Research on the Prediction Model for Early Biliary Stasis after Sleeve Gastrectomy Based on Machine Learning Algorithms

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PART 01

Research Background

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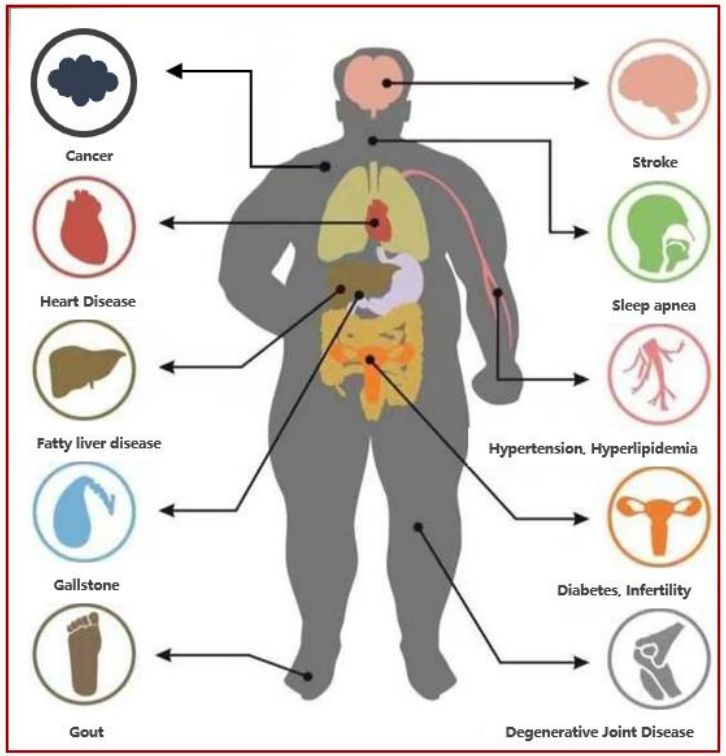
Obesity and related chronic diseases are a major public health problem that seriously endangers the health of the nation

Serious epidemic



Independent risk factors for chronic diseases

Lancet Diabetes Endocrinol, 2021, 9(6): 373-392.
Lancet Diabetes Endocrinol, 2021, 9(7): 446-461.

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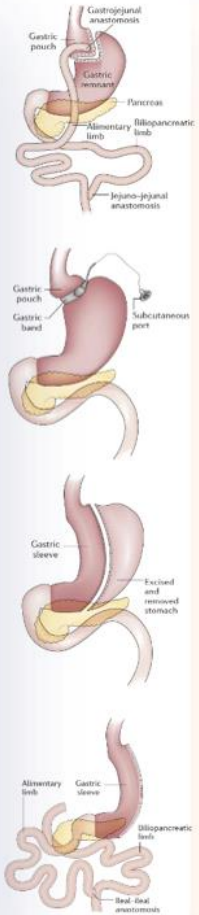
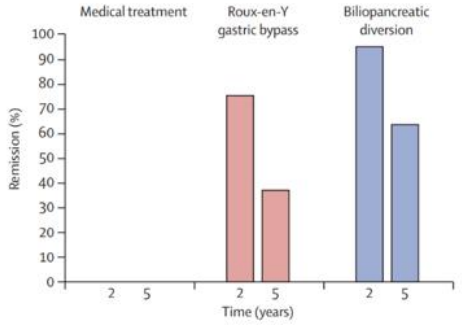
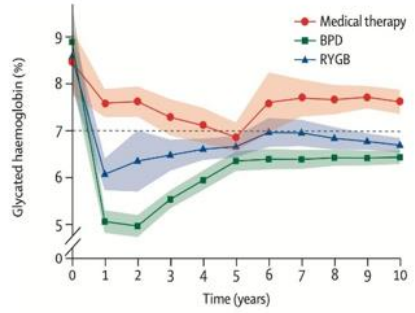


