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IN THE EXPERT'S FOCUS

Features of Chronic Pancreatitis and Associated Masses: A Focus on Endosonography ☆

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Abstract
EUS is highly accurate in the diagnosis of chronic pancreatitis. Pancreatic calcifications or five or more endosonographic criteria are consistent with chronic pancreatitis. Less than three criteria essentially rules out chronic pancreatitis. Three or four criteria are the best overall cutoffs. The number of criteria is used to estimate the *likelihood* of pancreatitis (i.e. low/medium/high), and is not recommended to stage the *severity* (i.e. mild/moderate/severe) of disease. Obtaining histology by FNA is not recommended in all patients with chronic pancreatitis changes. EUS is useful in distinguishing inflammatory from malignant masses in the pancreas. FNA is often not required as the EUS appearance of inflammatory changes alone or bulkiness without any perceptible mass has good negative predictive value. In indeterminate masses, FNA for cytology is recommended. Follow-up imaging after one to two months can be performed to catch the rare EUS false-negatives, and confirm resolution or stability of inflammatory masses.

Video related to this article

Video related to this article can be found online at http://dx.doi.org/10.1016/j.vjgien.2014.07.001.

1. Background

- EUS is highly accurate in diagnosing chronic pancreatitis
- There are nine standard diagnostic criteria:
  - Four parenchymal criteria: hyperechoic foci, hyperechoic strands, hypoechoic lobules, and cysts
  - Five ductal criteria: dilatation, dilated side branches, main duct irregularity, hyperechoic duct margins, and stones

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Calcifications or ductal stones are very specific for chronic pancreatitis, and is considered diagnostic for
- chronic pancreatitis.
- Pancreatic calcifications, or five or more endosonographic criteria is consistent with chronic pancreatitis. Less than three criteria essentially rules out chronic pancreatitis. Three or four criteria are the best overall cutoffs.
- The EUS features of a normal pancreas will be demonstrated, followed by the features of chronic pancreatitis.

2. Materials

- Linear and Radial Echoendoscope (UCT180; Olympus America, Center Valley, PA).

3. Endoscopic procedure

- Upper gastrointestinal tract EUS performed with examination of the pancreas, as previously described [1].

4. Tips and tricks

- The whole pancreas must be examined when chronic pancreatitis is suspected. This is to exclude conditions that can mimic chronic pancreatitis, such as main duct intraductal papillary mucinous neoplasms, identify potential causes and complications of chronic pancreatitis (such as cancer, pseudocysts, main duct stones) and identify potential interventions (e.g. distal pancreatectomy for severe chronic pancreatitis sparing the head of pancreas).
- The examination can be performed with either a linear and radial scope.
- Each feature of chronic pancreatitis, apart from calcifications, can be seen in the normal pancreas. The diagnostic probability of chronic pancreatitis increases with each additional feature, with three to four criteria being the best overall cutoffs for disease.
- A high index of suspicion is required for pancreatic cancer, however distinguishing a neoplastic from inflammatory mass can be challenging. Fine needle aspiration should be performed of any concerning lesion, ideally with inroom cytology to confirm diagnostic sufficiency of aspirated tissue.

5. Discussion

5.1. Normal pancreas

The normal pancreas appears as a homogeneous structure with a single anechoic smooth duct running within. The body and tail have a fine diffusely speckled ("salt and pepper") pattern. A small amount of fine diffuse heterogeneity is normal, as can small echogenic foci or short echogenic strands when a high degree of magnification is used. The gland contour is generally smooth but some margin lobularity can occur. The dorsal pancreas is generally more echogenic than the embryological ventral pancreas (the ventral anlage). The transition zone between the darker ventral anlage (head) to the brighter dorsal pancreas (uncinate, body/tail) is seen in approximately 50% of cases on EUS. The pancreatic head is generally more heterogeneous than the body and tail. The duct wall is barely perceptible, with similar echotexture to surrounding pancreatic tissue. Small side-branches can be seen in the normal pancreas, and should only be considered abnormal when larger than 1 mm. The course of the main pancreatic duct can be mildly tortuous, but beading with alternating duct size is abnormal. The duct normally tapers from the head to the tail, with 3 mm, 2 mm, and 1 mm being average duct sizes in the head, body and tail, respectively. In patients over 60 years old, an additional 1 mm for the main duct in each section is generally allowed due to expected gland atrophy.

5.2. Features of chronic pancreatitis

EUS uses parenchymal and ductal criteria to make a diagnosis of chronic pancreatitis. There are 9 accepted criteria, including four parenchymal (hyperechoic foci, hyperechoic strands, hypoechoic lobules, and cysts) and five ductal features (dilatation, dilated side branches, main duct irregularity, hyperechoic duct margins, and stones) (Table 1). Calcifications or ductal stones are very specific for chronic pancreatitis, and is considered diagnostic. EUS is a very sensitive test for calcifications or stones. In patients without calcifications, the number of endosonographic criteria (out of the remaining 8) is critical. Three or four criteria are the best overall cutoffs. Less than three criteria essentially rules out chronic pancreatitis, and five or more criteria are highly suggestive of chronic pancreatitis [2,3]. It should be noted that each EUS feature of chronic pancreatitis can be seen in a normal pancreas, and may be more common in the elderly and in people who smoke, drink alcohol regularly, or are obese. Other features such as gland atrophy and diffuse echogenicity have also been described on EUS, which are not part of the standard scoring system. The Rosemont classification system is another grading system [4], which divides EUS features of chronic pancreatitis into major and minor criteria (Table 1). It has not been fully validated and has similar interobserver agreement as the standard classification system [5]. The standard classification system will be used for this video demonstration.

The EUS criteria thresholds and ranges have been well validated to assess for the *probability* of disease, but not to stage the severity of disease. The severity of pancreatitis can be graded using the ERCP Cambridge classification system of severity of pancreatitis (Table 2) [6], which uses the features of stones, strictures, and duct and sidebranch dilation. These features can also be seen on EUS and as such, EUS can anticipate the ERCP Cambridge severity class. However, there is little correlation between the *probability*