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THE NECESSITY OF RE - EVALUATION OF SCORING SYSTEMS ACCORDING TO THE NEW CLASSIFICATION OF ACUTE PANCREATITIS

LITERATURE REVIEW

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ABSTRACT

Background and Aims - This study examined and analyzed the clinical significance of scores systems used in the evaluation of acute pancreatitis according to the new classification. The scope of study covered the period from 1974 to 2013. Committed is gathering and analyzing information published in PUBMED, COHRANE and BIOMED systems for the period .

Conclusions - The Organ Failure Based Scoring Systems look as better choice according new classification. Although using different components with strong predictive capabilities, no scale is characterized by a high enough sensitivity and specificity to ensure complex evaluation of patients with acute pancreatitis

Key Words: acute pancreatitis, severity assessment, organ failure, mortality prediction, local complications

INTRODUCTION

The clinical assessment of acute pancreatitis (AP) is in the background of the proper approach to this condition, with primary importance of the classification. The 1992 Atlanta Symposium has classified AP into two large groups: mild (MAP) and severe (SAP). The differentiation is made on the basis of presence of local and systemic complications [1].

Ultimately, the accuracy of prognostic indicators is related to the measures that are used during the hospitalization to classify the severity of AP. A drawback of many studies thus far has been the use of a variety of measures of severity and in particular, reliance on the outdated initial Atlanta classification [2, 3, 4]. In this regard, the 2012 revision of the Atlanta classification stratifies severity into three levels: MAP - absence of organ failure and absence of local complications. Moderately severe acute (ModAP) pancreatitis - presence of transient organ failure and/or local complications (transient organ failure is defined as organ failure that persists for 48, or less hours). SAP - presence of persistent organ failure (for more than 48 hours). [3, 4, 5].

For several years, considerable effort has been targeted to the early evaluation of patients with AP, with the goal of identifying the most - appropriate scoring system [6]. The useful scoring system should correspond with follow condition: easy calculation, good predictive values about severity and outcome, permit dynamic calculation, absent of time frame for calculation, appropriate assessment of organ failure (OF) (differentiation of transient and persistent OF). Despite the numerous scientific reports, there is still not a specific clinical and laboratory marker, sensitive enough to be used independently for assessment of AP. In our review we analyze the scoring systems and differentiate their benefits and weaknesses in everyday clinical practice.

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Ranson and Imrie

The attempts to assess the severity and to predict outcome in such patients dates back to 1974 when Ranson criteria were introduced [7]. It had enduring popularity but neither originally being subjected to any rigorous statistical validation, nor proved superior to any other quantification scheme. In 1980 a similar system was proposed by Imrie et al. [8]. Despite its predictive capabilities proven by clinical studies in recent years Imrie doesn't allow dynamic monitoring of the clinical condition and therapeutic results [9]. A meta-analysis published in 1999 has evidence a similar evaluation utility of both scoring systems and at the same time has shown that none of them could provide clinicians with a complex assessment of AP. [10] The role of systemic complications in mortality and morbidity decrease the usefulness of pathology-specific scoring systems such as Ranson and Imrie scores. According revision of Atlanta's criteria from 2012 we can conclude these systems as Ranson and Imrie aren't allowed differentiation between mild, moderate and severe AP [3].

APACHE scoring systems

The APACHE score was introduced in 1985 by Knaus [11]. It was created to evaluate patients in intensive care units and then was used to evaluate patients with AP. It is more precise than aforementioned two systems and could be calculated at any time during the disease course. Numerous studies reported sensitivity from 60 to 95 % and specificity from 70 to 90 %, PPV about 60 %, NPV about 80 % [12, 13, 14]. (**Table 1)** The daily determination of APACHE II is at the background of the proper monitoring of critically ill patients. Calculated by the 48th hour, the sensitivity to detect organ failure (OF) (P = 0.007), necrosis (P = 0.001) and mortality attains 93 %. Markedly higher scores by the 48th hour are observed in patients with SAP who developed necrosis, as well as in those with fatal outcome.

