

Supplementary material

Strzelczyk J, Boszko M, Kalinowski P, et al. Echocardiographic screening for liver steatosis. Pol Heart J. 2024.

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Appendix 1. Detailed description for the echocardiographic assessment of liver steatosis using hepato-renal index

Regions of interests (ROI) of at least 500 pixels size were placed in adjacent, possibly most uniform areas of liver parenchyma and right kidney cortex, usually in the middle of the image. Liver and kidney ROIs were placed preferably at the same depth of the image and if not feasible due to suboptimal image quality, within the shortest distance from each other. ROI placements and hepatorenal index (HRI) measurements were performed by two cardiologists blinded to liver biopsy results. Initial HRI measurements for comparison between cardiac and abdominal presets of the sector probe were performed by an experienced cardiologist. Final HRI measurements on images acquired with an abdominal preset were performed by the cardiologist in training.

Appendix 2. Description of study limitations

High prevalence of steatosis in the studied group may increase the positive predictive value of both, the HRI and the visual evaluation of fatty liver. Therefore, diagnostic performance of these methods in the non-obese population remains unknown.

Operator-dependent technique of image acquisition may affect subsequent image interpretation. Unfortunately, no interobserver concordance regarding image acquisition was available in this study.

Despite its overall simplicity, changing into the abdominal preset during echocardiographic study may be cumbersome and easy to forget in a hurried workplace.

On rare occasions the congenital or acquired absence of right kidney or the presence of parenchymal kidney disease makes the HRI assessment not feasible. However comparison of liver and spleen brightness remains as an alternative and may be facilitated by the use of dual image option on the echocardiographic machine.

It must be stressed that normal liver echogenicity on ultrasound does not exclude the presence of significant hepatic disease such as cirrhosis, where steatosis may no longer be present and fibrotic changes may not be visible on conventional 2-D images.

Table S1. Clinical characteristics of patients included in the study

	All patients (n = 220)	Patients with steatosis n = 150	Patients without steatosis n = 70	<i>P</i> -value (patients with vs. without steatosis)
Age, years, median (IQR)	41.5 (36–48)	42 (38–48)	38 (33–48)	0.02
Female sex, n (%)	67.3	59.1	84.5	<0.001
Height, cm, median (IQR)	170 (164–176)	171 (164–179)	168 (163–172)	0.011
Weight, kg, median (IQR)	123.5 (113.4–140)	127 (114–143)	119 (110–136)	0.02
Body mass index, kg/m ² , median (IQR)	43.6 (40.6–47.2)	43.6 (41.3–47.3)	43 (40.1–46.3)	0.28
Heart rate, beats per minute, mean (SD)	73.2 (9.9)	73.6 (10.2)	72.4 (9.2)	0.49
Systolic blood pressure, mm Hg, median (IQR)	134 (126–143)	136 (128–145)	130.5 (121–138)	<0.001
Diastolic blood pressure, mm Hg, median (IQR)	82 (77–89)	83 (78–90)	80 (75–85)	0.002
Hypertension, n (%)	61.6	68.9	46.5	<0.001
Diabetes mellitus, n (%)	27.3	32.4	15.5	0.008
Glucose, mg/dl, median (IQR)	97 (88–111)	101 (91–125)	92 (86–98)	<0.001
Insulin, mU/l, median (IQR)	19.3 (12.4–30.8)	23.7 (13.7–34.2)	14.3 (11.1–21.2)	<0.001
HOMA, median (IQR)	4.5 (2.9–8.5)	6 (5.5–6.4)	3.4 (2.4–4.4)	<0.001
HbA1c, %, median (IQR)	5.7 (5.3–6.1)	5.8 (5.5–6.4)	5.4 (5.2–5.7)	<0.001

TC, mg/dl, mean (SD)	178.3 (35.9)	177.9 (35)	179 (38)	0.71
LDL, mg/dl, median (IQR)	101 (84–123)	101 (83.5–123.5)	101 (86–121)	0.62
HDL, mg/dl, median (IQR)	44 (37–51)	43 (36–48)	47.5 (40–58)	<0.001
TG, mg/dl, median (IQR)	141 (107–194.5)	153.5 (118–224)	115.5 (94–144)	<0.001
HRI, median (IQR)	1.4 (1.1–1.6)	1.5 (1.4–1.7)	1.1 (1–1.2)	<0.001

Abbreviations: HbA1c, glycated hemoglobin; HDL, high density lipoproteins; HOMA, H_OMEostatic Model Assesment — Insulin Resistance; HRI, hepato-renal index; IQR, interquartile range; LDL, low-density lipoproteins; SD, standard deviation; TC, total cholesterol; TG, triglycerides

