

Journal meeting

Reporter : PGY 徐維良
Supervisor : VS 許璣文
2012/3/19

Extrapancreatic Inflammation on Abdominal Computed Tomography as an Early Predictor of Disease Severity in Acute Pancreatitis

Evaluation of a New Scoring System

Jan J. De Waele, MD,* Louke Delrue, MD,† Eric A. Hoste, MD, PhD,* Martine De Vos, MD, PhD,‡
Philippe Duyck, MD,† and Francis A. Colardyn, MD*

- (Pancreas 2007;34:185Y190)

Objective

- To introduce a new scoring system based on signs of systemic inflammation on computed tomography (CT) [ExtraPancreatic Inflammation on CT (EPIC) score] and evaluate this score as an early prognostic tool.

Pancreatitis

- Hard to do early risk stratification in acute pancreatitis especially in the first 24 h
- Because pancreatic necrosis only develops after a few days

Current scoring system

- Balthazar score
- CT severity index
- Ranson's score

TABLE 1. The Balthazar Score⁹

Grade	CT Finding
A	Normal pancreas
B	Pancreatic enlargement
C	Pancreatic inflammation and/or peripancreatic fat
D	Single peripancreatic fluid collection
E	Two or more fluid collections and/or retroperitoneal air

TABLE 2. The CT Severity Index¹⁰

Element	Finding	Points
Grade of AP	Normal pancreas	0
	Pancreatic enlargement	1
	Inflammation involving pancreas and peripancreatic fat	2
	Single fluid collection or phlegmon	3
	Two or more fluid collections or phlegmons	4
Degree of pancreatic necrosis	No necrosis	0
	Necrosis of one third of pancreas	2
	Necrosis of one half of the pancreas	4
	Necrosis of more than one half of the pancreas	6

The CT Severity Index indicates points for grade of AP plus points for degree of pancreatic necrosis.

Score	0-1	2-3	4-6	7-10
Mortality	0%	3%	6%	17%
Complication	0%	8%	38%	92%

Ranson's Criteria on Admission :

- age greater than 55 years
- a white blood cell count of > 16,000/ μ L
- blood glucose > 11 mmol/L (>200 mg/dL)
- serum LDH > 350 IU/L
- serum AST >250 IU/L

Ranson's Criteria after 48 hours of admission :

- fall in hematocrit by more than 10 percent
- fluid sequestration of > 6 L
- hypocalcemia (serum calcium < 2.0 mmol/L (<8.0 mg/dL))
- hypoxemia (P_{O_2} < 60 mmHg)
- increase in BUN to >1.98 mmol/L (>5 mg/dL) after IV fluid hydration
- base deficit of >4 mmol/L

The prognostic implications of Ranson's criteria are as follows :

- Score 0 to 2 : 2% mortality
- Score 3 to 4 : 15% mortality
- Score 5 to 6 : 40% mortality
- Score 7 to 8 : 100% mortality

Ref: Ranson JH, Rifkind KM, Roses DF, Fink SD, Eng K, Spencer FC (1974). "Prognostic signs and the role of operative management in acute pancreatitis". *Surgery, Gynecology & Obstetrics* 139 (1): 69-81.

Materials & methods

- Retrospective cohort study
- Adult, AP (ICD 9, 577.0)
- 2002 to 2005
- An abdominal CT scan was obtained within 24 h of admission
- CT images were independently reviewed by 2 radiologists
- Baseline data collected: age, sex, etiology, CRP at 48 h, Ranson score, APACHE II at 24 h, need for surgery, the ward admitted to

Materials & methods

- Primary end points :
development of severe dz (local complication or organ failure lasting at least 48 h) and hospital mortality
- Secondary end points :
Ranson's score, CRP level at 48 h and the length of hospital stay

Materials & methods

- Extra-Pancreatic Inflammation on CT(EPIC) score — based on the presence of signs of extrapancreatic inflammation (pleural effusion, ascites, and retroperitoneal inflammation)
- Range from 0 to 7

TABLE 3. Components of the EPIC Score

Sign of Extrapaneatrec Inflammation	Points
Pleural effusion	
None	0
Unilateral	1
Bilateral	2
Ascites in either one of these locations (perisplenic, perihepatic, interloop, or pelvis)	
None	0
One location	1
More than 1 location	2
Retroperitoneal inflammation	
None	0
Unilateral	1
Bilateral	2
Mesenteric inflammation	
Absent	0
Present	1

