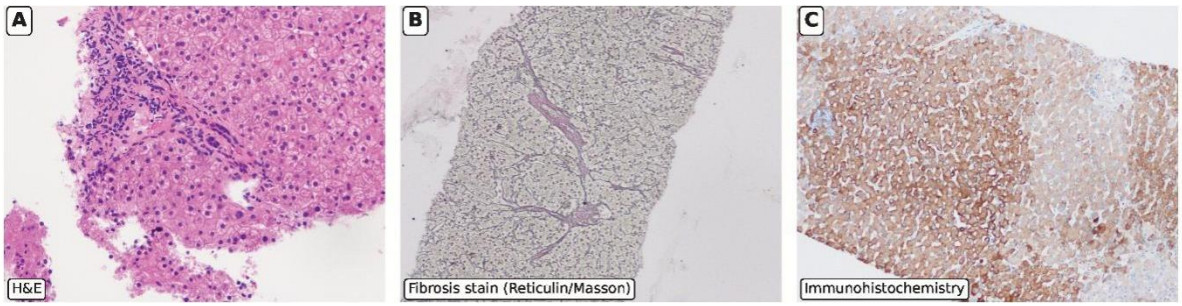
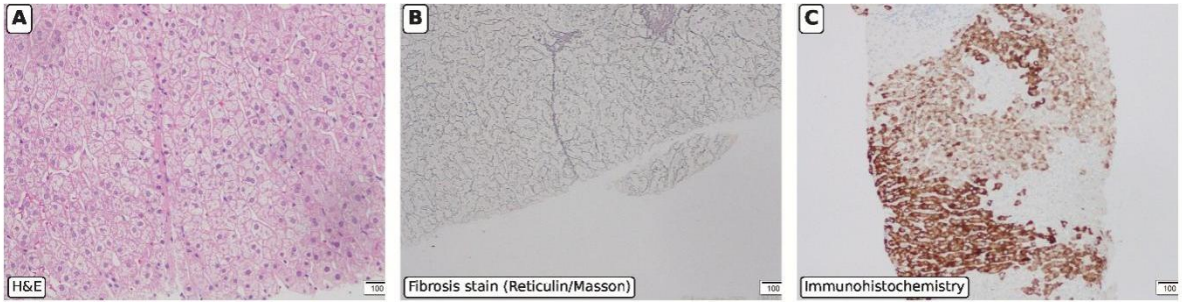
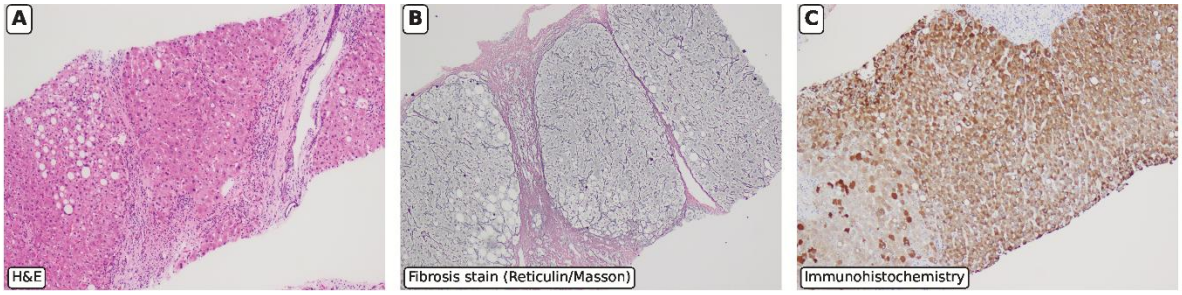


