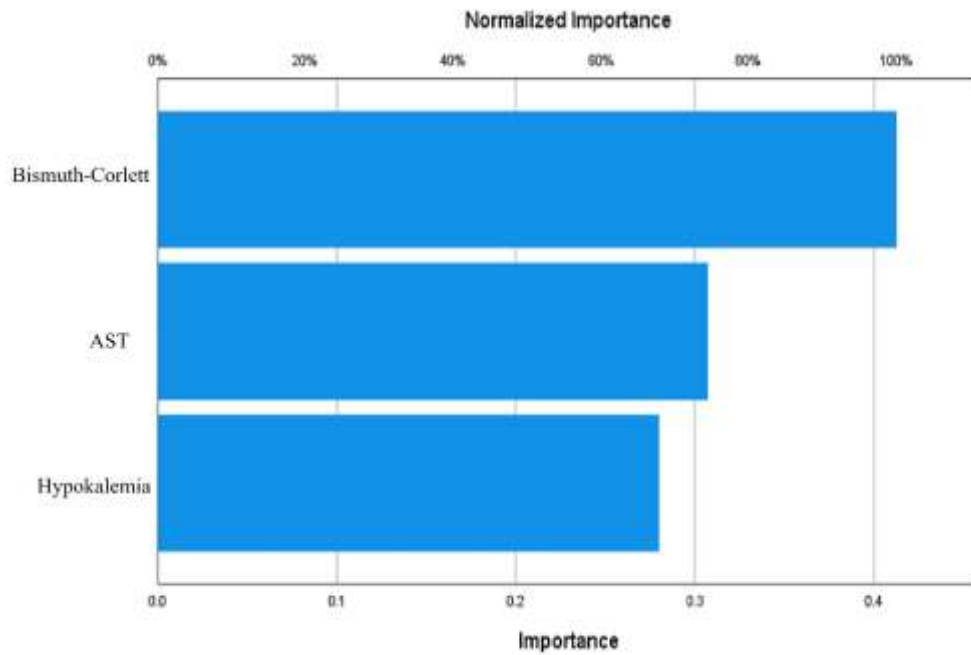
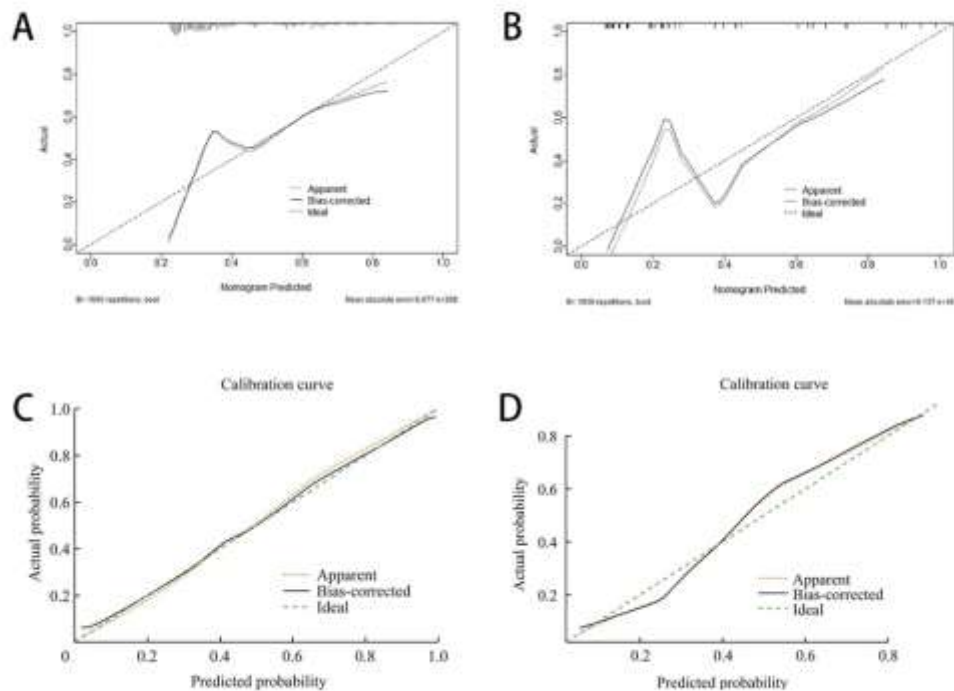




Supplementary Figure 1 Importance of predictor variables. The importance of each variable was shown as follows: Bismuth-Corlett classification (0.413; 100.0%), AST (0.307; 74.4%), hypokalemia (0.280; 67.8%)



Supplementary Figure 2 Calibration curves for the prediction models. A: LR training group calibration curves; B: LR validation group calibration curve; C: ANN training group calibration curves; D: ANN validation group calibration curve.