Diabetes remission

- Diabetes remission rate 2 years after surgery, **75%~95%**



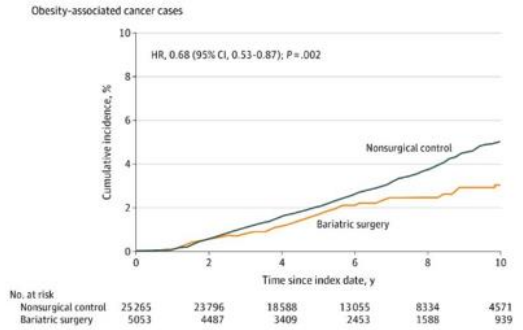
- 10 years after surgery, **87.5%** of T2DM achieve HbA1c <7.0%



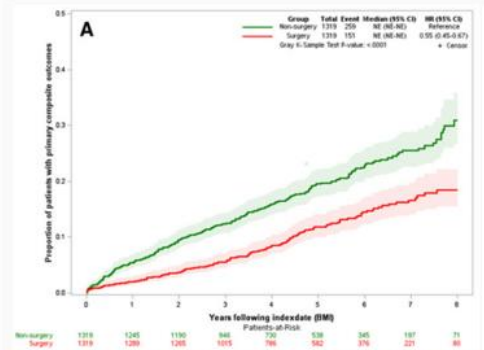
Lancet. 2015, 386(9997):964-973.
Lancet, 2021, 397(10271): 293-304.

Reducing chronic diseases

- **32%** reduction in cancer risk



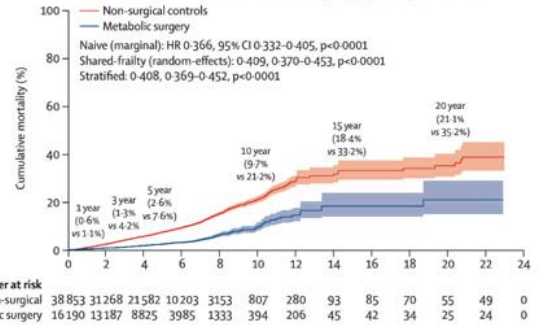
- **42%** reduction in risk of serious adverse cardiovascular events



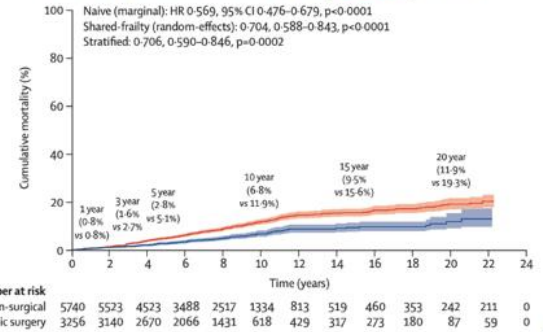
JAMA. 2022;327(24):2423-2433.
Circulation. 2021;143(15):1468-1480.

Extension of life expectancy

- Median life expectancy for T2DM increased by **9.3** years



- Median life expectancy for non-T2DM increased by **5.1** years



Lancet, 2021, 397(10287): 1830-1841.

