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Ultrasonic Demonstration of Small Pancreatic Islet Cell Tumors

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Abstract: In three patients real-time sonography successfully localized small pancreatic islet cell tumors measuring 7, 8, and 17 mm in size. Ultrasound is suggested as the initial radiologic examination for localization of endocrine pancreatic tumors. If ultrasound is negative or equivocal, computerized tomography, arteriography, and pancreatic venous sampling are indicated. **Indexing Words:** Pancreas · Insulinoma · Ultrasound

Insulin-producing tumors of the pancreas (islet cell tumors, insulinomas) are as a rule small adenomas 0.5–3.0 cm in size;[14] they are equally distributed throughout the head, body, and tail of the gland.[19] Surgical therapy is intricate,[11,19,21] particularly in occult, nonpalpable tumors.[3,6,19] As much as 15–30% of patients may require reinterventions.[1,19] Lethality associated with pancreatic surgery for insulinomas is reported to be as high as 6.5%.[11] Therefore once the diagnosis of insulinoma is clinically established (fasting hypoglycemia with an inappropriately elevated plasma insulin level), with few exceptions the majority of authors advocate preoperative tumor localization as an indispensable procedure.[2] Computerized tomography, angiography, and transhepatic pancreatic venous sampling have already proved to be of significant value. We present the ultrasonographic findings in three patients with a small pancreatic islet cell tumor.

SUBJECTS AND METHODS

Three patients (three women 58, 47, and 60 yr of age) with the clinical diagnosis of hypoglycemia and organic hyperinsulinemia were studied ultrasonographically. Ultrasound study was performed on an automatic 3.5-MHz mechanical real-time scanner and integrated static B-scanner (RA-1, Siemens). Patients were scanned in a supine, semierect position after a fasting period of at least 14 hr. When necessary, the pancreatic tail was scanned with the technique described by Jacobson et al[10] using the fluid-filled stomach as an acoustic window. All insulinomas were surgically confirmed.

RESULTS

Ultrasound successfully localized all three pancreatic islet cell tumors. In two patients the islet cell tumor was correctly identified in the head of the pancreas. One tumor was spherical in shape and well defined, 8 mm in diameter, and deeply embedded in the highly reflective pancreatic tissue (Fig 1). The sonographic texture was similar to that of surrounding vessels. Localization of this small tumor situated between the portal vein and the vena cava was therefore much facilitated by using real-time sonography.

The second islet cell tumor correctly identified in the pancreatic head was located in the uncinate process and was 17 mm in size. It was ellipsoid in shape and well demarcated against the surrounding pancreatic tissue and the adjacent splenic-portal confluence and the vena cava. The tumor exhibited a uniform low-level echo pattern, being much less echogenic than the pancreas and retroperitoneal fat planes.

In the third patient, the islet cell tumor was detected in the body of the pancreas (Fig 2). The spherical tumor was 7 mm in diameter and had clearly definable borders. Its echo pattern resembled that of both insulinomas described above.

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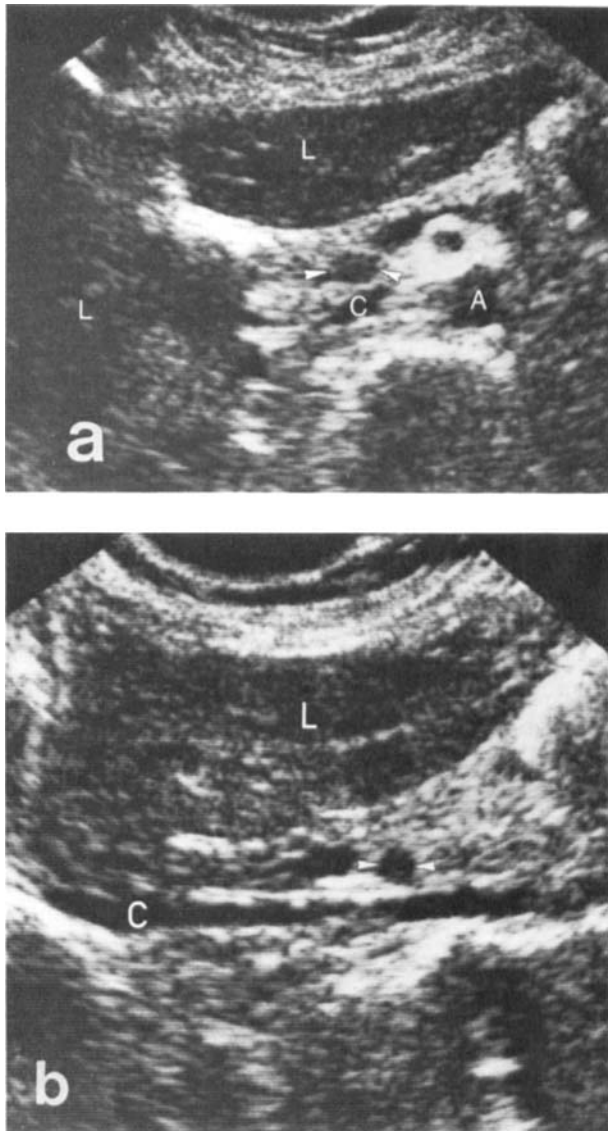

FIGURE 1. **a:** Cross section of the pancreas demonstrating an 8-mm insulinoma (arrows) in the upper portion of the pancreatic head. C: vena cava. L: liver. A: aorta. **b:** Corresponding longitudinal section of the pancreatic head. The insulinoma (arrows) is embedded in the pancreatic parenchyma caudally to the portal vein and ventrally to the vena cava (C). L: liver.

