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PRELIMINARY NOTE

The Use of Intravenous Amino Acids in the Visualization of the Pancreas With Seleno 75 Methionine

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In roentgenographic studies, the state of, and often even the position of, the pancreas must be inferred from indirect evidence. The development of ^{75}Se Selenomethionine by Blau, Manske and Bender was, therefore, a major step forward in the clinical study of this organ. Their procedure (1) as well as that of Burke and Goldstein (2) involves the use, as a secretory stimulent, of Cecekin, made abroad. At present it is available solely for limited experimental purposes. Haynie, *et al* (3) used Pancreozymin (Boots).

Sodee has made use of freshly prepared, fat-free veal as part of a meal, taken in a carefully timed sequence, for the same purpose (4). Rodriques-Antunez (5) has recently proposed the use of morphine to aid retention of the tagged enzymes formed within the organ. This possibility reactivated our lagging interest. We soon found that the meal he proposed, in combination with the morphine, frequently produced nausea and vomiting, even when the drug was reduced to 1/6 grain. The state of the vomitus indicated that stomach digestion was lacking. The use of sugar seemed of questionable advisability in such ill diabetic patients.

Since the obvious need was the addition of a carefully timed and quantitated amount of a digested protein to the blood, we began to use Aminosol (Abbott Laboratories) in a very slow intravenous infusion. This is a sterile 5 per cent solution of a blood fibrin hydrolysate, and is widely used for intravenous feeding following surgery.[2] No reactions have been observed at administration rates far above those contemplated here.

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[2]Assuming an administration of 100 cc, this represents 0.4 gm of Lysine, 0.05 of Tryptophan, 0.1 of each Methionine and Phenylalanine, 0.6 of Leucine, 0.2 of Isoleucine, 0.16 of Valine, 0.3 of Arginine, 0.2 of Glycine, 0.3 of Cysteine, and about 0.7 gm of other free amino acids, and 0.2 gm. of Tripeptides.

In order to avoid the problem of nausea, we have recently turned to the analagous synthetic Probanthine (Searle). Scans seem to be of equal quality, and concentration is excellent. No single instance of nausea has been observed with this combination of agents.

Our procedure is now standardized as follows:

(1) Within one hour of the start of the procedure, the fasting patient is given 15 mg Probantaine or 1/6 grain morphine intramuscularily. He may also have a cup of tea or black coffee.

(2) At the isotope laboratory, 250 μC of Selenomethionine is given intravenously. During the next 10-15 minutes the Aminosol infusion into a hand or arm vein is arranged. A *very slow* drip is started. If the rate of the drip is too fast, there is simply unfavorable dilution with inactive methionine. The optimal amount during the first half hour, during which the first scan is carried out, seems to be about 50 cc; more than a total of 100 cc is never used. Oldenorff and Kitano (6) observed that selenomethionine activity disappeared from the circulation rapidly and reappeared after 60-90 minutes, presumably as protein. Using counts over the head area during scanning, we found a much smaller variation in blood activity, *i e* of the order of 10-15 percent of the total.

(3) We intentionally avoid previous administration of other isotopes for preliminary liver scanning. This simply makes the problem more difficult by introducing added background. The ^{75}Se liver scan is amply sharp, under our conditions, to clearly indicate the shape and position of that organ. We simply mark with adhesive tape, the positions of the sternal notch, the costal margin, and when feasible, the area of abdominal distress.

(4) Scanning is started some 10-15 minutes after the beginning of the drip, with the first line about 2-2½ inches below the normal pancreas position, *i e* 2-3 inches below the tip of the rib cage. (In about half of the cases, the position of the head of the pancreas can be spotted as a "hot area" using the "howler" sound pitch.) Scanning is continued upward with a 0.5 to 0.6 cm spacing, a CRD of 40-50, a density of 50-75, and a speed of 28 cm/min, until the full width of the liver has been passed, and narrowing starts.

The problem is the visualization of a small organ lying along the edge of a much larger one. Hence the narrower the area of high count rate, the better the separation from the liver which normally lies anteriorily to the pancreas. In three phantom studies we showed that with the count rates secured, *(i e* 1500-2500), this may be achieved using a 3 inch crystal, and a hexagonal 19 hole collimator focusing at 4-4½ inches, but still giving essentially the same count rate at a depth of 7½ inches.

(5) The selection of the point for setting the light tube voltage is critical, and made difficult by the fact that both the pancreas and the liver continue to accumulate activity during the scan. The scan, to have good readability, must not consist of continuous dark lines, except over the liver. We have learned from experience that for our scanner (Picker Magnascanner) a relatively low voltage (850 vs 950-1000 for other organs), set with the count rate at 1200-

1500/min, is optimal. Attempts to decrease density by smaller light openings have decreased readibility. In all probability, the dose can be decreased without significantly affecting the scan quality. Because of high background, a second "dose" is not practical.

