ROLE OF MODIFIED APACHE II SCORING

IN ASSESSING PATIENTS WITH

GERNERALIZED PERITONITIS

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CERTIFICATE

This is to certify that the dissertation entitled **"ROLE OF MODIFIED APACHE II SCORING IN ASSESSING PATIENTS WITH GENERALISED PERITONITIS"** submitted by **Dr.A.K. JAYARAJ** to The Tamil Nadu Dr. M.G.R. Medical University, Chennai is in partial fulfillment of the requirement for the award of M.S. degree Branch I (General Surgery) and is a bonafide research work carried out by him under direct supervision and guidance.

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DECLARATION

I, Dr. A. K. Jayaraj declare that I carried out this work on **"ROLE OF MODIFIED APACHE II SCORING IN ASSESSING PATIENTS WITH GENERALISED PERITONITIS"** at Department of General Surgery, Government Rajaji Hospital during the period of December 2004 – February 2006. I also declare that this bonafide work or a part of this work was not submitted by me or any other for any award, degree, and diploma to any university, board either in India or abroad.

This is submitted to the Tamil Nadu Dr.M.G.R. Medical University, Chennai in partial fulfillment of the rules and regulation for the M.S. Degree examination in General Surgery.

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CONTENTS

INTRODUCTION

"The omission of predictions form the major goals of basic medical science has impoverished the intellectual content of clinical work since a modern clinician's main challenge in the care of patients is to make predictions".

Accurate prognosis is critical to the improvement of medical practice, the purpose of which is to improve patient survival. An accurate predictive ability would make it possible to measure more precisely, the value of intensive care and other new life-saving technologies. Precise prognosis or risk stratification before treatment would also enable clinical researchers to use natural experiments or observational studies to contrast the quality of care in various intensive care units (ICUs) and to identify those components of ICU structure and process that are linked to improved patient outcome. Such information could lead to changes in clinical decision-making that would improve overall ICU use, enhance patient satisfaction and guide the rational allocation of health care resources. It was progress towards these goals that inspired development of severity grading systems.

Many scoring systems have been designed and used successfully to grade the severity of acute peritonitis and intra-abdominal sepsis. The most widely used index, APACHE II (Acute Physiological and Chronic ill Health Evaluation), was developed from a group of medical and surgical patients. Although not specifically designed for general surgical practice it has been

successfully used by many authors to assess critically ill general surgical patients. It has also been compared with other scoring systems with good results.

Generalized peritonitis is the most common surgical emergency in India. Despite advances in surgical techniques, antimicrobial therapy and intensive care support, management of peritonitis continues to be highly demanding, difficult and complex. The spectrum of etiology of peritonitis continues to be different from that of western countries and there is paucity of data from India regarding its etiology, prognostic indicators, and mortality and morbidity patterns.

In our study, we propose to use the modified APACHE II scoring system to assess the patients attending our hospital with generalized peritonitis.

REVIEW OF LITERATURE

Throughout the evolution of surgery, intra-abdominal infections have been a continuous diagnostic and therapeutic challenge. Even with the availability of advanced and sophisticated medical technology today, this remains true. Until the end of the last century, intra-abdominal infections were treated non-surgically, and the mortality was 90 percent. Today, we are not quite sure about the mortality risk and reports range from 0 to 50 percent[3].

The past decade has seen a burst of activity and investigation into the pathophysiology, diagnosis and treatment of severe surgical infections. This has included many clinical reports as well as basic laboratory pursuits of the underlying pathophysiologic mechanisms of bacterial infection, bacterial virulence factors and the nature of the host response. The greatest efforts have been directed towards intra-abdominal infections.

During the same period, the variety and potency of antibiotics available have increased dramatically, and technical aspects of surgical respiratory support, organ replacement, and pharmacologic support in the intensive care unit have improved. Many publications have evaluated the efficacy of one or more of these treatment modalities. Although promising advances have been made, many reports do not include contemporaneous prospectively enrolled control groups. Even in those studies that do control treatments, the description of the patients is often insufficient to allow precise comparison with patient groups in other centers.

When considering intra-abdominal infections, the complexities of the disease process and of the host response make comparison of patients difficult. Definition of disease by one definition may differ dramatically in the severity of infection and in the host response to it. Our ability to support critically ill patients for long periods of time in the intensive care unit provides us with patients in whom the complexity of the disease and its therapy make it very difficult for even an expert clinician to predict outcome correctly.

Over the years, physicians have used a number of indices to describe patients with comparable extents of disease more precisely and reproducibly. This has been most extensively developed in the field of cancer, where are specific systems for different tumours such as Duke's classification for rectal cancer, the Columbia classification for breast cancer, the Clark and Breslow systems for melanoma and the more generalized tumour-node-metastases(TNM) system for cancers in general. Facial fractures, epiphyseal fractures, and open long-bone fractures all have classification schemes. The degree of coma following head injury, several trauma scores, burn indices, a nutritional index, Forrester's classification of acute myocardial infarction, Ranson`s criteria for acute pancreatitis, and Child-Turcotte classification for liver disease are all used.

Scoring systems had been found useful in predicting the outcome in critically ill patients, thus allowing application of resources for effective use.

The prognosis in peritonitis is decisively influenced by the health status of the patient at the beginning of the treatment and by any concomitant risk factors.

