

A scenic view of a rocky coastline with turquoise water and a large tree in the foreground. The text is overlaid on the left side of the image.

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20TH ANNUAL
GI SYMPOSIUM



Updates Acute Pancreatitis Evaluation and Management

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Disclosures

- None

Road map

- Background
- Acute pancreatitis definition and classification
- Management
 - Fluids
 - Nutrition
 - Antibiotic
 - Pain control

Definition

The diagnosis of acute pancreatitis requires two of the following three features:

- (1) *abdominal pain* consistent with acute pancreatitis (acute onset of a persistent, severe, epigastric pain often radiating to the back)
- (2) serum *lipase activity (or amylase activity)* at least *three times greater than the upper limit of normal*; and
- (3) characteristic findings of acute pancreatitis on imaging

Background

- >330,500 annual ED Visits
 - 12% increase since 2006
 - 76% patients are admitted
 - 3rd leading GI diagnosis
 - 0.5% Mortality
- 15-20% necrotizing pancreatitis
 - Major cause of morbidity and mortality

Etiology

- Gallstones (40-70%)
- Alcohol(25-35%)
- Everything else

Category	Specific etiologies	Associated clinical conditions, diagnostic findings, and “pearls”
Metabolic	Hypertriglyceridemia	Metabolic syndrome Diabetes Concomitant or provoked by alcohol consumption
	Hypercalcemia	Hyperparathyroidism Sarcoidosis Paraneoplastic syndrome
Autoimmune	Type I (lymphoplasmacytic sclerosing pancreatitis)	Age > 60 Elevated IgG4, ANA IgG4 cells (>10/hpf) on tissue staining Biliary obstruction, strictures* Pancreatic duct strictures without upstream dilation Focal pancreatic lesions* or diffuse pancreatic enlargement
	Type II (idiopathic duct-centric pancreatitis)	Age < 60 * (also often found in type II) More often RAP Coincident with inflammatory bowel disease Neutrophils infiltrating ductal cells, granulocyte epithelial lesion (GEL) on pathology
Congenital, structural	Pancreas divisum	Cofactor with tobacco, alcohol Cofactor with SPINK1, CFTR polymorphisms
	Todani type I/III choledochal cyst Anomalous pancreaticobiliary junction	Gallbladder and biliary malignancy (APBJ, type I cysts) Cystic dilation of biliary tree on imaging (type I/III cysts)



Category	Specific etiologies	Associated clinical conditions, diagnostic findings, and “pearls”
Genetic	PRSS1 SPINK1 CFTR CTRC	Onset childhood, young adult Cofactor with pancreas divisum
Neoplasia	Intraductal papillary mucinous neoplasm Pancreatic ductal adenocarcinoma Ampullary adenoma, adenocarcinoma	Pancreatitis onset, age > 55 Pancreatic duct dilation on imaging alone or with biliary dilation (double duct sign) Elevated CA19-9

Easler, J.J. (2019). ERCP in Recurrent Acute Pancreatitis. In: Mullady, D. (eds) Dilemmas in ERCP.

Classification

Pancreas

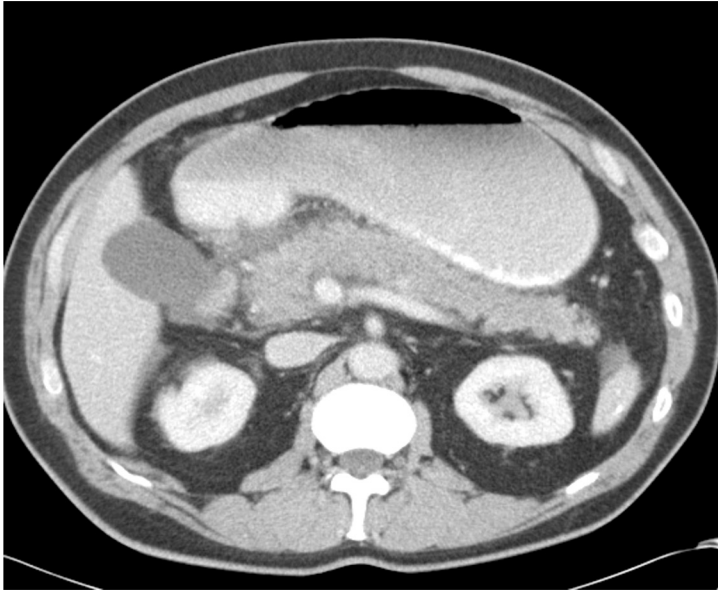
ORIGINAL ARTICLE

Classification of acute pancreatitis—2012: revision of the Atlanta classification and definitions by international consensus

Peter A Banks,¹ Thomas L Bollen,² Christos Dervenis,³ Hein G Gooszen,⁴
Colin D Johnson,⁵ Michael G Sarr,⁶ Gregory G Tsiotos,⁷ Santhi Swaroop Vege,⁸
Acute Pancreatitis Classification Working Group

