

## SUPPLEMENT

**Supplementary Table 1:** Detailed results of liver biopsy categorized by fibrosis stage

	Overall, n=134	No Fibrosis, n=83	Mild Fibrosis, n=14	Significant Fibrosis, n=28	Advanced Fibrosis, n=2	Liver Cirrhosis, n=7	p-value
<b>Histological Activity Grade, n (%)</b>							
0	59 (44.0%)	49 (59.0%)	6 (42.9%)	3 (10.7%)	0 (0%)	1 (14.3%)	<b>&lt;0.001</b>
1	69 (51.5%)	34 (41.0%)	7 (50.0%)	21 (75.0%)	2 (100%)	5 (71.4%)	
2	5 (3.7%)	0 (0%)	1 (7.1%)	4 (14.3%)	0 (0%)	0 (0%)	
<b>Histological Steatosis Grade, n (%)</b>							
0	25 (18.7%)	20 (24.1%)	2 (14.3%)	0 (0%)	1 (50.0%)	2 (28.6%)	0.510
1	38 (28.4%)	21 (25.3%)	4 (28.6%)	10 (35.7%)	1 (50.0%)	2 (28.6%)	
2	41 (30.6%)	27 (32.5%)	5 (35.7%)	8 (28.6%)	0 (0%)	1 (14.3%)	
3	30 (22.4%)	15 (18.1%)	3 (21.4%)	10 (35.7%)	0 (0%)	2 (28.6%)	

Abbreviations: n: number



**Supplementary Table 2:** Population characteristics by fibrosis stage from liver biopsy. The table compares characteristics, with statistical significance assessed by Chi-squared or Kruskal-Wallis test as appropriate, indicated by p-values.

Histological Fibrosis Stage	Overall, n=134	No Fibrosis, n=83	Mild Fibrosis, n=14	Significant Fibrosis, n=28	Advanced Fibrosis, n=2	Liver Cirrhosis, n=7	p-value
Age, years, mean ± SD	42.6 ± 13.3	41.5 ± 12.7	44.6 ± 16.2	40.5 ± 11.0	63.0 ± 9.90	54.9 ± 14.6	0.070
Sex, n (%)							
Male	47 (35.1%)	22 (26.5%)	8 (57.1%)	10 (35.7%)	1 (50.0%)	6 (85.7%)	<b>0.017</b>
Female	87 (64.9%)	61 (73.5%)	6 (42.9%)	18 (64.3%)	1 (50.0%)	1 (14.3%)	
BMI, kg/m <sup>2</sup> , mean ± SD	42.7 ± 10.4	44.0 ± 9.7	42.4 ± 11.7	44.0 ± 9.4	24.8 ± 7.5	28.0 ± 5.2	<b>0.002</b>
Platelets, G/L, median [IQR]	249 [106]	258 [105]	244 [34.0]	254 [83.3]	NA	115 [107]	<b>0.012</b>
INR (% of ULN), median [IQR]	96 [17]	96 [9]	96 [17]	87 [11]	96 [0]	130 [17]	<b>0.001</b>
Bilirubin (% of ULN), median [IQR]	157 [106]	147 [86]	169 [102]	167 [88]	157 [44]	427 [220]	<b>0.022</b>
Albumin, g/dL, median [IQR]	40.9 [5.1]	40.9 [3.5]	39.6 [5.8]	41.8 [6.9]	NA	38.1 [9.3]	0.432
MELD-Na, points, median [IQR]	7 [2]	7 [2]	8 [3]	7 [2]	NA	10 [1]	<b>0.017</b>
ALT (% of ULN), median [IQR]	94 [78]	92 [80]	94 [108]	111 [86]	173 [47]	82 [33]	<b>0.246</b>
AST (% of ULN), median [IQR]	69 [35]	66 [38]	66 [30]	80 [30]	133 [5]	84 [84]	<b>0.030</b>
ALP (% of ULN), median [IQR]	65 [28]	65 [30]	54 [23]	66 [18]	75 [13]	97 [13]	0.124
GGT (% of ULN), median [IQR]	160 [75]	159 [79]	127 [70]	171 [55]	181 [48]	210 [43]	0.231
HbA1c, %, median [IQR]	5.5 [1.4]	5.3 [1.0]	6.2 [1.8]	5.5 [1.4]	NA	5.1 [1.2]	0.279
ELF test, points, median [IQR]	8.9 [1.9]	8.8 [1.5]	8.6 [2.1]	8.3 [1.8]	NA	11.4 [2.0]	<b>0.009</b>
Etiology, n (%)							
MASLD/MASH	118 (88.1%)	77 (92.8%)	11 (78.6%)	26 (92.9%)	1 (50.0%)	3 (42.9%)	<b>&lt;0.001</b>
ArLD	3 (2.2%)	1 (1.2%)	0 (0%)	0 (0%)	1 (50.0%)	1 (14.3%)	
Viral	2 (1.5%)	0 (0%)	0 (0%)	1 (3.6%)	0 (0%)	1 (14.3%)	
Others	11 (8.2%)	5 (6.0%)	3 (21.4%)	1 (3.6%)	0 (0%)	2 (28.6%)	
VCTE probe, n (%)							
M	35 (26.1%)	14 (16.9%)	6 (42.9%)	8 (28.6%)	0 (0%)	7 (100%)	<b>0.002</b>