Since 1983, a number of systems designed to measure the severity of surgical infections have been published. The following is a brief description of a few of these systems.

SCORING SYSTEMS

THE APACHE SYSTEM:

In 1981, Knaus and others proposed a scoring system to be used for classifying patients admitted to intensive care units[4]. It consisted of two parts:

1. A physiology score representing the degree of severity of acute illness (the Acute Physiology Score)
2. A preadmission health evaluation indicating a patient's health status before the acute illness.

The APS was developed using an expert panel of multidisciplinary physicians who selected laboratory and clinical measurements important in predicting mortality[5]. They restricted the selection to physiological variables that were available or obtainable on or shortly after admission to an ICU. Relative weights of importance were assigned so each variable was weighted on the basis of its degree of abnormality and its relative importance compared with all its other measurements. Each physician in the group was free to suggest additions or deletions of variables included on an initial list. Ultimately, the panel agreed on a list of 34 physiological measurements, and relative weights of

importance were assigned on a scale from 0 to 4. The weights are neither symmetrical around the normal range nor uniform across different physiological measures.

In the original APACHE system, the greatest degree of abnormality for each physiological variable recorded within the initial 32 hours after ICU admission was used to create the score. Although 32 hours did allow for potential effect of therapy on physiology to be introduced, it provided time for all potential data to be available. The original APS for a patient was the total points for all 34 variables.

The second part of the original APACHE was the health questionnaire that assessed health status before admission. On the basis of answers to questions regarding 1) number of recent visits to a physician, 2) work status, 3)activities of daily living and 4) presence of carcinoma, a patient was given a pre- ICU admission classification ranging from `A` for excellent health and `D` for severe failing health. The end result of APACHE was a separate APS and chronic disease classification for each patient. (E.g.: 14D, 16C etc.)[2].

ACUTE PHYSIOLOGY SCORE

s	+4	+3	+2	+1	0	+1	+2	+3
ponse	180 or >	141-179	111-140		70-110		56-69	41-55
n Hg)	160 or >	131-159	111-130		70-110		51-69	
mm Hg)			26 or >	16-25	1-15	<1		
nce of acute Ml	Yes				No			
		Atrial arrhythmias + hemody namic instability	Atrial arrhythmias alone					>6 PVCs/min
	>8	3.5-8			0-3.4			
	7.7 or >	7.6-7.69		7.51-7.59	7.33-7.5		7.25-7.32	7.15-7.24
-ventilated	50 or >	35-49	26-34		12-25	10-11	7-9	
	>500	351-499		200-350	<200			
	70 or >	61-69	50-60		30-49		25-29	20-24
			5 L or >	3501-4999 ml	700-3500ml		480-699ml (20-29ml/h)	120-479ml (5-20ml/h)
	>150	101-150	81-100	21-80	10-20		<10	
	>8	3.6-7	2.1-3.5	1.6-2	0.16-1.5	<0.6		
nal units	2000 or >	500-1999			≤ 500			
	>8				3.5-8	2.5-3.4	<2.5	
		15 or >		5.1-14.9	0-5			
um) international				>160	0-160			
			1500 or >	101-1499	0-100			
	Total		Relative		None			
	>60		51-60	47-50	30-46		20-29	
(total)	>40,000		20,001-40,000	15,001-20,000	3000-15,000		1000-2999	
			>1,000,000	600,001-1,000,000	80,000-6,00,000		20,000-79,999	
) no anticoagulants	>12	5.1-12	3.1-5		0-3			
	Yes				No			
	Yes				No			
	Blood and/or CSF	2 sites other than blood or CSF		1 site other than blood or CSF	None			
	>41.0	39.1-41.0		38.6-39.0^0	36.0-38.5	34.0-35.9	32-33.9	30.0-31.9
l	16 or >		14-15.9	11.1-13.9	8-11.0		5.0-7.9	
	>800	500-800		251-499	70-250		50-69	30-49
	>180	161-180	156-160	151-155	130-150		120-129	110-119
	>7	6.1-7		5.6-6	3.5-5.5	3-3.4	2.5-2.9	
		>40		31-40	20-30	10-19		5-9
	>350	321-350		301-320	260-300		240-259	220-239
	3	4-6	7-9	10-12	13-15			

- **P(A-a) O_2 = FiO_2 (713) – $PaCO_2$ – PaO_2**
- **Total anergy - no response to all provocative skin tests including mumps and fungal. Relative – reduced to skin tests indicative of compromised cellular immunity.**

Qualifying Questions, based on health status 3-6 months before admission	Group	Description
Did the patient have weekly visits to a physician? Was the patient unable to work because of illness? Was the patient bedriddent or institutionalized because of illness? Had the patient suffered a relapse after systemic treatment for carcinoma?	D	Severe restriction of activity due to disease; includes patients bedridden or institutionalized due to illness
Was the patient's usual daily activity limited? Did symptoms occur with mild exercise? Had the patient received treatment for neoplasm with remission? Had the patient received uncomplicated hemodialysis?	C	chronic disease producing serious but not incapacitating restriction of activity
Did the patient see a physician monthly? Did the patient take medication chronically? Was the patient mildly limited in activity level due to illness? Did the patient have diabetes mellitus, chronic renal failure, a bleeding disorder, or chronic anemia?	B	mild to moderate limitation in activity because of chronic health problem
Negative responses to all of the above questions	A	prior good health with no functional limitations

Results with APACHE in the initial study group of 582 patients at George Washington University medical centre, demonstrated a direct relationship between the APS and the probability of death, a relationship that was duplicated in independent studies[6, 7, 8]. Health status before admission was directly related to outcome. Only the pre-admission class 'D' designation was independently associated with an increased mortality risk[5].