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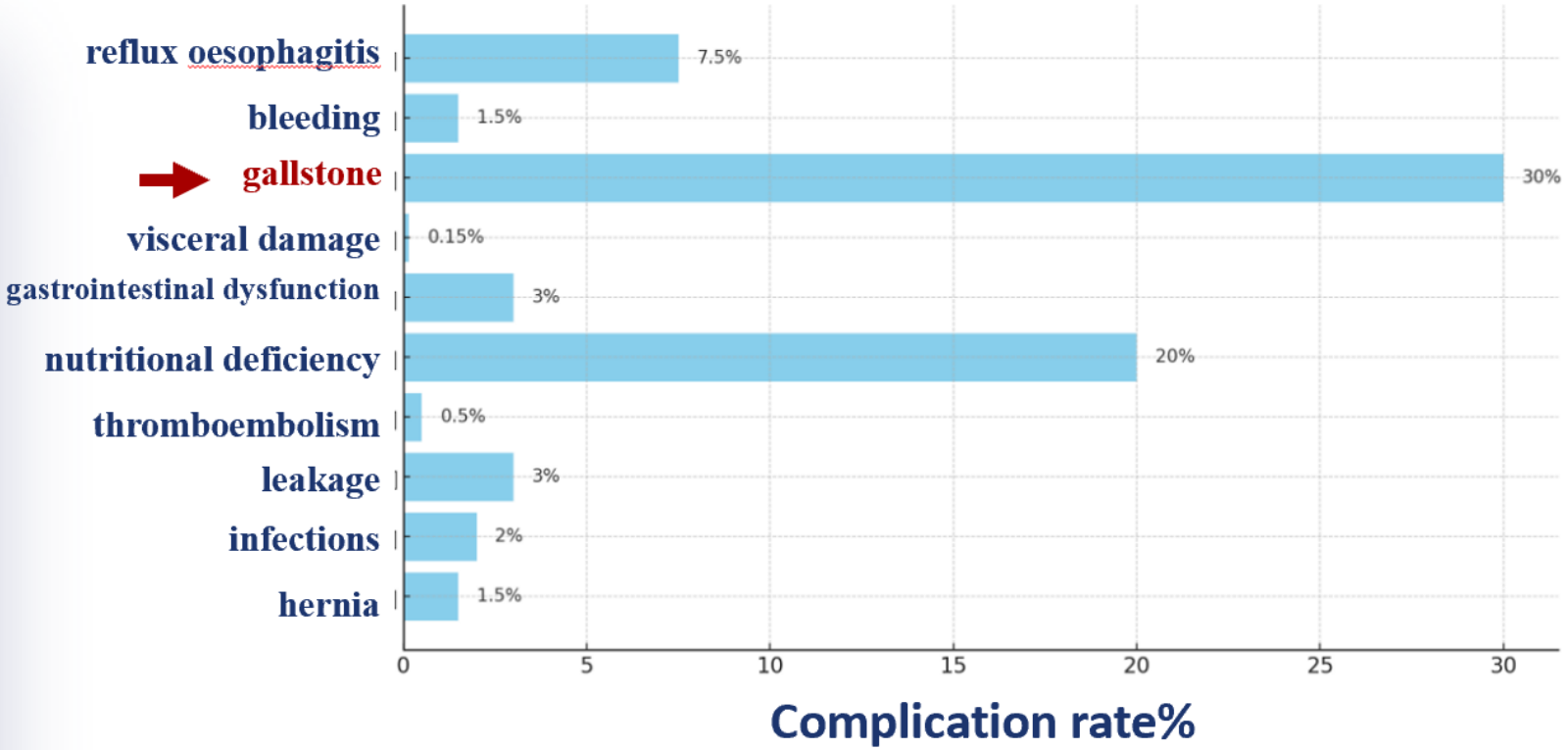
Postoperative-related complications



5.5 times
symptomatic gallbladder stones

5.4 times
Cholecystectomy

3.5 times
Complication of cholecystectomy

postoperative cholelithiasis

- Rapid weight loss
- Changes in bile composition
- Abnormal gallbladder function
- Hormonal changes in the gut
- Dietary and nutritional changes