- Interstitial edematous pancreatitis
- Necrotizing pancreatitis

- Interstitial edematous pancreatitis



- Necrotizing pancreatitis



Severity of Pancreatitis

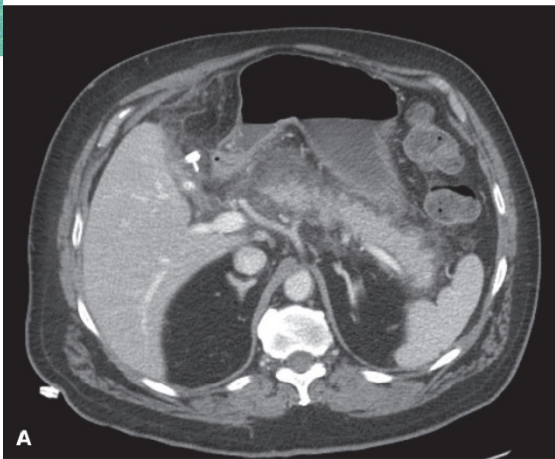
- Mild
 - No organ failure
 - No local or systemic complications
- Moderate
 - Transient organ failure (<48hrs)
 - Local or systemic complications without persistent organ failure
- Severe
 - Persistent organ failure (>48 hrs)



Complications of pancreatitis

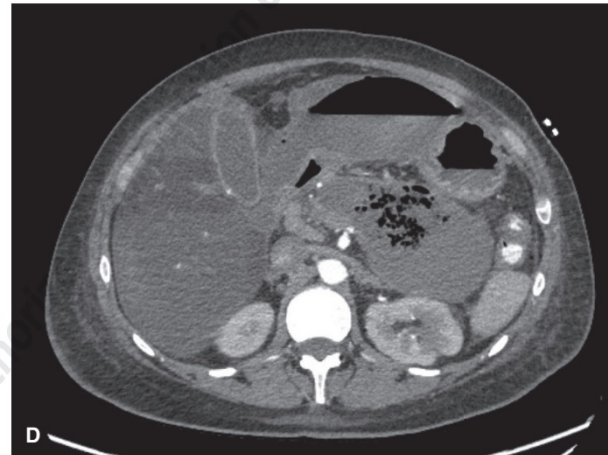
- Gastric outlet obstruction
- Portal/splenic thrombosis/pseudoaneurysm
- Colonic necrosis/Fistula
- Pancreatic/peripancreatic collections
- Abdominal compartment syndrome
- **SIRS** (HR>90 beats/min), RR >20 breaths/min, temperature >38 or <36 °C and WBC >1,200/mm³, <4,000/mm³ or bandemia ≥10%)
- **Organ failure**
 - Sustained (>48h)
 - Multiple Organ Failure (MOF)
 - Circulatory
 - Respiratory
 - Renal
- Exacerbation pre-existing conditions

<4 weeks
Acute
peripancreatic
collection



<4 weeks
Acute
peripancreatic
collection

<4 weeks
Acute necrotic
collection



Walled off
necrosis

Predictors of severity

Table 3. Performance of Clinical Scoring Systems and Laboratory Markers Using Admission Data From Training and Validation Cohorts

Score	Cut-off	Sensitivity	Specificity	PPV	NPV	AUC	Complete data ^a
APACHE-II	7	0.84 (±0.11)	0.71 (±0.06)	0.49 (±0.11)	0.93 (±0.08)	0.77 (±0.07)	96%
BISAP	2	0.61 (±0.20)	0.84 (±0.04)	0.54 (±0.10)	0.87 (±0.10)	0.72 (±0.10)	100%
Glasgow	2	0.85 (±0.08)	0.83 (±0.07)	0.61 (±0.06)	0.95 (±0.05)	0.84 (±0.06)	98%
HAPS	1	0.70 (±0.11)	0.53 (±0.21)	0.32 (±0.11)	0.85 (±0.13)	0.62 (±0.06)	99%
JSS	2	0.59 (±0.13)	0.92 (±0.05)	0.70 (±0.16)	0.88 (±0.07)	0.76 (±0.07)	95%
Panc 3	1	0.76 (±0.15)	0.52 (±0.05)	0.34 (±0.11)	0.87 (±0.11)	0.64 (±0.06)	99%
POP	9	0.57 (±0.15)	0.76 (±0.06)	0.43 (±0.16)	0.85 (±0.08)	0.67 (±0.09)	99%
Ranson	2	0.66 (±0.09)	0.78 (±0.10)	0.49 (±0.17)	0.88 (±0.08)	0.72 (±0.06)	98%
SIRS	2	0.70 (±0.18)	0.71 (±0.04)	0.43 (±0.10)	0.88 (±0.11)	0.70 (±0.10)	98%
BUN	23	0.56 (±0.10)	0.86 (±0.05)	0.57 (±0.14)	0.86 (±0.05)	0.71 (±0.03)	98%
Creatinine	1	0.77 (±0.09)	0.59 (±0.04)	0.38 (±0.08)	0.89 (±0.04)	0.68 (±0.06)	98%
Validation cohort							
APACHE-II	7	0.97 (±0.08)	0.44 (±0.06)	0.14 (±0.04)	0.99 (±0.02)	0.71 (±0.05)	100%
BISAP	2	0.62 (±0.20)	0.76 (±0.04)	0.20 (±0.06)	0.96 (±0.04)	0.69 (±0.11)	100%
Glasgow	2	0.65 (±0.24)	0.82 (±0.05)	0.22 (±0.08)	0.97 (±0.02)	0.74 (±0.10)	91%
HAPS	1	0.73 (±0.26)	0.58 (±0.09)	0.12 (±0.06)	0.97 (±0.02)	0.66 (±0.09)	92%
JSS	2	0.42 (±0.19)	0.89 (±0.05)	0.23 (±0.18)	0.95 (±0.01)	0.66 (±0.11)	91%
Panc 3	1	0.62 (±0.31)	0.52 (±0.05)	0.11 (±0.05)	0.94 (±0.04)	0.57 (±0.16)	100%
POP	9	0.46 (±0.31)	0.81 (±0.04)	0.16 (±0.12)	0.95 (±0.02)	0.64 (±0.16)	90%
Ranson	2	0.46 (±0.28)	0.80 (±0.03)	0.16 (±0.11)	0.95 (±0.02)	0.63 (±0.15)	91%
SIRS	2	0.69 (±0.16)	0.58 (±0.04)	0.11 (±0.03)	0.96 (±0.03)	0.64 (±0.01)	93%
BUN	23	0.65 (±0.26)	0.81 (±0.04)	0.21 (±0.09)	0.97 (±0.03)	0.73 (±0.13)	96%
Creatinine	1	0.77 (±0.20)	0.63 (±0.07)	0.14 (±0.12)	0.97 (±0.02)	0.70 (±0.11)	98%