Table S2. Results of the visual assessment of liver's steatosis by different observers compared to biopsy

	Experienced observer	Unexperienced observer I	Unexperienced observer II
Sensitivity, %	88	96	87
Specificity, %	77	57	81
PPV, %	89	82	92
NPV, %	75	87	72

Abbreviations: NPV, negative predictive value, PPV, positive predictive value

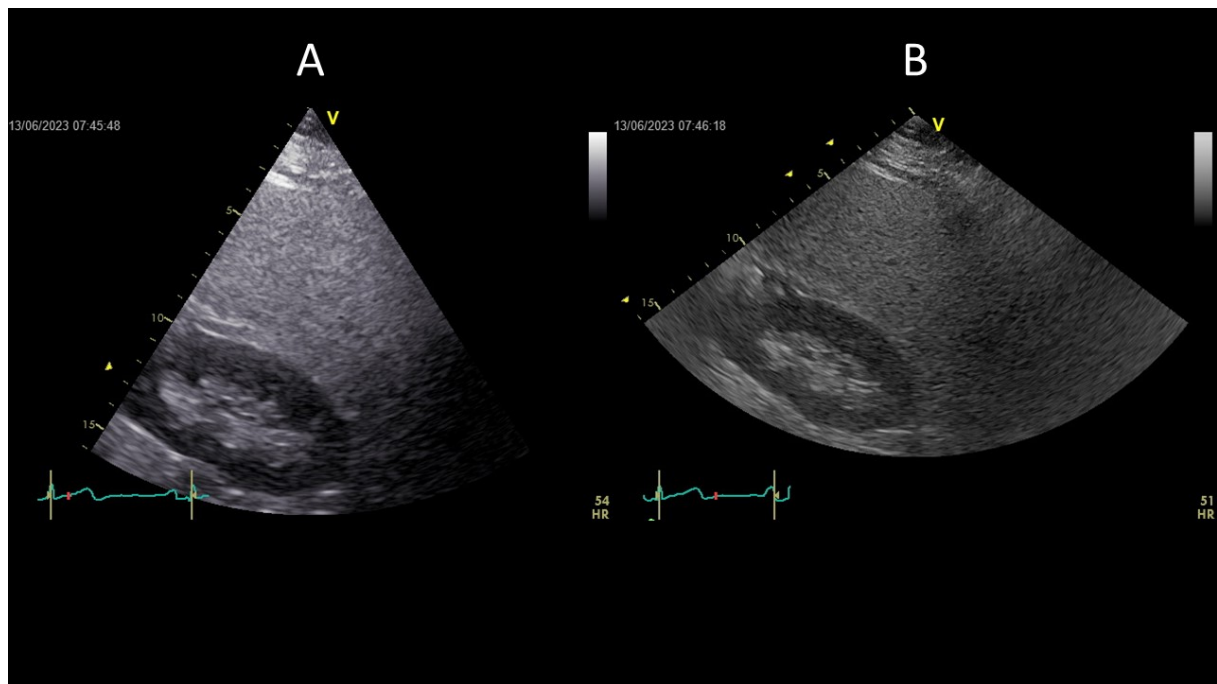


Figure S1. Cardiologic (A) and abdominal (B) ultrasonographic preset