Table 1. *Characteristics of prognostic systems in recent years*

Prognostic Score	*Author*	*Timeframe (≥ 48 hours)**	*Sensitivity %*	*Specifity %*	*PPV %*	*NPV %*	*Accuracy%*	*Severity (AUC/p)*	*Mortality (AUC/ p)*
RANSON	*Su Mi Woo et al 2011* *Schutte K et al 2008*	+ +	*91.67* *91.2*	*96.15* *74.4*	*95.65* *57.4*	*92.59* *95.7*	*94* *88*	*0.879* *0.94*	*P = 0.001*
IMRIE	*Su Mi Woo et al 2011* *Barreto et al 2007* *Schutte K et al 2008*	+ + +	*66.67* *98* *73.5*	*92.31* *56* *71.1*	*88.89* *94* *49%*	*75* *80* *87.7*	*80* *84* *78*	*0.805*	*P = 0.001*
CTSI	*Su Mi Woo et al 2011* *Schutte K et al 2008* *Bollen et al 2012*	+ + +	*62.5* *26.7* *87*	*65.38* *100.0* *83*	*62.5* *100.0* *53*	*65.38* *68.6* *97*	*64* *80* *84*	*0.84* *0.715* *0.88*	*P = 0.017*
BISAP	*Su Mi Woo et al 2011* *Bollen et al 2012*	- -	*79.17* *48*	*88.46* *82*	*86.36* *38*	*82.14* *88*	*84* *72*	*0.82* *0.68*	*P < 0.00*
SOFA	*Mason JM, et al 2010*	-	*91*	*79*	*48*	*82*	*84*	*0.80*	*P <0.00*
MODS	*Mason JM, et al 2010*	-	*84*	*78*	*49*	*85*	*82*	*0.80*	*P <0.00*
LODS	*Mason JM, et al 2010*	-	*90*	*69*	*38*	*80*	*86*	*0.82*	*P <0.00*
APACHE II	*Su Mi Woo et al 2011* *Schutte K et al 2008* *Bollen et al 2012*	- - -	*75* *83.3* *83*	*76.92* *68.9* *52*	*75* *51.7* *28*	*76.92* *91.2* *93*	*76* *91* *88*	*0.904* *0.861* *0.892*	*P < 0.001*

This clinical assessment score system is associated with different threshold values assessing the development of a severe disease and fatal outcome. The Atlanta Symposium has proposed cases with scores > 8 to be considered as severe. The Santorini Consensus Conference

in 1999 has accepted the APACHE system as the most accurate to assess AP patients, with threshold APACHE II and APACHE O scores > 6. The using of fixed cut-off value for predicting clinically severe disease and mortality is associated with increase the sensitivity and negative predictive value and concomitant decrease in specificity and positive predictive value compared with the optimal cut-off [15, 16]. Rithin Suvarna et al. 2011 [13] have reported on admission APACHE II score of more than 9 predicted more number of severe attacks (75%) but less number of mild attacks (60%). An APACHE II score of more than 10 had the best sensitivity, specificity and predictive value (P value <0.001) [17].

APACHE O is proposed by Johnson et al. [18], and has the evaluation power of the other systems used for AP scoring. Papachristou et al. 2006 [19] published a prospective study assessing the predictive value of APACHE O for SAP in patients with a BMI > 30, which showed similar results between APACHE O and APACHE II (AUC 0.895 and 0.893, respectively). Both APACHE II and APACHE O provide opportunity for daily monitoring of the time course of parameters, but the latter is inferior with regard to its evaluation and predictive value to APACHE II. Therefore, APACHE II and O have similar accuracy and efficacy in assessing the severity, systemic complications and need of intensive care in AP. The disadvantages of the systems is the difficult calculation, another flaw is the insufficient information provided with respect to local complications. So we conclude that APACHE II is the most usefull system of APACHE family and their dynamic calculation provides better information of disease course than single score value.

CT scoring systems

CT is the gold standard to distinguish and diagnosis local complications. Some CT criteria were proposed and included in Balthazar grading system [20] and CTSI [21]. CTSI score under 3 is related with lower morbidity and mortality less than 2% [22]. CTSI values > 5 detected on the 48th hour are associated with SAP and high incidence of subsequent necrosectomies [12]. CTSI score of 7-10 was able to predict a 92% morbidity and 17% mortality rate [22]. In the study of Thomas L. Bollen et al. (2012) [15] CTSI and Balthazar grade demonstrated the highest accuracy for predicting clinically SAP (AUC 0.88; AUC 0.79 respectivly). However, no statistically significant difference were observed between the two scoring systems [15]. Among the CT indices, Balthazar grade had the highest AUC for mortality (AUC 0.81) [15].