Materials & methods

- Continuous variables : Student t test or the Mann-Whitney U test
- Categorical data : χ^2 or Fisher exact test
- Correlation of EPIC score & 2nd end points : Pearson correlation coefficient
- Receiver operating characteristic (ROC) curves and area under ROC curve (AUROC) for performance of the EPIC, Balthazar & CT Severity Index
- Kappa statistic for interobserver variability

Results

- 40 of 129 AP were included (CT < 24 h)
- Mean age 50 (± 17.7) years
- Mean Ranson 3.3 (± 3.1)
- Mean APACHE II 8.2 (± 8.3)
- CRP at 48 h 25 mg/dL (± 16.1)
- 22 ICU admission
- 14 developed severe AP
- 15% in hospital mortality (6/40)

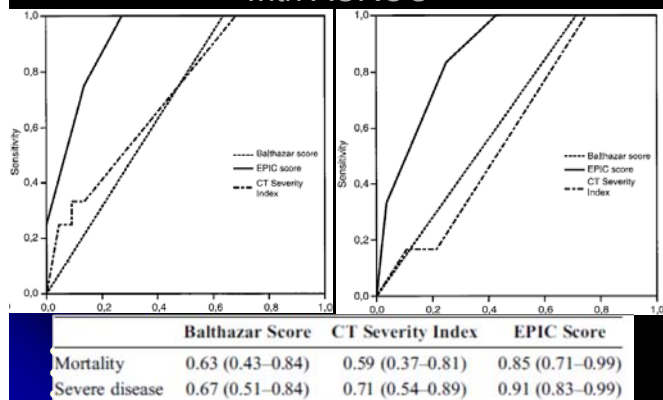
The EPIC score

- Mean 3.6 (± 2.0)
- Mortality 0% for EPIC score 0 to 3
- 67% for 7
- 31 (77%) had a Balthazar E score, their EPIC score ranged from 1 to 7

TABLE 4. Patient Classification According to the Balthazar and EPIC Score

Balthazar Score	EPIC Score							
	0	1	2	3	4	5	6	7
A	1	0	0	0	0	0	0	0
B	0	0	0	0	0	0	0	0
C	2	0	0	0	0	0	0	0
D	0	4	1	0	1	0	0	0
E	0	1	5	4	6	8	4	3

Predicting severe AP and mortality with AUROC



EPIC score

- For ≥ 4 , 100% sensitivity and 70.8 % specificity for predicting severe AP
- Correlated well with the Ranson score (Pearson correlation coefficient, 0.64, $p < 0.001$)
- Kappa statistic for the 2 observers : 0.63, indicating moderate to good agreement

Discussion

- Early & true prognostic value
- Without the need for IV contrast
- Organ failure V.S necrosis itself
- Better able to discriminate severity in patient with Balthazar score E

Limitation

- Selection bias
- Small sample size
- Limited to single center

Simple scoring system for the prediction of the prognosis of severe acute pancreatitis

Takashi Ueda, MD,^a Yoshifumi Takeyama, MD,^b Takeo Yasuda, MD,^a Naoki Matsumura, MD,^a Hidehiro Sawa, MD,^a Takahiro Nakajima, MD,^a Tetsuo Ajiki, MD,^a Yasuhiro Fujino, MD,^a Yasuyuki Suzuki, MD,^a and Yoshikazu Kuroda, MD,^a *Kobe and Osaka-sayama, Japan*

- (Surgery 2007;141:51-8.)

Background

- This investigation aimed to propose a simple scoring system for the prediction of the prognosis of severe acute pancreatitis (SAP)

Current scoring systems

- Ranson's score
- Glasgow score
- APACHE II score
- Japanese severity score (JSS)

Glasgow Score for Pancreatitis

Variable	Score one point if present
Age	>55 years
pO ₂	<8.0 kPa (60 mmHg)
WBC	>15000/cumm
Ca ²⁺	<2.0mmol/L
ALT	>100 IU
LDH	>600 IU
Glucose	>10 mmol/L
Urea	> 16 mmol/L
Albumin	< 32 g/L

Ref. Knaus WA, Et al. APACHE II: a severity of disease classification system. Crit Care Med 1985;13:818-29

Japanese severity score (JSS)