NPV, negative predictive value; PPV, positive predictive value.

^aPercentage of patients for whom complete clinical data were available to calculate the score for that scoring system.

Acute pancreatitis management

BUN

- BUN >25 mg/dL (8.9 mmol/L) (1 point)

Impaired mental status

- Abnormal mental status with a Glasgow coma score <15 (1 point)

SIRS

- Evidence of SIRS (systemic inflammatory response syndrome) (1 point)

Age

- age >60 years old (1 point)

Pleural effusion

- Imaging study reveals pleural effusion (1 point)

0-2 Points: Lower mortality (<2 percent)

3-5 Points: Higher mortality (>15 percent)

Acute pancreatitis Management



FLUIDS



NUTRITION

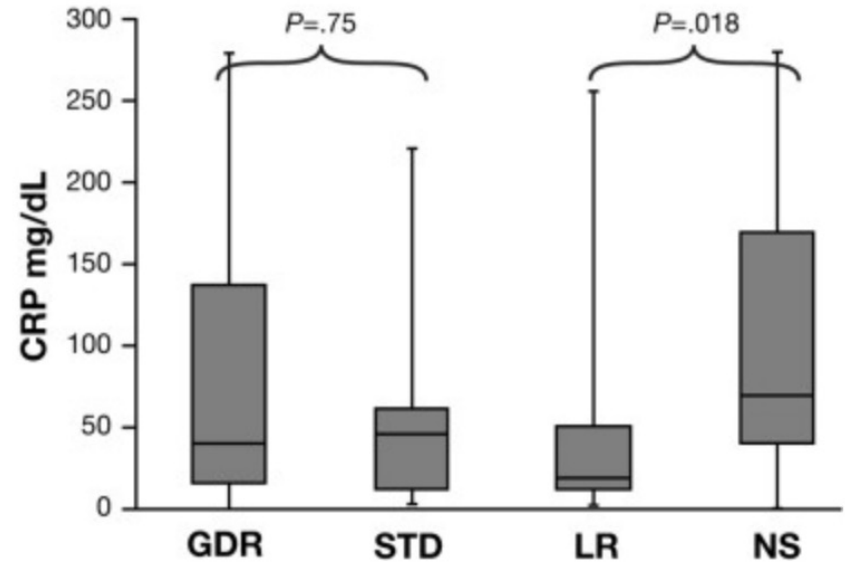
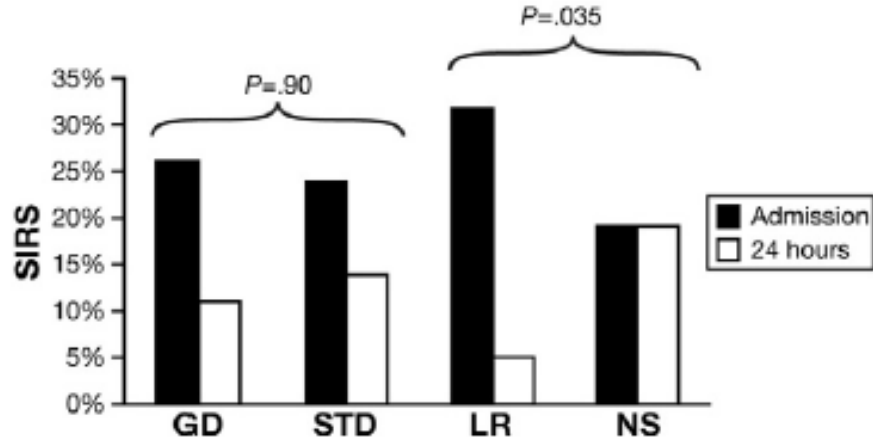


ANTIBIOTICS



PAIN
CONTROL

Fluids: type of fluid



(84% reduction vs 0%, respectively; P = .035);

Fluids: type of fluid



Contents lists available at [ScienceDirect](#)