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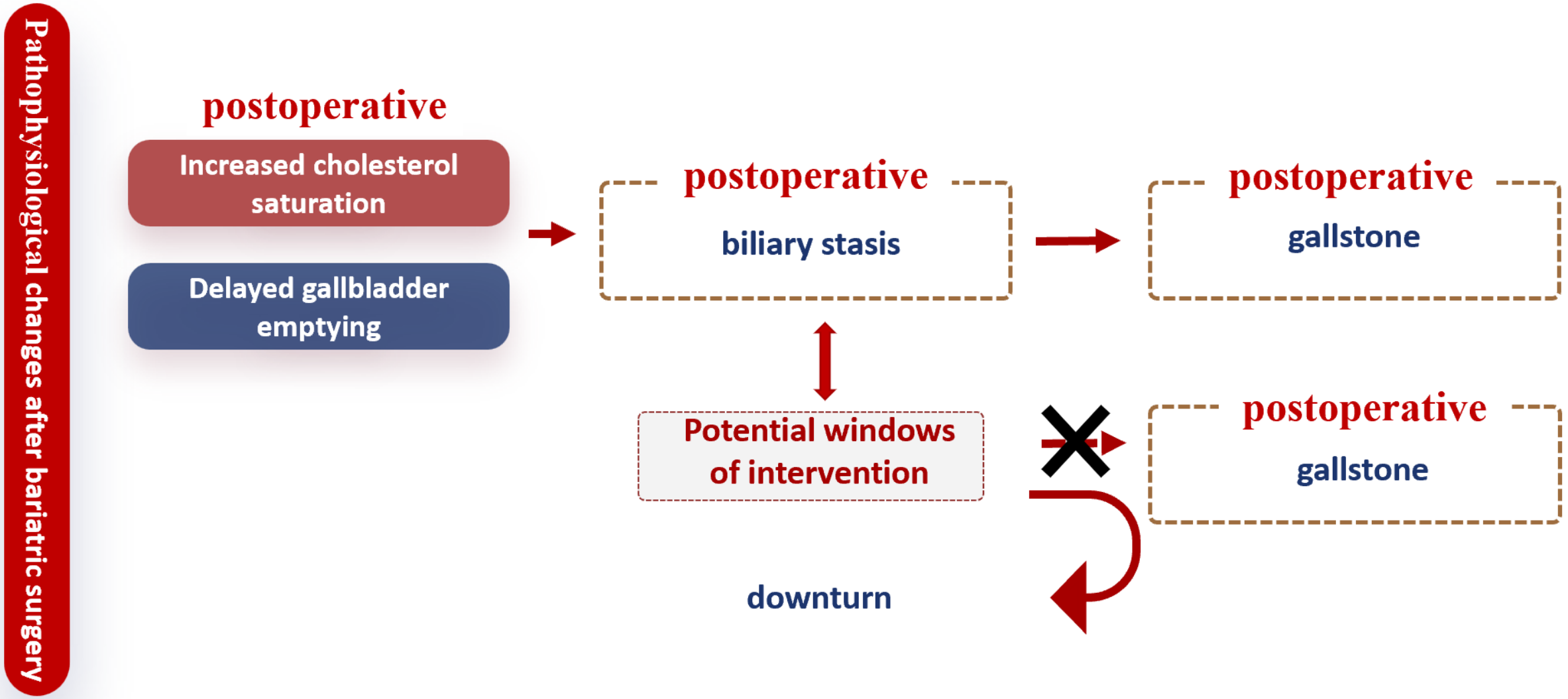

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Existing problems

01 Uncertainty about the onset of cholelithiasis after metabolic surgery

02 The risk of patient morbidity cannot be predicted preoperatively

03 Unclear programme of postoperative pharmacological interventions

04 Postoperative management cannot be personalised

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PART 02

Research Objective

Research on the prediction model for early biliary stasis after sleeve gastrectomy based on machine learning algorithms

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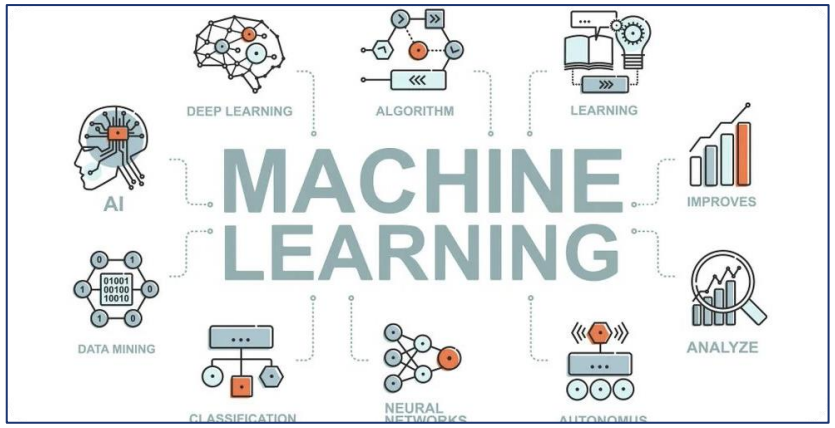

- machine learning-based model to predict the risk of early biliary stasis

- guidance on clinical treatment

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PART 03

Research Methods

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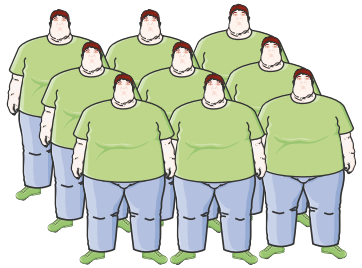
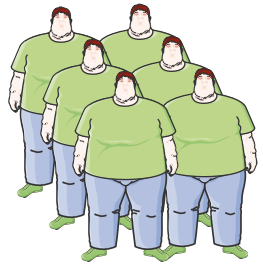
Data Collection and Patient Selection