CT based scores possessed good sensitivity and specificity for local complications [22], but remains with low specificity as a parameters for starting and monitoring of intensive therapy [23]. Despite the results of Tsuji et al. 2012 [24], the calculation of CT based systems before 48 hour is less informative. In patients with peripancreatic collection without necrosis and in these with acute necrotic collection without/or transient OF the behavior is quite same. In these cases despite of characteristics of local complication all of patients will be evaluated as ModAP. In 2% of cases OF is present despite absence of serious local damage, so we'll evaluate AP as severe although the CTSI score will be low. So "Do we need CT based score in evaluation of AP?" is the main question although positives results in literature.

BISAP

The simplicity of a scoring system is one of the most important factors when deciding what system to utilize in a clinical setting. BISAP is designed to predict the mortality risk during the first 24 hours of the diseases [25]. In a cohort study, BISAP was proved to have a high specificity but also a high negative predictive value at scores > 3 [25]. Incremental increases in the BISAP score (3 or more) have been shown to correlate with an increased risk of organ failure($P < 0.0001$), pancreatic necrosis and mortality [25, 26, 27]. In compare with other systems BISAP is characterized with similar capabilities in prediction severe forms and fatal outcome (BISAP - AUC 0.82; APACHE II - AUC 0.83; Ranson - AUC 0.94; CTSI – AUC 0.84) [26]. BISAP could assess the presence or lack of organ failure but could not define it as transient or persisting after the 24th hour. So this scoring system may suggest the need for intensive care or predicts severe course, but couldn't detect moderate pancreatitis and couldn't be used for dynamic tracking and monitoring of patient's started therapy.

Organ Failure (OF) Based Scoring Systems

According to modern concepts of AP the great determinant of severity is OF. There are still number of controversies about correlation of local damage and presence of systemic

complications [28]. Hence, only 50% of patients with necrotizing AP develop OF and are with SAP, whereas those with oedematous AP manifested OF in 15% of cases [29]. A study from the United Kingdom [30] found a correlation between duration and resolution of OF and severirty and disease outcome. Based on the 2012 global survey of pancreatologists [31] the consensus is that three organ systems (respiratory, cardiovascular and renal) fail most frequently in patients with AP. First meta-analysis of determinants of mortality in AP which includes papers from around the world with significant number of patients (1,478 patients) for conclusion is from Petrov et al. 2010 [4]. The authors have concluded that infect necrosis with persistent OF are two main determinant of fatal outcome so the correct evaluation of OF and right decision making for restoration of impaired organ function is the cornerstone of evaluation and determination of behavior in AP.

Several organ dysfunction scores have been developed for use in critically ill patients [32] as MODS, LODS, SOFA and Marshall [33, 34, 35]. Marshall et al. in 1995 developed MODS [33]. High MODS scores are related to severe multiorgan dysfunction and failure and therefore, with severe course of AP.

In 1996 Le Gall et al [35] created LODS to assess the probability of death during the hospital stay, but not to evaluate the severity of every system dysfunction, which makes it hardly applicable for monitoring of intensive care patients.

Marshall scoring systems for organ failure are the most sensitive for evaluation of AP patients. A Marshall score > 3 is associated with severe course, systemic complications and significant correlation with fatal outcome (P = 0, 007) [36]. Modified Marshall score is recomendet by Banks et al. in the revision of Atlanta classification in 2012 as the most accurate in severity evaluation [3].

The European Society of Intensive Care Medicine since advocated a score that includes six major organ systems to describe as quantitatively and objectively as possible the degree of organ dysfunction over time in critically ill patients - Sepsis-related Organ Failure Assessment (SOFA) [34, 37].