Supplementary Table 1 Baseline demographic and clinicopathological characteristics, *n* (%)

Characteristics	Modeling group (n=358)	Validation group (n=45)	χ^2/Z	<i>P</i> value
Gender				
Male	244 (68.2)	29 (64.4)	0.197	0.657
Female	114 (31.8)	16 (35.6)		
Age $\geq$ 65	241(67.3)	26 (57.8)	1.860	0.173
Pre-procedural PTBD	21 (5.9)	1 (2.2)	0.028	0.866
Chemotherapy	28(7.8)	6 (13.4)	2.400	0.200
Radiotherapy	9(2.5)	1(22.3)	0.365	0.546
Prior endoscopic intervention	144(40.2)	17(37.8)	0.055	0.815
Diabetes	63(17.6)	7(15.6)	0.176	0.675
Hypertension	113(31.6)	17(37.8)	2.831	0.150
Child-Pugh score				
A	34 (9.5)	6 (3.3)	3.749	0.153
B	250 (69.8)	35 (77.8)		
C	74(20.7)	4 (8.9)		

Cholelithiasis	99(27.7)	13(28.9)	0.495	0.482
Smoking	95(26.5)	11(24.4)	0.680	0.410
Alcohol consumption	83(23.2)	9(20.0)	0.000	0.987
Prior nasobiliary drainage	80(22.3)	7(15.6)	0.049	0.825
Prior surgical intervention	24(6.7)	4(8.9)	0.168	0.682
Cholecystectomy	35(9.8)	7(15.6)	0.262	0.609
Chronic cholecystitis	62 (17.3)	6(13.3)	0.133	0.715
Chronic pancreatitis	30(8.4)	3(6.7)	0.122	0.727
Antibiotic prophylaxis	165 (16.1)	20 (44.4)	3.759	0.053
Plastic stent placement	254 (70.9)	32 (71.1)	0.001	0.977
Metal stent placement	11 (3.1)	2 (4.4)	1.208	0.272
ENBD	179 (50.0)	20 (44.4)	1.033	0.309
Number of stents				
0	88 (24.6)	10 (22.2)	0.856	0.836
Single	167 (46.6)	22 (48.9)		
Multiple	103 (28.8)	13 (28.9)		
EST	105 (29.3)	24 (53.3)	0.440	0.507

Involvement of duodenum	36 (10.1)	4 (8.9)	3.648	0.131
Balloon dilatation	43(12.0)	5 (11.1)	0.067	0.796
Bouginage	68(19.0)	13 (28.9)	0.326	0.568
RFA	14(3.9)	6 (13.3)	0.156	0.693
Endoscopic stone extraction	45(12.6)	7 (15.6)	1.783	0.182
Duodenal diverticulum	59(14.5)	7 (15.6)	0.058	0.809
Bismuth-Corlett classification				
I	153 (42.7)	23 (51.1)	86.004	0.289
II	135 (37.7)	14 (31.1)		
IIIa	21 (5.9)	4 (8.9)		
IIIb	14 (3.9)	1 (2.2)		
IV	35 (9.8)	3 (6.7)		
Transfusion history	18(5.0)	5 (11.1)	4.803	0.058
Hypokalemia	57(15.9)	9 (20.0)	27..802	0.351
Hyperamylasemia	10(2.8)	1 (2.2)	1.116	0.291
Hypoproteinemia	91(15.4)	7 (15.6)	3.756	0.053