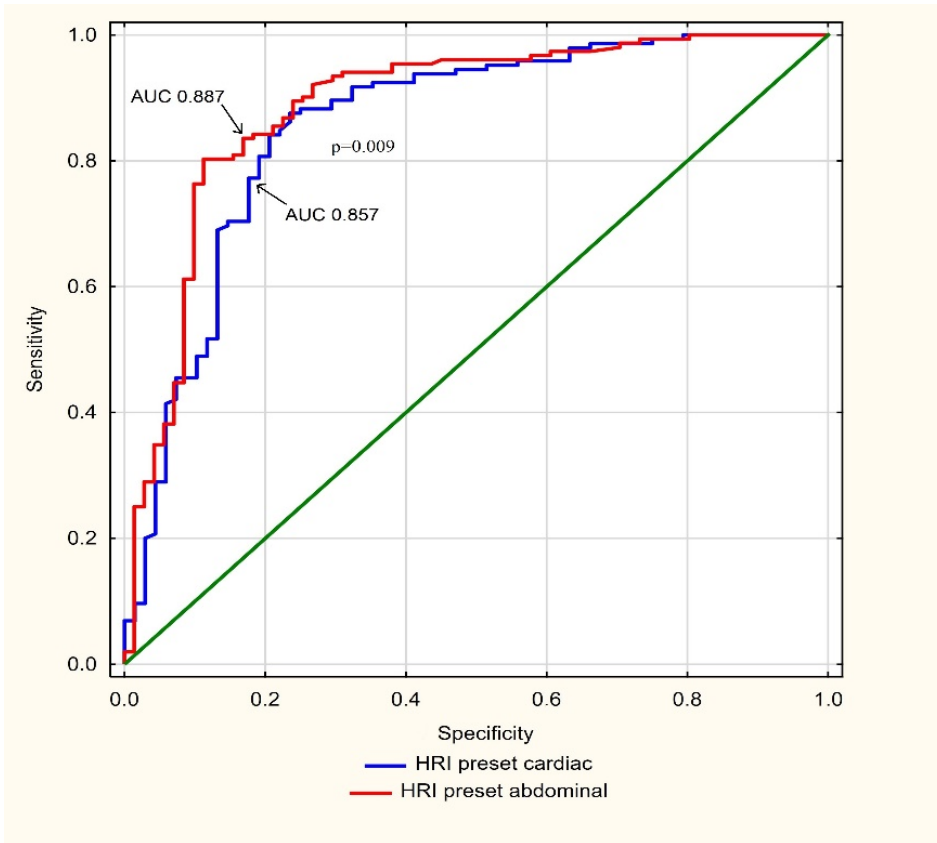


Figure S2. The area under the receiver operating characteristics curve for the diagnostic accuracy of hepatorenal index according to the abdominal and cardiologic preset performed on all images (n = 220)

Abbreviations: AUC, area under the curve, HRI, hepato-renal index

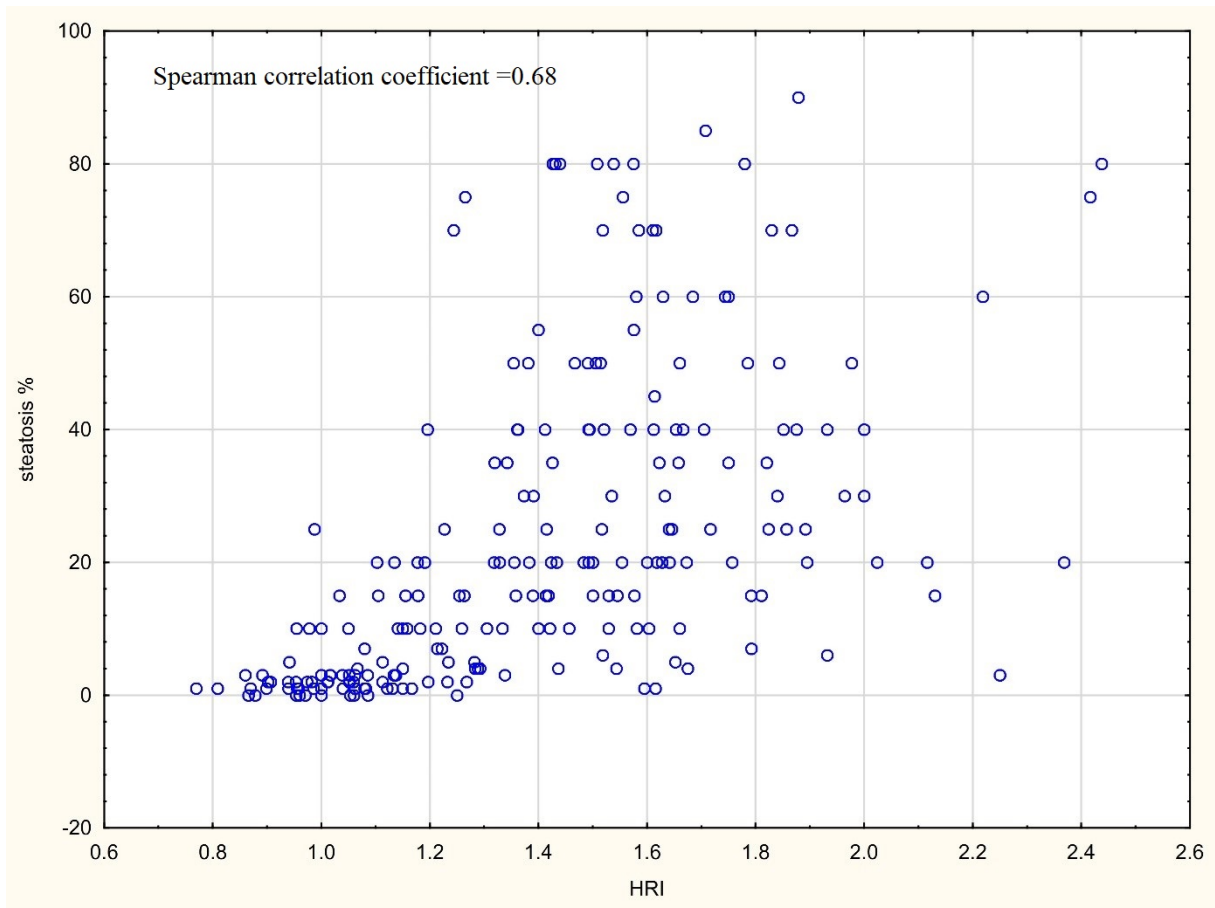


Figure S3. The Spearman correlation coefficient between hepatorenal index and degree of steatosis in the liver biopsy

