Intraoperative ultrasonography for insulinoma: a preliminary experience

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Background: A majority of insulinomas are benign and intrapancreatic. Because surgery is curative in 90% of cases, and almost 60% are not detected by preoperative imaging studies, precise intraoperative localization is essential. Recently, the use of high-resolution real-time ultrasonography has facilitated intraoperative detection. Methods: Intraoperative ultrasonography using a high-frequency probe was performed in four patients with biochemically proven insulinomas. Results: Ultrasonography helped to localize the insulinomas, and also helped in surgical decision-making by accurately documenting the relationship of the tumor to vital structures. Conclusion: Besides its ability to find islet cell tumors, intraoperative ultrasonography also affects surgical decision-making. [Indian J Gastroenterol 1997; 16: 58-59]

Key words: Pancreas tumor

With the availability of newer biochemical assays, endocrine tumors of the pancreas can be detected quite early. However, their preoperative localization is difficult even with the newer imaging techniques.

Insulinomas are the most common endocrine tumor of the pancreas: a majority are benign, solitary, and potentially curable. They are difficult to localize because of their small size. Blind resection of the pancreas with its high morbidity fails to achieve cure in many cases. Wide use of intraoperative ultrasonography (IOUS) in the last decade in developed countries shows promising results in localization and successful management of insulinomas.

Methods

Intraoperative ultrasonography was used in four patients with insulinoma diagnosed by fasting hypoglycemia and inappropriate elevation of serum insulin levels (radioimmunoassay: BARC, Mumbai). Preoperative ultrasonography was positive in one patient while CT scan, done in three cases, failed to detect the tumor.

All operations were performed by one surgeon. The abdomen was opened by a bucket-handle incision. The head of the pancreas was mobilized by extended Kocherization of the duodenum; the body and tail were exposed by entering the lesser sac and dividing the peritoneum along the superior and inferior borders of the pancreas and mobilizing the spleen when necessary. Systematic digital palpation of the entire pancreas was performed.

Real-time IOUS was performed using a 10 MHz sectoral transducer (Ultrasound 4L, USA) which was inserted into a long, sterile sleeve containing gel at the distal tip. The abdominal cavity was filled with warm saline to provide additional acoustic coupling. In the latter two cases, we placed the probe directly on the surface of the pancreas as peritoneal fluid is a good acoustic medium. The pancreas was scanned from the head across the body to the tail, visualizing it in a longitudinal (sagittal) plane. The radiologist was ignorant of palpation findings.

Results

Four insulinomas (proven histologically) were removed from these four patients. All tumors were intrapancreatic and their mean diameters ranged from 1.0 cm to 1.5 cm. The tumors were palpable intraoperatively in three patients. At IOUS, they were observed in all the four patients as discrete hypoechoic lesions well demarcated from the surrounding pancreatic tissue. In one patient, IOUS picked up a second lesion thought to be an adenoma. This was included in the distal pancreatectomy specimen, but could not be proved as insulinoma at histology.

IOUS also showed the anatomic relation of the pancreatic duct and vessels to the adenoma and thus helped to decide the type of operation performed (Table).

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Fig: Operative sonogram of patient 4 showing relationship of adenoma (large, solid arrow) to portal vein (curved, solid arrow) and inferior vena cava (open arrow)

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Table: Surgical impact of Intraoperative ultrasoundography

<table>
<thead>
<tr>
<th>No</th>
<th>Preoperative imaging</th>
<th>Palpatory findings</th>
<th>IOUS findings</th>
<th>Surgical procedure</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>US: +ve CT: -ve</td>
<td>Tumor in mid body</td>
<td>1.5 cm adenoma in mid body overlapping pancreatic duct</td>
<td>Enucleation</td>
<td>Cured at 4 years</td>
</tr>
<tr>
<td>2</td>
<td>US, CT, MRI: -ve</td>
<td>No tumor palpable</td>
<td>1.5 cm adenoma in mid body away from pancreatic duct</td>
<td>Enucleation</td>
<td>Cured at 4 years</td>
</tr>
<tr>
<td>3</td>
<td>US, CT -ve</td>
<td>Tumor in tail</td>
<td>1.1 cm adenoma in body close to pancreatic duct</td>
<td>Distal pancreatectomy</td>
<td>Cured at 1.5 years</td>
</tr>
<tr>
<td>4</td>
<td>US: -ve</td>
<td>Tumor in uncinate process</td>
<td>1.4 cm adenoma in uncinate process away from pancreatic duct and vessels</td>
<td>Enucleation</td>
<td>Postoperative death due to sepsis</td>
</tr>
</tbody>
</table>

US: ultrasoundography, CT: computerized tomography, MRI: magnetic resonance imaging

Discussion

Accurate localization of insulinoma is desirable to facilitate surgical resection and to obviate blind partial pancreatectomy. The success rate of angiographic localization ranges from 20%-90%. Success rates as high as 97% have been reported by using selective portal venous sampling. The reported success rate of CT scan ranges from 50%-80%. With the greater versatility and resolution now available with real-time sonography, better results are being reported, with detection rates of 60%. Thus, despite use of these techniques, failure to resect tumor because of inability to localize it before operation or at laparotomy still occurs in 20%-60% of patients. Better localization techniques may help detect these small and potentially curable neoplasms.

Lanc and Coupland first reported imaging of an insulinoma intraoperatively using high-resolution B-mode IOUS. Norton et al. imaged an insulinoma by IOUS that had neither been imaged preoperatively nor palpated intraoperatively. This modality has since become an important adjunct to surgical exploration, and in some cases is the most sensitive. Norton et al. found that IOUS is more sensitive in operative detection of insulinoma than palpation, detecting lesions as small as 0.7 cm. IOUS does have false-negative and false-positive results. It may fail to localize tumors in extrapancreatic locations and in the pancreatic tail. It may also pick up sonolucent mass lesions in the head of the pancreas which are normal lymph nodes.

Even though an insulinoma may have been localized by preoperative imaging studies, finding the tumor during operation is critical to ensure a successful outcome. IOUS can provide such information that is not available from palpation. The ability to display the exact relationship of the tumor to the pancreatic and common bile ducts and vessels is also important since it helps in deciding the nature of surgical procedure to be performed. Further, precise delineation may decrease the risk of postoperative pancreatic fistulas due to injury to the main pancreatic duct.

Close cooperation between the surgeon and the radiologist maximizes the potential of IOUS. Our observation that IOUS helps an experienced surgeon to find some non-palpable insulinomas and provides additional valuable information about its anatomic relationship strongly supports the use of IOUS during surgery for insulinoma.

References


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