

Evaluating the Impact of Weight-Based IV Contrast Dosing on Liver Enhancement: A Retrospective Analysis

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Introduction

Liver lesion detection and characterisation using contrast-enhanced CT imaging in the portal venous phase is critical for accurate diagnosis and treatment planning. Suboptimal liver enhancement, particularly in patients with steatotic livers, can lead to missed diagnoses and the need for further imaging, increasing both costs and patient burden. This audit evaluates the impact of weight-based IV contrast dosing protocols on liver attenuation to optimise imaging outcomes and reduce unnecessary follow-up imaging.

Aim

- To evaluate the effectiveness of a weight-based IV contrast dosing protocol in improving liver enhancement during CT imaging.
- To determine if this approach increases liver contrast enhancement, thus could help better characterisation of liver lesions (e.g., cysts, haemangiomas, other benign lesions, or metastases) and potentially reduce the need for further imaging, such as MRI, thereby optimising both diagnostic accuracy and cost efficiency.

Methodology

The audit reviewed 50 cases from 3 groups, all performed on the same scanner (NTCT – Old NTGH scanner). The focus was measuring liver enhancement in the post-contrast studies performed. The cases were identified from CRIS under the CT scan codes: CABPEC, CCHAPC, and CCABDC.

Weight (kg)	Omnipaque 350 (mls)	Weight (kg)	Omnipaque 350 (mls)
<50	60	<60	65
50-59	70	60-69	70
60-69	80	70-79	75
70-79	90	80-89	80
80-89	100	90-99	90
90-99	110	100-109	100
>100	120	110-119	110
		>120	120

Figure 1: Addenbrooke's protocol (shared by Dr David Bowden, Consultant Radiologist)

Figure 2: Modified weight-based protocol

Scan Periods

Period 1: 1st May 2024 to 30th May 2024 – non-weight-based protocol

Period 2: 3rd June 2024 to 11th July 2024 – 'Addenbrooke's protocol'

Period 3: 9th August 2024 to 6th November 2024 – modified weight-based protocol

References

- Portal venous phase. Radiopaedia.org. [https://radiopaedia.org/articles/portal-venous-phase?lang=gb#:~:text=liver%20parenchyma%20is%20at%20its,HU%20from%20the%20unenhan,ced%20baseline\).](https://radiopaedia.org/articles/portal-venous-phase?lang=gb#:~:text=liver%20parenchyma%20is%20at%20its,HU%20from%20the%20unenhan,ced%20baseline).) Published December 4, 2021. Accessed April 6, 2025.
- van Cooten VV, de Jong DJ, Wessels FJ, de Jong PA, Kok M. Liver Enhancement on Computed Tomography Is Suboptimal in Patients with Liver Steatosis. J Pers Med. 2021;11(12).
- Brink JA, Heiken JP, Forman HP, Sagel SS, Molina PL, Brown PC. Hepatic spiral CT: reduction of dose of intravenous contrast material. Radiology. 1995;197(1):83-8.

