

# Sequential BAVENO VI plus dedicated spleen stiffness measurement or a novel spleen-centered algorithm significantly enlarges non-invasive ruling out of high risk varices

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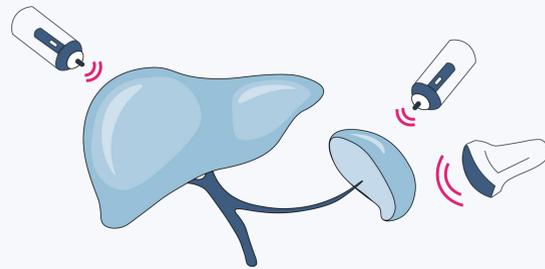
## Introduction

The BAVENO VI criteria, combining liver stiffness measurement (LSM < 20 kPa) and platelet count (>150 x10<sup>9</sup>/L), have set the stage for non-invasive assessment of patients with compensated advanced chronic liver disease (cACLD) who can safely avoid screening endoscopy at the cost of < 5% missed varices needing treatment (VNTs). Attempts to expand these two parameters (expanded BAVENO VI) to save a higher proportion of endoscopies resulted in a relevant loss of negative predictive value.

## Aim

We aimed to evaluate the potential additive value of spleen stiffness measurement (SSM) using spleen-dedicated vibration-controlled transient elastography (**FibroScan® Expert 630, EchoSens**) and in addition, to test a novel spleen-centered algorithm combining spleen size and SSM.

## Method



We first analyzed in a single-center fashion (Leuven) all consecutive patients with ACLD (LSM > 10 kPa) from 2020 till 2022 undergoing LSM/SSM and had available reports on upper endoscopy, abdominal ultrasound (spleen size, i.e. craniocaudal diameter) and platelet count. VNTs were defined as grade II or III esophageal varices or varices of any size with red spots. Different models were built in this derivation cohort (see Figure 1). Subsequently, these were tested in an external validation cohort (Mainz, Antwerp) with a higher prevalence of VNTs as this was the downfall of the expanded BAVENO VI criteria.

## Conclusions

The sequential BAVENO VI plus dedicated SSM (< 43 kPa) or the more simplified spleen-centered algorithm (size and stiffness) can safely and more extensively “rule out” VNT than the BAVENO VI criteria alone.

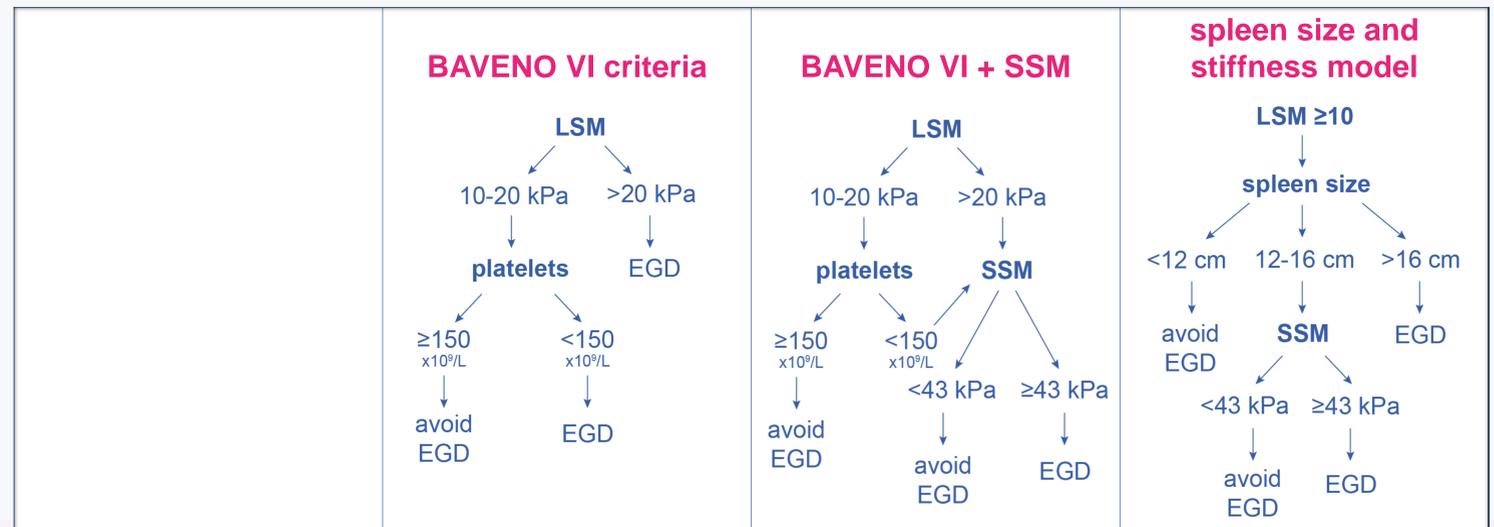
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## Results

The **derivation cohort** included 201 patients (123 men, mean age 58 years, 85.1% Child A - 14.9% Child B). Overall prevalence of VNTs was 11.9% (comparable to the ANTICIPATE study). In the derivation cohort, BAVENO VI criteria could spare 33.8% of screening endoscopies which could be doubled to 66.2% by applying sequential BAVENO VI/SSM-criteria (using a SSM cut-off at 43kPa) (Figure 1). A newly developed simple ‘spleen size and stiffness’ algorithm could save even more patients (71%) from undergoing endoscopy. All applied algorithms missed less than 5% of VNT.

The **validation cohort** included 176 patients (104 men, mean age 58 years, 70.4% Child A - 29.6% Child B). The prevalence of VNTs amounted to 34.7%. Applying the BAVENO VI criteria in this cohort spared a lower amount of screening endoscopies (8.5%). Adding SSM tripled the gain to 27%. The ‘spleen stiffness and size’ model equally avoided 31% of screening endoscopies, all at the cost of less than 5% of VNT being missed.



| DERIVATION COHORT (n = 201, 11.9% VNTs) |                |                 |                 |
|---|----------------|-----------------|-----------------|
| spared endoscopies                      | 33.8 %         | 66.2 %          | 71.1 %          |
| missed VNT                              | 0 %            | 4.2 %           | 4.2 %           |
| sensitivity - specificity               | 100 % - 38.4 % | 95.8 % - 74.6 % | 95.8 % - 80.2 % |
| PPV - NPV                               | 18.0 % - 100 % | 33.8 % - 99.2 % | 39.7 % - 99.3 % |
| VALIDATION COHORT (n = 176, 34.7% VNTs) |                |                 |                 |
| spared endoscopies                      | 8.5 %          | 27.3 %          | 31.3 %          |
| missed VNT                              | 0 %            | 3.3 %           | 4.9 %           |
| sensitivity - specificity               | 100 % - 13.0 % | 96.7 % - 40.0 % | 95.1 % - 45.2 % |
| PPV - NPV                               | 37.9 % - 100 % | 46.1 % - 95.8 % | 47.9 % - 94.5 % |

Figure 1. Performance of non-invasive models in the decision for screening endoscopy. EGD, esophagogastroduodenoscopy; LSM, liver stiffness measurement; NPV, negative predictive value; PPV, positive predictive value; SSM, spleen stiffness measurement; VNT, varices needing treatment

