The Impact of Image Optimisation on Liver Lesion Characterisation: A Case Study

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Introduction

Accurate characterisation of focal liver lesions is essential for determining prognosis and guiding clinical management. Although ultrasound is a first-line, non-invasive modality, its diagnostic value depends heavily on image optimisation and appropriate transducer selection. Suboptimal technique can obscure lesion features, reducing diagnostic confidence and potentially leading to unnecessary further imaging. This case demonstrates how optimised ultrasound parameters improved visualisation and influenced clinical decision-making.

Methods

The initial ultrasound examination was performed on a 60-year-old patient with a known 3.8 cm focal liver lesion, previously identified on CT performed for frank haematuria (figure 1). The lesion appeared most likely benign but was indeterminate on initial ultrasound, which was conducted using a low-frequency curvilinear transducer with inadequate depth, focus, and gain adjustment (figure 2 & 3).

Figure 1: CT liver demonstrating focal liver lesion (FLL)

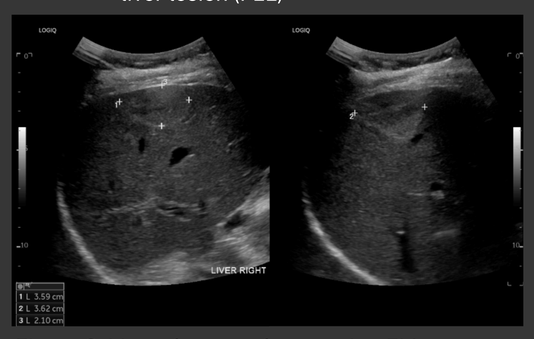
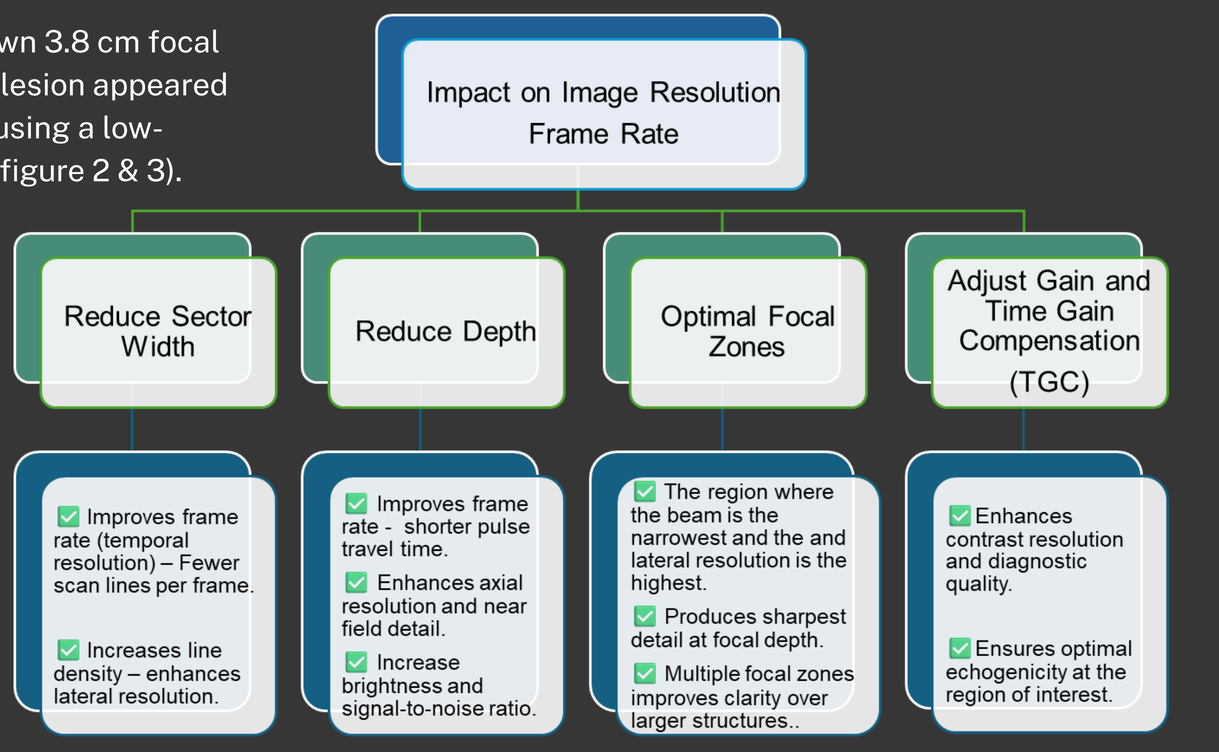


Figure 3: Liver ultrasound measuring FLL

Figure 2: Liver ultrasound



At three-month follow-up, multiple transducers were utilised, including a high-frequency linear transducer, to optimise lesion visualisation. The imaging approach included narrowing the sector width, selecting appropriate depth, accurately positioning the focal zone, tailoring the time-gain compensation curve, and adjusting the dynamic range to enhance contrast and lesion clarity. Microvascular Doppler was applied to assess the presence and distribution of vascularity.

Results

The optimised ultrasound examination significantly improved lesion characterisation compared to the initial study.

Figure 4: Transverse Liver demonstrating FLL

The lesion, located in segment VIII, measured 3.8 × 4.1 cm and was identified as hyperechoic relative to the surrounding liver parenchyma. It demonstrated a heterogeneous internal echotexture with patchy areas (Figure 4). Colour Doppler assessment revealed peripheral vascularity (Figure 6).
With further optimisation, microvascular Doppler demonstrated both peripheral and internal vascular flow (Figure 7), enhancing diagnostic confidence.

Additional optimisation through transducer selection was performed — the L2-9 GE linear probe was subsequently utilised, revealing a well-defined heterogeneous lesion with internal anechoic cystic changes (Figure 5).

These detailed sonographic features were not appreciated on the initial suboptimised scan. The improved imaging raised concern for possible malignancy and prompted further evaluation. Subsequent MRI confirmed the lesion to be an atypical haemangioma.

Figure 5 - FLL with high frequency linear transducer

Figure 6 - FLL with colour Doppler

Figure 7 - FLL with microvascular Doppler

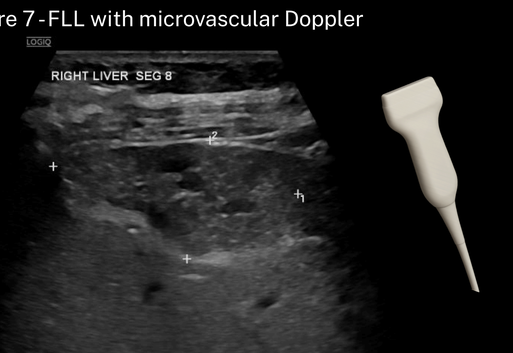
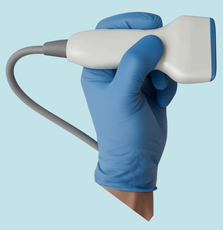


Figure 8 - FLL with high frequency linear transducer measurements



Conclusion

This case illustrates the vital impact of image optimisation and transducer selection by the operator in focal liver lesion evaluation. Applying best-practice sonographic techniques improves lesion morphology and vascular assessment, reducing indeterminate outcomes and the need for additional imaging.

References:
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