GI bleeding	13(3.6)	2 (4.4)	0.004	0.949
BMI, median (IQR)	20.12 (18.18-21.96)	21.10 (18.18-22.72)	-2.167	0.301
Total procedure time, median (IQR)	40.00 (25.00-50.00)	35.00 (23.00-45.00)	1.232	0.218
WBC, median (IQR)	7.30 (6.10-10.00)	7.00 (5.50-9.00)	1.746	0.081
ANC, median (IQR)	5.66 (4.30-7.80)	5.10 (3.76-7.00)	2.213	0.207
LYM, median (IQR)	0.90 (0.69-1.30)	1.06 (0.70-1.40)	-1.385	0.166
NLR, median (IQR)	6.14 (3.80-10.88)	5.00 (3.25-8.71)	2.501	0.102
PLT, median (IQR)	208.00 (149.00-271.00)	214.00 (170.00-282.00)	-1.329	0.184
TBIL, median (IQR)	205.40 (116.00-339.50)	166.60 (62.80-283.00)	2.528	0.124
DBIL, median (IQR)	155.40 (74.42-253.40)	126.10 (47.00-217.20)	2.516	0.052
ALT, median (IQR)	86.31 (53.09-152.54)	75.09 (51.36-133.87)	1.070	0.248
AST, median (IQR)	106.38 (60.49-189.85)	80.00 (52.20-124.21)	2.746	0.056
ALP, median (IQR)	485.00 (290.61-785.00)	423.55 (283.00-651.00)	1.842	0.065
GGT, median (IQR)	472.00 (279.75-820.50)	487.00 (248.00-842.00)	-0.094	0.925
Serum amylase, median (IQR)	46.50 (35.00-64.00)	50.50 (36.90-68.00)	-1.318	0.188

Serum lipase, median (IQR)	46.00 (21.00-96.00)	80.00 (41.00-136.00)	-4.003	0.389
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PTBD: Percutaneous transhepatic biliary drainage; ENBD: Endoscopic nasobiliary drainage; EST: Endoscopic sphincterotomy; RFA: Radiofrequency ablation; BMI: Body mass index(kg/m²); WBC: White blood cell (× 10⁹/L); ANC: Absolute neutrophil count (× 10⁹/L); LYM: Absolute lymphocyte count (× 10⁹/L); NLR: Neutrophil-lymphocyte ratio; PLT: Platelets (× 10⁹/L); TBIL: Total bilirubin(μmol/L); DBIL: Direct bilirubin(μmol/L); ALT: Alanine aminotransferase (U/L); AST: Aspartate aminotransferase (U/L); ALP: Serum alkaline phosphatase(U/L); GGT: γ-glutamyl transpeptidase(U/L); Total procedure time(min); Serum amylase(U/L); Serum lipase(U/L); IQR: Interquartile range.

Supplementary Table 2 Univariate logistic regression analysis of the modeling group, n (%)

Characteristics	PBI group(n=143)	Non-PBI group(n=215)	χ^2/Z	<i>P</i> value
Gender				
Male	95(66.4)	149(69.3)	0.326	0.568
Female	48(33.6)	66(30.7)		
Age, ≥65	100(69.9)	141(65.6)	0.738	0.390
Pre-procedural PTBD	10(7.0)	11(5.1)	0.548	0.459
Chemotherapy	6(4.2)	22(10.2)	4.341	0.037
Radiotherapy	3(2.1)	6(2.8)	0.168	0.682

Prior endoscopic intervention	57(39.9)	87(40.5)	0.013	0.909
Diabetes	24(16.8)	39(18.1)	0.109	0.741
Hypertension	39(27.3)	74(34.4)	2.030	0.154
Child-Pugh score				
A	11(7.7)	23(10.7)	2.403	0.182
B	96(67.1)	154(71.6)		
C	36(25.2)	38(17.7)		
Cholecystitis	45(31.5)	54(25.1)	0.732	0.188
Smoking	35(24.5)	60(27.9)	0.519	0.471
Alcohol consumption	32(22.4)	51(23.7)	0.087	0.768
Prior nasobiliary drainage	32(22.4)	48(22.3)	0.000	0.991
Prior surgical intervention	10(7.0)	14(6.5)	0.032	0.858
Cholecystectomy	16(11.2)	19(8.8)	0.538	0.463
Chronic cholecystitis	26(18.2)	36(16.7)	0.124	0.725
Antibiotic prophylaxis	76(53.1)	89(41.4)	4.773	0.029
Plastic stent placement	101(70.6)	153(71.2)	0.012	0.913
Metal stent placement	7(4.9)	4(1.9)	2.656	0.103

ENBD	76(53.1)	103(47.9)	0.943	0.331
Number of stents				
0	34(23.8)	54(25.1)	0.758	0.859
Single	66(46.1)	101(47.0)		
Multiple	43(30.1)	60(27.9)		
EST	84(58.7)	121(56.3)	0.213	0.645
Involvement of duodenum	19(13.3)	17(7.9)	2.748	0.097
Balloon dilatation	14(9.8)	29(13.5)	1.111	0.292
Bouginage	29(20.3)	39(18.1)	0.256	0.613
RFA	4(2.8)	10(4.7)	0.786	0.375
Endoscopic stone extraction	14(9.8)	31(14.4)	1.674	0.196
Duodenal diverticulum	22(15.4)	37(17.2)	0.208	0.649
Bismuth-Corlett classification				
I	18(12.6)	142(66.0)	71.135	<0.001
II	81(56.6)	47(21.9)		
IIIa	12(8.4)	9(4.2)		
IIIb	9(6.3)	5(2.3)		