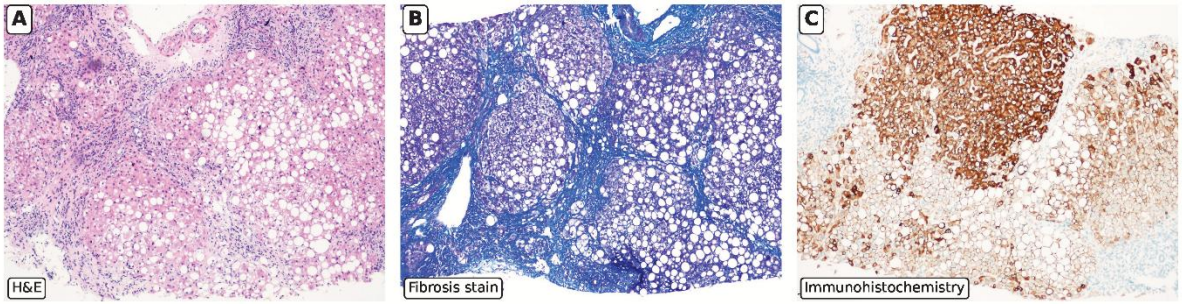
Supplementary Figure 1 Representative Scheuer stage S1 biopsy images. A: HE; B: Masson's trichrome; C: Reticulin stain.



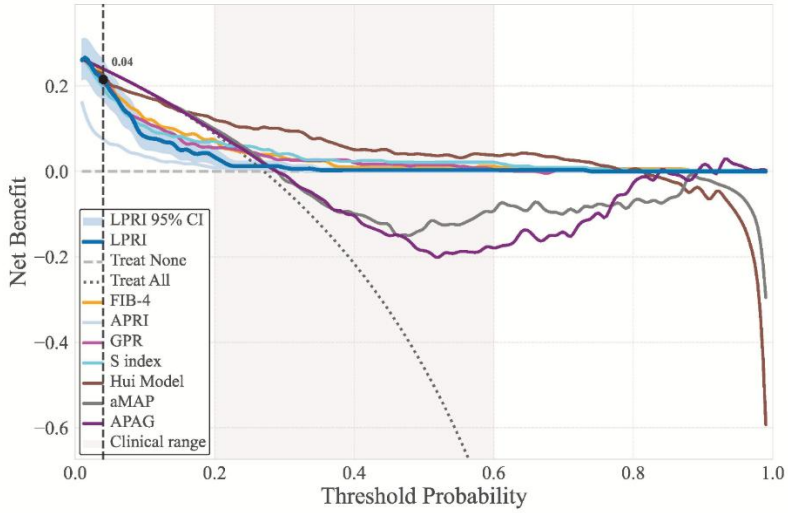
Supplementary Figure 2 Representative Scheuer stage S2 biopsy images. A: HE; B: Masson's trichrome; C: Reticulin stain.



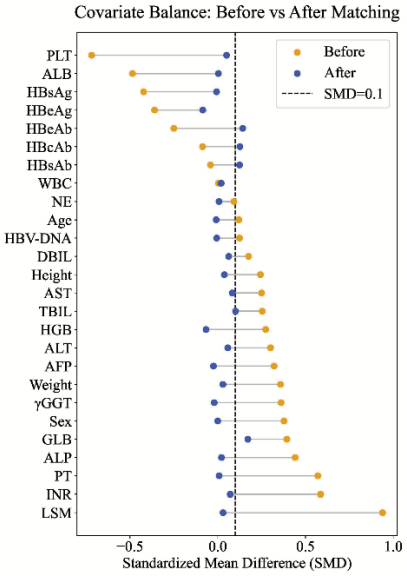
Supplementary Figure 3 Representative Scheuer stage S3 biopsy images. A: HE; B: Masson's trichrome; C: Reticulin stain.



