1. Morphologic diagnosis:

Brown adipose tissue: Hibernoma, benign

Arising from a section of brown adipose tissue adjacent to the aorta is an expansile pseudoencapsulated neoplasm (gross picture, left) comprised of sheets of round to polygonal mesenchymal cells supported by a fine fibrovascular stroma (photomicrograph, right). The neoplastic cells have indistinct margins and contain moderate to abundant amounts of foamy to multivacuolated eosinophilic cytoplasm which margins the nucleus. Nuclei are round to oval with a finely stippled chromatin pattern. Randomly scattered individual neoplastic cells within the mass are necrotic. There is a moderate degree of anisocytosis and anisokaryosis, and occasional cells are multinucleated. The overall mitotic rate average is 1 per 5 HPF, with occasional bizarre mitotic figures present.

In practice, malignancy is based on the presence of metastases or clear invasion, both of which were lacking in this tumor; mitotic rate varies greatly between tumors and seems to be an unreliable indicator or malignancy.
2. **Immunohistochemical marker:** Uncoupled protein 1 (UCP-1, Thermogenin)

3. **Ultrastructural findings:**

   Photomicrograph (left) and electron micrograph (right) of brown adipose tissue. Note the multilocular nature of stored lipid (L). The cytoplasm of brown adipocytes is crammed with mitochondria (M) which have numerous, closely packed cristae. These mitochondria are extremely rich in cytochromes, part of the electron transport chain involved in oxidative energy production; this accounts for the brown color of brown adipose tissue when examined macroscopically. Note the intimate association of capillaries (C) with the brown adipocyte in this micrograph.

**Discussion:**

The brown adipose tissue is mainly controlled by the sympathetic nervous system. It is abundant in rodents, cold-acclimated, and hibernating animals. In other animals it is present in neonates and undergoes involution in the adults. Several xenobiotics target brown fat either directly or indirectly. A few examples include PPAR modulators (diabetes, atherosclerosis), adrenergic agonists and antagonists, and fat-soluble environmental chemicals such as DDT and PCBs.

Classically, at low magnification, two types of cell can be seen in brown adipose tissue. Many cells, and especially cells at the center of lobules, are eosinophilic due to cytoplasm packed with mitochondria. Other cells, and especially those at the periphery of lobules have a clear cytoplasm which is due to the presence of multiple vesicles containing lipid.

Background incidence generally accepted as being <0.1%. Reported incidence from 1977-1981 was 3 in 3200 (0.09%). Charles River Laboratory compiled data from 31 different carcass 1989-2002 and found no hibernomas. The tables below contain historical control data from MPI Research.
Recommended literature:


Please send your comments/questions to the whole LCPG list by hitting “reply to all”. A final document containing this material with answers and a brief discussion will be posted on the C. L. Davis website by the end of the current month (http://www.cldavis.org/lcpg_english.html).