Mason et al. [16] have found that MODS (AUC 0.80) performed similarly to SOFA (AUC 0.80), APACHE II (AUC 0.82), and LOD (AUC 0.82) in severity assessment, when are calculated at 24 hrs of admission. The AUC values for predicting mortality among patients with SAP were found to be similar amongst SOFA, MODS and LOD scores on days one (0.750, 0.775, 0.776) and three (0.738, 0.726, 0.736) of ICU stay [38]. Juneja D et al. [39] (2010) have concluded that all scoring systems had comparable accuracy in predicting 30-day mortality, but SOFA had greater efficacy with its area under curve (0.93 (95% CI, 0.85-0.99). These systems are less informative in detection of local complication (SOFA p=0.687; Marshall p=0.775; APACHE II p=0.789) [36].

The organ dysfunction scores have several attractions: the score is calculated with a relevant and comprehensive set of biological data; indicate patients requiring intensive care, and indicate patients with higher risk of adverse events. Because of better association with severity and outcome, SOFA and Modified Marshall score are now recommended by the Pancreas Club in the revised Atlanta Classification scheme to assess the severity and the need of intensive therapy in AP patients [40]. (**Table 1)**

Peter A Banks et al. (2013) (3) and Dellinger et al. (2013) [5] have been introduced, such as the idea that the evolving pancreatitis process does not allow complete severity assessment during the first hours of onset **(Table 2)** The detection of local complication is not sufficient criteria to classify AP. Thus the assessment and monitoring of dynamic OF is the main factor for accurate severity evaluation and outcome prediction. The question remains: "Which system has to use in daily practice?" The role of APACHE II system is undoubtedly confirmed with high specificity and sensitivity over the years but the difficult calculation and review of the determinants of severity leave its application in the background. SOFA and Modified Marshall score have main role in severity assessment. Modified Marshall System is easier for calculation, but SOFA seem to be more informative [4, 6]. The two main determinants in mortality prediction are persistent OF and the presence of infected necrosis [4]. SOFA and APACHE II are the most usefull systems in predicting outcome with similar predictive values [40, 41]. Combining markers from scoring systems providing

detection / differentiation of OF and criteria for differentiation of local complications will determine a system with high efficiency in the evaluation of severity and outcome prediction.

Table 2. *Positives and negatives of the most used scoring systems*

Scoring system	*easy calculation*	*time frame for calculation*	*dynamic calculation*	*appropriate assessment of organ failure*		*appropriate assessment of local complication*	*appropriate prediction of severity*	*appropriate prediction of outcome*	*appropriate assessment of severity*
				Detection of OF	*Differentiation of persistent and transient OF*				
RANSON	+	+	-	+	-	-	+	+	-
IMRIE	+	+	-	+	-	-	+	-	-
APACHE II	-	-	+	+	+	-	+	+	+
CTSI	+	+	-	-	-	+	+/-	+/-	-
BISAP	+	-	-	+	-	-	+	+	-
SOFA	-	-	+	+	+	-	+	+	+
MODIFIED MARSHALL SCORE	+	-	+	+	+	-	+	+	+