Pancreatology

journal homepage: www.elsevier.com/locate/pan

Comparison of normal saline versus Lactated Ringer's solution for fluid resuscitation in patients with mild acute pancreatitis, A randomized controlled trial

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- RCT n=24 NS n=23 LR
- 24% reduction in SIRS at 24 hrs for LR vs 4.2% with NS (p=.002)
- No difference in SIRS at 48 hrs, mortality, and LOS
- No difference in CRP, ESR, Procalcitonin, or local complications

Fluid : rate of resuscitation

Early Aggressive Hydration Hastens Clinical Improvement in Mild Acute Pancreatitis

Aggressive:

- 20 ml/kg bolus followed by 3 ml/kg/h

Standard

10 ml/kg bolus followed by 1.5 mg/kg/h

	Aggressive hydration (N=27)	Standard hydration (N=33)	Adjusted odds ratio (95% CI)
Clinical Improvement within 36 h	19 (70%)	14 (42%)	7.0 (1.8–27.8)
Development of SIRS	4 (14.8%)	9 (27.3%)	0.14 (0.02–0.92)
Persistent SIRS	2 (7.4%)	7(21.2%)	0.12 (0.02–0.94)
Development of hemoconcentration	3 (11.1%)	12 (36.4%)	0.08 (0.01–0.49)

CI, confidence interval; SIRS, systemic inflammatory response syndrome.

Authors and year	Aggressive (number and severity)	Nonaggressive (number and severity)	Outcomes		Comments
			Aggressive	Nonaggressive	
Mao et al 2009	36; severe AP	40; severe AP	Mechanical ventilation - 94.4% Mortality - 30.6%	Mechanical ventilation - 65%, mortality - 10%	HCT with rapid fluids was 35.6% and 38.5% with slower infusion. Worse outcome with rapid fluids
Mao et al 2010	56; severe AP	59; severe AP	Sepsis - 78.6% Mortality - 33.9%	Sepsis - 57.6% Mortality - 15.3%	Rapid hemodilution: HCT <35 slower hemodilution: HCT >35 Worse outcome with rapid fluids
Wu et al 2011	19 (Goal directed)	21	58% reduction in SIRS	42% reduction in SIRS	$P = .85$ for SIRS No difference in the mean volume of fluid infused between the 2 groups
Buxbaum et al 2017	27	33	70% clinical improvement 7.4% SIRS	42% clinical improvement 21.1% SIRS	Patients had mild AP. Significant benefit seen with aggressive fluids
Cuéllar-Monterrubio et al 2020	43	45	13.3% had SIRS at day 7	13.9% had SIRS at day 7	Patients randomized after 64.5 and 65.2 hours of onset of AP; no difference in pancreatic necrosis or organ failure

Authors and Year	RL (n)	NS (n)	Severity of AP (RL vs NS)	Outcomes		Comments
				Reduction in SIRS (RL vs NS)	Reduction in CRP (RL vs NS)	
Wu et al (2011)	19	21	Mild; 31% and 19% had SIRS	84% (31% to 5%) reduction vs 0 (19% to 19%) ($P = .03$)	51 vs 104 mg/L ($P = .018$)	Overall, favored RL Patients were included after a median of 9 and 5 days after onset of AP; study terminated prematurely
de-Madaria et al (2018)	19	21	Mild, 47.4% vs 66.7% had SIRS	15.8% vs 42.9% ($P = .06$)	28 vs 166 mg/L ($P = .04$)	Overall, favored RL Borderline significance for SIRS reduction
Choosakul et al (2018)	23	24	Mild; 34.8% vs 41.7% had SIRS	26.1% vs 33.4% at 48 hours ($P = 0.88$)	No difference in CRP	Overall, no benefit
Lee et al (2020)	61	60	Mild	37/5% vs 32.2% at 24 hours 41.9% vs 38.3% at 48 hours	Not studied	Overall, no benefit for primary outcome i.e. SIRS but favored RL for secondary outcomes of intensive care unit admission and hospital stay. 82% of patients in RL group received approximately 2 liters of NS before randomization

AP, acute pancreatitis; CRP, C-reactive protein; HCT: hematocrit; NS, normal saline; RL, Ringer's lactate; SIRS, systemic inflammatory response syndrome.

The NEW ENGLAND JOURNAL *of* MEDICINE

ORIGINAL ARTICLE

Aggressive or Moderate Fluid Resuscitation in Acute Pancreatitis

E. de-Madaria, J.L. Buxbaum, P. Maisonneuve, A. García García de Paredes,
P. Zapater, L. Guilabert, A. Vaillo-Rocamora, M.Á. Rodríguez-Gandía,
J. Donate-Ortega, E.E. Lozada-Hernández, A.J.R. Collazo Moreno, A. Lira-Aguilar,
L.P. Llovet, R. Mehta, R. Tandel, P. Navarro, A.M. Sánchez-Pardo,
C. Sánchez-Marin, M. Cobreros, I. Fernández-Cabrera, F. Casals-Seoane,
D. Casas Deza, E. Lauret-Braña, E. Martí-Marqués, L.M. Camacho-Montaño,
V. Ubieto, M. Ganuza, and F. Bolado, for the ERICA Consortium*

