was 3–5 cm long, white and thin-walled. The duct was partly surrounded by fat and pancreatic tissues. No papilla was observed around its duodenal opening. At slaughter when the duct was cut the mucosa of the stump appeared to be yellow in colour near the hilus of the liver.

The *ductus pancreaticus* connected with the common bile duct at about 2 cm before the duodenal opening.

Microscopical studies

The wall of the common bile duct appeared to be about 1 mm thick by microscopy. The outer layers were surrounded by a serosal coat and

consisted of circular connective tissue fibres. Smooth muscle layers were detected in only distal sections of the duct near the duodenum. In some areas pancreatic tissues were observed in the wall of the duct (Fig. 1).

The inner layers of the wall consisted of folded mucosal tissues with epithelial surface and glandular structures surrounded by a loose connective tissue network of *lamina propria* (Fig. 2).

In the *lamina propria*, dispersed granulocytes and lymphocytes were present and also prominent accumulations of lymphatic cells were observed (Fig. 3 and 4).

The epithelium was composed of tall columnar epithelial cells with basal, rounded and regular nuclei (Fig. 5 to 7). A few goblet cells were located within *lamina epithelialis.* The cytoplasm of the epithelial cells was pale in HE-stained sections, especially in the deep glands. In mucous glands the cytoplasm of epithelial and goblet cells was ballooned by mucous secretions. Mucus also was present freely in the lumina of the glands.

Numerous globule leucocytes were present in superficial and glandular epithelium. The cells were located basally within the epithelium. They were identified on the basis of large eosinophilic rounded globules. The nuclei were chromatin-rich and rounded being quite similar in appearance to those of the lymphocytes. Eosinophilic granulocytes were easily identifiable in proprial tissues (Fig. 8) while mast cells were difficult to detect in HE-stained sections. Mast cell granules appeared small and faintly-stained.

All the fixatives used were suitable for histologic studies. However, our impression was that Bouin's solution and paraformaldehyde preserved the tissues particularly well.

Discussion

The results of the present study showed that morphological characteristics of the wall of the common bile duct in Finnish reindeer are largely similar to those in other animal species (e.g. McMinn and Kugler, 1961, Dellman and Brown, 1976, Rahko 1971, 1973). The duct is short, elastic and thin-walled with smooth mucosal folds consisting of epithelial and glandular structures. Connective tissue fibres of *lamina propria* are loose while the outer layers of the duct contain circular mesenchymal elements with smooth muscle fibres in distal parts of the duct.

The entering of the *ductus pancreaticus* into bile duct to form the *ductus communis* was observed as previously described by Akaevskij (1939). This is typical in sheep and goats, while in most domestic mammals the pancreatic and hepatic ducts are separate anatomic structures (Schmidt and Ivy, 1937, Elias and Sherrick, 1969, Dellman and Brown, 1976).

A new finding not previously described is the extension of pancreatic acini into proprial tissues of the bile duct (Figure 1). The significance of this peculiar anatomical feature is unclear to the authors. Further studies are needed to elucidate if the pancreatic acini described are ectopic pancreatic tissues or normal projections in the form of *caput biliaris* in additon to the previously described *capiti duodenalis* and *omentalis.* Electron microscopic studies showed that the ultrastructural features of pan-creatic acini of bile ductal walls appear similar to those in normal acini of mammalian animals (Rahko and Nikander, 1990).

Lamina epithelialis contains numerous globule leucocytes (Gregory, 1979, Nikander and Rahko, 1990). The cell has not previously been identified in reindeer. The globule leucocyte is known to occur within different epithelial tissues of many other animal species and in man. The frequency with which the cell appears, however, is usually associated with parasites e.g. Gregory, 1979. The animals in the present study were treated with anthelmintica in the preceding autumn and were thus considered to be free from clinical helminthosis (Holmström & al., 1989). Further studies are to be performed in order to elucidate the frequency of globule leucocytes in Finnish reindeer.

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Fig. 1. Transverse section of *ductus hepaticus communis.* The dark-stained areas of the mucosa consist of pancreatic acini (arrows). HE, x 32.

Fig. 2. Mucosal layer of *ductus hepaticus communis*, containing surface epithelium (to the left) and glands with pale cytoplasm (arrow). HE, x 400.

