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Transcolonic scintigraphy for diagnosis of canine portosystemic shunts

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Abstract : Transcolonic scintigraphy using ^{99m}Technetium pertechnetate ($^{99m}TcO_4$) was performed in 5 dogs with portosystemic shunts. In all dogs, the activity in the heart was seen before liver activity. Also time activity curve was reversed. The mean shunt index in 5 dogs was 82.3% (range 79.6~87.1%). Transcolonic scintigraphy is quick, simple and useful diagnostic method for canine portosystemic shunts.

Key words : canine, portosystemic shunts, shunt index, $^{99m}TcO_4$.

Introduction

Portosystemic shunts occur as the consequence of an abnormal vascular connection between the portal venous system and the systemic circulation[1,2]. Congenital portal vascular anomalies have been reported in dogs and cats[3,4]. Acquired portosystemic anastomosis can occur secondary to chronic liver disease. Diagnosis of portosystemic shunts can sometimes be difficult because clinical signs are quite variable and nonspecific[5].

Several nuclear medicine imaging techniques have been used to diagnose portosystemic shunts in dogs and cats[1,6,7]. The use of per rectal technetium pertechnetate for the scintigraphic evaluation of portal blood flow has been described in dogs and cats. Technetium placed in the colon is absorbed across the colonic mucosa and enters the portal circulation. The dynamics of the rise in radioactivity in the liver and heart are monitored using a gamma camera[8,9]. In the normal dogs, the radioactivity reaches the liver prior to the heart. But in the dogs with portosystemic shunts, some radioactivity will reach the heart before or at the same time it reaches liver[1,3,5].

This paper describes the transcolonic image using $^{99m}TcO_4$ for diagnosis of portosystemic shunts in 5 dogs.

Materials and Methods

Transcolonic images were obtained in 5 dogs referred to the Veterinary Medical Teaching Hospital at Cornell University for evaluation of portosystemic shunts.

All dogs were evaluated by physical examination, serum biochemical analysis and nuclear transcolonic imaging.

Nuclear imaging : Dogs were imaged using a high reso-

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Table 1. Signalments and historical complaints in the dogs

Dog No.	Breed	Age	Sex	Complaints
1	Miniature-Dachshund	6Yrs	FS	vomiting, abnormal behavior, polydipsia/polyuria
2	Golden-Retriever	4mon	F	lack or weight gain, lethargy
3	German-Shepherd	2Yrs	M	vomiting, ptyalism, weight loss, behavioral change
4	Irish-Terrier	4mon	M	encephalopathic signs
5	Mixed	6mon	M	encephalopathic signs

FS : female spayed, M : male, F : female.

lution gamma camera (Siemens mobile LEM) with a 20% window and a setting of 140KeV. The gamma camera was connected to an Apple 8100 computer (Siemens ICON soft ware).

All dogs were positioned in right lateral recumbency. A soft rubber catheter was inserted into the descending colon. 10 to 20mCi of $^{99m}TcO_4$ was administered through the catheter. At the end of data collection, a summed image enables identification of the liver and heart. A region of interest was manually drawn around each area. Time activity curves were created by applying the region of interests to the dynamic images. Shunt index was calculated by dividing the summed counts in the heart by the summed counts in the heart and liver. A small external radioactive source was placed at the xiphoid to aid in identifying the liver.

Results

The signalments and historical complaints are summarized in Table 1. Three dogs had increased in serum alkaline phosphatase activity (range 142~305IU/L ; normal 12~122IU/L), also decreased in serum albumin (range 2.3~2.8g/dl ; normal 3~4.5g/dl). Two dogs had decreased in serum total protein (range 4.1~5g/dl ; normal 5.6~7.9g/dl).

In nuclear transcolonic image, radioisotope activity was detected in the liver prior to its detection in the heart(Fig 1)