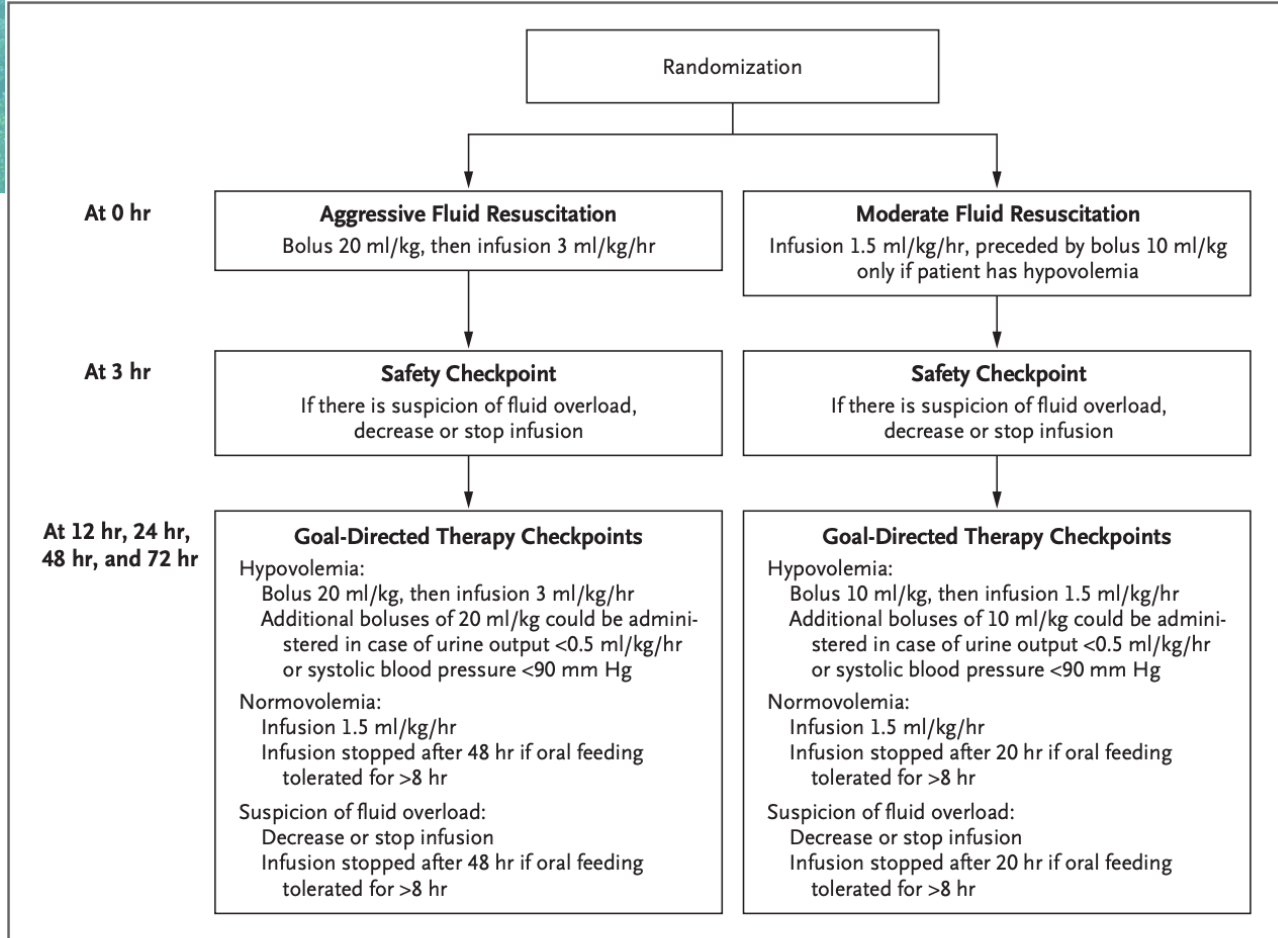


Figure 1. Fluid Resuscitation Protocol.