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REFERENCES

1. Bradley EL III. A clinically based classification system for acute pancreatitis. Summary of the International Symposium on Acute Pancreatitis, Atlanta, Ga, September 11 through 13, 1992. Arch Surg 1993; 128: 586–590.
2. Bollen TL, van Santvoort HC, Besselink MG, et al. The Atlanta Classification of acute pancreatitis revisited. The British journal of surgery. Jan 2008;95(1):6-21.
3. Banks PA, Bollen TL, Dervenis C, et al. Classification of acute pancreatitis--2012: revision of the Atlanta classification and definitions by international consensus. Gut. Jan 2013;62(1):102-111.
4. Petrov MS, Shanbhag S, Chakraborty M, Phillips AR, Windsor JA. Organ failure and infection of pancreatic necrosis as determinants of mortality in patients with acute pancreatitis. Gastroenterology. 2010;139(3):813-20.
5. Dellinger EP, Forsmark CE, Layer P, Lévy P, Maraví-Poma E, Petrov MS, Shimosegawa T, Siriwardena AK, Uomo G, Whitcomb DC, Windsor JA; Pancreatitis Across Nations Clinical Research and Education Alliance (PANCREA). Determinant-based classification of acute pancreatitis severity: an international multidisciplinary consultation. Ann Surg. 2012;256(6):875-80.
6. Karan Kapoor[1], Peter A Banks[2] Early Prognostic Evaluation of Acute Pancreatitis: An On-Going Challenge Journal of the Pancreas Vol 14, No 2 (2013)
7. Ranson JH, Rifkind KM, Roses DF, Fink SD, Eng K, Spencer FC. Prognostic signs and the role of operative management in acute pancreatitis. Surg Gynecol Obstet 1974; 139: 69-81
8. Imrie CW. Prognostic indicators in acute pancreatitis. Can J Gastroenterol 2003; 17: 325–328.
9. DR. NASIM AFZAL TARAR DR. IRFAN ZAFAR HAIDAR DR. AZHAR IQBAL Dr. Maqsood ul Hassan EVALUATION OF MODIFIED GLASGOW SCORING SYSTEM (IMRIE) Professional Med J Jun 2010;17(2):199-204.
10. M. Hirota et al.: Severity assessment of acute pancreatitis signs in acute pancreatitis: a meta-analytic study. Crit Care Med 1999;27:2272–83.
11. Larvin M, McMahon MJ. APACHE II score for assessment and monitoring of acute pancreatitis. Lancet 1989; 2:201–204.
12. Leung TK, Lee CM, Lin SY, Chen HC, Wang HJ, Shen LK, Chen YY. Balthazar computed tomography severity index is superior to Ranson criteria and APACHE II scoring system in predicting acute pancreatitis outcome.2005 Oct 14;11(38):6049-52.
13. Rithin Suvarna, Aravind Pallipady, Nithish Bhandary, Hanumanthappa The Clinical Prognostic Indicators of Acute Pancreatitis by Apache II Scoring Journal of Clinical and Diagnostic Research. 2011 June, Vol-5(3): 459-463
14. Wilson C et al : Prediction of the outcome in acute pancreatitis: a comparative study of

APACHE II. Clinical assessment and multiple factor scoring systems. Br. J Surg 1990 Nov; 77(11):1260-4.
15. Thomas L. Bollen et al. A Comparative Evaluation of Radiologic and Clinical Scoring Systems in the Early Prediction of Severity in Acute Pancreatitis Am J Gastroenterol 2012; 107:612–619
16. Mason JM, Babu BI, Bagul A, Siriwardena AK. The performance of organ dysfunction scores for the early prediction and management of severity in acute pancreatitis: an exploratory phase diagnostic study. Pancreas. 2010; 39(7): 1104-8.
17. Kemppainen E, Puolakkainen P, Lepp¨aniemi A, Hietaranta A, Gr¨ onroos J, Happiainen R. Diagnosis of acute pancreatitis. Ann Chir Gynaecol 1998; 87: 191–194.
18. J. Johnson CD. APACHE O: A new predictior of severirty in acute pancreatitis Gut 1996 38(Suppl.1):35
19. Papachristou GI, Papachristou DJ, Avula H, Slivka A, Whitcomb DC Obesity increases the severity of acute pancreatitis: performance of APACHE-O score and correlation with the inflammatory response. 2006;6(4):279-85.
20. Balthazar EJ. Staging of acute pancreatitis. Radiol Clin North Am 2002; 40:1199-209.
21. Balthazar EJ. Acute pancreatitis: assessment of severity with clinical and CT evaluation. Radiology 2002;223:603–613
22. Knoepfli AS, Kinkel K, Berney T, Morel P, Becker CD, Poletti PA (2007). "Prospective study of 310 patients: can early CT predict the severity of acute pancreatitis?". Abdom Imaging 32 (1): 111–115.
23. Bollen TL, Singh VK, Maurer R, Repas K, van Es HW, Banks PA, Mortele KJ. Comparative evaluation of the modified CT severity index and CT severity index in assessing severity of acute pancreatitis. AJR Am J Roentgenol. 2011 Aug;197(2):386-92.
24. Yoshihisa Tsuji,1, 2 Naoki Takahashi,2 and Chiba Tsutomu1 Pancreatic Perfusion CT in Early Stage of Severe Acute Pancreatitis Hindawi Publishing Corporation International Journal of Inflammation Volume 2012, Article ID 497386
25. Wu BU , Johannes RS , Sun X et al. The early prediction of mortality in acute pancreatitis: a large population-based study . Gut 2008 ; 57 : 1698 – 703 .
26. Papachristou GI, Muddana V, Yadav D, O'Connell M, SandersMK, Slivka A, et al. Comparison of BISAP, Ranson's, APACHE-II, and CTSI scores in predicting organ failure, complications, and mortality in acute pancreatitis. Am J Gastroenterol. 2010; 105(2): 435-41; quiz 42.
27. Singh VK, Wu BU, Bollen TL, et al. A prospective evaluation of the bedside index for severity in acute pancreatitis score in assessing mortality and intermediate markers of severity in acute pancreatitis. The American journal of gastroenterology. Apr 2009;104(4):966-971
28. Lee BJ , Kim CD , Jung SW e t al. Analysis of factors that aC ect the mortality rate in severe acute pancreatitis . Korean J Gastroenterol 2008 ; 51 : 25 – 33 .
29. Lankisch PG, Pflichthofer D, Lehnick D. No strict correlation between necrosis and organ failure in acute pancreatitis. Pancreas 2000;20:319–22.
30. Johnson C, Abu-Hilal M. Persistent organ failure during the first week as a marker of fatal outcome in acute pancreatitis. Gut 2004; 53:1340-4.
31. Petrov MS, Vege SS, Windsor JA. Global survey of controversies in classifying the severity of acute pancreatitis. Eur J Gastroenterol Hepatol 2012; 24:715-21.
32. R. Mofidi, P. V. Patil, S. A. Suttie and R. W. Parks Risk assessment in acute pancreatitis British Journal of Surgery 2009; 96: 137–150
33. Marshall JC, Cook DJ, Christou NV, Bernard GR, Sprung CL, Sibbald WJ. Multiple organ dysfunction score: a reliable descriptor of a complex clinical outcome. Crit Care Med 1995; 23: 1638-52.
34. Vincent JL, Moreno R, Takala J, Willatts S, De Mendonca A, Bruining H, et al. The SOFA (Sepsisrelated Organ Failure Assessment) score to describe organ dysfunction/failure. On behalf of the Working Group on Sepsis-Related Problems of the European Society of Intensive Care Medicine. Intensive Care Med 1996; 22: 707-10.
35. Le Gall JR, Klar J, Lemeshow S, Saulnier F, Alberti C, Artigas A, et al. The Logistic Organ Dysfunction system. A new way to assess organ dysfunction in the intensive care unit. ICU Scoring Group. JAMA 1996; 276: 802-10.

