

Diagnosis of Pancreatic Disease by Photoscanning^{1,2,3}

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INTRODUCTION

Blau and Manske substituted radioactive selenium-75 for sulfur in methionine and demonstrated that about 6 per cent of a dose of this compound could be demonstrated in the pancreas two hours after administration. The concentration of Se⁷⁵ selenomethionine under these conditions was 8 or 9 times that found in the liver (1). Recently Blau, Manske and Bender reported in an abstract (2) that they had developed a method of administration of this compound to humans that insured maximum concentration in the human pancreas satisfactory for scintillation scanning. We wish to report the application of this technique to humans with suspected pancreatic disease.

MATERIALS AND METHODS

Selection of Patients: Patients with diagnosed malignancy or those suspected of having pancreatic disease were referred to the Nuclear Medicine Unit for pancreas scan. Fifty-eight patients were studied. Thirty-seven of these patients had technically adequate scans and evidence allowing a firm diagnosis. Only this latter group has been subjected to analysis.

Performance of Scans: Scintiscans were performed using the technique of Blau, *et al* (2). Patients were prepared for testing by giving two glasses of milk and then nothing by mouth until the testing was completed. Two hours after the milk, 100 units of pancreozymin⁷ in 20 ml of saline was administered intravenously over 3 to 4 minutes. Se⁷⁵ selenomethionine⁸ in a dose of 3 μ c per kilo-

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²Supported in part by a grant from the United States Public Health Service, and the Nuclear Medicine Research Fund.

³Presented at the 10th annual meeting of the Society of Nuclear Medicine, Montreal, Canada, June 27, 1963.

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gram of body weight to a limit of 200 μc was given intravenously one hour after the pancreozymin. Thirty minutes following the injection, the patient was placed in a supine position under the photoscanner,¹ count rates were determined over the liver and the photoscanning device was set appropriately. The area from the top of the liver activity to the umbilicus was scanned. A delayed action scan was performed three hours later.

RESULTS

Illustrative Cases

Normal Pancreas: A liver scan with Colloidal Gold-198 is compared to a pancreas scan with Se^{75} selenomethionine in Figure 1A & 1B.

This patient had no pancreatic disease and the scans demonstrate a normal liver and good visualization of the head and body of the pancreas.

Pancreatic neoplasms: Figure 2A illustrates a pancreas scan interpreted as normal in a patient with a small (2 cm) islet cell carcinoma. The islet cell carcinoma was present on the medial border of the head of the pancreas and in retrospect there may be an indentation in this area.

Figure 2B contrasts this appearance with a markedly abnormal pancreas scan in a patient with an extensive pancreatic carcinoma. The absence of uptake of radioactivity in the patient with extensive pancreatic carcinoma is a fairly typical finding in large lesions and is probably due to the associated pancreatitis that occurs in this condition.

Pancreatitis: The pancreas scan of a patient with chronic pancreatitis is seen in Figure 3A. This patient's scan demonstrates the typical absence of uptake in the pancreas most often observed in this condition. Figure 3B also illustrates de-

¹Picker Magnascanner, Picker X-Ray Corporation, White Plains, New York.

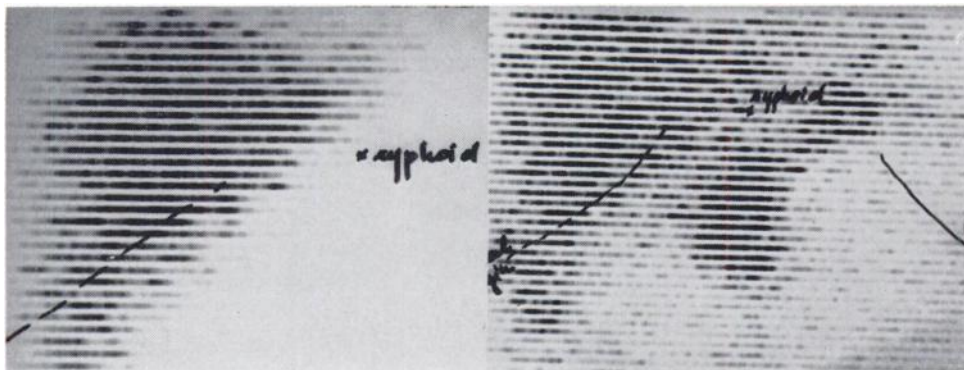


Fig. 1a

Fig. 1b

Figure 1. Normal Patients.