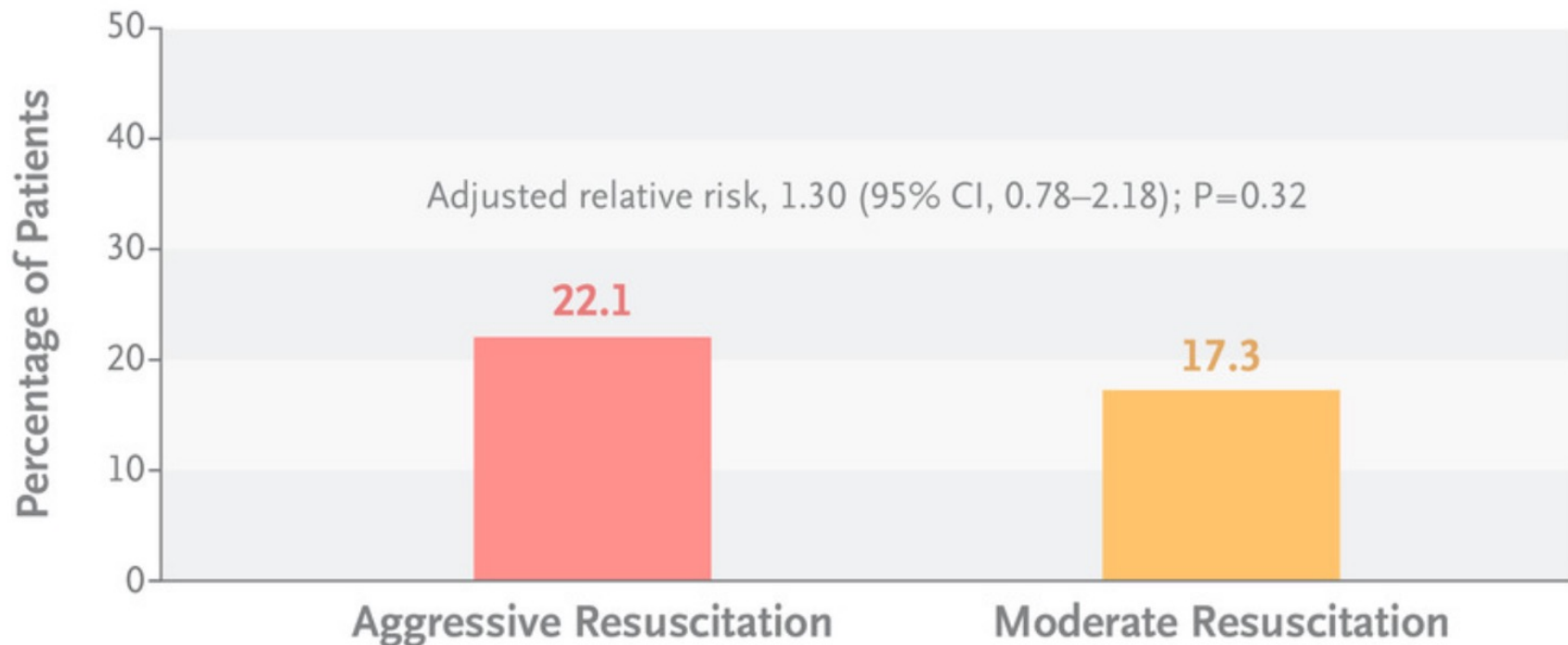
Patients who presented with acute pancreatitis were randomly assigned to receive goal-directed aggressive or moderate fluid resuscitation with lactated Ringer's solution.

