Algorithm to rule out clinically significant portal hypertension combining Shear-wave elastography of liver and spleen: a prospective multicentre study

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Algorithm to rule-out clinically significant portal hypertension combining Shear-wave elastography of liver and spleen: a prospective multi-center study

Christian Jansen¹, Christopher Bogs*², Wim Verlinden², Maja Thiele³, Philipp Möller¹, Jan Görtzen¹, Jennifer Lehmann¹, Michael Praktiknjö¹, Johannes Chang¹, Aleksander Krag³, Christian P. Strassburg¹, Sven Francque²+, Jonel Trebicka¹³*

¹Department of Internal Medicine I, University of Bonn, Germany.
²Department of Gastroenterology and Hepatology, University Hospital Antwerp, Belgium.
³Department of Gastroenterology and Hepatology, Odense University Hospital, Odense, Denmark.

* and + contributed equally to this work.

Correspondence to: Prof. Jonel Trebicka, MD, PhD. Department of Internal Medicine I, University of Bonn, Sigmund-Freud Str. 25, D-53105 Bonn, Germany. jonel.trebicka@ukb.uni-bonn.de, Tel: +49 228 287 15507, Fax: +49 228 287 15768

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Abbreviations:
OV: oesophageal varices, HVPG: hepatic venous pressure gradient, CSPH: clinically significant portal hypertension, TE: transient elastography, SWE: Shear-wave elastography, L-SWE: liver SWE, S-SWE: spleen SWE, MELD: model for end-stage liver disease

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Recently, the UK guidelines on variceal bleeding \(^1\) and other reports have introduced the role of elastography for the diagnosis of oesophageal varices (OV) \(^2, 3\). Development of OV is likely when the hepatic venous pressure gradient (HVPG) is higher than 10 mmHg, which defines clinically significant portal hypertension (CSPH). Baveno VI implemented transient elastography (TE) as a tool to rule-in CSPH in viral etiologies and to rule-out varices (need of screening endoscopy for varices) \(^4\). Furthermore, CSPH has a strong prognostic value in cirrhotic patients.

Recent studies introduced Shear-wave elastography of the liver (L-SWE) as a promising tool to diagnose portal hypertension. These studies find good diagnostic accuracy of L-SWE with specificity and sensitivity ranging around 80% and superior to TE. However, in more than 30% of the patients CSPH could not be ruled-in or ruled-out, since their SWE-values were between the cut-offs.

This prospective multi-center study investigated the sequential use of liver and spleen stiffness measured by SWE to rule-out CSPH, measured invasively within maximal 48 hours. The study included 158 patients, of which 61.4% were male. Main etiology was alcohol (56%), non-alcoholic steatohepatitis occurred in 17% and chronic viral hepatitis in 8%. Mean Child-Pugh score was 7 (A: 62.7%; B: 28.5%; C: 8.8%) while mean model for end-stage liver disease (MELD) score was 10 (6 – 28) points. Mild ascites was present in 25 patients and severe ascites in 43 patients. The patients gave their written consent for all procedures and the local ethics committee of the University of Bonn (Nr. 121/14) approved the study in accordance with the Declaration of Helsinki, as well as for Antwerp (15/13/135) and Odense (2599).

The study identified an algorithm using sequential SWE measurements of liver and spleen. Patients with L-SWE≥16.0kPa had a high probability of having CSPH, while also in some patients with L-SWE<16kPa CSPH was present. In this latter collective of patients, S-SWE≥26.6kPa was used to identify further patients with CSPH. Indeed, from 109 patients receiving L- and S-SWE measurements in the same session, 76 patients had L-SWE≥16.0kPa. 65 of these patients were correctly classified as having CSPH and 11 had no CSPH, therefore being misclassified. 33 patients had L-SWE<16.0kPa. In these patients, S-SWE cut-off of 26.6kPa was used to further classify them. By doing so, 32 patients, of which 26 did not have CSPH and 6 had CSPH, were correctly classified and only one patient with CSPH was misclassified.
using this method (Figure 1). These two cut-offs combined, had a sensitivity of 98.6% and a specificity of 70.3% (Table 1).

As presented above, this study offers an easy algorithm with high diagnostic accuracy to rule-out CSPH by using sequential L- and S-SWE. The presence of CSPH, as the prerequisite for varices, has prognostic value. Importantly, also the success of therapy for portal hypertension might be dependent on the presence of CSPH, as shown recently that non-selective beta-blockers might have a better response in patients with CSPH compared to patients without. Therefore, the diagnosis of CSPH is important information for clinical decisions.

Interestingly, this algorithm including L- and S-SWE was elaborated to rule-out CSPH more accurately with a sensitivity of 98.6%, which clearly surpassing recent results for this purpose. The added value of S-SWE seems to be particularly high in patients with L-SWE<16.0kPa. In these patients, S-SWE of 26.6kPa or higher is able to detect patients with CSPH with very high accuracy, while S-SWE below 26.6kPa rules out CSPH with a very high probability.

In conclusion, this study demonstrates for the first time that S-SWE improves accuracy of L-SWE to assess CSPH in cirrhotic patients of different etiologies.

References


Competing interests: none declared

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Table 1. Diagnostic performance of the algorithm for the diagnosis of CSPH.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Cut-off value [kPa]</th>
<th>Sensitivity [%]</th>
<th>Specificity [%]</th>
<th>Positive predictive value [%]</th>
<th>Negative predictive value [%]</th>
<th>Diagnostic accuracy [%]</th>
<th>Correctly classified [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-SWE [kPa]</td>
<td>16.0</td>
<td>98.6</td>
<td>70.3</td>
<td>86.6</td>
<td>96.3</td>
<td>89.0</td>
<td>84.5</td>
</tr>
<tr>
<td>S-SWE [kPa]</td>
<td>26.6</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

CSPH, clinically significant portal hypertension; L- and S-SWE, liver- and spleen-

Shear-wave elastography.