Table 1. Japanese criteria for grading the severity of acute pancreatitis*

Factor	Clinical sign	Laboratory data
Prognostic factor I (2 points)	Shock Respiratory failure Mental disturbance; severe infection Hemorrhagic diathesis	Base excess ≤ -3 mEq/L Ht $\leq 30\%$ (after hydration) BUN level ≥ 40 mg/dL or creatinine level ≥ 2.0 mg/dL Calcium ≤ 7.5 mg/dL Blood sugar level ≥ 200 mg/dL Pao ₂ ≤ 60 mm Hg (room air) LDH level ≥ 700 IU/L Total protein ≤ 6.0 g/dL Prothrombin time ≥ 15 sec Platelet count $\leq 1 \times 10^5/\text{mm}^3$ CT grade IV or V
Prognostic factor II (1 point)		
Prognostic factor III	SIRS score ≥ 3 (2 points) Age ≥ 70 yr (1 point)	

*Severe: at least 1 item in prognostic factor I is present or ≥ 2 items in prognostic factor II are present; moderate: none of the items in prognostic factor I and only 1 item in prognostic factor II is present; mild: none of the items in prognostic factor I or II is present. Sum of the points for the positive prognostic factor was defined as the JSS. Ht, hematocrit level; SIRS, Systemic Inflammatory Response Syndrome.

Ref. 1. Saitoh Y, Yamamoto M. Evaluation of severity of acute pancreatitis according to a report of the cooperative national survey in Japan. Int J Pancreatol 1991;9:51-8.
2. Ogawa M, Hirota M, Hayakawa T, Matsuno S, Watanabe S, Atomi Y, et al. Development and use of a new staging system for severe acute pancreatitis based on a nationwide survey in Japan. Pancreas 2002;25:325-30.

Current scoring systems

- Useful for discrimination between mild AP and SAP are not always useful for the prediction of the prognosis in SAP
- Very complicated (Ranson/Glasgow/APACHE II/JSS 11/8/14/18 factors)
- Simple prognostic score (SPS) – 3 factors

Patients and methods

- 137 SAP
- Overall mortality rate 29.2% (nation 27%)
- Severity evaluated by JSS ≥ 2
- Time interval between onset and admission : 56 $\pm$ 2 hours
- CE-CT for all patients
- If < 48 h and (-), then performed again 1 ~2 days after ad
- If necrosis presented, CE-CT again 3 to 7 days after ad

Definition

- Necrosis : uneven density in the parenchyma
- Infection : (+) blood/ necrotic tissue bacterial culture
- Organ dysfunction :
AST/TB/Cr/BUN/PaO₂/hypoxia

methods

- Compare factors between survivor/nonsurvivor group
- Age, WBC, lymphocyte, PLT, Hct, PT, PaO₂ level, base excess, LDH, Cr, BUN, Ca²⁺, blood sugar, TP, AST, TB, amylase, lipase, CRP, IL-6
- AUROC for significant prognostic factors
- Multivariate analysis

methods

- Mann-Whitney *U* test
- ROC curves for AUC and optimum cutoff level of each factor
- Logistic regression analysis for multivariate testing
- SPSS II software

Results

Table II. Significant prognostic factors between survivor group and nonsurvivor group by univariate analysis

Parameter	Survivor	Nonsurvivor	P value	AUC
BUN level (mg/dL)	21 ± 2	39 ± 4	<.01	0.75
LDH level (IU/L)	724 ± 52	1599 ± 217	<.01	0.75
Creatinine level (mg/dL)	1.3 ± 0.1	2.8 ± 0.3	<.01	0.74
Calcium level (mg/dL)	7.4 ± 0.1	6.0 ± 0.3	<.01	0.74
Blood sugar level (mg/dL)	169 ± 8	273 ± 31	<.01	0.74
Base excess level (mEq/L)	-0.7 ± 0.6	-4.7 ± 1.1	<.01	0.72
Total bilirubin level (mg/dL)	2.0 ± 0.2	3.1 ± 0.4	<.01	0.65
Pao ₂ (mm Hg)	77 ± 2	69 ± 4	.02	0.64
CRP level (mg/dL)	18 ± 1	24 ± 2	.01	0.64
Aspartate aminotransferase level (IU/L)	112 ± 16	228 ± 65	.02	0.63
Age (y)	52 ± 1	58 ± 2	.02	0.63

- Optimum cutoff levels of BUN and LDH were determined by ROC curves (25 mg/dL and 900 IU/L, respectively).