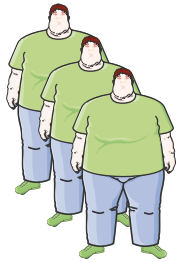


900 patients underwent sleeve gastrectomy

Retrospective Clinical Data Analysis



training (600 patients)



test (300 patients)

Division into Training and Test Sets

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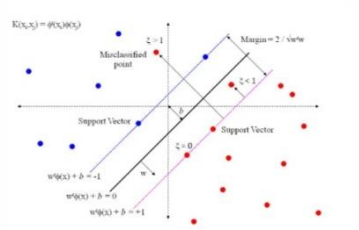
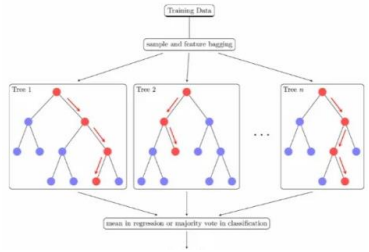
Feature Selection and Model Construction

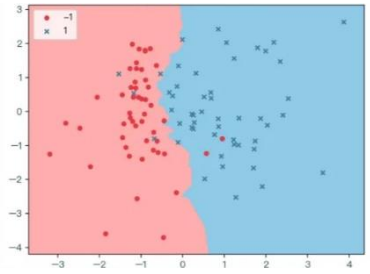
Univariate analysis and identifying variables most predictive of early biliary stasis



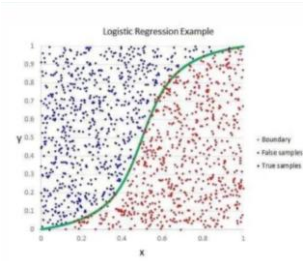
support vector machine



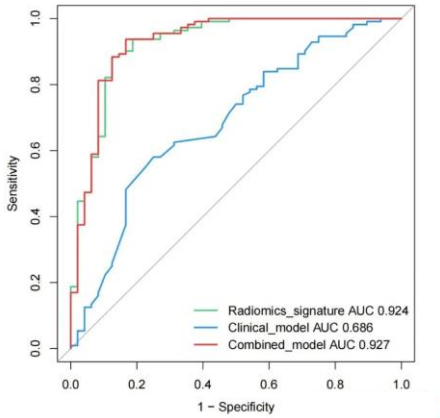
random forest



K-nearest neighbors



logistic regression



- Discriminative ability
- calibration
- clinical utility

Univariate Analysis for Feature Selection

Application of Machine Learning Algorithms

Receiver Operating Characteristic Curve Analysis

Evaluation

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PART 04

Research Results

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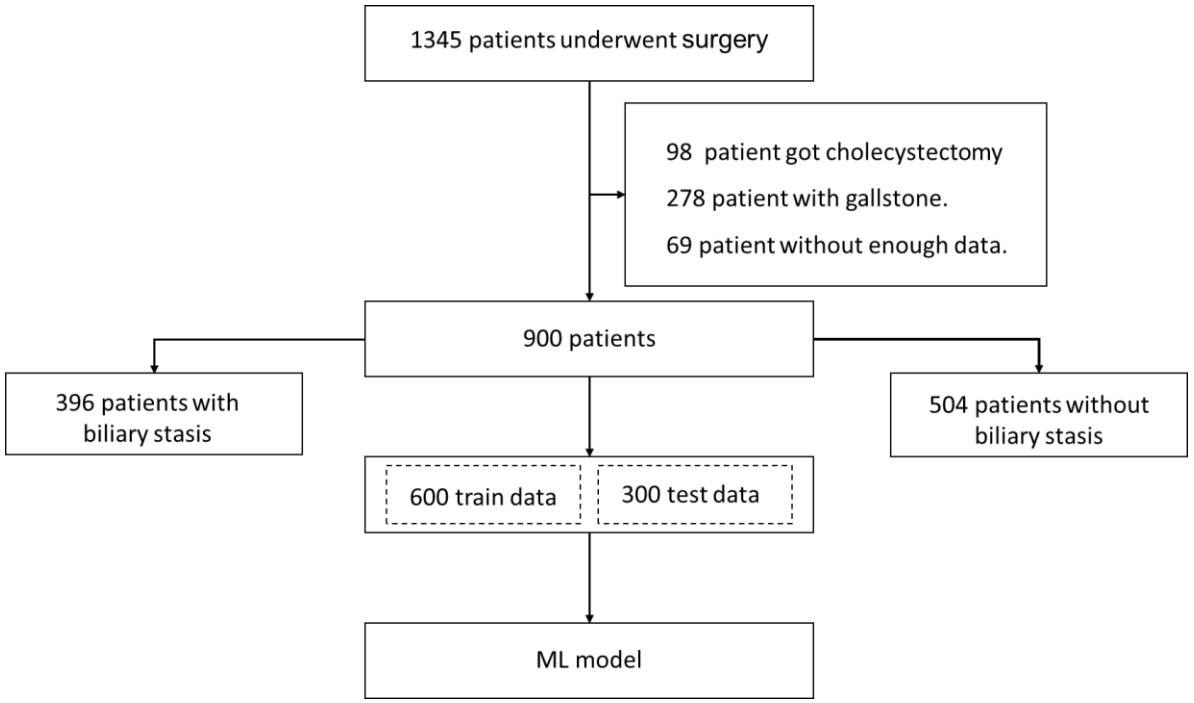
1. Flowchart and patients features