Histological Fibrosis Stage	Overall, n=134	No Fibrosis, n=83	Mild Fibrosis, n=14	Significant Fibrosis, n=28	Advanced Fibrosis, n=2	Liver Cirrhosis, n=7	p-value
XL	92 (68.7%)	64 (77.1%)	8 (57.1%)	18 (64.3%)	2 (100%)	0 (0%)	
Failed	7 (5.2%)	5 (6.0%)	0 (0%)	2 (7.1%)	0 (0%)	0 (0%)	
VCTE, kPa, median [IQR]	6.6 [5.3]	6.2 [3.9]	6.8 [5.1]	6.2 [4.5]	NA	39.9 [41.1]	<b>0.004</b>
DAX-Auto pSWE median of 5 measurements, kPa, median [IQR]	3.1 [1.6]	3.0 [1.3]	3.1 [1.1]	3.0 [1.5]	NA	10.2 [6.9]	<b>0.003</b>
DAX-Auto pSWE – single measurement, kPa, median [IQR]	3.0 [2.0]	2.9 [1.7]	3.1 [1.3]	2.8 [1.7]	NA	10.0 [2.6]	<b>&lt;0.001</b>
UDFF median of 5 measurements, %, median [IQR]	18 [16]	19 [14]	14 [16]	19 [13]	NA	7 [11]	0.155
UDFF median – single measurement, %, median [IQR]	18 [14]	18 [17]	19 [17]	19 [13]	NA	12 [12]	0.273
CAP, dB/m, median [IQR]	295 [78]	293 [74]	319 [157]	315 [72]	NA	265 [0]	0.894
cCAP, dB/m, median [IQR]	300 [69]	300 [86]	268 [50]	300 [43]	NA	308 [25]	0.770

Abbreviations: ALT: alanine aminotransferase; ALP: alkaline phosphatase; ArLD: alcohol-related liver disease; AST: aspartate aminotransferase; Auto pSWE: automated point shear wave elastography; BMI: body mass index; (c)CAP: (continuous) controlled attenuation parameter; DAX: deep abdominal (transducer); ELF: enhanced liver fibrosis test; GGT: gamma-glutamyl transferase; HbA1c: glycated hemoglobin; INR: international normalized ratio; IQR: interquartile range; MASLD: metabolic dysfunction-associated liver disease; MELD-Na: model for end-stage liver disease sodium score; n: number; SD: standard deviation; UDFF: ultrasound-derived fat fraction; ULN: upper limit of normal; VCTE: vibration-controlled transient elastography