- A. Liver scan performed with Colloidal gold-198 in a patient with a normal liver and pancreas.
- B. Normal Se^{75} selenomethionine pancreas scan in the same patient outlining the liver and the pancreas which are clearly separated by a clear zone.

TABLE I
CLINICAL CORRELATION OF PANCREAS SCANS

<i>Diagnosis</i>	<i>Normal</i>	<i>Abnormal</i>	<i>Equivocal</i>
Normal Pancreas	12	1	2
Pancreatic Neoplasm	1	7	3
Pancreatitis	1	8	2

creased concentration of radioactivity in the pancreatic area with a large "cold" area in the region of the head of the pancreas. At operation, this patient had a large 18 cm pseudocyst of the pancreas and chronic pancreatitis.

Clinical Correlation: For purposes of determination of the accuracy of the test in correlation with the clinical diagnosis, the patients were roughly divided into three categories: normal pancreas, pancreatitis and pancreatic or peripancreatic neoplasm. The results of this analysis are seen in Table I.

A *normal pancreas* was found at exploratory celiotomy in fifteen patients. The pancreas scans were interpreted as normal in twelve of the fifteen and a patchy decrease in uptake was noted in two patients. In one instance, interpretation of the photoscan was not possible because of hepatomegaly.

Pancreatic or peripancreatic neoplasms were diagnosed in eleven patients. Exploratory celiotomy was carried out in seven of these with histologic confirmation of the diagnosis in six. Four patients with a highly probable clinical diagnosis of pancreatic carcinoma were not explored due to their poor condition and expired after leaving the hospital without postmortem examination. Eight of these eleven patients had pancreatic carcinoma. Pancreas scan was

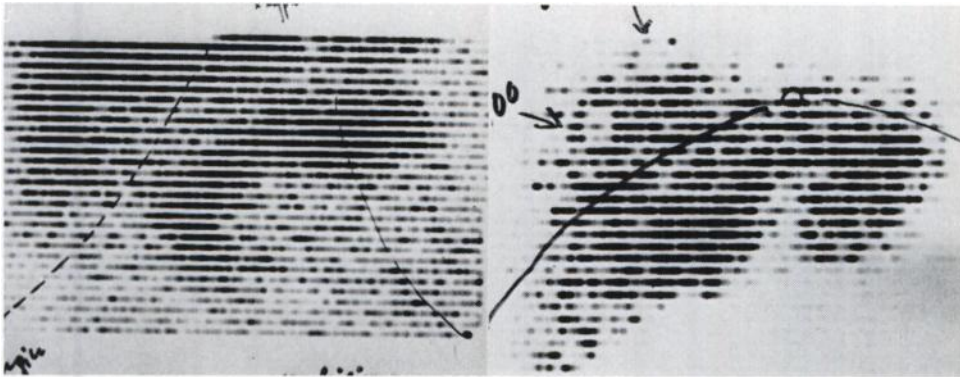


Fig. 2a

Fig. 2b

Figure 2: Pancreatic Neoplasms.

- A. Pancreas scan interpreted as normal in a patient that proved to have a 2 x 2 cm islet cell carcinoma along the medial border of the uncinate process. In retrospect an indentation is faintly discernable in this area.
- B. Absence of concentration of Se^{75} selenomethionine in the region of the pancreas in a patient with an extensive pancreatic carcinoma. Note the prominent notch between the right and left lobe. This may have been due to the large mass of tumor producing separation of the two lobes.

abnormal in seven of these patients and an equivocal defect was seen in the eighth patient. Two patients had carcinoma of the ampulla of Vater. The scans in both patients were felt to show equivocal decrease in uptake. In one patient with an islet cell carcinoma, the scan was felt to be normal.

The diagnosis of chronic pancreatitis was made in eleven patients. Exploration was carried out in nine of these cases with biopsy of the pancreas in eight of them. The remaining two patients had typical pain, pancreatic calcification and measured steatorrhea. In eight patients decreased or absent concentration of selenomethionine was found. One patient had a normal scan and in two cases the scans were equivocal because of an enlarged liver. Pseudocysts appeared as "cold" areas in four of these patients.