THE APACHE II SYSTEM:

The APACHE II system is a revised version of the original APACHE and was published in1985. The number of physiologic measurements was reduced from the original 34 to 12. Infrequently measured physiologic variables such as serum osmolarity, lactic acid level, and the skin testing for anergy were deleted, as were potentially redundant variables. Each variable was deleted based upon clinical judgement and then evaluated using a multivariate comparison of the original APACHE system with each proposed revision, the total R^2 and the correct classification rate for hospital mortality were used standards. The smallest number of variables that reflected physiologic derangement for all vital organ systems as well as maintained statistical precision was 12.

Age and severe chronic health problems reflect diminished physiologic reserve and hence they have been directly incorporated into APACHE II. Chronologic age is a well-documented risk factor for death from acute illness that is independent of the severity of disease.

THE APACHE II SCORING

	HIGH ABNORMAL RANGE					LOW ABNORMAL RANGE			
PHYSIOLOGIC VARIABLE	4	3	2	1	0	1	2	3	4
Temperature rectal(oC)	≥41	39-40.9		38.5-38.9	36-38.4	34-35.9	32-33.9	30-31.9	≤29.9
Mean arterial pressure (mmHg)	≥160	130-159	110-129		70-109		50-69		≤49
High rate (ventricular response)	≥150	140-179	110-139		70-109		55-69	40-54	≤39
Respiratory rate	≥50	35–49		25–34	12–24	10–11	6–9		<5
Oxygenation Pao2 (mmHg)	≥500	350-499	200-349		<200				
Arterial pH	≥7.7	7.6-7.69		7.5-7.59	7.33-7.49		7.25-7.32	7.15-7.24	<7.15
Serum sodium mMol/L	≥180	160-179	155-159	150-154	130-149		120-129	111-119	<110
Serum potassium mMol/L	≥3.5	2-3.4	1.5-1.9		0.6-1.4		<0.6		
Haemtocrit %	≥60		50-59.9	46-49.9	30-45.9		20-29.9		,20
WBC x 1000 (total mm3)	≥40		20-39.9	15-19.9	3-14.9		1-2.9		<1
Serum HCO3 Venous blood mMol	≥52	41-51.9		32-40.9	22-31.9		18-21.9	15-17.9	<15
Glasgow coma score= 15-actual GCS									

AGE POINTS: <44 = 0; 45-54 = 2; 55-64 = 3; 65-74 = 5; ≥75 = 6.

Chronic ill-health evaluation (severe organ insufficiency) Points: presence of chronic illness requiring the following :

(a) for non-operative or emergency postoperative patients – 5

(b) for elective postoperative patients – 2

During the validation, it was found that three of the four chronic health classifications (B, C, and D) were associated with higher death rates, when age and acute physiologic derangement were controlled. However, only the most severe chronic organ system insufficiency or immunocompromised state (Class D) markedly influenced outcome. It was also discovered that non-operative and emergency surgery admissions had a substantially higher risk for death from their prior organ system insufficiency than elective surgical admissions. This was probably because patients with the most severe chronic conditions were not considered to be candidates for elective surgery. Therefore non- operative or emergency operative admissions with a severe chronic organ system dysfunction were given an additional five points, while similar elective surgical admissions were given only two points. The maximum possible APACHE II score is 71[9].

THE SIMPLIFIED ACUTE PHYSIOLOGICAL SCORE (SAPS):

This system was developed by Le Gall et al in 1984 as an independent attempt to simplify APACHE. A multiple regression technique was used to select 13 variables namely age; heart rate; systolic blood pressure; temperature; respiratory rate; urine output; blood urea nitrogen; hematocrit; white blood cell count; serum glucose, potassium, and sodium levels; and

Glasgow coma score. The initial score was calculated using the most abnormal value within the initial 24 hours of ICU admission. To a large extent, the same weights used in the original APACHE system were used[2].

Comparisons have been made of the relative predicted accuracy of SAPS versus APACHE II, both in multidiagnostic data bases and within specific disease categories[6,8,10]. The results indicate that there is a measurable improvement in predictive accuracy, defined as percent area under a Receiver-Operator Characteristic curve, for APACHE II as compared with SAPS when the comparison was performed with multidiagnostic data. However, when comparisons were made within a single diagnostic category virtually equal accuracy was observed. The difference between these results is explained by the differences in the systems. SAPS produces probability estimates without use of specific diagnostic or chronic health variables, therefore comparisons between it and APACHE II (which does use both these additional variables) should favour APACHE II. Within a single diagnostic category, however the two systems are similar enough in design that large sample sizes are necessary to detect differences in predictive accuracy[2].