Results: Trial halted early due to differences in safety outcomes

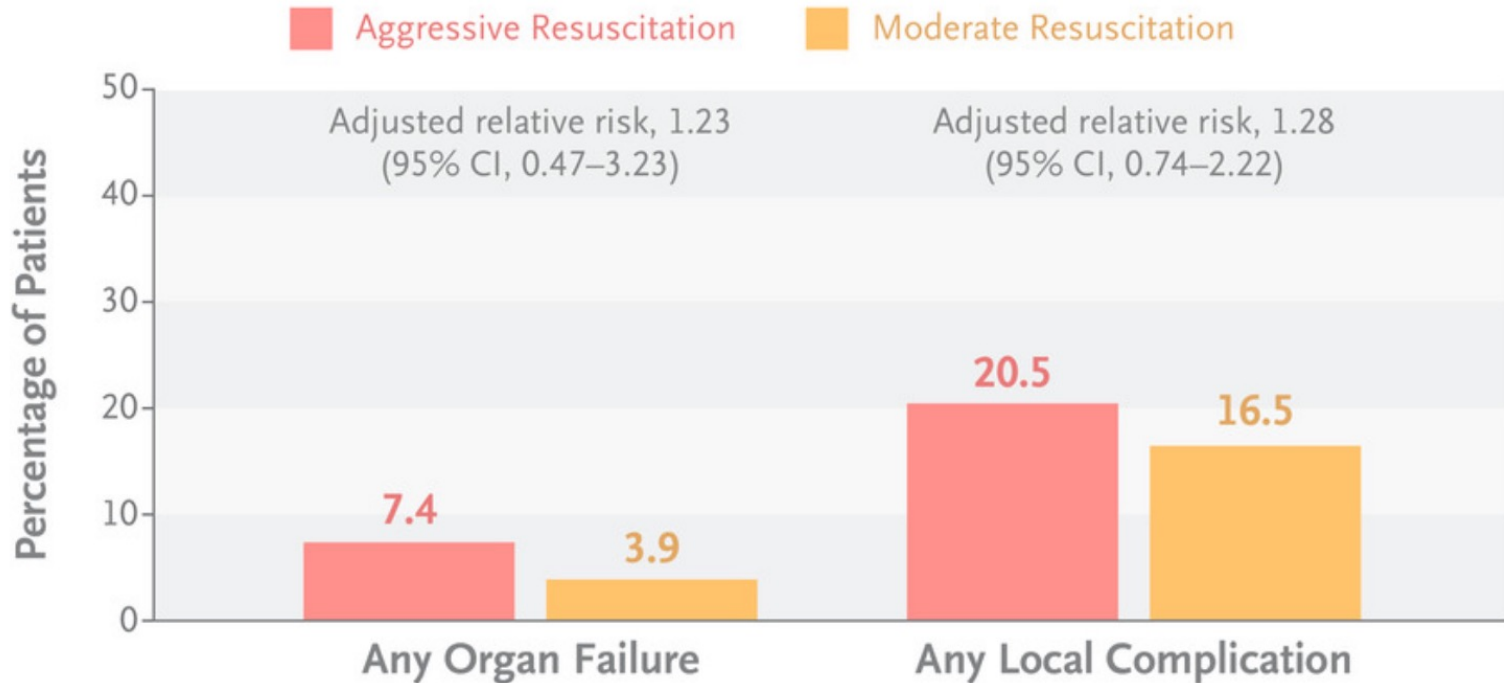
Table 3. Safety Outcomes.*

Outcome	Aggressive Fluid Resuscitation (N=122)	Moderate Fluid Resuscitation (N=127)	Relative Risk (95% CI)	Adjusted Relative Risk (95% CI)	P Value
	<i>number (percent)</i>				
Fluid overload†	25 (20.5)	8 (6.3)	3.25 (1.53–6.93)	2.85 (1.36–5.94)	0.004
Moderate-to-severe fluid overload‡	6 (4.9)	1 (0.8)	6.25 (0.76–51.13)	3.62 (0.37–35.22)	0.23
Symptoms of fluid overload: dyspnea	22 (18.0)	10 (7.9)	2.29 (1.13–4.64)	1.85 (0.95–3.61)	0.08
Signs of fluid overload	32 (26.2)	14 (11.0)	2.38 (1.34–4.24)	2.36 (1.33–4.19)	0.003
Peripheral edema	12 (9.8)	4 (3.1)	3.12 (1.04–9.42)	2.70 (0.90–8.09)	0.07
Pulmonary rales	30 (24.6)	13 (10.2)	2.40 (1.32–4.38)	2.36 (1.30–4.28)	0.004
Increased jugular venous pressure, hepatojugular reflux, or both	5 (4.1)	3 (2.4)	1.74 (0.42–7.10)	1.53 (0.33–7.11)	0.58
Evidence of fluid overload on hemodynamic testing or imaging	13 (10.7)	7 (5.5)	1.93 (0.80–4.68)	1.34 (0.54–3.36)	0.53
Evidence of heart failure on echocardiogram	0	1 (0.8)	0.35 (0.01–8.43)§	NA	0.32
Radiographic evidence of pulmonary congestion	13 (10.7)	7 (5.5)	1.93 (0.80–4.68)	1.34 (0.54–3.36)	0.53
Invasive cardiac catheterization	1 (0.8)	2 (1.6)	0.52 (0.05–5.67)	0.50 (0.05–5.51)	0.56

Moderately Severe or Severe Acute Pancreatitis during Hospitalization



Secondary Outcomes





CONCLUSIONS

Among patients with acute pancreatitis, early aggressive fluid resuscitation did not lead to a lower risk of moderately severe or severe acute pancreatitis than moderate fluid resuscitation and was associated with an increased risk of fluid overload.

Limitations

- Landmark trial but...
 - Underpowered due to early termination
 - In the aggressive group, bolus given without assessment of volume status

Nutrition

Early versus on-demand nasoenteric tube feeding in acute pancreatitis

Table 2. Primary and Secondary End Points, According to the Intention-to-Treat Analysis.*

Outcome	Early Tube Feeding (N=101)	On-Demand Tube Feeding (N=104)	Risk Ratio (95% CI)	P Value
Primary composite end point: infection or death — no. (%)	30 (30)	28 (27)	1.07 (0.79–1.44)	0.76
Secondary end points				
Infection — no. (%)†	25 (25)	27 (26)	0.97 (0.70–1.34)	0.87
Infected pancreatic necrosis	9 (9)	15 (14)	0.74 (0.43–1.26)	0.28
Bacteremia	17 (17)	18 (17)	0.98 (0.68–1.43)	1.00
Pneumonia	12 (12)	13 (12)	0.97 (0.63–1.50)	1.00
Death — no. (%)	11 (11)	7 (7)	1.27 (0.85–1.89)	0.33
Necrotizing pancreatitis — no. (%)‡	64 (63)	65 (62)	1.06 (0.77–1.47)	0.76
CT severity index§	4±2	4±3	—	0.29
ICU admission after randomization — no. (%)	18 (18)	20 (19)	0.95 (0.66–1.38)	0.86
Mechanical ventilation — no. (%)	12 (12)	14 (13)	0.93 (0.60–1.44)	0.84
New-onset organ failure — no./total no. at risk (%)¶				
Single organ failure	26/67 (39)	31/73 (42)	0.92 (0.65–1.32)	0.73
Persistent single organ failure	10/67 (15)	10/73 (14)	1.05 (0.65–1.70)	1.00
Multiple organ failure	7/67 (10)	6/73 (8)	1.14 (0.67–1.95)	0.77
Persistent multiple organ failure	4/67 (6)	4/73 (5)	1.05 (0.51–2.14)	1.00

Early vs Delayed Feeding in Patients with Acute pancreatitis

- Systematic review and meta-analysis of 11 RCTs
- Early (<48 hrs) vs Late (>48 hrs)
 - No increase in adverse events in mild-mod or severe AP
 - Early associated with reduction in LOS in mild-mod AP

Nasogastric vs Nasojejunal

Randomized Controlled Trial > [Pancreas](#). 2012 Jan;41(1):153-9.

doi: 10.1097/MPA.0b013e318221c4a8.