Results

- Multivariate analysis : the independent predictable factors for prognosis were LDH level ($p < 0.01$) and blood sugar level ($p = 0.01$)

Utility of BUN/LDH/BS/CE-CT

BUN 25 mg/dl
15/50 %
LDH 900 U/L
15/53 %
BS 170 mg/dl
13/43 %
CT necrosis
7/46 %

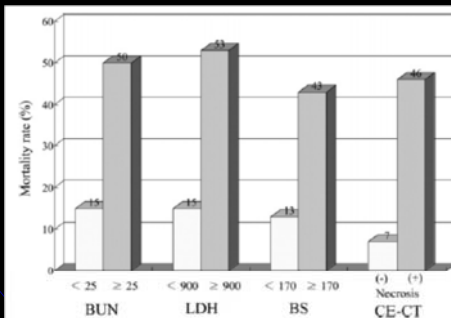


Fig 1. Usefulness of BUN level, LDH level, blood sugar (BS) level, and CE-CT for the prediction of mortality rate on admission in SAP.

SPS (simple prognostic score)

- BUN level ≥ 25 mg/dl
- LDH level ≥ 900 IU/L
- Pancreatic necrosis in CE-CT
- 0 to 3 points

SPS for predicting mortality

SPS	Mortality rate
0	2% (1/42)
1	18% (7/40)
2	48% (12/25)
3	67% (20/30)

SPS for predicting infection and organ dysfunction

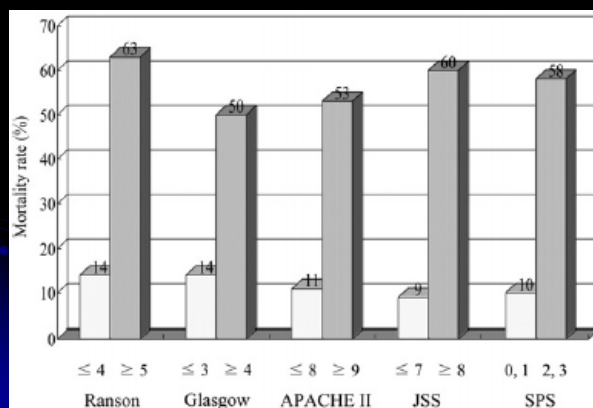
SPS	Infection rate	Organ dysfunction
0	2% (1/42)	24% (10/42)
1	13% (5/40)	50% (20/40)
2	48% (12/25)	80% (20/25)
3	53% (16/30)	100% (30/30)

Optimum cutoff level of SPS

- 1.5

SPS	Mortality	Infection	Organ dysfunction
0,1	10% (8/82)	7% (6/82)	37% (30/82)
2,3	58% (32/55)	51% (28/55)	91% (50/55)

SPS V.S conventional score

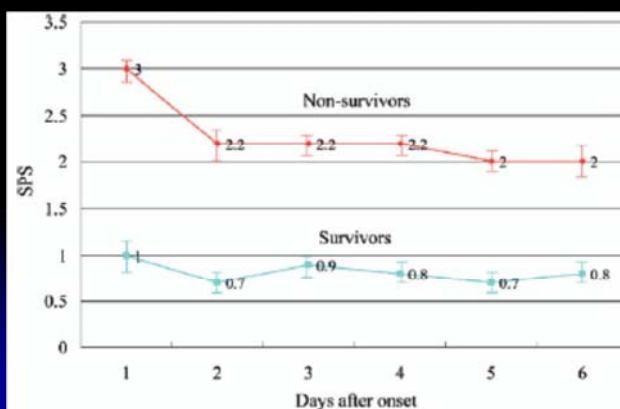


SPS V.S conventional score

Table IV. Comparison of usefulness (AUC of ROC curves) of 5 scoring systems

Scoring system	AUC for mortality rate	AUC for infection	AUC for organ dysfunction
Ranson	0.83	0.82	0.84
Glasgow	0.75	0.73	0.74
APACHE II	0.81	0.73	0.88
JSS	0.83	0.79	0.86
SPS	0.83	0.81	0.83

Change of SPS



Discussion

- Not for separating SAP from mild AP
- Rise of BUN level -> initial hypovolemia and hypercatabolism in SAP
- BUN -> most useful prognostic factor within 24 h after onset
- Increased LDH -> cellular injuries, a sensitive indicator of pancreatic necrosis

Discussion

- BUN increase -> within 24 h
- LDH, pancreatic necrosis -> 24 to 72 h
- Highest admission SPS -> 48 to 72 h
- SPS seems to be useful at 24 to 72 h after onset and for 3 days after admission

Conclusion

- SPS is simple and provides sufficient predictive power to facilitate clinical decision- making

Thanks for you attention!!