	Train data	Test data	X2	p
Age(year)	36.51±18.32	38.22±17.56	-1.313	0.192
Sex(male)	378 (63.0%)	181 (60.3%)	1.082	0.312
Diabetes (yes)	45.21	43.67	0.882	0.232
FLD (yes)	501 (83.5%)	233 (77.7%)	2.011	0.712
TC (high)	458 (76.3%)	214 (71.3%)	0.151	0.281
HDL-C (low)	398 (66.3%)	184 (61.3%)	0.523	0.322
LDL-C (high)	411 (68.5%)	221 (73.7%)	0.432	0.115
UA (high)	256 (42.7%)	138 (46.0%)	0.895	0.354
AST (high)	429 (71.5%)	189 (63.0%)	0.832	0.655
biliary stasis	275 (45.8%)	121 (40.3%)	0.422	0.562

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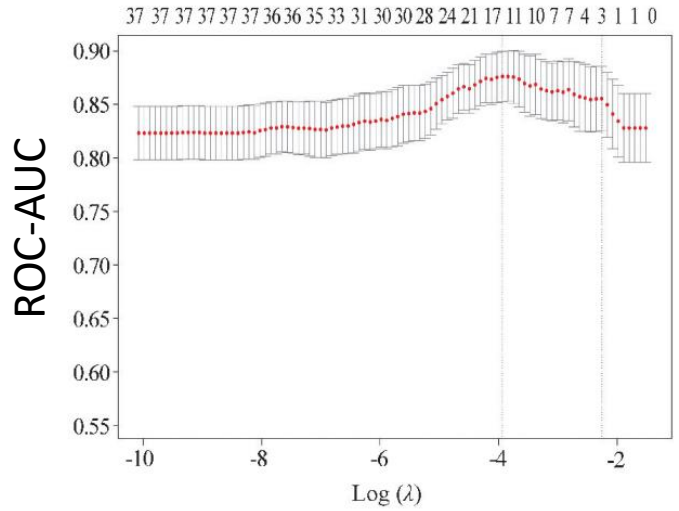
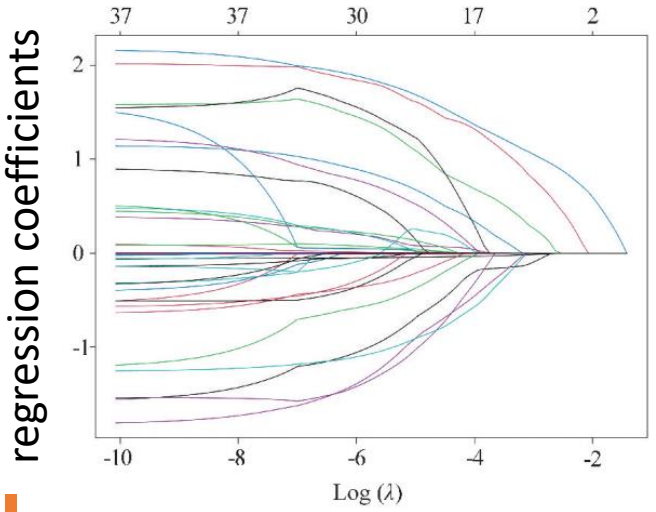
2. Screening of clinical variables