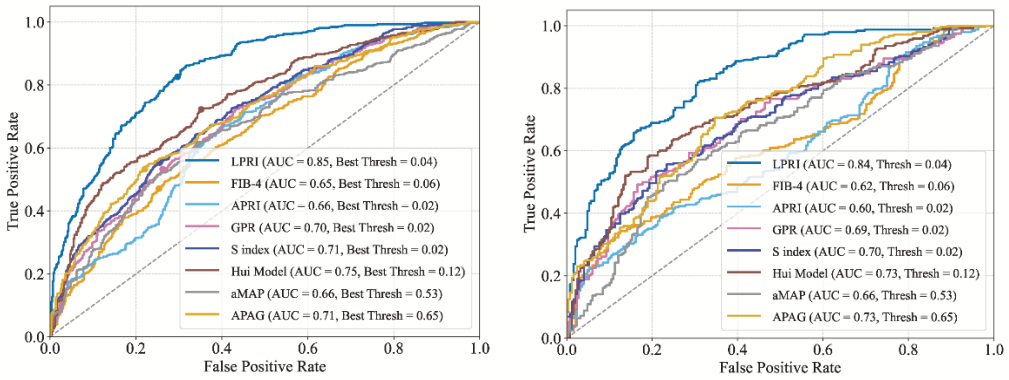
Supplementary Figure 4 Representative Scheuer stage S4 biopsy images. Representative liver biopsy images for Scheuer stage S1-4. A: HE; B: Masson's trichrome; C: Reticulin stain.



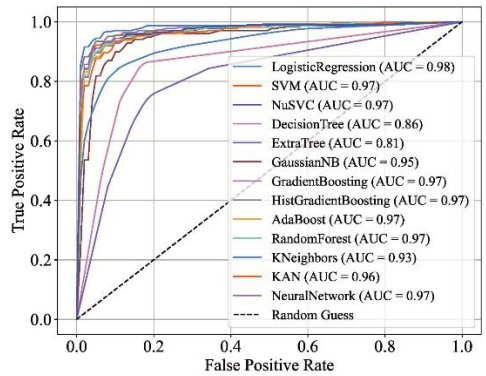
Supplementary Figure 5 Decision curve analysis for all noninvasive test models. Alt text: Decision curve analysis displaying the net clinical benefit of each non-invasive model across a range of risk thresholds.



Supplementary Figure 6 26 feature receiver operating characteristic curves (balanced data). Alt text: Receiver operating characteristic curves for 13 machine learning and deep learning models using 26 baseline features on balanced data. Each curve shows the true positive rate versus the false positive rate for each model, allowing visual comparison of the classification performance in significant liver fibrosis prediction.

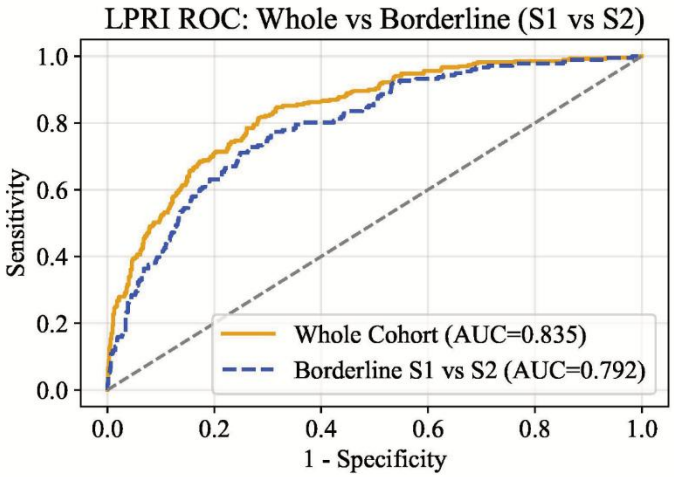


Supplementary Figure 7 Comparison of receiver operating characteristic curves for non-invasive test models in training and validation datasets on balanced data. Receiver operating characteristic (ROC) curves for non-invasive test models with best thresholds (balanced train data). ROC curves comparing multiple non-invasive test models, including liver stiffness-platelet ratio index and conventional indices, on the training set after balancing. Each curve represents the model performance for classifying significant liver fibrosis, with the AUC values provided. ROC Curves for non-invasive test models with best thresholds (balanced validation data). ROC curves for multiple non-invasive test models, including liver stiffness-platelet ratio index and other indices, evaluated on the validation set after balancing. The plot shows the sensitivity and specificity trade-offs for each model in the validation cohort with corresponding AUC values.