**Supplementary Table 3:** Quality metrics of liver biopsies of the overall cohort

Variable	Median (IQR)	Minimum	Maximum
Biopsy length, cm	1.9 (1.5-2.2)	1	8
Number of portal fields, n	8.0 (6.0-13.0)	1	27

Abbreviations: cm: centimeters, IQR: interquartile range; n: number



**Supplementary Table 4:** Detailed liver biopsy results categorized by steatosis grade

	Overall, n=134	No Steatosis, n=25	Mild Steatosis, n=38	Moderate Steatosis, n=41	Severe Steatosis, n=30	p-value
<b>Histological Activity Grade</b>						
0	59 (44.0%)	21 (84.0%)	18 (47.4%)	14 (34.1%)	6 (20.0%)	<b>&lt;0.001</b>
1	69 (51.5%)	4 (16.0%)	18 (47.4%)	26 (63.4%)	21 (70.0%)	
2	5 (3.7%)	0 (0%)	1 (2.6%)	1 (2.4%)	3 (10.0%)	
<b>Histological Ballooning</b>						
0	40 (29.9%)	10 (40.0%)	16 (42.1%)	10 (24.4%)	4 (13.3%)	<b>0.028</b>
1	16 (11.9%)	0 (0%)	3 (7.9%)	5 (12.2%)	8 (26.7%)	
2	1 (0.7%)	0 (0%)	0 (0%)	0 (0%)	1 (3.3%)	
3	40 (29.9%)	10 (40.0%)	16 (42.1%)	10 (24.4%)	4 (13.3%)	
<b>NAS Score, points, median [IQR]</b>	2 [2.5]	0 [0]	1.5 [1]	3 [0]	5 [1]	<b>&lt;0.001</b>

Abbreviations: n: number; IQR: interquartile range

**Supplementary Table 5:** Population characteristics by steatosis grade from liver biopsy. The table compares characteristics, with statistical significance assessed by Chi-squared or Kruskal-Wallis test as appropriate, indicated by p-values.

Histological Steatosis Grade	Overall, n=134	No Steatosis, n=25	Mild Steatosis, n=38	Moderate Steatosis, n=41	Severe Steatosis, n=30	p-value
Age, years, mean ± SD	42.6 ± 13.3	43.8 ± 16.0	43.3 ± 15.0	43.4 ± 11.7	39.7 ± 10.5	0.819
Sex, n (%)						
Male	47 (35.1%)	10 (40.0%)	9 (23.7%)	12 (29.3%)	16 (53.3%)	0.115
Female	87 (64.9%)	15 (60.0%)	29 (76.3%)	29 (70.7%)	14 (46.7%)	
BMI, kg/m <sup>2</sup> , mean ± SD	42.7 ± 10.4	36.3 ± 12.2	42.3 ± 9.5	45.4 ± 8.8	44.9 ± 10.1	<b>0.036</b>
Platelets, G/L, median [IQR]	249 [106]	225 [168]	233 [72]	249 [97]	263 [103]	0.063
INR (% of ULN), median [IQR]	96 [17]	96 [10]	96 [17]	96 [17]	87 [9]	0.125
Bilirubin (% of ULN), median [IQR]	157 [106]	167 [147]	157 [119]	157 [60.0]	153 [90.5]	0.903
Albumin, g/dL, median [IQR]	40.9 [5.1]	40.8 [5.3]	41.1 [5.1]	40.2 [4.3]	41.6 [5.2]	0.607
MELD-Na, points, median [IQR]	7 [2]	8 [2]	7 [2]	7 [2]	6 [1]	0.001
ALT (% of ULN), median [IQR]	94 [78]	69 [58]	88 [54]	94 [72]	142 [89]	0.007
AST (% of ULN), median [IQR]	69[35]	63 [51]	63 [29]	70 [33]	80 [30]	0.659
ALP (% of ULN), median [IQR]	65 [28]	62 [31]	65 [27]	68 [31]	58 [21]	0.669
GGT (% of ULN), median [IQR]	160 [75]	159 [62]	163 [64]	178 [74]	138 [71]	0.471
HbA1c, %, median [IQR]	5.5 [1.4]	5.2 [0.4]	5.5 [1.8]	5.6 [1.8]	5.7 [1.1]	<b>0.045</b>
ELF Test, points, median [IQR]	8.9 [1.9]	8.9 [2.0]	8.9 [2.3]	8.9 [1.3]	8.7 [1.2]	0.976
Etiology, n (%)						
MASLD/MASH	118 (88.1%)	15 (60.0%)	34 (89.5%)	40 (97.6%)	29 (96.7%)	<b>0.022</b>
ArLD	3 (2.2%)	2 (8.0%)	0 (0%)	0 (0%)	1 (3.3%)	
Viral	2 (1.5%)	1 (4.0%)	0 (0%)	1 (2.4%)	0 (0%)	
Others	11 (8.2%)	7 (28.0%)	4 (10.5%)	0 (0%)	0 (0%)	
VCTE probe, n (%)						
M	35 (26.1%)	12 (48.0%)	11 (28.9%)	6 (14.6%)	6 (20.0%)	0.169

