



Occult Insulinoma on the Cranial Surface of Pancreatic Body: Essential Role of Coronal MR Imaging

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Insulinomas are the most common islet cell tumor of the pancreas. They are usually small at clinical presentation and the diagnosis is mainly based on clinical and laboratory findings. Tumor localization may require several modalities, including ultrasonography, computed tomography (CT), magnetic resonance (MR) imaging, and angiography. We report a case of insulinoma at the cranial surface of the pancreas, which was not identified on axial but only on coronal MR imaging. The importance of coronal imaging in detecting such small pancreatic tumors is emphasized.

Key words: insulinoma, MR imaging, pancreas

INTRODUCTION

Insulinomas, first recognized by Whipple in the 1930s¹, are the most common hyperfunctioning islet cell tumor of the pancreas that can be surgically cured. Most insulinomas tend to be small at initial imaging with 90% less than 2 cm and 50% less than 1.3 cm in diameter². Their occurrence is distributed evenly throughout the entire pancreas³. Precise localization of an underlying insulinoma is crucial but often difficult. Insulinomas are usually characterized by their tendency to be significantly enhanced by contrast-enhanced helical CT and dynamic MR imaging⁴. Most reported studies of insulinomas on CT and MR imaging have included only axial views⁵. We present a case of a small insulinoma on the cranial surface of the pancreatic body, which could only be identified by coronal contrast enhanced MR imaging.

CASE REPORT

A 48-year-old male experienced nonspecific symptoms and tiredness, more evident in the morning, for 2 years. The patient had no relevant medical or surgical condition.

Received: April 18, 2007; Revised: May 18, 2007; Accepted: June 14, 2007

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Physical examination revealed little. However, a series of laboratory examinations revealed a fasting hypoglycemia (39 mg/dl) and a serum insulin level of 20.4 mU/ml.

As the clinical presentation suggested the presence of insulinoma, dual phase single helical CT was performed using a Siemens Somatom Plus 4 scanner (Siemens Medical Systems, Germany). The arterial phase was commenced at 30 seconds and the portal venous phase at 70 seconds after intravenous contrast administration. Each phase was acquired in one breath-hold with 5 mm collimation and 1.5 pitch. Images were reconstructed at 5 mm increments. There was no abnormal finding on the CT images, so MR imaging was performed for further evaluation. MR imaging was performed with a 1.5-T whole body scanner (Magnetom Vision Plus; Siemens Medical Systems, Germany). On the axial non-enhanced and contrast-enhanced biphasic MR images, the pancreas looked normal until coronal sections were made. There was a 1 cm well-defined homogeneous nodule on the cranial surface of the pancreatic body showing low signal intensity on coronal T1-weighted images and mild high signal intensity on coronal T2-weighted images, in contrast to normal pancreas (Fig. 1a-b). Dynamic contrast-enhanced coronal study was performed with fat-saturation following bolus intravenous injection of 0.1 mmol gadolinium per kilogram of body weight. Images were acquired in arterial phase (30 seconds), portal venous phase (70 seconds) and equilibrium phase (180 seconds). The nodule was hyperintense on arterial phase images (Fig. 1c) and isointense on portal venous and equilibrium phases. We reviewed the axial CT and MR images and found that the

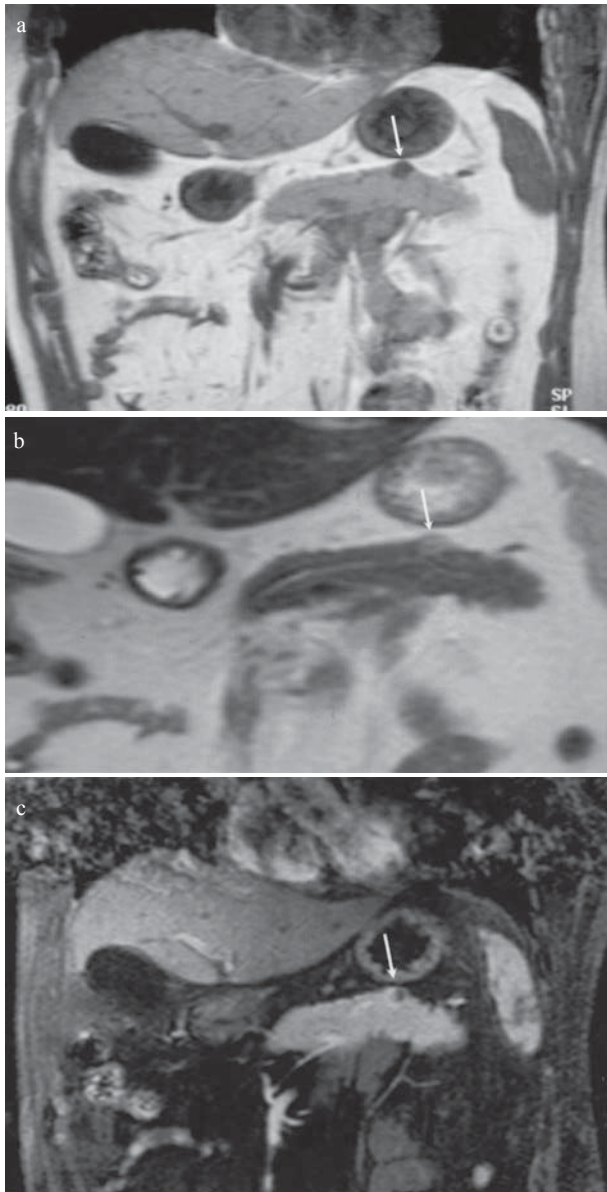


Fig. 1 Coronal MR images demonstrated a small tumor (arrows) on the cranial surface of the pancreatic body. The lesion was hypointense on T1-weighted image (a), hyperintense on T2-weighted image (b), and hyperintense on arterial-phase fat-saturated T1-weighted image (c).

tumor, which was of similar density to liver, had been overlooked as part of the normal pancreas (Fig. 2).