THE APACHE III PROGNOSTIC SYSTEM:

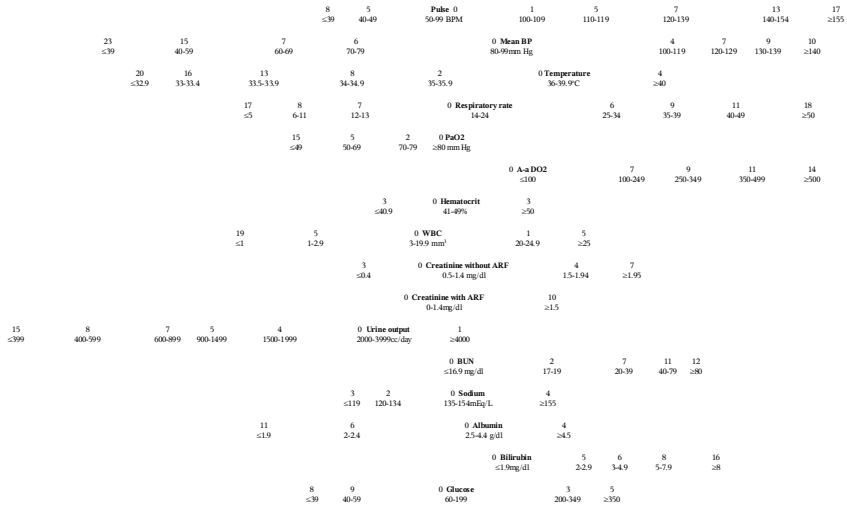
This system was developed by Knaus et al in 1991 with an objective to refine the APACHE methodology in order to more accurately predict hospital mortality risk for critically ill hospitalized adults. This system consists of two options: 1) an APACHE III score, which can provide initial risk stratification for severely ill hospitalized patients within independently defined patient groups; and 2) an APACHE III predictive equation, which uses APACHE III score and reference data on major disease categories and treatment location immediately prior to ICU admission to provide risk estimates for hospital mortality for individual ICU patients.

The scores and the equation were formulated after analyzing data collected prospectively form 17,440 unselected adult medical and surgical intensive care unit admission at 40 U.S. hospitals. Analysis was carried out to study the relationship between the patient's likelihood of surviving to hospital discharge and the following predictive variables: major medical and surgical disease categories, acute physiologic abnormalities, age, pre-existing functional limitations, major co morbidities and treatment location immediately prior to ICU admission.

Results of this analysis showed that a five point increase in APACHE III score (range 0 to 299) was independently associated with a statistically significant increase in the relative risk of hospital death (Odds ratio 1.10 to 1.78) within each of 78 major medical and surgical disease categories. The overall predictive accuracy of the first day APACHE III equation was such that, within 24 hours of ICU admission, 95% of the patients could be given a risk estimate for hospital death that was within 3% of that actually observed (r^2 =0.41). Recording changes in the APACHE III score on each subsequent day of ICU therapy provided daily updates in these risk estimates[11].

Barie et al in a prospective study on 844 consecutive patients in the surgical intensive care unit comparing the APACHE II and III scoring system for predicting mortality, observed an overall mortality of 7% in the surgical intensive care unit and 9.1% in the hospital. The relationship between APACHE II and III scores for individual patients was linear and correlated significantly ($p< 0.0001$). Overall and in all subgroups, both the scoring systems over-estimated the mortality, but estimations made by APACHE III were significantly ($p< 0.01$) higher.

APACHE III SCORING FOR VITAL SIGNS AND LABORATORY TESTS



SEPSIS SCORE:

Developed by Elebute and Stober in 1983, this system divides the clinical features of the septic state into four classes to which they ascribed a subjective degree of severity on an analogue scale. The attributes were

1) Local effects of tissue infection,
2) Degree of temperature elevation,
3) Secondary effects of sepsis and
4) Laboratory data.

The possible range of scores under this system is 0 to atleast 45, depending on how the tables are interpreted. This system has been examined in detail by Dominioni and associates. They reported on 135 patients with broad variety of infectious problems, including peritonitis, pneumonia, wound infection, urinary tract infection, abscess, septicemia and mediastinitis. The sepsis scores ranged from 10 to greater than 30. In a group of patients with an overall mortality rate of 56%, they observed deaths of 13 of 64 patients (20%) with scores of 20 or below and 63 of 71(89%) with scores greater than20. if a score of 20 is arbitrarily chosen as a point above

SEPSIS SCORE

SCORING OF LOCAL EFFECTS OF TISSUE INFECTION

Attribute	Score
Wound infection with purulent / enterocutaneous fistula	2
Requiring only light dressing changed not more than once daily.	
Requiring to be dressed with a pack, dressing needing to be changed more than once daily, requiring application of a bag and/or requiring suction.	4
Pemtonitis	
Localized	2
Generalized	6
Chest infection	
Clinical or radiological sings of chest infection without productive cough	2
Clinical or radiological signs of chest infection with a cough producing purulent sputum.	4
Full clinical manifestations of lobar/ bronchopneumonia	6
Deep – seated infection (e.g. subphrenic abscess. Pelvic abscess. empyema thoraces, acute or chronic osteomyelitis)	6

SCORING OF PYREXIA (ORAL TEMPERATURE)

Attribute	Score
Maximum daily temperature > (c^0)	0
36-37.4	1
37.5-38.4	2
38.5-39	3
>39	3
<36	Add
Minimum daily temperature >37.5^{0}c	1
If 2 or more temperature peaks above 38.40c in 1 day	1
If any rigours occur in a day	1
Temperature should be recorded at least 4 times in 24 hours; record for the period is assessed as above and "pyrexia score" computed.	