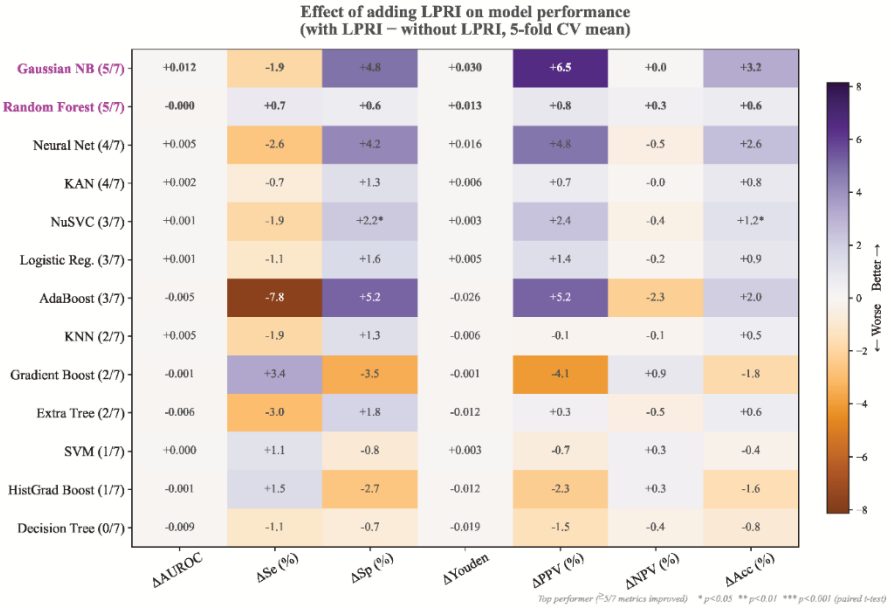


Supplementary Figure 8 Covariate balance before and after propensity score matching. Standardized mean differences (SMD) are plotted for all baseline variables. Dot plot showing SMD for all baseline variables before and after propensity score matching. The SMD of each variable is represented as a point, with lines indicating

the thresholds for acceptable balance. The plot illustrates an improved covariate balance after propensity score matching.



Supplementary Figure 9 Borderline-case analysis (Scheuer S1 *vs* S2) using liver stiffness-platelet ratio index thresholds. Borderline-case analysis restricted to Scheuer S1 versus S2 (n=908; S1=732, S2=176). LPRI showed good discrimination at the critical boundary (AUC=0.792). At the Youden-optimal threshold (LPRI=3.988), sensitivity=0.773, specificity=0.691, PPV=0.376, and NPV=0.927. For pragmatic triage, a dual-threshold strategy was evaluated: rule-out threshold LPRI=3.077 (sensitivity=0.903, specificity=0.469, NPV=0.953) and rule-in threshold LPRI=6.508 (specificity=0.902, sensitivity=0.403, PPV=0.497), with an indeterminate zone between 3.08 and 6.51 requiring additional assessment.



Supplementary Figure 10 Performance evaluation of machine learning and deep learning models trained with 26 features versus 26 features plus liver stiffness-platelet ratio index for diagnosing significant liver fibrosis in chronic hepatitis B patients. Heatmap showing improvement in sensitivity, specificity, and Youden Index after adding the Liver Platelet Ratio Index to the machine learning models.

Supplementary Table 1 Delong's of LPRI with other models

Model comparison	*Z* value	*P* value
LPRI *vs* APRI	10.80	3.4E-27
LPRI *vs* FIB-4	10.45	1.54E-25
LPRI *vs* GPR	7.88	3.37E-15
LPRI *vs* aMAP	7.85	4.05E-15
LPRI *vs* S index	7.51	5.99E-14
LPRI *vs* APAG	6.81	1E-11
LPRI *vs* Hui	6.50	8.24E-11

Supplementary Table 2 Performance of machine learning and deep learning models using 26 features on balanced dataset