Abbreviations: HRI, hepatorenal index

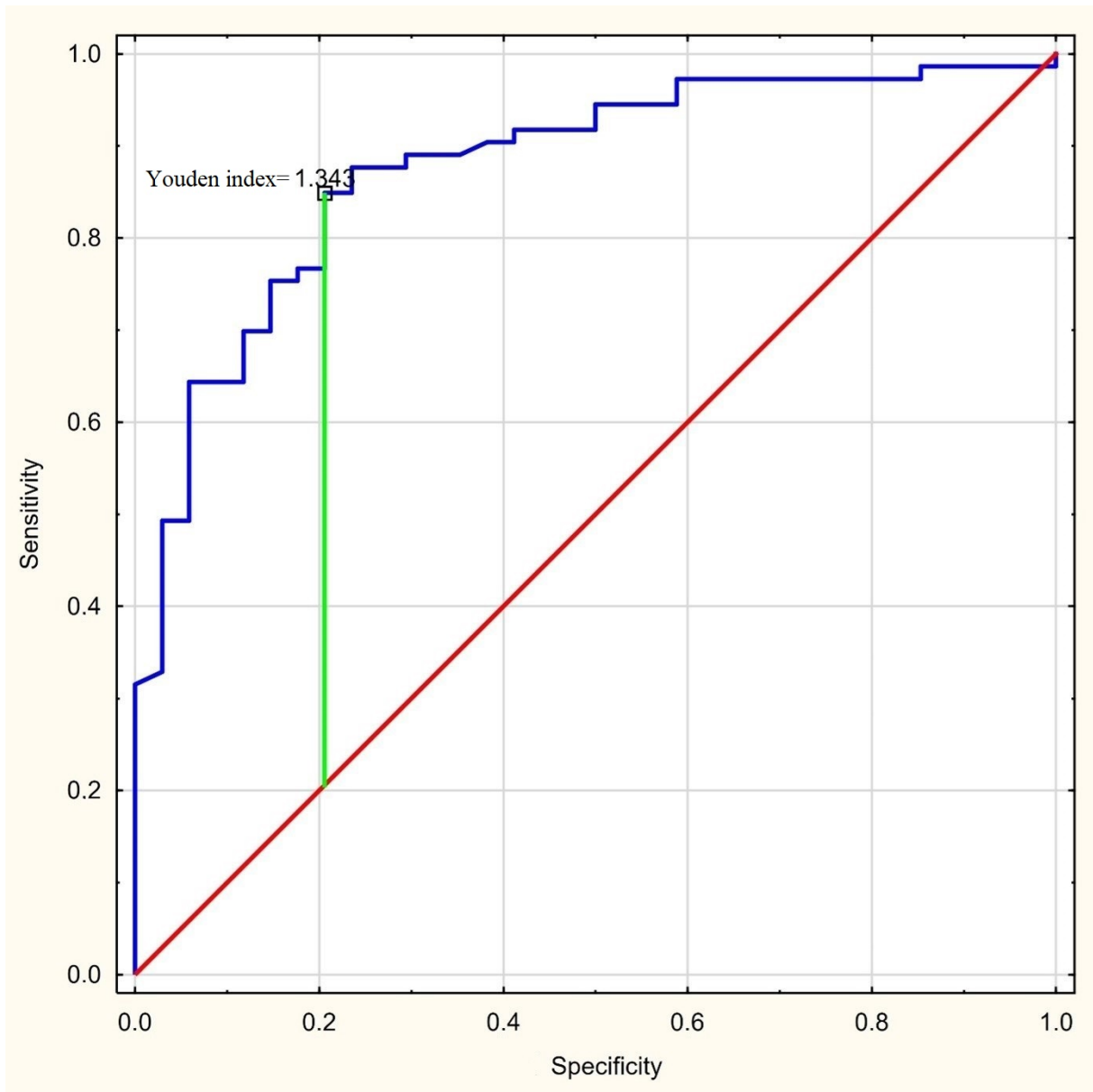


Figure S4. Receiver operating characteristics curve in the training set of images (n = 111) acquired with sector probe using an abdominal preset

Abbreviations: HRI, hepato-renal index