Assessment of severity of acute pancreatitis: a comparison between old and most recent modalities used to evaluate this perennial problem

Raffaele Pezzilli and Francesco Mancini

**Subject headings**
pancreatitis/diagnosis; pancreatitis/radiography; severity assessment; evaluating studies

Acute pancreatitis is an acute inflammatory process of the pancreatic gland. According to the Atlanta classification system, there are two forms of acute pancreatitis: mild acute pancreatitis, characterized by interstitial edema, which is self-limiting and severe acute pancreatitis characterized by local complications such as necrosis, abscesses, pseudocysts and the presence of organ dysfunction\[1\]. The mortality due to severe pancreatitis is about 25%-50% and is due mainly to infection of the necrosis\[2\]. Early identification of patients with severe acute pancreatitis is essential for the correct care of the disease and the avoidance of complications.

Over the past 20 years, many schemes have been proposed for identifying severe pancreatitis. The aim of this paper is to review the current criteria for the early assessment of severity of acute pancreatitis.

**CLINICAL CRITERIA**

Bank et al\[3\] analyzed the incidence of cardiac, pulmonary, kidney, hematological, metabolic and neurological complications in 75 patients with acute pancreatitis and they reported a mortality rate of 56% if one or more complications were present. Subsequently, Agarwall and Pitchumoni\[4\] conducted a retrospective study involving 76 patients and proposed a scheme comprised of simplified clinical criteria. In both studies, a 48-hour observation period was necessary for the clinical criteria. Furthermore, these clinical assessments depend on the experience of the clinical team and are difficult to standardize.

**CLINICAL AND LABORATORY CRITERIA**

Ranson et al\[5\] identified a series of 11 criteria evaluated in 100 patients with acute pancreatitis in 1974. The Ranson score is still widely used at present in judging severity. Five of the 11 criteria are considered upon hospital admission and 6 in the following 48 hours. They reported that most patients with less than two positive items survived; in those with 3 or 5 positive items, the mortality rate was about 20%, and in those with 6 or more positive items, the mortality reached about 50%. There is a correlation between 3 or more Ranson positive criteria and the high incidence of pancreatic necrosis and systemic complications. Later studies confirmed a sensitivity from 40% to 90%\[14\]. The Ranson score has been recently criticized for the following reasons: a good assessment of severity requires the determination of all items and requires 48 hours of observation for the judgement of severity, thus delaying the proper treatment after the onset of pain. Talamini et al\[9\] have proposed a score called the Glasgow score which seems to be more precise than that of Ranson, with a sensibility for the assessment of severe acute pancreatitis of 56%-85%\[10,11\].

Another simplified score has been set up by Fan et al\[12\], utilizing only two biochemical parameters (azotemia and glycemia). This score system has a sensitivity of about 75% in the assessment of the severity of acute pancreatitis.

More recently the APACHE II score\[13\] which takes into consideration age, presence of chronic associated diseases and some biochemical parameters has been proposed for the assessment of the severity of acute pancreatitis. Wilson et al\[14\] have reported a score of 6.3 in patients with mild acute pancreatitis, of 9.4 in those with severe pancreatitis and of 14.1 in those with fulminant pancreatitis.
BIOCHEMICAL CRITERIA
The search for a marker able to evaluate the severity of acute pancreatitis at the early stage is the aim of the present research in the field of pancreatology. The evaluation of the severity of acute pancreatitis by means of serum pancreatic enzyme determination has been a boon\[15-17\]. We recently evaluated serum amylase and lipase in 66 patients with acute pancreatitis\[15\]. Most of these patients were studied within 24 hours from the onset of pain. Twenty patients had no alterations of the pancreatic gland at imaging, 36 had pancreatic edema and 10, pancreatic necrosis. The elevation of the serum pancreatic enzyme s overlapped in the three groups.

The determination of serum C-reactive protein\[18\] is at present widely used for the assessment of the severity of acute pancreatitis. Serum levels of this protein greater than 100mg/L indicate a severe acute pancreatitis in about 60%-80% of the cases. The determination of the C-reactive protein is easy to perform and inexpensive. However, its sensitivity is good only after the first 48 hours from the onset of pain\[6,19\].