SCORING OF SECONDARY EFFECTS OF SEPSIS

Attribute	Score
Obvious jaundice in the absence of established hepatobiliary disease.	2
Metabolic acidosis	
Compensated	1
Uncompensated	2
Renal failure	3
Gross disturbance of mental orientation /level of consciousness (e.g. delirium., coma)and /or other focal neurological manifestations of pyemia/septicemia having excluded other causes.	3
Bleeding diathesis from disseminated intravascular coagulation	3

SCORING OF LABORATORY DATA

Attribute	Score
Blood culture	
Single positive cultures	1
Two or more positive cultures separated by 24 hours	3
Single positive culture + history of invasive procedure	3
Single positive culture + cardiac murmur and/or tender enlarged spleen	3
Leukocyte count (x 10^9/L)	
12-30	1
>30	2
<2.5	3
Hemoglobin level in the absence of obvious bleeding (gm/dl)	
7-10	1
>7	2
Platelet count (x 10^9/L)	
100-150	1
<100	2
plasma albumin level (gm/L)	
31-35	1
25-30	2
<25	3
Plasma total bilirubin level in the absence of clinically obvious jaundice> 25 mol/L	1

Total score is sum of individual scores.

which death is predicted, the overall accuracy for this prediction will be 114 of 135 (84%).

THE MANHEIM PERITONITIS INDEX:

Wacha and co-workers developed this index which incorporates information regarding age, gender, organ failure, cancer, duration of peritonitis, involvement of the colon, extent of spread within the peritoneum and the character of the peritoneal fluid, to define risk.

The Manheim Peritonitis Index

Risk factor	**Weighing if present**
Age > 50 years	5
Female sex	5
Organ failure*	7
Malignancy	4
Preopertative duration of peritonitis >24 h	4
Origin of sepsis not colonic	4
Diffuse generalized peritonitis	6
Exudate	
Clear	0
Cloudy, purulent	6
Faecal	12

* Definitions of organ failure

Kidney	creatinine level > 117 mmo/L
	Urea level > 167 mmol /L
	Oliguria < 20ml / h
Lung	Po2 < 50 mmHg
	PCo2 > 50 mmHg
Shock(definition according to Shoemaker)	Hyperdynamic or Hypodynamic
Intestinal obstruction (only if Profound)	Paralysis > 24 h or complete mechanical ileus

The possible scores range from 0 to 47, and patients with score above 26 are defined as having peritonitis[4].

Billing et al evaluated the effectiveness of this system in a multicenter study involving 2003 patients. The overall mortality was 19.5%. The maximal score was 47. 522 patients had a score of >26 and a mortality rate of 55% which was significantly greater than the 7% mortality observed in the 1481 patients who had a score of < 26[13].

PERITONITIS INDEX ALTONA:

Teichmann and associates, in a report concerning scheduled reoperation for diffuse peritonitis, referred to this index. In this study, they observed that mean pertionits index for patients who died was 1.59, whereas that for patients who lived was 0.38. this index uses age, extent of infection, malignancy, cardiovascular risks, and leucopenia, to stratify patients[4].

POSSUM:

Physiological and Operative Severity Score for enUmeration of Mortality and morbidity (POSSUM) and its Portsmouth modification (P-POSSUM) were developed to provide risk-adjusted analysis in patients undergoing surgery. It consists of two parts:

Physiological assessment:

It provides exponential score on 12 variables. The physiological variables are: age, cardiac signs, respiratory signs, systolic blood pressure, pulse, coma score, serum urea, sodium, potassium, haemoglobin, white cell count, and ECG.

Operative severity:

- operative magnitude
- number of operations within 30 days
- blood loss

- peritoneal contamination
- presence of malignancy
- timing of operation.

This scoring system produced assessments for morbidity and mortality rates, which did not significantly differ from observed rates and has been acknowledged as the most appropriate of the currently available scores for general surgical practice.

USES OF PROGNOSTIC SCORING SYSTEMS:

Prognostic scoring systems have proved useful in risk stratification of patients for clinical trials and in the assessment of the quality of care delivered in ICUs. It is likely that they will assist the decision process regarding ICU admission. The role they will ultimately have in individual patient care decisions remains to be determined

1. Clinical studies:

A central problem in conducting a clinical trial with acutely ill patients is the need to ensure that both the treatment and control groups are at an equivalent baseline risk of death or another important outcome. Randomization is used to spread these risks evenly between the patients groups, but randomization can only ensure that patients, not their risks are randomly distributed. For example, in the evaluation of a new form of

therapy for peritonitis, potential patients could range from a 19 year old with a rupture appendix to a 72 year old with emphysema and cancer of perforated colon. Appropriate conclusions regarding the efficacy of a new peritonitis treatment could not be reached unless the patients and their accompanying risks were evenly distributed between treatment and control groups. A prognostic scoring system permits investigators to stratify patients according to risk before randomization to ensure that risks are evenly distributed[2].

Schein et al in their study on emergency operations for perforated ulcers, divided their patients based on APACHE II score, into two groups – those with low risk (score < 10) and those with high risk (score >10). They found that the mortality rate in the low risk patients was only 8% whereas it was 33.3% in the patients with a score >10[15.] Similar stratification of patients was done in numerous other studies[9,16,17,18].

