Usefulness of endoscopic ultrasound to diagnose the severity of chronic pancreatitis

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Introduction

It is well known that chronic pancreatitis (CP) can lead to poor patient outcome. Traditionally, endoscopic retrograde pancreatography (ERP) and pancreatic function tests (e.g., secretin stimulating test) have been considered gold standards for the diagnosis of CP. However, by the time abnormalities are detected with these conventional tests, CP may already be at an advanced stage. Therefore, there is a need to better diagnose and assess the severity of CP at an early stage in order to provide appropriate treatment.

Several investigators have reported the use of endoscopic ultrasonography (EUS) for the diagnosis of CP, and EUS is now considered the most sensitive imaging modality for this purpose because of its ability to place the transducer in close proximity to the pancreas. EUS has a very low risk of complications and can detect abnormalities suggestive of CP in the pancreatic parenchyma and ductal system, which are not visible by any other imaging modality. Many investigators have compared the EUS findings with the other modalities (ERP or noninvasive pancreatic function tests) to evaluate the diagnostic value of CP. However, by the time abnormalities are detected with these conventional tests, CP may already be at an advanced stage. Therefore, there is a need to better diagnose and assess the severity of CP at an early stage in order to provide appropriate treatment.

Several investigators have reported the use of endoscopic ultrasonography (EUS) for the diagnosis of CP, and EUS is now considered the most sensitive imaging modality for this purpose because of its ability to place the transducer in close proximity to the pancreas. EUS has a very low risk of complications and can detect abnormalities suggestive of CP in the pancreatic parenchyma and ductal system, which are not visible by any other imaging modality. Many investigators have compared the EUS findings with the other modalities (ERP or noninvasive pancreatic function tests) to evaluate the diagnostic value of CP. The results of these studies suggest that the ductal and parenchymal abnormalities detected by EUS correlate with the presence of CP. Moreover, EUS findings have also been shown to correlate with histology. Because of the high sensitivity of EUS to detect subtle abnormalities undetectable by other modalities, EUS is expected to be able to diagnose early stage CP for improving the prognosis of patients with CP.

Normal pancreas on EUS

For EUS diagnosis of CP, understanding of the normal image is important. Normal pancreas shows a homogeneous, finely reticular pattern in the parenchyma, no
dilated ducts, and a nonhyperechoic ductal margin without side-branch ectasia (Fig. 1). Understanding of images from the normal pancreas is fundamental for diagnosis of CP.

### EUS features of CP and its diagnosis

Up until now, several EUS criteria for diagnosis of CP were advocated. Traditional EUS criteria for CP include hyperechoic foci, hyperechoic strands, parenchymal lobularity, irregular pancreatic duct margins, hyperechoic pancreatic duct margins, visible pancreatic side branches, pancreatic duct dilation, shadowing calcifications, and cysts (Table 1). Each EUS criterion was classified according to two categories, parenchymal changes or ductal changes. In particular, the three parenchymal changes on EUS (hyperechoic foci, hyperechoic strands, and parenchymal lobularity; Fig. 2a–c) cannot be detected as well by other current modalities; therefore, these features are considered important for diagnosis of early CP.

EUS is able to evaluate the severity of CP depending on the number of criteria present with high sensitivity and specificity. Opinion varies among researchers; however, the presence of CP is diagnosed when EUS reveals at least 2–3 of the above features, and disease severity is classified as mild (2 or 3 to 4 features), moderate (5 to 6 features), or severe (more than 7 features), by comparison with endoscopic retrograde cholangiopancreatography findings, considered the gold standard. We also studied the number of EUS criteria required to diagnose CP of each level of severity as determined by ERP (ERP grading with the Cambridge classification was used as the gold standard for diagnosis of CP) using the above-mentioned EUS features. Sixty-seven patients who underwent both ERP and EUS for not only CP but also for various other pancreatobiliary diseases were studied. Among the subjects, 28 (42%) were classified by ERP as normal, 5 (8%) as equivocal, 11 (16%) as having mild CP, 14 (21%) as having moderate CP, and 9 (13%) as having severe CP. As expected, diagnostic certainty was approximately 80% for “greater than or equal to equivocal” when more than three EUS criteria were present. The severity of CP was likely mild when 3–4 features were obtained, moderate when five to six criteria were obtained, and severe when more than seven criteria were present.

Some investigators have also reported that EUS criteria correlated with histological abnormality. Espe-