Fig. 3. The cytoplasm of epithelial cells in the glands is filled with mucous. Round cells and eosinophilic granulocytes are present in submucosal areas (arrows). HE, x 256.

Fig. 4. Cross section through the wall of common bile duct, showing a prominent lymphatic nodule. HE, x 256.

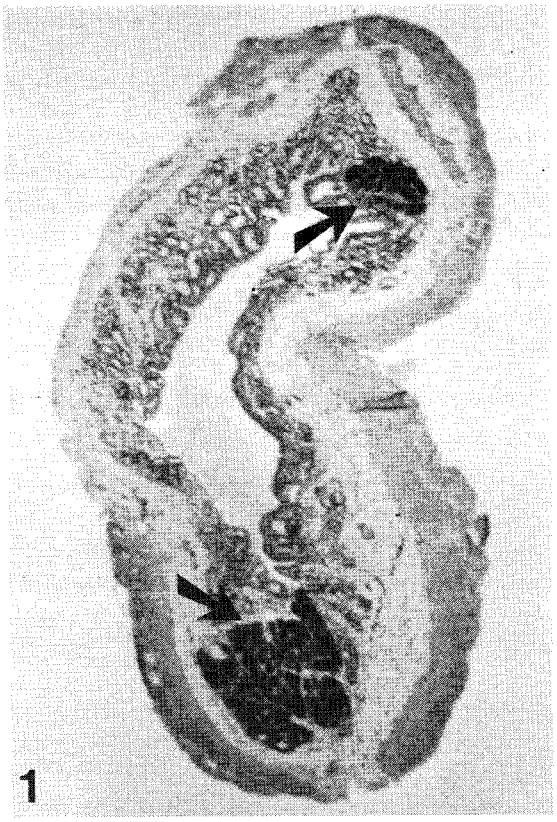
Figures 5–8, see page 8

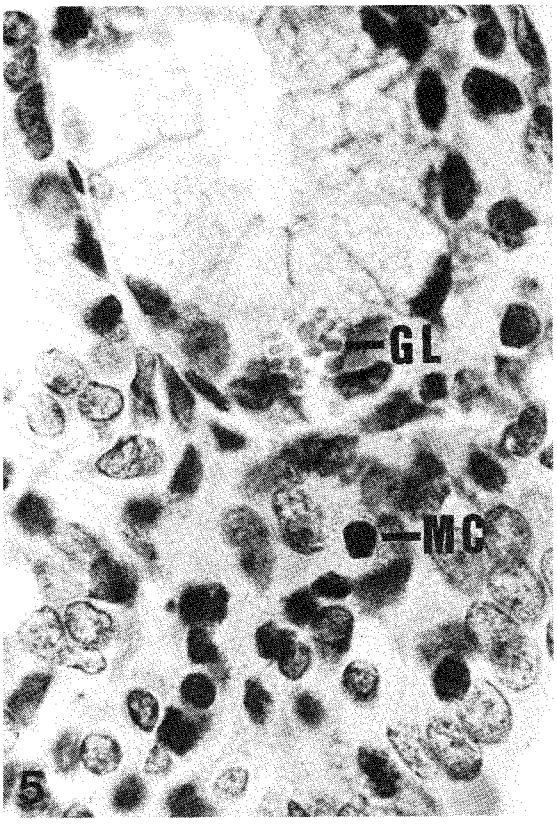
Fig. 5. The cytoplasm of epithelial cells is pale in the deep glands. Note the structural difference between intraepithelial globule leucocyte (GL) and mast cell (MC) located in the *lamina propria.* HE, x 1040.

Fig. 6. Globule leucocytes (arrows) are frequent in superficial and glandular epithelium. HE, x 1040.

Fig. 7. Typical location and appearance of intraepithelial globule leucocytes (arrows). HE, x 1040.

Fig. 8. Infiltration of eosinophilic granulocytes (arrows) surrounded by connective tissue elements. Compare the appearance of nucleus and intracytoplasmic granules of eosinophilic granulocytes to those of the globule leucocytes illustrated by Figures 5 to 7. HE, x 1040.