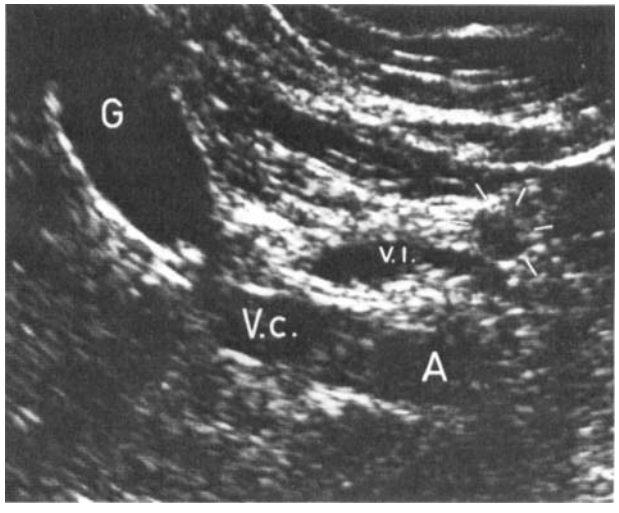

FIGURE 2. Cross section of the pancreas showing a 7-mm insulinoma in the body of the pancreas (arrows). VC: vena cava. A: aorta. VL: lienal vein. G: gallbladder.

At surgical exploration all three insulinomas were found by bidigital palpation and removed by simple local enucleation, thus effecting the cure.

DISCUSSION

Surgical therapy for insulin-producing tumors has been complicated by the fact that the neoplasms are usually small and difficult to find, particularly in occult, nonpalpable tumors. Successful preoperative localization of insulinomas facilitates surgical resection, reduces operative times, and obviates the need for blind partial or subtotal pancreatectomy.[6]

The success rate of angiographic localization varies between 38 and 91%.[21] With refined techniques including selective angiography of pancreatic vessels, magnification and subtraction technique, a tumor as small as 0.5 cm may be demonstrated.[19]

Selective transhepatic venous sampling for localization of endocrine active tumors is most specific, though highly invasive and time-consuming.[3,9,17] In inpalpable insulinomas, pancreatic venous sampling may offer little additional help to find surgically and locally excise the tumor, but it may roughly indicate the segment of pancreas to be blindly resected.[3]

With computerized tomography in selected cases, tumors as small as 1 cm in diameter or less have been identified by us.[8] Dunnick and associates[4] were successful in only 6 of 14 insulinomas. Daggett and associates[2] and van Heerden et al[21] correctly identified only one of seven islet cell tumors. Contrast enhancement was found to be a reliable criterion in small insulinomas.[8]

Gray-scale sonography has been shown to be of significant value for the detection of pancreatic tumors.[16] Due to refinements in instrumentation and novel scanning techniques, the head and body of the normal pancreas can be demonstrated in nearly 90%.[7,13] Using the fluid-filled stomach as an acoustic window, visualization of the pancreatic tail has been improved up to nearly 70%.[12] Using modern gray-scale equipment, pancreatic carcinomas as small as 2 cm in diameter that do not alter the size or contour of the pancreas can be identified by virtue of their altered echo pattern alone.[20]

Islet cell tumors are even more difficult to detect, since they are usually only 1–2 cm in size. Among the few investigators, Egli and associates[5] were the first to report ultrasonic demonstration of a 1.8-cm insulinoma in a 12-yr-old boy. Otto and associates[14] correctly visualized a 1.5-cm insulinoma in the head of the pancreas. Sarti and Sample[18] detected a 1.5-cm insulinoma in the uncinate process. Dunnick and associates[4] were successful in 3 of 12 surgically proven islet cell tumors measuring more than 5 cm in size. Daggett and associates[4] correctly identified 2 of 11 islet cell tumors, the smallest tumor being 1.8 cm in diameter.

As we could demonstrate, ultrasound may detect islet cell tumors even less than 1 cm in size. The reliability of the method, however, remains to be proven. Sonographic visualization of small islet cell tumors located in the head and body of the pancreas is much facilitated by the surrounding vascular anatomy. Due to overlying bowel gas, identification of a small insulinoma located in the pancreatic tail is more difficult, if not impossible.

In localization of pancreatic tumors, in our experience real-time sonography proved superior to conventional articulated-arm compound scanners. The principal advantage of real time is its independence of body and respiratory movement and the greater flexibility and ease with which the region of interest may be located and defined.

Once the diagnosis of organic hyperinsulinism is clinically established, we suggest ultrasound as the initial radiologic examination. If ultrasound is negative or equivocal, the next procedure should be computerized tomography. Computerized tomography is superior to ultrasound in its ability to image the pancreatic tail and is complementary to ultrasound in detecting liver metastases and retroperitoneal lymphomas, thus demonstrating the possible malignant potential of the tumor. Negative computerized tomography is followed by arteriography. In problem cases, selective transhepatic portal and pancreatic venous sampling may be indicated.

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