(6) At the conclusion of this first scan, and while the film record is being developed, we carefully use the same collimator and make a series of static counts, taking readings from the rate meter (time constant 1 to 5 sec). Obviously, the majority of counts are used to quantitate activity in all portions of the area of the dot scan which appear to constitute the pancreas. There are corresponding counts in what appear to be cooler areas on either side on the pancreas. The same technique is used to accurately indicate the beginnings of the more heavily labeled liver (Fig. A). Such counts, being static, and free from contrast enhancement, have a high degree of statistical accuracy, and permit the drawing of outlines of the two organs for comparison with the photo scan. Being all made in a 5 minute (or less) period, they are free from concentration gradients, and thus entirely comparable. If, as sometimes happens, the photoscan is too dark (or too light) such "back up" data is invaluable. The Aminosol drip is then discontinued.

The patient is given a cup of hot Sanka and a second scan is made (7). This provides an opportunity to optimize scanner contrast and settings. Normally the second scan is similar to, but somewhat darker than the first, and usually suggests a slight increase in size.

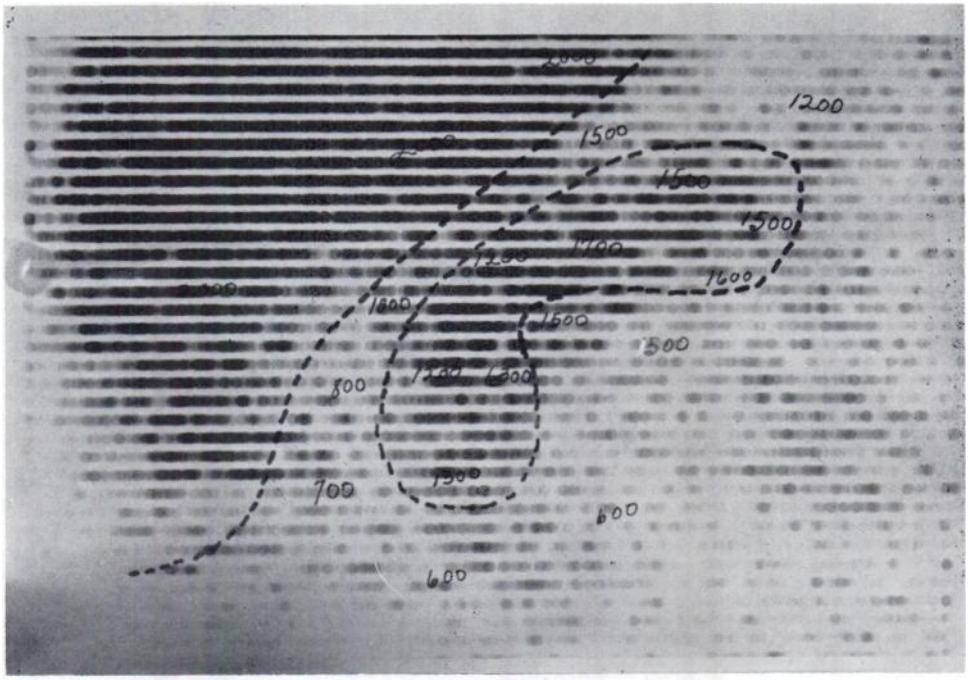

Fig. A

(7) Such data soon demonstrated that using the intravenous amino acid technique of supplying the building blocks for enzyme formation, maximum activity in the organ is secured in 30-45 minutes. Subsequent changes involve primarily increase in, or redistribution of, background, particularly in the intestines. That this can, in the inactive supine individual, become a major source of error is easily seen in scans with no pancreatic activity. Loops of intestine have been clearly visualized. This has led, in recent cases, to having the patient move about, and the giving of a warm liquid meal before the third and final scan. Indications to date are that the induced peristalsis helps remove such activity from the pancreatic surroundings, while the morphine-probanthine holds the pancreatic activity virtually unchanged Fig. B.

(8) Polaroid copies, set to increase or decrease contrast, are made of all pertinent scans. This has helped greatly.

Since the adoption of this intravenous stimulation technique, somewhat more than 25 scans have been carried out. In a limited number, the head was sharply seen, but the tail of the pancreas, as others have found, merged into the liver opacity. In this series, one proven cyst, one proven carcinoma, and at least two cases of severe pancreatitis without visualization, were found. There were three others with faulty or partial visualization, and in two of these, malfunction was confirmed by the triolein-oleic acid procedure. All these cases were correctly "diagnosed" on the basis of the scans secured.

Three cases originally done by the Rodriquez procedure have been repeated with the above technique. The diagnostic value of the repeat scans was remarkably better.

We are most optimistic that this simplified procedure which uses only readily available materials, allows much better control of biochemical conditions, and

Fig. B

provides numerical data in addition to dot and photoscans, will make use of pancreatic studies much more practical and clinically useful for the average isotope laboratory.

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Preliminary Notes

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