36. Tercio De Campos, Cinara Cerqueira, Laíse Kuryura, José Gustavo Parreira, Silvia Soldá, Jacqueline AG Perlingeiro, José Cesar Assef, Samir RasslanMorbimortality Indicators in Severe Acute Pancreatitis 2008; 9(6):690-697.
37. Vincent JL, De Mendonca A, Cantraine F et al. Use of the SOFA score to assess the incidence of organ dysfunction/failure in intensive care units: results of a multicenter, prospective study. Crit Care Med 1998; 26:1793-800.
38. Halonen, Kimmo I. MD; Pettilä, Ville MD, PhD; Leppäniemi, Ari K. MD, PhD; Kemppainen, Esko A. MD, PhD; Puolakkainen, Pauli A. MD, PhD; Haapiainen, Reijo K. MD, PhD Multiple organ dysfunction associated with severe acute pancreatitis June 2002 - Volume 30 - Issue 6 - pp 1274-1279
39. Juneja D, Gopal PB, Ravula M. Scoring systems in acute pancreatitis: which one to use in intensive care units? J Crit Care. 2010 Jun;25(2):358.e9-358.e15
40. Polychronis Pavlidis,1 Siobhan Crichton,2 Joanna Lemmich Smith,1 DavidMorrison,3 Simon Atkinson,3 Duncan Wyncoll,1 andMarlies Ostermann1 Improved Outcome of Severe Acute Pancreatitis in the Intensive Care Unit Critical Care Research and Practice Volume 2013, Article ID 897107
41. K. M. Pal,1 PashtoonMurtaza Kasi,1 Mohammad Tayyeb,1 S. M. Faisal Mosharraf,2 and Zafar Fatmi3 Correlates ofMorbidity andMortality in Severe Necrotizing Pancreatitis International Scholarly Research Network Volume 2012, Article ID 215193.