IV	23(16.1)	12(5.6)		
Transfusion history	11(7.7)	7(3.3)	3.540	0.060
Hypokalemia	39(27.3)	18(8.4)	22.918	<0.001
Hyperamylasemia	6(4.2)	4(1.9)	1.725	0.189
Hypoproteinemia	44(30.8)	47(21.9)	1.788	0.181
GI bleeding	5(3.5)	8(3.7)	0.012	0.911
BMI, median (IQR)	21.10(18.18-22.59)	20.45(18.99-22.47)	-2.237	0.025
Total procedure time, median (IQR)	38.00(24.00-46.25)	40.00(22.50-51.00)	1.416	0.157
WBC, median (IQR)	7.10(5.70-9.22)	6.80(5.55-8.60)	1.941	0.052
ANC, median (IQR)	5.40(3.97-7.20)	5.00(3.54-6.85)	2.367	0.018
LYM, median (IQR)	1.00(0.70-1.33)	1.07(0.79-1.36)	-1.362	0.173
NLR, median (IQR)	5.23(3.49-9.65)	4.46(2.96-7.58)	2.643	0.008
PLT, median (IQR)	213.00(165.75-279.00)	217.00(179.00-284.50)	-1.166	0.243
TBIL, median (IQR)	179.70(80.50-311.05)	168.40(81.15-265.75)	2.647	0.008
DBIL, median (IQR)	130.90(54.42-228.17)	119.90(67.45-188.73)	2.734	0.006
ALT, median (IQR)	80.99(52.34-137.63)	91.71(54.08-133.24)	1.032	0.302

AST, median (IQR)	88.99(55.33-149.70)	97.00(59.00-152.14)	2.839	0.005
ALP, median (IQR)	456.65(283.30-674.26)	563.00(338.15-786.02)	1.703	0.089
GGT, median (IQR)	473.50(252.52-832.42)	544.16(343.08-868.05)	-0.104	0.917
Serum amylase, median (IQR)	49.00(36.00-65.00)	47.00(37.83-66.25)	-1.1325	0.185
Serum lipase, median (IQR)	62.50(28.87-123.00)	65.00(36.25-164.500)	-4.188	<0.001

PTBD: Percutaneous transhepatic biliary drainage; ENBD: Endoscopic nasobiliary drainage; EST: Endoscopic sphincterotomy; RFA: Radiofrequency ablation; BMI: Body mass index(kg/m²); WBC: White blood cell ($\times 10^9$ /L); ANC: Absolute neutrophil count ($\times 10^9$ /L); LYM: Absolute lymphocyte count ($\times 10^9$ /L); NLR: Neutrophil-lymphocyte ratio; PLT: Platelets ($\times 10^9$ /L); TBIL: Total bilirubin(μ mol/L); DBIL: Direct bilirubin(μ mol/L); ALT: Alanine aminotransferase (U/L); AST: Aspartate aminotransferase (U/L); ALP: Serum alkaline phosphatase(U/L); GGT: γ -glutamyl transpeptidase(U/L); Total procedure time(min); Serum amylase(U/L); Serum lipase(U/L); IQR: Interquartile range.

Supplementary Table 3 Construction of LR model

Characteristics	β	SE	Wald	<i>P</i>	OR	95%CI
Bismuth-Corlett classification	0.393	0.089	19.619	<0.001	1.482	1.245-1.764
Hypokalemia	1.491	0.297	25.251	<0.001	4.440	2.483-7.942
AST	0.003	0.001	7.075	0.008	1.003	1.001-1.005

Based on these three factors, the identified model equation was $Y = \text{Logit } P = -1.842 + 0.393 \times \text{Bismuth-Corlett Classification} + 1.491 \times \text{Hypokalemia} + 0.003 \times \text{AST}$

Supplementary Table 4 Importance of independent variables

	Importance	Normalized importance
Bismuth-Corlett classification	0.413	100.0%
AST	0.307	74.4%
Hypokalemia	0.280	67.8%

The importance of each variable was shown as follows: Bismuth-Corlett classification (0.413; 100.0%), AST (0.307; 74.4%), hypokalemia (0.280; 67.8%)