Clinical Application of Computed Tomography for the Diagnosis of Feline Hepatic Lipidosis

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ABSTRACT. The usefulness of computed tomography (CT) for the diagnosis of feline hepatic lipidosis (FHL) was evaluated. Liver CT number was 54.7 ± 5.6 HU (mean ± SD) in 26 healthy cats. We fast 6 healthy cats for 72 hr to induced FHL experimentally and the cats were assessed by CT and serum biochemical analysis. Liver CT number of the six cats was 53.8 ± 3.0 HU before fasting, 46.8 ± 2.4 HU after fasting, and 50.2 ± 3.6 HU two weeks after restarted feeding. The decreased CT number was associated with the elevation of serum non-esterified fatty acid (NEFA) and β-hydroxybutyrate levels. These results indicate that measurement of CT number of the liver is an effective procedure for the diagnosis of FHL.

KEY WORDS: computed tomography, feline hepatic lipidosis.


Feline hepatic lipidosis (FHL) is a metabolic disorder caused by excessive accumulation of triglycerides in hepatocytes that ultimately impairs liver function. Though, global surveys of feline hepatobiliary diseases have not been done, it is generally agreed that FHL is the most common liver disease in cats [7]. Diagnosis of FHL is based on cytology or histopathologic evaluation of liver specimen [5]. Hepatic biopsy can be performed by percutaneous fine-needle aspiration (FNA), but it lacks histopathological information, and regarded as least accurate diagnostic procedure for liver diseases [3, 5]. In contrast, tissue biopsy with core needles, laparoscopy or laparotomy is more invasive and sometimes requires sedation or anesthesia. Moreover, histopathological estimation of fatty droplets accumulation in the hepatic tissue seems subjective.

Fat is relatively radiolucent, so that objects rich in fat component are described as lower attenuation by Computed Tomography (CT) [4]. CT has been applied for evaluation of various liver diseases in human, including diagnosis of fatty liver [6]. In this study, we investigated the usefulness of CT for the diagnosis of FHL.

Twenty-six clinical healthy cats and two cats with suspected lipidosis were investigated. Control cats were kept in our laboratory (n=6) or provided by the owner (n=20). These cats have normal plasma levels of alkaline phosphatase (ALP), alanine aminotransferase (ALT), aspartate aminotransferase (AST) and bilirubin. CT scan was performed with multislice helical CT (Siemens Somatom 2, Siemens, Munich, Germany) at 130 kV, 60 mAs, and 5 mm slice thickness without contrast enhancement. Sedation with medetomidine-HCl (Domitor, Meiji seika, Tokyo,Japan) was performed if necessary. A transverse section image of liver was obtained at just caudal to the xiphoid process. Area of liver parenchyma was selected manually from the image to avoid blood vessels and area of inhomogeneity. The mean CT number and the standard deviation of the area were calculated with computer assisted image analyzer and expressed in Hounsfield unit (HU).

CT number in control cats was 54.7 ± 5.6 HU (mean ± SD), ranged from 42.6 to 64.8 HU (Fig. 1) without significant difference between male and female cats (p=0.27, Student’s t-test). There were also no significant correlations between CT number and body weight or age (p=0.51, 0.21 respectively, Spearman rank correlation test). Then, we examined two clinical cases suspected with FHL (Fig. 1).
One cat had clinical signs including long-term anorexia, rapid weight loss (from 4.5 kg to 3.2 kg within a month). Hematologic exam revealed leukopenia (2,900/µl) elevated plasma activity of ALT (275 IU/l), AST (216 IU/l) and ALP (856 IU/l) levels, and bilirubinemia (1.6 mg/dl). Bone marrow aspiration was performed but no abnormality was found. Abdominal CT scan revealed low liver CT number (32.2 HU) compared with control cats. This cat recovered by nutritional support with antibiotics three weeks after the first inspection. The liver CT number was increased to 39.0 HU. The other cat also had similar clinical signs including long-term anorexia, rapid weight loss (from 8 kg to 3.8 kg within three months). Plasma ALP activity was slightly high (134 IU/l). However plasma ALT and bilirubin levels
were within normal range. Abdominal CT scan of this cat revealed marked adrenomegaly. Adrenal grand tumor was strongly suspected. Liver CT number of the cat was remarkably low (27.0 HU). The owner did not consent to further examination and treatment.

It has been reported that FHL can be induced by fast experimentally [1, 2]. Thus, we starved 6 clinical healthy cats for 72 hr and the cats were assessed by CT scan and plasma biochemistry. CT number of the six cats was 53.8 ± 3.0 HU (mean ± SD, ranged from 50.0 to 57.0 HU) before fasting, 46.8 ± 2.4 HU (ranged from 43.5 to 49.5 HU) after fasting for 72 hr, and 50.2 ± 3.6 HU (ranged from 46.0 to 54.9 HU) 2 weeks after restarted feeding (Fig. 2A). Serum non-esterified fatty acid (NEFA) and β-hydroxybutyrate levels were measured in commercial laboratory (Mitsubishi Kagaku Bio-Clinical Laboratories, Tokyo, Japan). These levels rose after fasting for 72 hr (Fig. 2B, C). Four cats with high serum β-hydroxybutyrate level (more than 300 µmol/l) had lower liver CT number after fasting (Fig. 2A, B). These results indicated that fat accumulation in the liver is detectable by CT scan. Cytology specimens of the liver could be obtained from four of the six cats after fasting. Accumulation of fatty droplets was observed in hepatocytes from all of the four cats (Fig. 3). There was no remarkable change in serum ALP, ALT, AST and total bilirubin levels during the period.

In this study, we determined reference range of CT number of clinical healthy cats as 54.7 ± 5.6 HU. Two clinical cases suspected with FHL showed lower CT number, below 35 HU. Decrement of CT number was observed after fasting for 72 hr in six clinical healthy cats. In conclusion, measurement of CT number of the liver is a non-invasive and effective procedure for the diagnosis of FHL and evaluating fat accumulation in liver.

REFERENCES