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# Liver, Pancreas and Gallbladder

Monday, January 14, 2008
1:00 PM

I. Liver and Gallbladder
  A. Liver
    i. Pale spots are either central veins or small branches of portal veins
    ii. Central veins (terminal hepatic venules)
      1) Outflow of liver to hepatic vein
      2) Surrounded by hepatocytes
      3) All by itself in the center of a lobule
      4) Connected to sinusoids
    iii. Portal veins/hepatic triad
      1) Portal veins surrounded by connective tissue
        a) No smooth muscle
        b) Largest vessel of triad
        c) Connected to sinusoids
      2) Bile duct
        a) Circle of prominent nuclei
        b) Cuboidal epithelium
      3) Hepatic artery branch
        a) Ring of smooth muscle
        b) Looks like normal arteriole
    iv. Liver tissue
      1) Hepatocytes
        a) Line up in plates
        b) EM shows lots of organelles and glycogen appears as black clusters near smooth ER
        c) Cell surface has two types
          i) Facing blood and space of Disse
          ii) Surface involved w/ bile canliculus w/ junctional complexes to isolate bile from blood
      2) Sinusoids between plates of hepatocytes
        a) Lined by thin layer of endothelium
          i) EM shows discontinuous lining to allow passage into Disse
          ii) Numerous microvilli
          iii) No organized basal lamina
        b) Will see Kupfer cells (macrophages)
          i) EM shows lysosomes
      3) Space between hepatocytes and endothelial cells = "space of Disse"
        a) Blood flows from portal veins/hepatic arteries --> sinusoids --> central veins
        b) Bile flows from canaliculi --> canals of Hering (low cuboidal cells) --> bile ducts in portal canals --> hepatic ducts --> common hepatic duct
      4) Hepatic outflow does not follow organization of liver lobules vs. inflow at periphery of each lobule
        a) Classic: Microscope based --> connective tissue surrounds hexagon w/ central vein in middle
        b) Portal: bile produced in one lobule goes to one duct; triangle w/ central veins as three corners and triad in center
        c) Liver Acinus of Rappaport: spans btwn two triads; elliptical w/ hepatic artery and portal vein as core
          i) Zone 1 - closest to vessels, gets most oxygen/blood; toxins kill it off first,

but most likely to survive is hypoxic
ii) Zone 2 - intermediate
iii) Zone 3 - most isolated, most subject to hypoxia

5) Collagen
a) Around portal canals and less around central veins
b) Thin layers around sinusoids

v. Bile Canaliculi
1) Chicken wire arrangement
2) Extends btwn plates of hepatocytes

B. Gall Bladder
i. Extensive folds of mucosa extending into lumen get distended when gallbladder is full
ii. Tall, simple columnar epithelium and underlying connective tissue (Lamina propria)
iii. Muscularis externa is scattered bundles of smooth muscle
iv. Adventitia is dense CT binding gall bladder to liver
v. Surface of bladder facing abdominal cavity is a serosa

II. Pancreas
A. Exocrine
i. Divided into smaller areas by slits of open space/CT
ii. Lighter spots are islets of Langerhans, endocrine
iii. Large number of acini w/ some fat cells
1) Periphery of each acinus stains blue/purple (basal side of cells) due to abundance of RER
2) Apical portion should be pink because of Golgi and secretory granules
iv. Smaller cells in central region of acinus are centroacinar and represent initial portion of duct that extends into larger excretory ducts outside lobule
v. Intercalated ducts appear btwn lobules w/ nuclei btwn acini; pale cytoplasm
1) Contribute bicarbonate and Na/H2O to exocrine secretion
2) Lining epithelium of interlobular ducts is simple cuboidal epithelium or simple columnar in larger ducts

B. Endocrine
i. Islets of Langerhans
1) Pale areas of cells
2) Scattered distribution
3) Alpha, beta, gamma responsible for glucagon, insulin and somatostatin
4) Don't have to recognize individual cell types
ii. Vascular Supply much richer to endocrine portions of pancreas
iii. Chrome-alum staining allows distinction of cell types
1) Alpha cells stain reddish, periperal
2) Beta cells more central, stain purple
iv. EM of endocrine cells shows basal RER, apical secretory granules