The tuning interval for the Lasso regression parameter λ;

The regression coefficients for each clinical variable;

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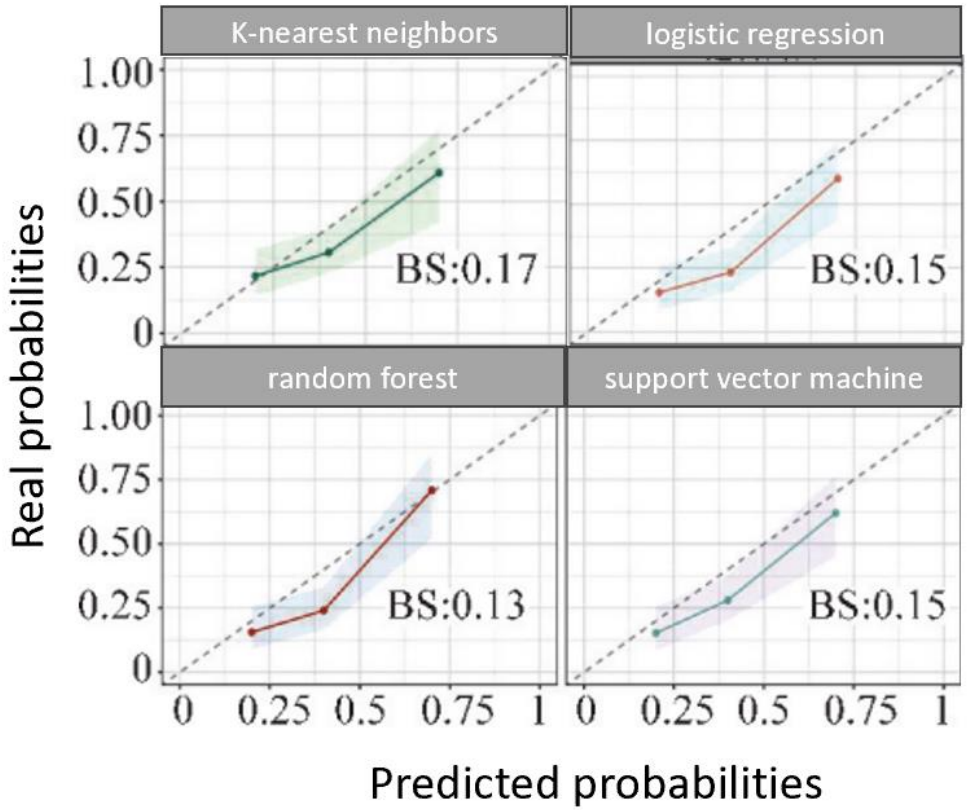
3. Superiority of the Random Forest Model

Machine Learning	Train				Test			
	AUC	95%CI	sensitivity	specificity	AUC	95%CI	sensitivity	specificity
logistic regression	0.822	(0.731, 0.905)	69.1%	61.0%	0.744	(0.687, 0.930)	64.9%	63.4%
support vector machine	0.715	(0.662, 0.801)	65.4%	60.2%	0.693	(0.600, 0.711)	55.3%	69.2%
K-nearest neighbors	0.818	(0.733, 0.872)	70.2%	66.9%	0.713	(0.609, 0.842)	61.2%	66.2%
random forest	0.873	(0.832, 0.912)	71.9%	76.0%	0.771	(0.602, 0.892)	68.3%	66.5%

The diagnostic performance of each model in the training and test sets;

Calibration curves for various machine learning models;



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PART 05

Conclusion

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Summary of Key Findings

Effectiveness of the Random Forest Algorithm in predicting early biliary stasis;

improving patient care and management through the use of the predictive nomogram;

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Acknowledgment

中日友好医院
CHINA-JAPAN FRIENDSHIP HOSPITAL

减重糖尿病手术
健康管理中心

We look forward to more co-operation!

Contact me

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