Histological Steatosis Grade	Overall, n=134	No Steatosis, n=25	Mild Steatosis, n=38	Moderate Steatosis, n=41	Severe Steatosis, n=30	p-value
XL	92 (68.7%)	11 (44.0%)	26 (68.4%)	32 (78.0%)	23 (76.7%)	
Failed	7 (5.2%)	2 (8.0%)	1 (2.6%)	3 (7.3%)	1 (3.3%)	
VCTE, kPa, median [IQR]	6.6 [5.3]	6.9 [5.2]	6.1 [4.7]	6.3 [4.8]	7.4 [7.8]	0.697
DAX-Auto pSWE median of 5 measurements, kPa, median [IQR]	3.0 [2.0]	4.2 [3.0]	2.9 [2.6]	2.8 [1.3]	3.0 [1.6]	0.168
DAX-Auto pSWE – single measurement, kPa, median [IQR]	3.0 [2.0]	4.2 [3.0]	2.9 [2.6]	2.8 [1.3]	3.0 [1.6]	0.168
UDFF median of 5 measurements, %, median [IQR]	18 [16]	8 [13]	12 [11]	23 [9]	23 [8]	<0.001
UDFF median – single measurement, %, median [IQR]	18 [14]	7 [11]	14 [13]	23 [11]	22 [12]	<0.001
CAP, dB/m, median [IQR]	295 [78]	248 [118]	273 [71]	322 [70]	322 [87]	0.033
cCAP, dB/m, median [IQR]	300 [69]	243 [88]	278 [75]	339 [62]	313 [44]	<0.001

Abbreviations: ALT: alanine aminotransferase; ALP: alkaline phosphatase; ArLD: alcohol-related liver disease; AST: aspartate aminotransferase; Auto pSWE: automated point shear wave elastography; BMI: body mass index; (c)CAP: (continuous) controlled attenuation parameter; DAX: deep abdominal (transducer); ELF: enhanced liver fibrosis test; GGT: gamma-glutamyl transferase; HbA1c: glycated hemoglobin; INR: international normalized ratio; IQR: interquartile range; MASLD: metabolic dysfunction-associated liver disease; MELD-Na: model for end-stage liver disease sodium score; n: number; SD: standard deviation; UDFE: ultrasound-derived fat fraction; ULN: upper limit of normal; VCTE: vibration-controlled transient elastography

## Supplementary Methods

For data management, Microsoft Excel was employed. Microsoft Word facilitated document creation and editing. GPT-4 was utilized exclusively for enhancing the text's style and readability. Statistical analyses were supported by specific R packages: cutpointr (1.1.2), ggplot2 (3.4.2), openxlsx (4.2.5.2), pROC (1.18.5), table1 (1.4.3), and tidyverse (2.0.0).

