The Experimental Study of Muscular Clearance Using Radioisotope

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Recently much attention has been paid to the peripheral circulation of patients under hypothermia and the microcirculation of patients with edema. In this study, the ratio of static muscular clearance to kinetic muscular clearance was investigated on normal dogs and dogs with ligation of femoral artery. Muscular clearance t½ of dogs with experimental head injuries was also measured with scintilltion counter.

Method: Using adult dogs, experimental cerebral compression and contusion were made by insertion of balloon into the subdural space and by insertion of blood (5.0 ml) into the intracerebrum. ^{131}I-Na 3μc was perpendicularly injected into gastrocnemius 1cm deep under nembutal anesthesia. Muscular clearance was measured with scintillation counter and recorder, and making the recorded curve into semi-logalithm table, t½ was calculated.

Result: In normal dogs, static muscular clearance t½ was average 4.6 minutes, and kinetic muscular clearance t½ was average 3.4 min. The ratio was 1.35. In dogs with ligation of femoral artery, the muscular clearance was prolonged immediately after ligation—static muscular clearance t½ was 7.6 min, and kinetic, 8.1 min. and the ratio was 0.94. But the muscular clearance recovered as time elapsed though the ratio was not beyond 1.0. In cases of cerebral contusion, muscular clearance showed almost the same time as normal, and 2 to 4 days after the operation, it was a little prolonged and after that became gradually normal. In cases of cerebral compression, remarkable difference in clearance time was not recognized.

Symposium I. Organ Scanning

Scanning Techniques and Pancreas Scanning

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A. Scanning Techniques

The factors to be considered for evaluating scan images are 1) detecting system, 2) display system and 3) choice of radioisotopes and their compounds.

1. Detecting system

(1) Detectors
- (a) Moving type
  - (i) Area scanning
  - (ii) Section scanning (Kuhl)
  - (iii) Cylindrical scanning (Kuhl)
- (b) Stationary type
  - (i) Scintillation camera (Anger)
  - (ii) Autofluoroscope (Bender)
  - (iii) Autofluorograph (Ter-Pogossian)
  - (iv) Gamma-ray camera (Kellershohn)

(2) Collimators
- (a) Types
  - (i) Cylindrical type
  - (ii) Tapered type
  - (iii) Honey comb type
- (b) Shielding
  - (i) High energy type
  - (ii) Medium energy type
  - (iii) Low energy type

While the moving-detector type scanner has an advantage of high resolution, the stationary type, such as a scintillation camera, requires very little time for scanning and enables to record serial variations of radioisotope distribution in organ with period of minutes.

2. Display system
- (a) Color scanning
  - (i) Color scanning (Mallard)
  - (ii) Multicolor printout (Hine)
  - (iii) Colored multiscintigram (Ozeki)
  - (iv) Color recording system (Kakehi)

(b) Tape recorder method
(c) Readout system
  (i) Rescan (Harris)
  (ii) Closed circuit TV system (Bender and Blau)
  (iii) Photocopying (Dewey)
  (iv) Digital computer analysis (Brown)

Color scanning makes it possible to express the information value with colors. Cut-off technique, photocopying, TV system or rescan method is the way to enhance contrast of original scan records.

3. Choice of radioisotopes and their compounds

The low-energy gamma emitters with short half lives are now being used. Short half life isotope gives less radiation to the patient and more information for scan records without increment of radiation. Low gamma-ray photons need little shielding and small crystals. Technitium-99m, Cesium-131, and Mercury-197 would be the choice of isotopes. Cesium-131 is now proved to be useful for detecting and visualizing myocardial infarctions.

B. Pancreas Scanning

Since 1962, the usefulness of radioisotope scanning with Selenomethionine-75 for the diagnosis of pancreatic disease have been investigated in our department. A total of 118 pancreatic scans were parformed on the 46 patients until the end of August in 1965. Visualization of the pancreas was obtained in 90% of the cases. In 5 patients, the pancreas was not visualized presumably because

Sixteen of 46 patients had pancreatic car-

Sixteen of 46 patients hd pancreatic carcinoma and 10 cases were proved to have a lesion by operation or autopsy. In our study, it was possible to visualize a tumor in the pancreas as small as 3 centimeters in diameter. Depression or deformity of pancreas due to extrapancreatic tumor was found in 2 cases. All 3 patients with chronic pancreatitis had normal scans.

Liver Scanning

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In 1951, Cassen and his associates and Mayneord et al, reported the method of Area Scanning technique and apparatus. Since that time, numerous reports on hepatic scanning have appeared. ^{131}I rose bengal, ^{131}I human serum albumin, colloidal ^{198}Au, ^{99}Mo and ^{99m}Tc have been used, and the scan image has been produced by either the imprint or the photoscan method.

These studies have shown that the hepatic scan is a useful method at the diagnosis of space occupying lesion, such as liver tumor, cyst and abscess.

This study has been performed by using colloidal ^{198}Au as a radioactive agent for hepatic scanning. Scans of liver tumors (61 cases) are examined and also the fundamental investigation has been performed.

This study indicates that a space occupying lesion centrally located in right lobe should be at least 3 cm. in diameter to be detected, and in left lobe must be at least 2 cm. in diameter to be detected. But we believe that, if liver scanning is performed at the same time using peritoneoscopy and liver function tests, our diagnostic accuracy must be high. Scans of livers affected with diffuse pathologic processes such as, chronic hepatitis and cirrhosis also frequently show characteristic abnormalities. Tow hundred and sixty seven cases of liver diseases are included in the series, and correlation of scan pattern and liver diseases is shown (Table 1). As one of characteristic abnormalities, splenic visualization is noted in the hepatic scans of patients with liver diseases, namely, in 20 of the 35 cases with chronic hepatitis and 32 of the 35 cirrhotic patients.

Liver biopsy demonstrates the correlation between the visualization of spleen in the hepatic scans and fibrosis in liver, but liver cell degeneration, cell infiltration and proliferation of Kupffer's cell. On experimental