Granulocyte elastase has been evaluated in the search for biochemical markers able to evaluate the severity of acute pancreatitis even earlier than the C-reactive protein determination. This protein is released by activated neutrophils and it is able to damage cellular membranes and the extracellular matrix. Gross et al\[20\] and Dominguez-Munoz et al\[21\] have reported that 70%-80% of the patients with severe acute pancreatitis studied within 48 hours from the onset of the pain were correctly identified using this protein. More recently interleukin 6, released by activated macrophages and the interleukin 8 released by neutrophils have been proposed as markers of the severity of acute pancreatitis. These two cytokines are released rapidly in severe forms of acute pancreatitis (within 24 hours from the onset of pain) and have a specificity greater than that of C-reactive protein (80%-100%)\[22-24\].

The soluble receptor of interleukin 2, which is released by the activated lymphocytes is able to identify 70% of the patients with severe acute pancreatitis studied within 24 hours from the onset of pain\[25\]. We have demonstrated\[26\] that the human pancreatic secretory trypsin inhibitor, produced by the pancreatic acinar cells and the hepatocytes is able to correctly identify 70% of the cases studied within 24 hours from the onset of pain. All these studies demonstrate that the immune system is early activated at an early phase during the course of acute pancreatitis. However, the determination of these proteins, except for C-reactive protein and granulocyte elastase, is not feasible for routine use. We hope that in the near future simple techniques for the determination of these proteins will be developed.

RADIOLOGICAL CRITERIA
Balthazar et al\[27\] have demonstrated that contrast enhanced computed tomography is able to assess the severity of acute pancreatitis. They divided the severity of acute pancreatitis into 5 categories. In 83 patients with acute pancreatitis, they found that the mortality was nil in stages A, B and C, and reached 17% in those of grade E. The findings of left-sided or bilateral effusions on chest radiograph within 24 hours of admission were associated with a severe outcome\[28\].

RADIOLOGICAL AND BIOCHEMICAL CRITERIA
Serum creatinine greater than 152.6 µmol/L and/or the presence of pathological chest radiographs (pulmonary densification and/or pleural effusions) are capable of identifying, within 24 hours of admission to the hospital, subgroups of both patients at higher risk of adverse clinical outcome and of patients with necrotizing pancreatitis\[29\].

CONCLUSION
In conclusion, the Ranson, Glasgow and Fan criteria are at present useful in clinical practice for their simplicity and low costs. The APACHE II score gives useful information in patients with a more severe form of acute pancreatitis. Serum determination of interleukins may play a role in the assessment of the severity of acute pancreatitis only when rapid techniques for their determination are developed. At present, C-reactive protein is the marker which is the easiest to perform and which has the lowest cost. The evaluation of both chest radiographs and serum creatinine is also simple to carry out in the Emergency Room.

REFERENCES
1 Bradley EL. A clinically based classification system for acute pancreatitis. Summary of the International Symposium on Acute Pancreatitis, Atlanta, GA, September 11 trough 13, 1992. Arch Surg, 1993;128:586-590
2 Banks PA. Predictors of severity in acute pancreatitis. Pancreas, 1991;6(Suppl 1):S7-S12
3 Bank S, Wise L, Gersten M. Risk factors in acute pancreatitis. Am J Gastroenterol, 1983;78:637-640
4 Agarwall N, Pitchumoni CS. Simplified prognostic criteria in acute pancreatitis. Pancreas, 1986;1:69-73
5 Ranson JHC, Riffkind KM, Roses DF, Dink S, Eng K, Spencer FC. Prognostic signs and the role of operative management in acute pancreatitis. Surg Gynecol Obstet, 1974;139:69-81
6 Wilson C, Heads A, Shenkin A, Imre CW. C reactive protein, antiproteases and complement factors as objective markers of severity in acute pancreatitis. Br J Surg, 1989;76:177-181
7 Talamini G, Basi C, Falconi M, Sartori N, Fruilioni L, Di Francesco V, Vesentini S, Pederzoli P, Cavallini G. Risk of death from acute pancreatitis. Role of early, simple “routine” data. Int J Pancreatol, 1996;19:15-24
8 Ranson JHC. The timing of biliary surgery in acute pancreatitis. Ann Surg, 1979;189:654-663
Imrie CW, Benjamin IS, Ferguson JC, McKay AJ, Mackenzie I, O'Neil JO, Blumgart LH. A single center double blind trial of Trasylol therapy in primary acute pancreatitis. *Br J Surg.*, 1978;65:337-341

