**Journal of Hepatology**

**Definition of SPSS: Computer-assisted image processing for better quantification.**

--Manuscript Draft--

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<tr>
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Definition of SPSS: Computer-assisted image processing for better quantification.

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Dear Editors,

We appreciate the interest of Nicoară-Farcău et al. in our recent multicenter study published in *Journal of Hepatology* (1) and we share their effort to highlight the impact of total cross-sectional SPSS (spontaneous portosystemic shunt) area (TSA) on the outcome of patients with liver cirrhosis.

In their letter to the editors, the authors bring up issues, all of which are related to a lack of a generally consented definition of SPSS. In fact, the lack of data on SPSS was the reason for the members of the international Baveno cooperation to form the Baveno VI-SPSS group and to conduct the largest studies on this topic so far (1,2).

In response to Nicoară-Farcău and colleagues, we agree that gastrorenal shunts seem important, since they are found in many patients with gastric varices and therefore possibly associate with bleeding. In total, 990 SPSS in patients with available follow up data were found. The distribution of the types of SPSS is shown in table 1. Moreover, we calculated the fraction of patients developing variceal bleeding according to the presence of a certain SPSS type. The rate of variceal bleeding in patients with gastrorenal shunt was 12.2%, not significantly different from other types of SPSS (table1).

A possible reason for this finding is the current lack of radiologic predictors of progression of SPSS due to the cross-sectional design of our study(3). However, splanchnic and systemic hemodynamics in cirrhotic patients can change and longitudinal studies on the dynamic of SPSS are needed.

Another reason lies in the challenges in quantifying SPSS. Currently, those measurements need to be performed manually by a trained professional. This is especially challenging for (para-) esophageal varices, which tend to build collateral...
networks, which are almost impossible to quantify by hand. Hence, these were not quantified in our recent studies. However, automated, computer-assisted quantification of SPSS could be a solution. Currently, we have developed a computer application based on image processing. This application, based on MATLAB, measures the diameter of each shunt and calculates automatically the cross-sectional area of the SPSS, through image processing, independently whether it is CT or MRI (see Supplementary Video). This application may facilitate the calculation of TSA and may save significant time for health care professionals.

In conclusion, we acknowledge that we need a unified definition of SPSS. Using modern computer-assisted techniques might help us overcome the mostly technical obstacles in quantifying all SPSS, leading us to refer to the same definition in the future.

**Table 1.**

<table>
<thead>
<tr>
<th>Type of SPSS</th>
<th>Total</th>
<th>No Bleeding</th>
<th>Bleeding</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splenorenal</td>
<td>384</td>
<td>328</td>
<td>56</td>
<td>14.6</td>
</tr>
<tr>
<td>Mesocaval</td>
<td>67</td>
<td>58</td>
<td>9</td>
<td>13.4</td>
</tr>
<tr>
<td>Mesorenal</td>
<td>9</td>
<td>8</td>
<td>1</td>
<td>11.1</td>
</tr>
<tr>
<td>Inferior Mesenteric-Caval</td>
<td>22</td>
<td>19</td>
<td>3</td>
<td>13.6</td>
</tr>
<tr>
<td>Gastrorenal</td>
<td>49</td>
<td>43</td>
<td>6</td>
<td>12.2</td>
</tr>
<tr>
<td>Umbilical</td>
<td>420</td>
<td>347</td>
<td>73</td>
<td>17.4</td>
</tr>
<tr>
<td>Others</td>
<td>39</td>
<td>35</td>
<td>4</td>
<td>10.3</td>
</tr>
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</table>

**Legend to Supplementary Video:**

First, we select the image (CT/MRI). Once the image is uploaded, we press the detection button in order to select the area of the SPSS. Automatically, the area will appear below the image. If we need to select more SPSS, we can repeat the process. Finally, the total SPSS area is shown.
References


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Application for SPSS detection.mp4