Balthazar Ct Severity Index versus Apache 2 Score in Predicting the Severity of Acute Pancreatitis

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Abstract:
Background: *Acute pancreatitis has a variable clinical presentation. Due to the potential of catastrophic deterioration, early assessment of severity is essential. Various clinical scoring systems are available to assess severity of pancreatitis. Extent of pancreatic necrosis has been correlated with fatal outcome in the past few years[1, 3, 4, 5]. There is a need to evaluate the efficacy of clinical scoring system versus CT severity index to triage the patient into intensive care.*
Objective: *To compare the efficacy of Balthazar CT severity index versus APACHE 2 score in predicting the severity of acute pancreatitis.*
Material and methods: *A retrospective, cross sectional, analytical study was done on 30 patients over past 2 years. Clinical features, laboratory investigations, CT abdomen reports including the Balthazar CT severity index were obtained from the medical records department. Patients were categorised into mild, moderate and severe acute pancreatitis based on revised Atlanta classification[2]. APACHE 2 scores were compared with CT severity indices. The data was analysed by AVOVA and ROC.*
Results: *Patients were categorised into mild moderate and severe acute pancreatitis. 60% of the patients had moderate acute pancreatitis according. Mild and severe cases accounted for 16% and 23% respectively. Analysis of variance with Kruskalwallis test, with 95% confidence limits was highly significant (p=0.00). Multiple Comparisons with Mannwihtney test correlated significantly with severe pancreatitis (p= 0.00). On analysing APACHE 2 scores with the Revised Atlanta severity classification, it correlated significantly on Kruskalwallis between 95% confidence limits (p= 0.018). However multiple comparisons with Mannwihtney test correlated significantly with severe pancreatitis (p= 0.01) but failed to correlate with mild pancreatitis. ROC curves were used to analyse modality of choice for each category of acute pancreatitis. Area under the curve was used to determine cut off points of significance along with sensitivity and specificity. CT severity index was a better modality for mild and moderate and APACHE 2 was a better modality for severe pancreatitis.*
Conclusions: *CT severity index is a better predictor of severity of acute pancreatitis. APACHE 2 score correlates better with severe acute pancreatitis.*

I. Introduction

Acute pancreatitis has a variable clinical presentation. In majority of patients, the course is mild and self-limiting. However 20% of them run a protracted course with multi-organ dysfunction. 1-7% of them succumb to the disease(1). Due to the potential of catastrophic deterioration, early assessment of severity is essential. Various anatomical, physiological and clinical scoring systems are available to assess severity of pancreatitis(6 ,7). CT severity index is an objective score of severity in relation to its local complications. Studies have shown that it also correlates with the overall outcome. Extent of pancreatic necrosis has be correlated with fatal outcome in the past few years(3, 4, 5). There is a need to evaluate the efficacy of clinical scoring system versus CT severity index to triage the patient into intensive care and aggressive management of patients with acute severe pancreatitis.

Objective:

To compare the efficacy of Balthazar CT severity index versus APACHE 2 score in predicting the severity of acute pancreatitis.

II. Material And Methods

Source of data: Data from the records of patients admitted with acute pancreatitis over the past two years.
Study type: A retrospective, cross sectional, analytical study.

The study was done by collecting medical records of patients admitted between, 1st January 2013 to 31st December 2014. A minimum of 30 patients diagnosed with acute pancreatitis and undergone CT abdomen were studied.Detailed history, clinical findings, laboratory investigations and CT abdomen reports including the

Balthazar CT severity index were captured. Patients were categorised into mild, moderate and severe acute pancreatitis based on revised Atlanta classification (5). APACHE 2 scores were calculated for every patient.

Sample and sampling technique: A sample size of minimum 30 was selected using sampling technique based on inclusion and exclusion criteria.

Inclusion criteria:
* Patients with acute pancreatitis as defined by Revised Atlanta Classification [5].
* Patient should have undergone CT abdomen and scored on Balthazar index for severity of pancreatitis.

Exclusion criteria:
* Trauma to abdomen.
* Recent abdominal surgery, Gastrointestinal instrumentation.

Data analysis: Collected data will be analysed by AVOVA and ROC.

III.   Results

Age:
Among the patients with acute pancreatitis, 43.33% were aged below 45 years and 56.66% were aged above 45 years.

Severity of acute pancreatitis based on Revised Atlanta Classification:
Patients were categorised into mild moderate and severe acute pancreatitis. 60% of the patients had moderate acute pancreatitis according. Mild and severe cases accounted for 16% and 23% respectively.

Balthazar CT severity score
Patients were assigned severity index based on the inflammatory changes and the extent of necrosis on CT according to Balthazar CT severity index. 50% of our patients scored 3. Necrosis was present in 23% of the patients.
The Balthazar CT severity index was compared with Revised Atlanta severity classification[2].

