

## String sign: Can we make it more scientific?

Dear Editor,

We read with great interest the study by Hakim *et al.*, regarding the interobserver variability of string sign of pancreatic cysts among experienced endosonographers.<sup>[1]</sup>

We agree with authors that string sign is a useful and reliable test that can be used to improve the diagnostic accuracy of other pancreatic cyst fluid studies when used in combination.

The study showed that while a good interrater agreement among different experienced endosonographers in assessing its positivity, was observed; a disagreement on the minimum length of the string sign to be considered positive and poor interrater agreement with marked interobserver variability (>5 mm) in the measured length of the formed string, was noticed also.

Therefore, the authors concluded that a positive string sign should be interpreted with caution and not used as a single test but in combination with other tests to differentiate mucinous from nonmucinous cysts.

String sign is inherently a subjective test and lacks a theoretical framework for predicting the viscoelastic nature of the fluid, which can be objectively characterized by the viscous and elastic response of a fluid under deformation (rheological behavior).

In order to overcome the subjective nature of the string sign, we developed a new rheological assay in which (using a rheometer) a wide array of viscoelastic properties (rheological curves) can be generated and recorded.

In our study,<sup>[2]</sup> we found that the cutoff value of pancreatic cyst fluid viscosity,  $\eta_c$ , can serve as an independent marker to distinguish between mucinous and non-mucinous cysts. It was found that  $\eta_c > 1.3$  cP characterizes mucinous cysts, whereas  $\eta_c < 1.3$  cP is typical for non-mucinous cysts. Moreover, we could

differentiate between three distinct flow curves of the rheological behavior of pancreatic cyst fluids according to dynamic viscoelastic properties. Types I and II hypothesized to correlate with non-mucinous cysts, and type III with mucinous cysts [Figure 1]. This simple and rapid diagnostic tool can be immediately implemented after EUS-FNA sampling, and provides for a low variability rate compared to the commonly used, subjective string sign technique. Although the findings are promising, they must be further confirmed in a large-scale study.

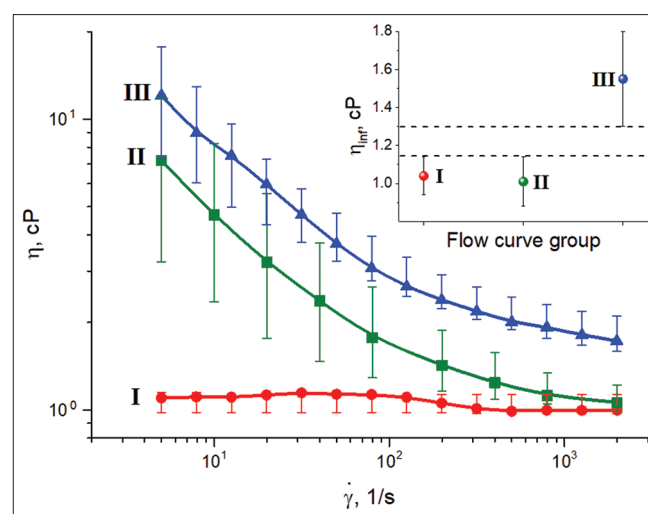
In conclusion, the string sign as it is currently performed, suffers from significant shortcoming due to its subjective nature. Rheological properties (“scientific” string sign), instead, can overcome the disadvantages of the standard string sign and replace it in clinical practice.

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Nil.

### *Conflicts of interest*

There are no conflicts of interest.



**Figure 1.** Representative types I, II and III flow curves. The graph inset shows the values of infinite viscosity,  $\eta_c$ , depicting the difference between the minimal value of type III and the maximum value of types I and II

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