2. Quality of care measurement:

At the costs of medical care, especially hospital care have increased, quality assessment has become a major priority for ICUs, government hospitals, and third party payers. Not adjusting mortality and complication rates for risks before treatment, however, is an insensitive way to assess a hospital's or an ICU's performance. A suburban shock and trauma unit will

have a far different patient population than a inner city ICU. A prognostic scoring system that establishes a predicted mortality rate before treatment for an ICU on the basis of patient-by-patient measurement of risk will permit the ICUs to compare the predicted outcome to its observed outcome. The difference between predicted and actual death rates is one direct measure of quality of care and this technique can also provide unique insights regarding the usefulness of specific treatments.

Michael Marsh et al in 1990, in a study conducted to assess prediction of mortality by using the APACHE II scoring system in ICUs, observed that the predicted risk for hospital death among non-operative patients in Rochester Methodist Hospital was significantly higher than the risk predicted at Saint Mary's Hospital. Further evaluation revealed that both the groups of patients had similar mean ages. When the APACHE II scores were examined, they observed that the mean acute physiology score of the patients at Rochester Methodist Hospital was significantly higher than the score observed at Saint Mary's Hospital[19].

Knaus and co-workers in 1982, in a study comparing the outcome of acutely ill patients treated in French and American ICUs, observed that for patients with severe gastrointestinal disorders, the French hospital death rate was significantly higher than the one predicted in American hospitals.

Investigations into this discrepancy led to the conclusion that the disparity may have been due in part to a more aggressive surgical approach to acute pancreatitis in France[20].

3. Allocation of Resource:

An important issue fore very ICU is in deciding which patients to admit. Because cost containment dominates health care policy, we would like to improve patient selection to ICU care. An objective method to identify the relative risk of patients might be useful to support clinical judgement and to establish priorities for ICU admission during the periods of limited bed availability[2].

Yet another important issue is to determine which patients have 100% mortality and further aggressive therapy would be futile.

Borlase et al in their study conducted in 1990, suggested that an APS>25, a Glasgow coma score < 7 and a creatinine > 4.5 mg/dl were good predictors of mortality on the first day of ICU admission. This study did not demonstrate an enhanced predictive power with sequential APACHE scoring as shown by trend analysis. In considering the daily cost of predicted SICU non-survivors ($ 1500/day), if treatment had been stopped after10 days of aggressive therapy with no improvement, the potential savings

would have reached almost $ 250,000 or 4% of the total cost for the 100 patients studied[21].

4. Statistical versus clinical judgement:

One of the interesting aspects of the uses of the scoring systems is a comparison of the expectations that physicians and patients have regarding their prognosis and how their clinical and personal assessments compare to probabilities produced by the application of prognostic scoring systems.

Kruse and associates found that there were no substantial differences in accuracy between the APACHE scores at ICU admission and the assessment made by ICU physicians and nurses. But, there was a significant disagreement regarding the outcome of 40% of the admissions between the physicians and the nurses[22].

Meyer and his associates observed that clinical assessment is superior to APACHE II in predicting outcome in critically ill surgical patients, although the difference was small. A similar observation was made by Marks and his associates in a patient population that comprised of both medical and surgical patients. But, they observed that although the predictions could be successfully applied to the population as a whole, none of the tests were suitable for predicting outcome on an individual patient[24].

5. Individual Patient care decisions:

For many clinicians, the most important question regarding prognostic scoring system is how they can help with individual patient care decisions. Prognostic scoring systems will never be able to predict outcome with 100% specificity, but accurate risk estimates of death or complications at the 90 to 99% level could be useful. Before clinicians actually integrate such risk estimates into their practice, however, they should consider the implications of a risk prediction for an individual patient. The argument frequently used is that group statistics do not apply to single individuals. Although individual patients do have unique features they also share many common features with previous patients and consideration of these common characteristics permits us to anticipate their response and predict their outcome. Moreover, if probabilities did not have a role in clinical decision-making, then we would never be able to use past experience to guide future decisions.

Prognostic scoring systems can assist us in ensuring that clinical predictions are well calibrated and accurate for a patient. Because they estimate a patient's potential to benefit from therapy, they are also estimating, in an unbiased manner, an individual's comparative entitlement to medical care[2].

Singh and his associates used APACHE II scoring system to define their patients in whom they studied the role of zipper laparotomy in the management of abdominal sepsis. They defined the patient group as those having an APACHE II score range of 27-30[25].

Schein and his associates utilized the APACHE II score in choosing the type of surgery to be performed in their patients with perforated ulcers. In chronic duodenal ulcer patients, definitive surgery was performed only if the APACHE II score was below 11, whereas those with higher scores were subjected to simple closure. Likewise in patients with perforated gastric ulcers, closure or wedge excision of the ulcer was elected, if technically feasible; in the high-risk group (APACHE II score > 10). In the low-risk group (score <11), truncal vagotomy and antrectomy or partial gastrectomy were performed for ulcers situated in the prepyloric region or the body respectively[15].

LIMITATIONS OF PROGNOSTIC SCORING SYSTEMS

The use of prognostic scoring systems for clinical decision-making raises many ethical, philosophical and practical issues. The most important practical requirements are that its predictions must approach infallibility and it must be reproducible. The original APACHE II score used a single assessment on first day of ICU admission. While this had been shown to be

an excellent method for stratifying patients into comparable risk groups for audits or clinical trials, it is inadequate for predicting individual prognosis for several theoretical and practical reasons.