Blamey SL, Imrie CW, O'Neil J, Gilmour WH, Carter DC. Prognostic factors in acute pancreatitis. *Gut*, 1984;25:1340-1346

London NJM, Neoptolemos JP, Lavelle J, Bailey I, James D. Contrastenhanced abdominal computed tomography scanning and prediction of severity of acute pancreatitis: a prospective study. *Br J Surg.*, 1989;76:268-272

Fan ST, Choi TK, Lai ECS, Wong J. Prediction of severity of acute pancreatitis: an alternative approach. *Gut*, 1989;30:1591-1595

Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification. *Crit Care Med*, 1985;13:818-829

Wilson C, Heath DI, Imrie CW. Prediction of outcome in acute pancreatitis: a comparative study of APACHE-II, clinical assessment and multiple factor scoring systems. *Br J Surg.*, 1990;77:1260-1264

Pezzilli R, Billi P, Miglioli M, Gullo L. Serum amylase and lipase concentrations, and lipase/amylase ratio, in the assessment of etiology and severity of acute pancreatitis. *Dig Dis Sci*, 1993;38:1265-1269

Fan ST, Choi TK, Lai ECS, Wong J. Prediction of severity of acute pancreatitis: an alternative approach. *Gut*, 1989;30:1591-1595

Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification. *Crit Care Med*, 1985;13:818-829

Wilson C, Heath DI, Imrie CW. Prediction of outcome in acute pancreatitis: a comparative study of APACHE-II, clinical assessment and multiple factor scoring systems. *Br J Surg.*, 1990;77:1260-1264

Pezzilli R, Billi P, Miglioli M, Gullo L. Serum amylase and lipase concentrations, and lipase/amylase ratio, in the assessment of etiology and severity of acute pancreatitis. *Dig Dis Sci*, 1993;38:1265-1269

Pezzilli R, Billi P, Platì L, Bongiovanni F, Morselli Labate AM, Miglioli M. Human pancreas specific protein/procarboxypeptidase B: a useful serum marker of acute pancreatitis. *Digestion*, 1994;55:73-77

Gullo L, Ventrucci M, Pezzilli R, Platì L, Naldoni P. Diagnostic significance of serum elastase 1 in pancreatic disease. *Br J Surg.*, 1987;74:44-47

Mayer AD, McMahon MJ, Bowen M, Cooper EH. C-reactive protein: an aid to assessment and monitoring of acute pancreatitis. *J Clin Pathol.*, 1984;37:207-211

Pezzilli R, Billi P, Cappelletti O, Barakat B. Serum C-reactive protein in the acute biliary pancreatitis. Is it a reliable marker for the early assessment of severity of the disease. *Italian J Gastroenterol Hepatol*, 1997;29:554-557

Gross V, Schohelrich J, Leser HG, Salm R, Lausen M, Ruckauer K, Schoflel U, Lay L, Heinisch A, Farthmann EH, Gerok W. Granulocyte elastase in assessment of severity of acute pancreatitis. Comparison with acute phase proteins C-reactive protein, α1-antitrypsin, and protease inhibitor α2-macroglobulin. *Dig Dis Sci.*, 1990;35:97-105

Dominguez Munoz JE, Carballo F, Garcia MJ, De Diego JM, Rabago L, Simon MA, de la Morena J. Clinical usefulness of polymorphonuclear elastase in predicting the severity of acute pancreatitis: results of a multicenter study. *Br J Surg.*, 1991;78:1230-1234

Blamey SL, Imrie CW, O'Neill J, Gilmour WH, Carter DC. Prognostic factors in acute pancreatitis. *Gut*, 1984;25:1340-1346