CT severity Index

	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Kruskalwallis test value	p
				Lower Bound	Upper Bound		
Mild	6	1.33	1.033	.25	2.42	17.012	.000
Moderate	17	3.18	1.131	2.59	3.76		HS
Severe	7	4.71	1.799	3.05	6.38		
Total	30	3.17	1.683	2.54	3.80		

Multiple Comparisons - by Mannwhitney test

Dependent Variable: CT severity Index

		Mean Difference (I-J)	p	
Mild	Moderate	-1.843	.017	sig
	Severe	-3.381	.000	HS
Moderate	Severe	-1.538	.040	sig

Analysis of variance with Kruskalwallis test, with 95% confidence limits was highly significant (p=0.00). Multiple Comparisons with Mannwihtney test correlated significantly with severe pancreatitis (p= 0.00).

Apache 2 Score

30% of our patients scored an APACHE 2 score of less than 7 and remaining 70% scored more than 7.

	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Kruskalwallis test value	p
				Lower Bound	Upper Bound		
Mild	6	9.33	3.204	5.97	12.70	8.025	.018
Moderate	17	8.76	3.993	6.71	10.82		sig
Severe	7	18.71	8.118	11.21	26.22		
Total	30	11.20	6.483	8.78	13.62		

Multiple Comparisons - by Mannwhitney test

Dependent Variable: APACHE 2

		Mean Difference (I-J)	p	
Mild	Moderate	.569	.890	NS
	Severe	-9.381	.008	HS
Moderate	Severe	-9.950	.001	HS

On analysing APACHE 2 scores with the Revised Atlanta severity classification, it correlated significantly on Kruskalwallis between 95% confidence limits (p= 0.018). However multiple comparisons with Mannwihtney test correlated significantly with severe pancreatitis (p= 0.01) but failed to correlate with mild pancreatitis.

ROC curves were used to determine:

- The cut off points at which the modalities were significant
- To determine, which of the two were better modalities to detect mild, moderate and severe acute pancreatitis respectively.

Comparison of pancreatitis based on severity:

A*   **B****   **C*****
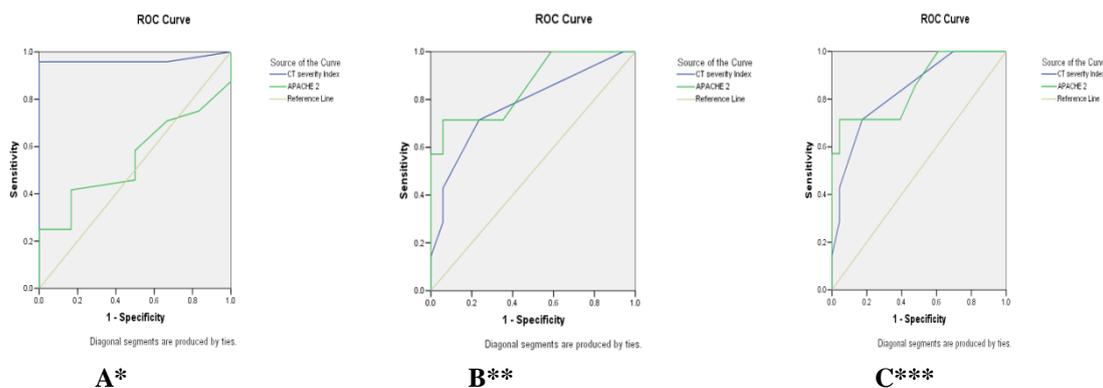
A. **Mild Pancreatitis**

Area Under the Curve

Test Result Variable(s)	Area	Std. Error	p	Asymptotic 95% Confidence Interval	
				Lower Bound	Upper Bound
CT severity Index	.965	.035	.001	.896	1.034
APACHE 2	.552	.112	.697	.332	.772

B. Moderate Pancreatitis
Area Under the Curve

Test Result Variable(s)	Area	Std. Error(a)	Asymptotic Sig.(b)	Asymptotic 95% Confidence Interval	
				Lower Bound	Upper Bound
CT severity Index	.777	.113	.036	.556	.998
APACHE 2	.857	.090	.007	.681	1.033

The test result variable(s): CT severity Index, APACHE 2 has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.
a Under the nonparametric assumption
b Null hypothesis: true area = 0.5

C. Severe Pancreatitis

Area Under the Curve

Test Result Variable(s)	Area	Std. Error^a	Asymptotic Sig.^{b}	Asymptotic 95% Confidence Interval	
				Lower Bound	Upper Bound
CT severity Index	.835	.086	.008	.666	1.004
APACHE 2	.854	.090	.005	.677	1.031

The test result variable(s): CT severity Index, APACHE 2 has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

Apache 2 score was compared with CT severity index for acute pancreatitis categorised into mild, moderate and severe. From the ROC area under curve, CT severity index is a better modality in detecting mild pancreatitis (p= 0.001). It has specificity of 100% and sensitivity of 95.8% in detecting mild pancreatitis with a CT severity score of 2.5 and below. Off the two modalities, CT severity index is a better modality in detecting moderate pancreatitis (p= 0.001) from the ROC area under curve. It has specificity of 76.5% and sensitivity of 71.4% in detecting mild pancreatitis with a CT severity score of 2.5 to 3.5.