With the clear identification of tumor location, the patient underwent successful surgical enucleation. The histopathological finding was consistent with insulinoma. After surgery, his insulin level returned to normal (0.1 mU/ml) and the patient recovered with an uneventful five-year follow-up.

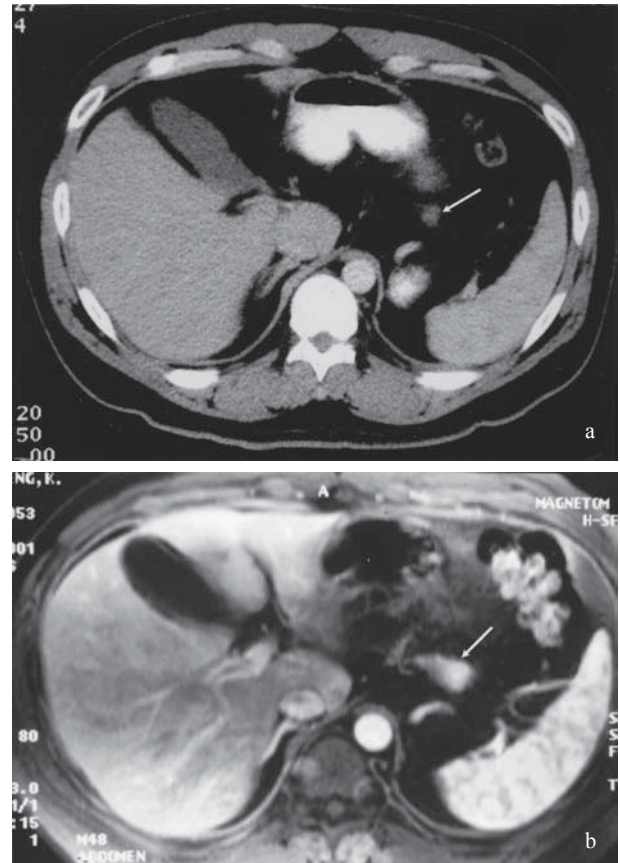


Fig. 2 The tumor (arrows) was missed as partial volume of normal pancreas on axial images, including arterial-phase CT (a) and arterial-phase fat-saturated T1-weighted MR image (b).

DISCUSSION

Insulinomas are diagnosed clinically by Whipple's triad, including the three conditions: symptomatic hypoglycemia (lower than 50 mg/dl), low serum glucose at the time of the symptoms, and relief of symptoms when the serum glucose is raised to normal. Although 90% of these tumors are benign, they are still potentially fatal due to the risk of lethal hypoglycemia. Preoperative localization of an insulinoma is crucial to significantly reduce the operation time⁶, but is challenging since these tumors are usually small (< 2 cm) at presentation.

Selective angiography or venous sampling was the invasive radiographic method to delineate insulinomas before the development of helical CT. Axial conventional CT frequently fails to detect these small lesions because of long scanning time and lack of arterial phase images. With

more advanced helical CT, several articles have emphasized that the arterial phase images can detect early and intense enhancement of the hypervascular tumors and improve the tumor detection rate⁷. In the study of Suzuki et al., the sensitivity of enhanced arterial-phase helical CT imaging was 85.7%⁸. Another comparative study of state-of-the-art imaging modalities for insulinoma detection showed that the sensitivity of fat saturation T1-weighted contrast-enhanced biphasic MR imaging was equivalent to that of biphasic helical CT⁹. Insulinomas often have a markedly longer relaxation time than most pancreatic adenocarcinomas and normal pancreas, resulting in greater conspicuousness on T1-weighted and T2-weighted images¹⁰.

In our case, the tumor measured about 1 cm in diameter, which is not too small to be detected on CT, and the difficulty of tumor detection mainly resulted from its location. When the tumor is situated on the cranial surface of the pancreatic body, the tumor and normal pancreatic tissue may not be physically scanned into the same axial image. In this particular circumstance, the axial scan would transect the tumor and peri-pancreatic fat, rather than the tumor and normal pancreatic tissue. Thus, the tumor can be overlooked as part of the volume of the pancreas and not be able to be visualized on axial CT or MR imaging, even on an axial dynamic study. In contrast, coronal images showed the tumor and normal pancreas simultaneously, which resulted in good tissue contrast for comparison. Thus, minimizing motion artifacts and maximizing tissue contrast between the tumor and normal pancreatic parenchyma are the keys to detection of these small tumors.

In conclusion, we strongly recommend that coronal MR imaging is essential to localize insulinomas, especially when no remarkable finding is identified on axial imaging.

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