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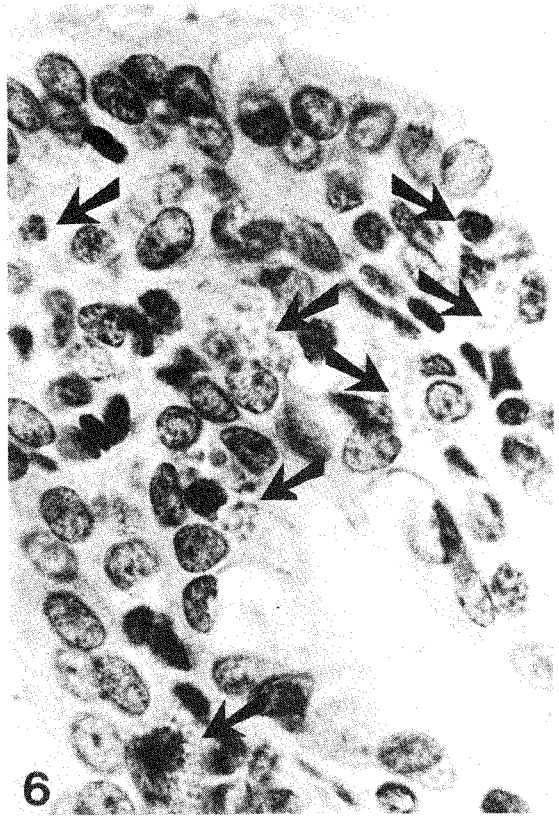
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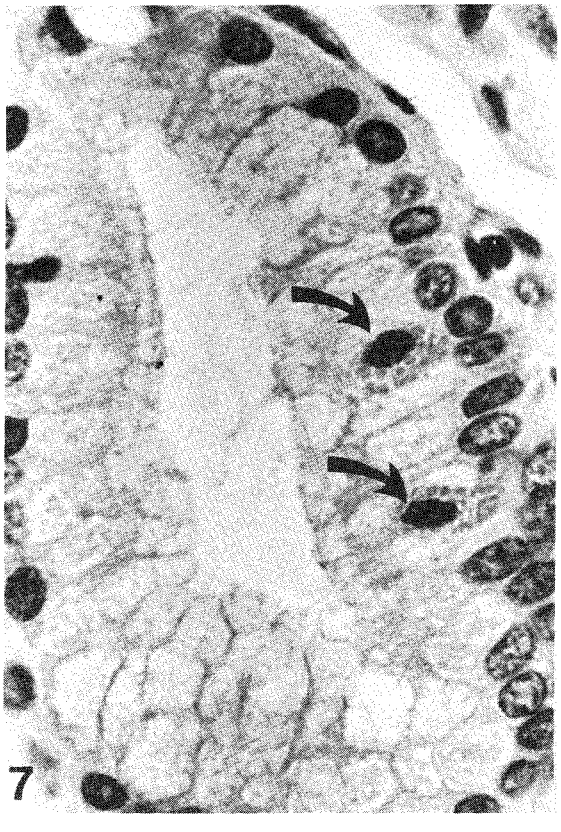
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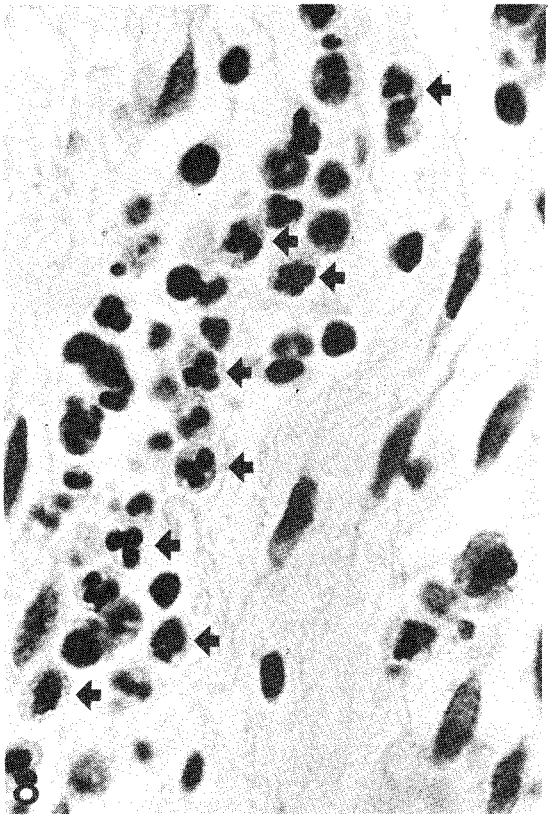
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