Apache 2 score of 11 and more has specificity of 73.9% and sensitivity of 71.4% in detecting severe pancreatitis. In comparison, CT severity index has specificity of 82.6% and sensitivity of 71.4%. From the ROC area under curve, APACHE 2 score is a better modality in detecting severe pancreatitis (p= 0.005) in comparison with CT severity index

		ATLANTA SEVERITY			
		Mild	Moderate	Severe	Total
APACHE 2	Less than 7	2	7	0	9
		22.2%	77.8%	.0%	100.0%
	More than 7	4	10	7	21
		19.0%	47.6%	33.3%	100.0%
Total		6	17	7	30
		20.0%	56.7%	23.3%	100.0%

Fishers exact test p=.146, NS

IV. Discussion
Acute pancreatitis is a disease with varied presentation. The spectrum can range from pain abdomen to systemic inflammatory response syndrome, sepsis and death. To reduce the mortality , the severity of pancreatitis has to be precisely assessed at an early state. The severity can be objectively assessed by clinical numeric scoring systems and CT severity index. The outcomes depend on the severity of presentation[8].

APACHE 2 score was devised as a prognostic scoring system in the critically ill patients. It assesses the present physiology of disease on the background of co- morbidities and age. It is commonly used to aid detection of organ failure. This score indirectly reflects the disease severity. [9,10] Patients with a score of more than 7 were likely to have a complicated course of acute pancreatitis. The sensitivity of this modality in identifying severe acute pancreatitis was estimated to be around 70% by Balthazar EJ. [1] The sensitivity and specificity of this modality was comparable among two studies by Larvin et al and Gurleyik et al[11, 12]. Sensitivity of 65% and 75% respectively. Specificity of 86% and 79% respectively. The positive predictive value of APACHE 2 score was time dependent. It was demonstrated to be 67% at 24 hours and 71% at 48 hours after admission by Larvin et al[11]. However lower positive predictive value of 57% was found by Gurleyik et al[12]. Our study compared CT severity index versus APACHE 2 score in determining the severity of acute pancreatitis independently for the three classes: Mild, moderate and severe acute pancreatitis. We found that APACHE score was a better modality in predicting severe acute pancreatitis with specificity of 73.9% and sensitivity of 71.4% in detecting severe pancreatitis with an APACHE 2 score of 11 and more. However it proved to be inferior in comparison to CT severity index in identifying mild and moderate acute pancreatitis. The APACHE 2 system allows monitoring of the disease progression as well as assessment of response to therapy. It is however less accurate in predicting the local necrotic complications[13].

CT severity index is a consolidated scoring system based on the inflammatory process , tissue edema, fluid collection and extent of necrosis[14]. This modality is directly representative of the local complications of acute pancreatitis[15]. A score of more than 5 was found to have 8 fold increase in mortality and 10 fold increase in risk requiring necrosectomy[5]. Balthazar et al demonstrated 3% mortality rate with a CT severity index of more than 3. The mortality rose to 17% with scores more than 7[4]. Gurleyik et al found a sensitivity of 62 %, specificity of 86% and a positive predictive value of 98% for CT severity index of more than 3. Makoto et al compared clinical/ laboratory scoring systems with CECT to predict severity of acute pancreatitis. They found a mortality of 30.8% in patients who were categorised into severe pancreatitis by both CECT and clinical/ laboratory scoring. However 14.8 % case mortality was noted in patients assessed with clinical/ laboratory scoring alone as severe acute pancreatitis. They encountered no fatal outcomes in severe pancreatitis labelled by CECT alone. Hence they concluded that CECT is not required as a routine modality to assess severity and can be used in patients categorised as severe based on the clinical/ laboratory parameters[3]. In sharp contrast,our study found CT severity index as a better predictor of severity overall. Particularly better at predicting mild and moderate acute pancreatitis in comparison to APACHE 2 score. Specificity of 100% and sensitivity of 95.8% in detecting mild pancreatitis with a CT severity score of 2.5 and below. Specificity of 76.5% and sensitivity of 71.4% in detecting mild pancreatitis with a CT severity score of 2.5 to 3.5.

Scoring systems allow triage of patients into severity classes. Patients with higher scores require close monitoring and aggressive management. The CT severity index correlates better with severity and has the added advantage of determining the extent of local complications.

V. Conclusions

The recent progress in the identification, prognostication and management of severe acute pancreatitis has reduced the overall mortality of the disease. Scoring systems allow us to triage patients with severe acute pancreatitis into intensive care facilities. CT severity index is a better predictor of the overall severity of acute pancreatitis. It is a better modality in identifying mild, moderate and severe acute pancreatitis.
APACHE 2 score correlates better with severe acute pancreatitis. However it is inferior to CT severity index in identifying mild and moderate varieties. APACHE 2 score has the added advantage of assessment on daily basis and assessment to response to treatment.

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