1. It does not reflect the dynamic pathophysiological changes that occur during the patient's stay in the ICU.
2. Although the APACHE II score with the exception of neurologic points is based on objective data, derivation of risk of death is based on a subjective choice of a single specific diagnostic category or major organ system as the primary cause of ICU admission. The correct choice can sometimes be extremely difficult to make, especially among patients with multiple organ system failure and high mortality rates, precisely the group of patients in whom a correct prediction is important. An incorrect choice can lead to a wrong computation of risk of death and therefore, a wrong prediction.
3. Therefore, it would be unacceptable to clinicians, patients and relatives to base major clinical decisions on just one assessment[26].

Hence, further research and analysis is required to arrive at the ultimate goal of developing ideal and 100% infalliable prognostic system.

AIMS AND OBJECTIVES

The following were the aims and objectives of the study:

1. To stratify the patients with generalized peritonitis based on their scores at admission.
2. To correlate the mortality rates observed with the scores.
3. To correlate the various postoperative outcomes observed with the scores.

PATIENTS AND SCORING

One hundred and forty patients of acute generalized peritonitis, treated in Government Rajaji Hospital between December 2004 to February 2006, were studied prospectively. Children below 14 years were excluded from the study. All cases with either primary peritonitis or that due to anastomotic dehiscence were excluded.

Clinical evaluation as well as hematological and biochemical investigations were carried out. Patients were treated with intravenous fluid and correction of electrolyte imbalance as indicated by the results of serum electrolytes and urea. Urethral catheter was inserted to monitor hourly urinary output and naso-gastric tube inserted to decompress the stomach. The parameters of modified APACHE II were assessed and recorded at the time of admission.

Modified APACHE II scoring:

Modified APACHE II scoring system is a simplified form of the original APACHE II scoring. The following Acute Physiological parameters of APACHE II are included –temperature, mean arterial blood pressure, heart rate, respiratory rate, serum sodium, potassium, creatinine, bicarbonate, haematocrit and white blood cell count. Arterial pH and arterial oxygenation of APACHE II was omitted in this modified scoring. Agarwal

and his associates have proved that “arterial pH and arterial oxygenation are not essential for risk stratification in perforation peritonitis” in their study[28].

The scores ranged from 0 to 4 on each side of normal value. Zero score represents normal values, an increase to 4 indicating the extreme end of high or low abnormal levels. Included in this study as a part of Acute Physiological Score was the serum urea. This was scored using the paratmeter similar that of serum creatinine as follows: serum urea 15 mmol/L = 4, 9-14 mmol/L =3, 5-8 mmol/L = 2, 1.4-4 mmol/L = 0, 1-1.39 mmol/L =1, <1 mmol/L =2.

Age points are as follows for adult patients:

44 = 0; 45-54=2; 55-64 =3; 65-74 =5; >74=6.

Chronic ill health score assigned as follows:

. For non-operative or emergency postoperative patients – 5

. Elective postoperative patients – 2

Organ insufficiency or immuno-compromised state must have been evident prior to hospital admission and conform to following criteria:

- Liver: Biopsy proven cirrhosis and documented portal hypertension or prior episodes of hepatic failure, encephalopathy or coma.
- CVS: New York heart Association Class IV

- RS: Chronic restrictive, obstructive or vascular disease resulting in severe exercise restriction, chronic hypoxia, hypercapnea, severe polycythemia, severe pulmonary hypertension or respiratory dependency.
- RENAL: Receiving chronic dialysis
- IMMUNO-COMPROMISED: The patient has received therapy that suppresses resistance to infection. E.g.: immunosuppression, chemotherapy, radiation, long term or recent steroids, or has a disease that is sufficiently advanced in suppress resistance to infection. E.g.: leukemia, lymphoma, AIDS.

After adequate resuscitation and assessment, patients underwent exploratory laparatomy in emergency setting. At surgery the source of contamination was sought for and controlled. The peritoneal cavity was irrigated with 5-6 litres of warm normal saline and the decision to insert a drain was left to the discretion of the operating surgeon. Abdomen was closed with continuous, number one non-absorbable suture material. Although all patients received appropriative perioperative broad spectrum antibiotics, the drug regimen was not uniform.

ANALYSIS:

Demographic, clinical, preoperative, and /or postoperative complications data on each patient were entered into a standard profoma. Each patient's postoperative outcome / mortality were compared to determine the significance of the severity of illness on postoperative complications and mortality.

MODIFIED APACHE I

PHYSIOLOGIC VARIABLE	4	3
Temperature rectal(oC)	≥41	39-40.9
Mean arterial pressure (mmHg)	≥160	130-159
High rate (ventricular response)	≥150	140-179
Respiratory rate	≥50	35–49
Serum sodium mMol/L	≥180	160-179
Serum potassium mMol/L	≥3.5	2-3.4
Haemtocrit %	≥60	
WBC x 1000 (total mm3)	≥40	
Serum HCO3 Venous blood mMol	≥52	41-51.9
Serum Urea mMol/L	>15	9–14

AGE POINTS: <44 = 0; 45-54 = 2; 55-64 = 3; 65-74 = 5; ≥75 = 6.