DISCUSSION

As a result of this experience we feel that photoscans of the pancreas performed with Se^{75} selenomethionine are a useful addition to the available diagnostic procedures for pancreatic disease. However, certain limitations have been encountered in this series of patients which are expected to limit the diagnostic accuracy of the procedure in the diagnosis of pancreatic neoplasms. For example, it is expected that normal variations in the size and shape of the pancreas and in the concentration of radioactivity will probably mean that small lesions or lesions located at the very periphery of the organ will be missed. Also the concentration of radioactivity in the liver may obscure the pancreas outline if there is enlargement or downward displacement of the liver. In addition, the long physical half-life of Se^{75} should provoke caution in terms of radiation ex-

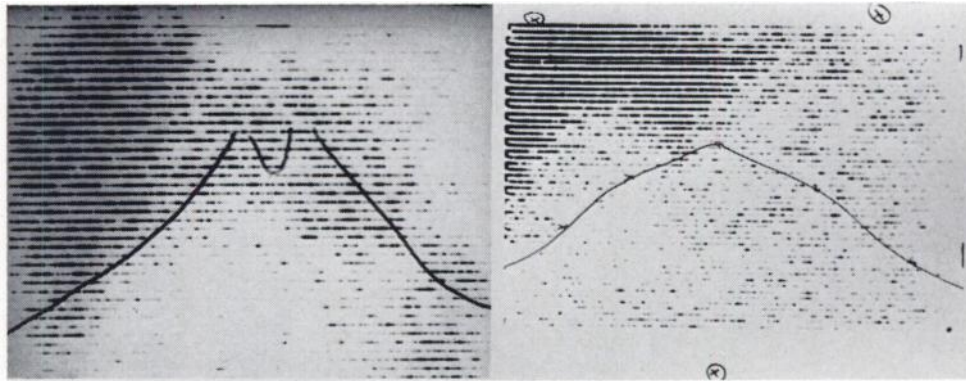


Fig. 3a

Fig. 3b

Figure 3: Pancreatitis.

- A. Typical loss of Se^{75} selenomethionine concentration in the pancreatic area in a patient with chronic pancreatitis. Note the increased activity in the left upper quadrant which is thought to be in the intestinal tract.
- B. The large "cold" area in the right upper quadrant proved to be an 18 cm pancreatic pseudocyst in a patient with chronic pancreatitis. Again note activity in the intestinal tract. There often is increased activity in the intestine when pancreatic uptake is poor.

posure to the patients. The total body radiation dose to the patient has been estimated to be about 0.6 rad (4).

In spite of these limitations we find the pancreas photoscan with Se^{75} selenomethionine a useful adjunct in the evaluation of patients with diseases of the pancreas and biliary tree, and in excluding pancreatic involvement in patients with metastatic neoplasm (3). The test has been helpful in detecting abnormality in patients with pancreatitis and may find its greatest clinical usefulness in this condition.

It is hoped that refinement in this technique or development of other pancreatic localizing agents will permit a more precise evaluation of this organ. In the meantime this technique offers a simple method of visualizing the pancreas without an operative procedure.

SUMMARY AND CONCLUSION

The results of pancreas photoscans performed with Se^{75} selenomethionine in 37 patients have been reviewed in an attempt to establish the reliability and usefulness of the test in the diagnosis of pancreatic disease. The pancreas was well visualized in 12 out of 15 normal patients. In eight of eleven patients with pancreatitis and in seven of eleven patients with pancreatic or peripancreatic carcinoma, abnormalities consisting of diffuse decrease in concentration or local reduction in uptake were observed. The procedure proved useful in evaluating patients suspected of having pancreatic carcinoma and in the diagnosis of pancreatitis. It was also useful in excluding pancreatic abnormality in patients with metastatic neoplasm, although it seems likely that small lesions that are peripherally placed could be missed by this technique.

Certain difficulties with interpretation, brought about by variations in the normal size, shape and concentrating ability of the pancreas and interference from radioactivity in the liver were encountered and are expected to limit the diagnostic accuracy of the procedure. In spite of its limitations at the present time, the technique offers a simple method for visualizing the pancreas without an operation and deserves further application.

ACKNOWLEDGMENTS

We wish to thank Ray W. Dielman, R.T. for technical assistance and Dr. William H. Beierwaltes for helpful advice and criticism.

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