Pancreatic scanning

Many attempts have been made to visualize accurately the human pancreas. The most recent has been the introduction by Blau and Bender¹ in 1962 of ⁷⁵Se selenomethionine to scan the pancreas. This technique is at present the only method for direct demonstration of pancreatic morphology short of laparotomy.

Insulin contains zinc and ⁶⁵Zn has good physical characteristics as a biological tracer, but pancreatic uptake is not sufficiently specific for adequate visualization. The marked uptake of amino acids by the pancreas is well known, that of cystine and methionine being quite high. This concentration of amino acids is related, of course, to the vigorous synthesis of pancreatic enzymes. Unfortunately none of the constituent elements of the amino acids—hydrogen, oxygen, nitrogen, and sulphur—have isotopes with radiation emissions and physical half-lives that are suitable for external counting procedures. As long ago as 1942 Tarver and Schmidt² reported the marked affinity of the pancreas for ³⁵S-methionine; but ³⁵S emits beta rays only and penetration of beta rays in tissues is not sufficient to permit external scanning. Because of the chemical similarity between sulphur and selenium, Blau³ was able to prepare ⁷⁵Se selenomethionine by yeast biosynthesis, the yeast being grown on a low sulphur medium containing inorganic ⁷⁵Se (a gamma-emitting isotope of selenium). He subsequently showed that selenomethionine had the same properties as methionine and was incorporated intact into the pancreatic juice proteins without prior metabolic change⁴.

Techniques for performing pancreatic scans have varied but remain, in general, comparable: 3 μ Ci/kg. body weight of the isotope is administered intravenously and surface scanning is commenced between half to one hour later. The conventional antero-posterior scan takes about 40 minutes to complete. The isotope is concentrated by both the pancreas and the liver, hence it is essential to follow the selenomethionine scan with a ¹⁹⁸Au colloid gold scan (which outlines the liver but not the pancreas). Most discussion has been over the pre-scan preparation of the subject. Initially Blau and Bender¹ proposed a rather complicated régime involving a special diet and injections of Cecikin (Vitrum) and propantheline bromide, the object being both to improve the synthesis of pancreatic enzymes and retain these in the gland sufficiently long for the scan to be completed. Rodríguez-Antúnez⁵ used morphine to delay further pancreatic emptying. Recent experience suggests that no special preparation is required, the subject being scanned after a normal breakfast.^{6,7}

A variety of scanning machines is available. Best results would seem to be obtained with a large (5in.) crystal and a broad focus collimator. It is an advantage to record the scintillations both in black and white on photosensitive paper (the photoscan) and as a coloured outline (the scintiscan). ⁷⁵Selenium has a 120-day physical half-life and an effective half-life in man of 56 days. The total body radiation dose is 1.3 r⁸. This is within the acceptable range for diagnostic procedures.

Visualization of the pancreas is usually satisfactory; a review of the published series suggests that about 75% of scans are readable. Having stated this it is essential to make the point that interpretation is not always easy and requires much experience. Great attention, while scanning, to certain technical aspects is also necessary. Failure to visualize the pancreas may be because of an overlying liver, but in a number of apparently normal subjects the gland fails to take up the isotope for reasons which are unknown at present^{7,9}.

It is to be expected that most attention has been focused on the early diagnosis of pancreatic tumours which show as filling defects on the scan. A number of reports stress, however, the high incidence of false-positives: 'cold spots' in a normal pancreas.^{6,8} This suggests that insufficient is known about the features of the normal pancreatic scan. Information is now becoming available on the variations in normal pancreatic morphology as reflected in the selenomethionine scan. In contrast to the impression given in standard textbooks of anatomy the position of the pancreas varies in the upper abdomen. The gland may be in a horizontal or high transverse position and the

shape may be either sigmoid or horseshoe. Furthermore there is normally an area of reduced uptake in the neck of the gland which corresponds anatomically to the thinnest portion of the organ. Isotope activity in the bowel is seldom a problem, but there is a constant area contiguous with the lower border of the gland which may represent uptake by the wall of the upper jejunum. The pancreatic scan is constant and reproducible^{7,8}.

Despite the paucity of information about normal variations in pancreatic scans, patterns of abnormality are beginning to emerge: filling defects with pancreatic neoplasms, diffuse reduction in uptake when pancreatitis is present, retroperitoneal lesions in the upper abdomen which displace or distort the pancreatic outline. We have seen increased concentration of selenomethionine in an islet-cell tumour associated with the Zollinger-Ellison syndrome.⁷

Clearly more experience is needed before a final assessment can be made of the value of pancreatic scanning. The technique is frequently of limited value in patients with obstructive jaundice because an enlarged liver precludes accurate interpretation. It remains to be seen whether scanning will make the early diagnosis of pancreatic carcinoma a reality; the resolving power of the presently available scanners is about 3 cm. but lesions may have to be larger to be recognized. The method could prove to be valuable in making a retrospective diagnosis of pancreatitis when serum enzymes have returned to normal; but we need to understand why the occasional normal gland fails to show up on scanning. Techniques and machines can be improved, the cost of the procedure (at present about £10 a scan) must be reduced, and more objective methods, such as surface counting, are required for recording pancreatic uptake. This type of study lends itself to computer analysis.

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