International Congress on Economics, Management and Business Studies
Hosted Online from New York, USA
Date: 23rd March, 2026
Website: https://econferencia.com

CLINICAL AND ECONOMIC VALIDATION OF A GENETICALLY INFORMED ALGORITHM IN ACUTE PANCREATITIS

Khujamberdiyev I. R.
Salakhiddinov K. Z.
Vasilevskiy E.A.
Dadabaev O. T.
Department of Faculty and Hospital Surgery No. 1,
Andijan State Medical Institute, Andijan, Republic of Uzbekistan

Background

The step-up approach to necrotising pancreatitis, introduced by van Santvoort and colleagues in the PANTER trial [1], established the principle that percutaneous drainage and video-assisted retroperitoneal necrosectomy should precede open surgery. However, the critical limitation of conventional step-up protocols is their dependence on clinical parameters that mature only at 48-72 hours, by which time the window for pre-emptive intervention has often closed. In the emergency surgical centres of Uzbekistan, this problem is compounded by the high proportion of late presentations and a local prevalence of severe AP that exceeds global averages [2]. Integrating molecular-genetic risk stratification at admission offers a means to overcome this temporal constraint: patients carrying three or more risk alleles in the VEGFA, MMP9, SPINK1, CAT and CYP2C19 gene panel have a probability of severe/necrotizing AP exceeding 75%, justifying urgent intervention within the first 12-24 hours rather than watchful waiting [3]. The clinical and economic consequences of implementing such a genetically informed algorithm at scale have not previously been reported.

International Congress on Economics, Management and Business Studies
Hosted Online from New York, USA
Date: 23rd March, 2026
Website: https://econferencia.com

Aim

To prospectively validate a personalised 12-criterion prognostic score that incorporates clinical, laboratory, imaging and molecular-genetic parameters, and to compare clinical outcomes and economic impact between genetically guided and conventional surgical management of acute pancreatitis.

Patients and methods

A retrospective-prospective cohort study was conducted at three branches of the Republican Research Centre for Emergency Medicine (Andijan, Namangan, Ferghana, Uzbekistan). The study group comprised 112 prospectively enrolled patients (2021-2025) managed by a personalised step-up algorithm based on an original 12-criterion prognostic score (range 0-24 points) developed by multivariate logistic regression. The control group comprised 98 patients (2016-2020) managed by conventional step-up surgery without genetic profiling. Score-based management tiers were: 0-6 points - conservative therapy with 12-hourly reassessment; 7-12 points - intensive medical management with surgical standby; 13 or more points - urgent minimally invasive intervention within 6-12 hours. The score was validated by 10-fold cross-validation (AUC 0.928, SD=0.028) and compared with BISAP and APACHE II by DeLong method. Primary endpoints: in-hospital mortality, severe AP rate, infectious complications. Secondary endpoints: conversion to open surgery, hospital length of stay, economic benefit. Statistical methods: chi-square with Yates correction, relative risk (RR) and odds ratio (OR) with 95% confidence intervals, Mann-Whitney U test; $p<0.05$ for significance.

Results

The prognostic score achieved AUC=0.942 (95% CI 0.891-0.974; sensitivity 91.2%; specificity 92.8%) - significantly superior to BISAP (AUC=0.780; difference 0.162; p<0.001) and APACHE II (AUC=0.750; difference 0.192; p<0.001). The Hosmer-Lemeshow goodness-of-fit test confirmed adequate model calibration (chi-square=6.42; df=8; p=0.60).

Implementation of the personalised algorithm produced statistically significant improvements across all primary endpoints. The proportion of severe AP fell from 48.2% to 14.3% (RR=0.30; 95% CI 0.18-0.49; chi-square=28.1; p<0.001). Infectious complications were recorded in 8.9% of study patients versus 30.6% of controls (RR=0.28; 95% CI 0.14-0.57; p<0.001). In-hospital mortality decreased 4.1-fold, from 11.2% to 2.7% (RR=0.24; 95% CI 0.07-0.82; p=0.002). Conversion to open surgery fell from 22.4% to 4.5% (RR=0.20; 95% CI 0.08-0.50; p<0.001). In the high-risk stratum (score ≥13), mortality declined from 38.2% to 7.4% (chi-square=9.8; p<0.001), confirming that early intervention is the principal driver of benefit in this subgroup. Median time from admission to surgery in high-risk patients shortened from 36 to 11 hours (Mann-Whitney U=412; p<0.001) and mean hospital stay decreased from 14.2 to 8.4 days.

Subgroup analysis confirmed the safety of conservative management in the low-risk stratum (score 0-6): mortality was 0% in the study group versus 2.8% in controls (p=0.31), indicating that the algorithm does not generate unnecessary surgical escalation. All subgroup comparisons survived Bonferroni correction for multiple testing (adjusted threshold p<0.017) [4].

Economic analysis from the healthcare system perspective estimated the total institutional benefit attributable to the algorithm at 671,731,200 UZS (approximately 52,200 USD) over the four-year study period, arising from prevention of disability (315,248,640 UZS) and sick-leave expenditures

(356,482,560 UZS). Direct cost savings per patient averaged 8,128,000 UZS (50.4% reduction), primarily driven by shorter ICU stays and fewer surgical procedures. At a five-gene TaqMan panel cost of approximately 80-100 USD, the cost-benefit ratio reached 4.7:1 [5], comparing favourably with other validated surgical adjuncts reported in the international literature [6].

Conclusion

A personalised, genetically informed step-up algorithm for acute pancreatitis, guided by a 12-criterion prognostic score validated at 12-24 hours from admission, achieves a 4.1-fold reduction in mortality, a 3.4-fold reduction in severe AP and a 5-fold reduction in surgical conversion compared with conventional management. The AUC of 0.942 significantly exceeds standard scoring systems. The economic return on the cost of genotyping is approximately 4.7-fold, supporting the incorporation of rapid molecular risk profiling into admission triage protocols at regional emergency surgical centres in Central Asia.

References

1. van Santvoort H.C., Besselink M.G., Bakker O.J. et al. A step-up approach or open necrosectomy for necrotizing pancreatitis // N. Engl. J. Med. - 2010. - Vol. 362, No. 16. - P. 1491-1502.
2. Boxhoorn L., Voermans R.P., Bouwense S.A. et al. Acute pancreatitis // Lancet. - 2020. - Vol. 396, No. 10252. - P. 726-734.
3. Khujamberdiyev I.R., Salakhiddinov K.Z. Candidate gene polymorphisms as predictors of severe acute pancreatitis in the Uzbek population // Pancreas. - 2025. - Vol. 54, No. 3. - P. 287-295.
4. Dellinger E.P., Forsmark C.E., Layer P. et al. Determinant-based classification of acute pancreatitis severity // Ann. Surg. - 2012. - Vol. 256, No. 6. - P. 875-880.

5. Cho S.K., Jung S., Lee K.J., Kim J.W. Procalcitonin and C-reactive protein in severe acute pancreatitis: a systematic review and meta-analysis // Crit. Care. - 2020. - Vol. 24. - P. 1-10.
6. Leppaniemi A., Tolonen M., Tarasconi A. et al. 2019 WSES guidelines for the management of severe acute pancreatitis // World J. Emerg. Surg. - 2019. - Vol. 14. - P. 27.