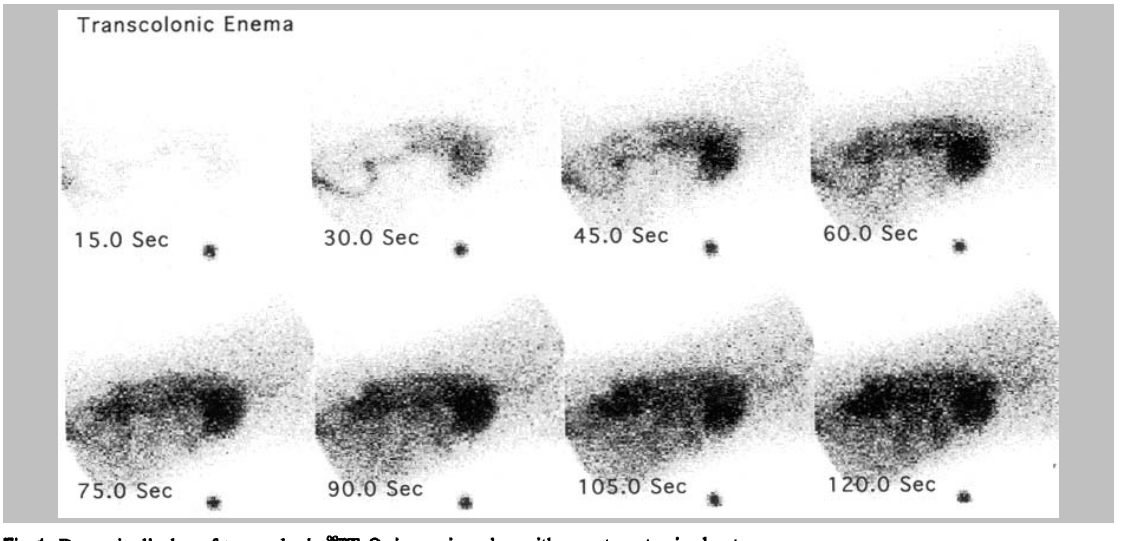

Fig 1. Dynamic display of transcolonic $^{99m}TcO_4$ image in a dog with a portosystemic shunts.

and time activity curve was reversed (Fig 2). The mean shunt index in 5 dogs was 82.3% (range 79.6~87.1%).

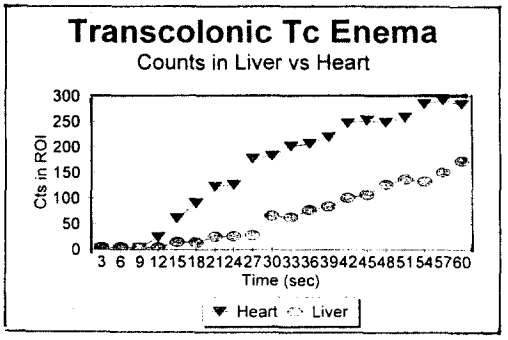

Fig 2. Time activity curves derived from a transcolonic scintigram performed on dog with portosystemic shunts.

Discussion

Congenital portosystemic shunts occur as single macroscopic vascular connections between the main portal vein or a portal tributary and the caudal vena cava or other systemic vein and may be subdivided anatomically into intrahepatic and extrahepatic forms[5]. These occur either as a result of the persistence of a fetal vessel. Acquired portosystemic shunts take the form of multiple small extrahepatic vessels. These develop secondary to portal hypertension and may be subdivided on the basis of their pathogenesis[5,10].

Routine serum chemistry test and a variety of enzymes of liver origin have been seen to lack both diagnostic sensitivity and specificity. In general, serum chemistry is not specific test for diagnosis of portosystemic shunts and is affected in a variety of diseases involving the liver[1,5].

Nowadays, the transcolonic scintigrpahy is very important and specific method for diagnosis of canine portosystemic shunts. At the beginning, transcolonic scintigraphy was used to study portal hemodynamics in human patients. The radionuclide is absorbed into the portal circulation and the portal blood flow monitored by a gamma camera[8,9,11]. Per rectal portal scintigraphy has been used in dogs and cats as an objective non-invasive technique to quantify an presurgical portosystemic shunt index. After surgery the technique has been used in dogs only to evaluate the success of the surgery and the need for further surgery[1,3].

$^{99m}TcO_4$ is the most commonly used radionuclide in veterinary nuclear medicine, because it has a short half life and has emission characteristics that are ideal for clinical imaging[7,9]. The $^{99m}TcO_4$ is rapidly absorbed through the colonic mucosa into the portal blood stream. It can be considered an inert radiopharmaceutical relative to the target organs of the liver and heart. The dynamics of the rise in radioactivity in the liver and heart are monitored using a gamma camera. In the normal dogs, the radioactivity reaches the liver before the heart. However, in the dogs with portosystemic shunts, radioactivity reaches the heart before or same time the liver[6,8]. In this study, the dynamic image showed that the radioactivity of heart was detected prior to heart. Two cases, a large shunt vessel was identified in transcolonic image.

Shunt index values in normal dogs are generally 5% to 15%[1,8]. Previous studies of dogs with congenital portosystemic shunts reported shunt index of 84%[1] and 78%[12]. In this study, mean shunt index was 82.3% and these results were similar to previous researches. The shunt index shows the degree of severity in portosystemic shunts.

Mesenteric portography, an operative procedure requiring general anesthesia and surgical catheterization of a mesenteric vein, is a definitive diagnostic method of portosystemic shunts[13]. But scintigraphy appears to offer a non-invasive method of diagnosis and is as specific as mesenteric portography for portosystemic shunts[1,14].

Conclusively, transcolonic scintigraphy is quick, simple and useful diagnostic method for canine portosystemic shunts.

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