Evaluation of early enteral feeding through nasogastric and nasojejunal tube in severe acute pancreatitis: a noninferiority randomized controlled trial

Namrata Singh ¹, Brij Sharma, Manik Sharma, Vikas Sachdev, Payal Bhardwaj, Kalaivani Mani, Yogendra Kumar Joshi, Anoop Saraya

Clinical Trial > [Am J Gastroenterol](#). 2005 Feb;100(2):432-9.

doi: 10.1111/j.1572-0241.2005.40587.x.

A randomized study of early nasogastric versus nasojejunal feeding in severe acute pancreatitis

F C Eatock ¹, P Chong, N Menezes, L Murray, C J McKay, C R Carter, C W Imrie

Am J Gastroenterol. 2005 Feb;100(2):432-9

Enteral vs Parenteral nutrition

Meta-Analysis > Intern Med. 2012;51(6):523-30. doi: 10.2169/internalmedicine.51.6685.

Epub 2012 Mar 15.

Meta-analysis: total parenteral nutrition versus total enteral nutrition in predicted severe acute pancreatitis

Fengming Yi ¹, Liuqing Ge, Jie Zhao, Yuan Lei, Feng Zhou, Zhifen Chen, Youqing Zhu, Bing Xia

Safety and efficacy of total parenteral nutrition versus total enteral nutrition for patients with severe acute pancreatitis: a meta-analysis

[Wen Li](#), [Jixi Liu](#) ✉, [...], and [Jingtao Li](#)  [View all authors and affiliations](#)

[All Articles](#) | <https://doi.org/10.1177/0300060518782070>

Nutrition take-home

- Enteral therapy preferred
- Enteral vs Parenteral:
 - ↓ **infection**, ↓ **organ failure**, ↓ **LOS**, ↓ **surgical intervention**, ↓ **mortality**
- NG and NJ equivalent
- Type of formulation not critical
- Parenteral if EN not possible e.g. ileus
- Early nutritional support is critical!
- The presence of fluid collections is not a contraindication to feeding

Antibiotics

Assessment of Prophylactic Carbapenem Antibiotics Administration for Severe Acute Pancreatitis: An Updated Systematic Review and Meta-Analysis

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Department, Zhuji People's Hospital, Shaoxing, China

Table 2. Analysis of SAP outcomes

Carbapenems versus no antibiotic	Studies, <i>n</i>	OR	95% CI	<i>p</i> value	Heterogeneity (<i>I</i> ²), %	Model
Infected pancreatic or peripancreatic necrosis	6	0.74	0.44, 1.23	0.24	0	FE
Mortality	6	0.69	0.41, 1.16	0.17	0	FE
Surgical intervention	4	0.97	0.53, 1.79	0.93	0	FE
Pancreatic pseudocyst	3	0.59	0.23, 1.55	0.28	0	FE
Additional antibiotics	3	0.59	0.23, 1.54	0.28	58	RE
Dialysis	3	2.34	0.12, 45.21	0.57	89	RE
Use of respirator or ventilator	3	1.90	0.43, 8.29	0.40	83	RE
ICU treatment	2	2.97	0.61, 14.39	0.18	85	RE
ARDS	2	0.80	0.33, 1.91	0.61	0	FE
Organ failure	2	0.63	0.32, 1.24	0.19	0	FE
Complications	3	0.48	0.28, 0.84	0.009	0	FE
Fluid collections	2	0.91	0.50, 1.65	0.76	0	FE
Infections	3	0.27	0.08, 0.87	0.03	78	RE
Extrapancreatic infections	3	0.64	0.15, 2.75	0.54	70	RE
Pulmonary infection	2	1.23	0.44, 3.44	0.69	0	FE
Blood infection	2	0.60	0.20, 1.76	0.35	0	FE
UTI	2	0.97	0.30, 3.16	0.97	28	FE

SAP, severe acute pancreatitis; CI, confidence interval; OR, odds ratio; FE, fixed-effects model; RE, random-effects models; ICU, intensive care unit; ARDS, acute respiratory distress syndrome; UTI, urinary tract infection.

Pain control

- Goal is pain relief
 - Opiates
 - Fentanyl
 - Morphine (no evidence that it worsens pancreatitis)

Summary

- Fluid resuscitation
 - Moderate resuscitation approach
 - 1.5ml/kg/hr with a 10cc/kg bolus if hypovolemic
 - Hr < 120, MAP 65-85, UO 0.5-1 cc/kg/hr
 - LR preferred (unless hypercalcemia is preferred).
- Nutrition
 - Enteral preferred within 24-48 hrs if pain improving
 - Start with low-fat, low residue, soft diet
- Pain control
 - IV narcotics
- Antibiotics
 - None initially
- Determine and address underlying etiology

Pancreatitis Guidelines

- American Gastroenterology Association
 - 2007: AGA institute technical review on acute pancreatitis
 - **2018: Initial management of acute pancreatitis**
- American College of Gastroenterology
 - 2006: Practice guidelines in acute pancreatitis
 - 2013: Management of acute pancreatitis
- American Pancreatic Association/International Association of Pancreatology
- 2012: IPA/APA evidence based guidelines for the management of acute pancreatitis

Thank you!!

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