Data Collected & Results

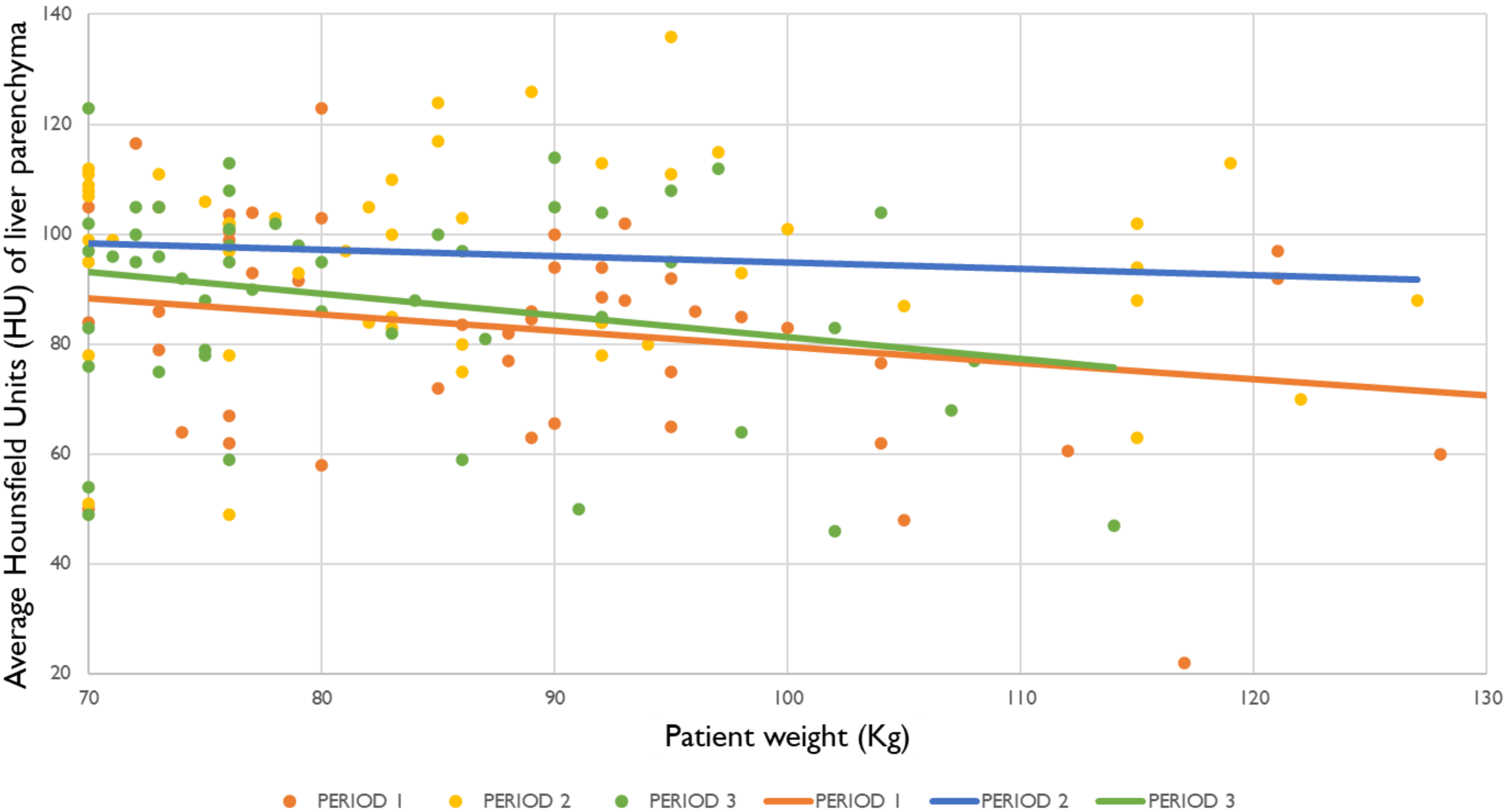
Relevant patient demographics

Contrast Enhancement Measurements:

- Portal vein enhancement (HU): Measured using a 100 mm² region of interest (ROI)
- Right lobe of the liver (HU): Measured contrast enhancement using a 300 mm² ROI
- Left lobe of the liver (HU): Measured contrast enhancement using a 300 mm² ROI
- Spleen enhancement (HU): Measured using a 300 mm² ROI

Exclusions: Scans with significant artifacts, patients who weighed <70kg

Comparison of liver enhancement using weight-based contrast



Conclusion

- The best liver enhancement was achieved with the Addenbrooke's contrast scale.
- The least enhancing was with the non weight-based contrast.
- The modified Addenbrooke's approach gave better enhancement than no weight-based contrast, however not as good as the full Addenbrooke's scale.

Options Going Forward/Suggestions for Future

- Addenbrooke's contrast scale for all (best option – but likely at a cost)
- Modified Addenbrooke's for most patients
 - Addenbrooke's usage in a selective group
 - E.g., For all cancer patient staging scans and surveillance for colorectal cancers – better detection of metastases and characterising benign lesions, thus decreasing the need for MRI liver
 - E.g., Quadruple liver phase scans - lesions incidentally picked up in the liver
- Check the number of Liver MRI requests per month for the next year to aid in evaluating whether this has an impact (MRI liver requests are not done immediately so recommend looking at this over a yearly period)
- Recording weight and contrast volume electronically on CRIS (not on paper)