Application of 2D Shear Wave Elastography with Aplio i800 EUS to GIST and Early Chronic Pancreatitis

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Introduction

Recently, clinical interest to tissue stiffness assessment using Shear Wave Elastography (SWE) has emerged. Chronic pancreatitis, particularly early chronic pancreatitis, presents minimal morphological changes, making diagnosis that is based solely on morphologic findings of EUS prone to inconsistencies. SWE supports parenchymal fibrosis with quantitative analysis of local stiffness in the pancreas. In gastric GISTs, stiffness assessment may serve as an adjunctive modality for differential diagnosis and malignancy risk stratification; however, it is generally considered challenging due to their anatomical conditions and measurement stability. In this report, Shear Wave Elastography (SWE) was performed using the Aplio i800 EUS and the GF-UCT260 Linear Echoendoscope in two cases: Case 1: A case of gastric GIST in which stiffness was measured within the tumor, Case 2: A case suspected of early chronic pancreatitis in which pancreatic parenchymal stiffness was measured. We discuss the validity and feasibility of SWE measurements based on these cases.

Case Presentation

Case 1. A 70-year-old male underwent endoscopic ultrasound (EUS) for surveillance of a pancreatic cyst. Incidentally, a 28 mm × 23 mm hypoechoic submucosal tumor was detected on the lesser curvature of the mid-body of the stomach. The tumor was contiguous to the fourth layer.

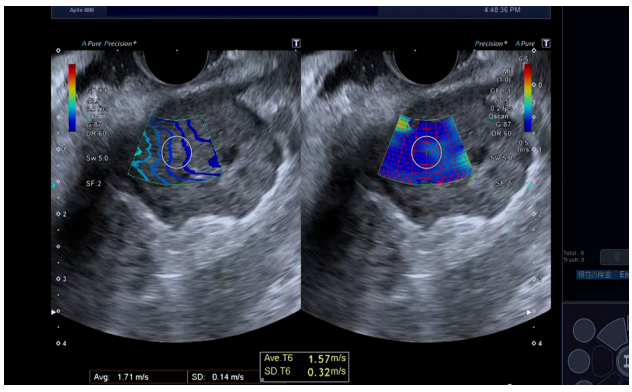

Figure 1: median shear wave velocity

Although SWE assessment is generally considered difficult for gastric submucosal tumors, it was feasible in this case. Measurements were obtained from multipleregions of interest (ROIs) in the tumor, and differences in SWE values according to ROI location were also demonstrated. In this case, the median shear wave velocity was 1.38 m/s, with a standard deviation (SD) was 0.28 m/s (Figure 1).

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The propagation map displayed the contour lines as parallel, supporting the validity and reliability of the measurement. The SD value was used as an indicator of reliability, and the measurement was considered valid under the condition of SD ≤ 0.3 (Figure 2).

