Color liver perfusion imaging

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Disclosure of Commercial Interest

Neither I nor my immediate family members have a financial relationship with a commercial organization that may have a direct or indirect interest in the content.

Note: Non-FDA approved software will be discussed.
Dual blood supply

<table>
<thead>
<tr>
<th></th>
<th>Portal vein</th>
<th>Hepatic artery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal liver</td>
<td>80%</td>
<td>20%</td>
</tr>
<tr>
<td>HCC</td>
<td>37%</td>
<td>63%</td>
</tr>
</tbody>
</table>

Color liver perfusion imaging

Portal vein

Hepatic artery

Hepatic veins
Color liver perfusion imaging

Portal vein

Hepatic artery

Hepatic veins
Color liver perfusion imaging

![Graph showing enhancement over time for Aorta and Portal vein](image)
Color liver perfusion imaging

Enhancement (HU) vs Time (seconds)

- Aorta
- Portal vein
- PVC=50%
- HAC=50%
Color liver perfusion imaging

![Graph showing enhancement (HU) over time (seconds) for Aorta, Portal vein, and Delayed phases. Annotations include HAC=50%, PVC=50% for Aorta, and HAC=−100%, PVC=−100% for Portal vein and Delayed phases.](image-url)
Color scale

- Brightness = Hounsfield units
- Color = Phase of enhancement
- Saturation = Degree of enhancement

Enhancement

None → Intense

- Aortic phase
- Portal venous phase
- Delayed phase
Hemangioma
HCC
HCC

Color

HAC

PVC
Hepatic artery and portal vein coefficients

78 untreated liver lesions in 64 patients
Hepatic artery and portal vein coefficients

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Hepatic artery and portal vein coefficients

78 untreated liver lesions in 64 patients
Hepatic artery and portal vein coefficients

78 untreated liver lesions in 64 patients
Sensitivity and specificity for diagnosing malignant liver lesions

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Hypervascular with washout</td>
<td>72%</td>
<td>81%</td>
</tr>
<tr>
<td>B. Hypervascular with washout, or hypodense on all phases</td>
<td>89% *</td>
<td>72%</td>
</tr>
<tr>
<td>C. Perfusion (HAC $&gt;-3%$, HAC $&lt;30%$, and PVC $&lt;40%$)</td>
<td>85%</td>
<td>78%</td>
</tr>
<tr>
<td>D. B and C</td>
<td>76%</td>
<td>97% *</td>
</tr>
</tbody>
</table>

* statistically significant difference compared to criterion A.
Conclusions

• Hepatic artery and portal vein coefficients calculated from triphasic CT can be used to classify hypervascular liver lesions.

• Hepatic artery and portal vein coefficients improve the specificity for diagnosing malignancy in liver lesions, when combined with traditional relative enhancement criteria (such as washout).
Custom research web PACS
Liver lesion classification

Density of the lesion compared to surrounding liver:
Arterial phase: Hyperdense ☐ Isodense ☐ Hypodense ☐
Delayed phase: Hyperdense ☐ Isodense ☐ Hypodense ☐

Hounsfield unit measurements:

<table>
<thead>
<tr>
<th>Phase</th>
<th>Aorta</th>
<th>Portal vein</th>
<th>Liver lesion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterial</td>
<td>300</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>Portal venous</td>
<td>200</td>
<td>200</td>
<td>80</td>
</tr>
<tr>
<td>Delayed</td>
<td>100</td>
<td>100</td>
<td>50</td>
</tr>
</tbody>
</table>

Hepatic artery coefficient (HAC): 26%
Portal vein coefficient (PVC): 4%
Lesion classification: Malignant
Acknowledgements

• Aya Kamaya
• Bao Do
• Terry S. Desser
• Christopher F. Beaulieu
• Shreyas S. Vasanawala
• Gloria L. Hwang
• Daniel Y. Sze
Predicted versus measured hepatic vein enhancement

\[ y = 0.71x + 0.0 \]

\[ r^2 = 0.78 \]