Models	AUROC	Youden	PPV (%)	NPV (%)	Acc (%)	Sensitivity (%)	Specificity (%)
Using 26 features							
Logistic Regression	0.98	91.26	97.02	94.45	95.62	94.17	97.09
SVM	0.97	88.66	96.58	92.37	94.32	91.90	96.76
NuSVC	0.97	87.03	95.58	91.84	93.51	91.25	95.77
Decision Tree	0.86	72.76	87.33	85.90	86.37	85.41	87.35
Extra Tree	0.81	62.65	81.51	81.29	81.33	81.54	81.12
Gaussian NB	0.95	81.51	89.91	91.75	90.75	91.90	89.61
Gradient Boosting	0.98	88.31	96.32	92.38	94.16	91.89	96.43
HistGrad Boosting	0.98	90.29	95.50	95.05	95.14	94.83	95.46
AdaBoost	0.97	87.01	93.96	93.43	93.51	93.19	93.82

Random Forest	0.97	87.33	94.78	92.81	93.67	92.53	94.80
KNeighbors	0.93	74.04	87.39	86.86	87.02	86.71	87.33
KAN	0.97	86.39	95.54	91.65	93.19	90.94	95.45
Neural Network	0.98	89.30	97.07	92.84	94.65	92.23	97.08

Supplementary Table 3 Covariate balance before and after propensity score matching

Variable	SMD_before	SMD_after	VarRatio_before	VarRatio_after	p_value_before	p_value_after
Sex	0.377	0.000	0.762	1.000	0.000	1.000
Age	0.121	-0.009	1.112	0.867	0.056	0.993
Weight	0.357	0.029	0.985	0.739	0.000	0.555
Height	0.243	0.038	0.694	0.916	0.001	0.993
HBV-DNA	0.124	-0.006	2478.350	1.413	0.020	0.232
HBsAg	-0.422	-0.007	0.294	1.281	0.000	0.178
HBsAb	-0.042	0.124	0.395	2.530	0.129	0.852
HBeAg	-0.360	-0.085	0.000	0.921	0.000	0.658
HBeAb	-0.250	0.142	0.037	1.661	0.000	0.178
HBcAb	-0.086	0.126	0.034	0.867	0.001	0.555
WBC	0.004	0.020	1.091	0.990	0.890	0.993
NE	0.092	0.007	14.918	0.847	0.768	0.972
HGB	0.273	-0.067	0.762	0.645	0.000	0.555
PLT	-0.718	0.050	1.113	1.152	0.000	0.296
PT	0.570	0.008	1.340	1.237	0.000	0.555
INR	0.586	0.071	1.985	1.116	0.000	0.759
ALB	-0.486	0.004	0.938	0.584	0.000	0.925
GLB	0.394	0.172	1.249	1.049	0.000	0.101
TBIL	0.254	0.101	2.227	2.325	0.000	0.993
DBIL	0.176	0.062	2.274	1.909	0.000	0.972
ALT	0.301	0.057	2.618	1.251	0.000	0.993

AST	0.250	0.083	1.595	1.116	0.004	0.852
γGGT	0.361	-0.020	7.405	1.142	0.000	0.555
ALP	0.441	0.021	0.920	1.215	0.000	0.993
AFP	0.321	-0.024	3.129	0.514	0.000	0.101
LSM	0.939	0.030	5.251	0.686	0.000	0.232

Supplementary Table 4 Borderline Analysis (Scheuer S1 *vs* S2): Operating characteristics of liver stiffness-platelet ratio index thresholds

Threshold strategy	LPRI threshold	Sensitivity	Specificity	PPV	NPV
Youden-optimal	3.99	0.77	0.69	0.38	0.93
Rule-out (Se ≥ 0.90)	3.08	0.90	0.47	0.29	0.95
Rule-in (Sp ≥ 0.90)	6.51	0.40	0.90	0.50	0.86

Rule-out and rule-in thresholds were selected to target high sensitivity (sensitivity ≥ 0.90) and high specificity (specificity ≥ 0.90), respectively.