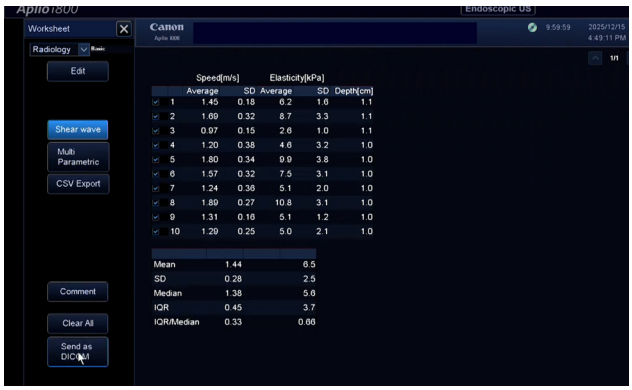

Figure 2: SD value

Case 2. An 80-year-old male with high risk of familial pancreatic cancer underwent EUS for surveillance of pancreatic cancer. His father and brother had pancreatic cancer. EUS revealed hyperechoic strands, lobularity, and a hyperechoic margin of the main pancreatic duct, suggesting early chronic pancreatitis. In this case, early chronic pancreatitis was suspected due to a high-risk background of a family history of pancreatic cancer in his father and brother. I present the SWE findings obtained prior to definitive diagnosis and discuss their significance and limitations in early diagnosis and follow-up. In this case of early chronic pancreatitis, tissue stiffness was assessed using SWE, with the ROI size set at 1 mm in diameter. As a criterion for measurement reliability, an SD < 0.3 was adopted, and the pancreatic parenchyma stiffness was evaluated using results meeting this condition. The mean stiffness value measured by SWE exceeded 1.8 m/s, suggesting a stiffer pancreatic parenchyma compared with the normal pancreas (Figure 3).

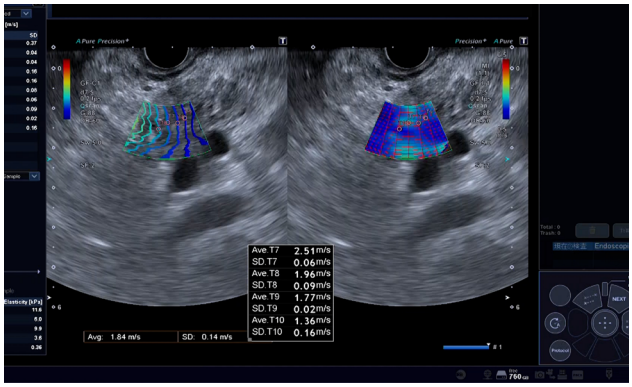

Figure 3: Mean stiffness value measured by SWE

Discussion

Key points

I measured the stiffness of a gastric submucosal tumor and early chronic pancreatitis using 2D-SWE. In both cases, the propagation map displayed contour lines that were parallel, with SD values below 0.3, findings that support the validity and reliability of the measurements. Although shear wave propagation via SWE can be challenging in tumors with internal heterogeneity, it is noteworthy that stiffness measurement, even of the gastric submucosal tumor, was successfully performed using SWE.

Explanation

In the differential diagnosis of gastric submucosal tumors, previous reports have indicated that a high stiffness value suggests the possibility of a gastrointestinal stromal tumor (GIST). Quantitative measurement of tumor stiffness using SWE is therefore expected to facilitate the differential diagnosis between GIST and other submucosal tumors. While the diagnosis of chronic pancreatitis has traditionally been based on subjective assessment of B-mode imaging findings, the quantitative evaluation of pancreatic stiffness now enables an objective diagnosis. Furthermore, this technology may allow quantitative assessment of the degree of pancreatic fibrosis, which cannot be evaluated using conventional B-mode imaging alone.

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Features of new technology

In 2D-SWE, the propagation map is a display mode showing the position of shear waves at specific time intervals. It visualizes that in soft tissues the lines are closer together (indicating slower velocity), whereas in hard tissues the lines are farther apart (indicating faster velocity). Compared with point-SWE, the propagation map facilitates the determination of a reliable measurement ROI, resulting in more stable measurement values.

Tips and Limitations

It is important to place the measurement ROI in an area with a high-quality B-mode image showing no structures or artifacts, minimal distortion in the propagation map, and uniform color display in both the elasticity map and dispersion map.

The presence of the pancreatic duct, blood vessels, or heterogeneous tissue may cause disturbances in the propagation map, making measurement difficult.

Conclusion

Shear wave elastography measurements were performed using 2D-SWE to assess the stiffness of gastric submucosal tumors and early chronic pancreatitis. Propagation maps facilitated reliable, high-precision stiffness measurements. Because 2D-SWE allowed measurement of intratumoral stiffness, which was difficult to obtain with conventional SWE, quantitative evaluation may enable differential diagnosis of neoplastic lesions. Furthermore, it is expected that this approach will enable quantitative measurement of the degree of pancreatic fibrosis.

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