Chronic ill-health evaluation (severe organ insufficiency) Points: presence of chronic illness requiring the fo

(a) for non-operative or emergency postoperative patients – 5

(b) for elective postoperative patients – 2

One hundred and forty patients of generalized peritonitis were prospectively studied during the period form December 2004 to February 2006.

AGE GROUP AFFECTED:

Age ranged from 16 years to 80 years with the mean age of 39.92 ± 12.18. In this study, majority of the patients belonged to 36-45 years age group, followed by 46-55 years age group.

Age in years	No. of patients	Percentage
16-25	16	11 %
26-35	32	23 %
36-45	49	35 %
46-55	33	24 %
56-65	7	5 %
>65	3	2 %

SEX INCIDENCE:

Gender	No. of patients	Percentage
Male	121	86 %
Female	19	14 %
uTotal	140	

Among 140 cases studied, there were 121 male cases, and 19 female cases, and male: female ratio was 6.4: 1

CLINICAL PRESENTATION:

The clinical presentation of the patients varied according to the pathology. The patient of duodenal ulcer perforation usually had a short history of pain starting in epigastrium or upper abdomen along with generalized tenderness and guarding. The patients with small bowel perforation presented with prolonged history of fever followed by the appearance of pain in lower abdomen associated with vomiting or constipation. Clinical examination revealed abdominal distension. Only 50% had evidence of pnumoperitoneum on chest X-ray done in erect posture.

Appendicular perforations had characteristic pain starting in the periumblical area or right iliac fossa along with vomiting and fever. None of the patients of appendicular perforation showed evidence of gas under diaphragm on erect Chest X-ray.

In majority of the cases the presentation to the hospital is late with well established generalized peritonitis with purulent of fecal contamination and varying degrees of septicemia. The signs and symptoms are typical and it is possible to make a clinical diagnosis of peritonitis in all patients.

CAUSES OF PERITONITIS:

The commonest cause of peritonitis was perforation of the duodenal ulcer, which was found in 68% of patients. Other causes were ileal perforation in 9% cases, gastric perforation in 6% cases, gangrene small bowel in 5% cases, colonic perforation in 2% cases. Other rare causes are ruptured liver abscess (1%) , perforation -? unknown cause (3.1%) cases.

ETIOLOGY	NO. OF PATIENTS	PERCENTAGE
Duodenal Ulcer Perforation	95	68 %
Ileal perforation	12	9 %
Appendicular perforation	9	6 %
Gastric Perforation	9	6 %
Gangrene gut	7	5 %
Colon perforation	3	2 %
Other causes	5	4 %

The perforation of proximal gastrointestinal tract was five times as common as perforations of distal gastrointestinal tract.

POST-OPERATIVE COMPLICATIONS:

55 patients incurred postoperative complications in this study, and the morbidity rate was 46%. The following table shows the postoperative complications in patients who underwent laparotomy (patients who expired were excluded).

COMPLICATIONS	NO. OF PATIENTS	PERCENTAGE
Wound infection	54	45 %
Wound dehiscence	12	10 %
Respiratory complications	19	16 %
Intra-abdominal abscess	16	13 %
Entero-cutaneous fistula	5	4 %

HOSPITAL STAY:

The mean range of stay of patients in the hospital ranged from 10-14 days. The following table shows the duration of hospital stay of patients with generalized peritonitis, excluding those who died.

NO. OF DAYS	NO. OF PATIENTS	PERCENTAGE
< 10	26	22 %
10 - 14	67	56 %
15 – 19	15	13 %
20 – 24	7	6 %
> 24	4	3 %

MODIFIED APACHE II SCORES:

Modified APACHE II scores at the time of admission ranged from 0 to 29. The mean score in survivors was 5.32 ± 4.72. The mean score in non-survivors was 14.24 ± 5.50.

STATUS	NO. OF PATIENTS	PERCENTAGE	MEAN SCORE
Overall	140	-	-
Survivors	119	85 %	5.32 ± 4.72
Non-survivors	21	15 %	14.24 ± 5.50

Patients were stratified into four groups according to their scores at admission (0-4; 5-9; 10-14; >14).

SCORES	TOTAL	PERCENTAGE	SURVIVORS		NON-SURVIVORS	
			TOTAL	PERCENTAGE	TOTAL	PERCENTAGE
0 - 4	59	42 %	59	42 %	-	
5 – 9	39	28 %	35	25 %	4	3 %
10- 14	27	19 %	19	14 %	8	6 %
> 14	15	11 %	6	4 %	9	6 %
Total	140	-	119	85 %	21	15 %

MORTALITY:

21 patients with generalized peritonitis died in the present study. Overall mortality rate in this study was 15%. Among those suffered mortality 18 were males, and 3 were females. 17 patients belonged to the operative group and died in the postoperative period, and 4 patients died in the preoperative period during resuscitation.

There were no death among patients, who scored 0-4, whereas mortality was 10.25% in those who scored 5-9, 29.6% in those who scored 10-14, and 60% in patients who scored >14.

SCORES	NO. OF PATIENTS	EXPIRED	MORTALITY
0 – 4	59	-	-
5 – 9	39	4	10.25%
10 – 14	27	8	29.6%
> 14	15	9	60%
TOTAL	140	21	15%
$x^2 = 27.76$			
p = 0.0001			

There is a significant association between the modified APACHE II scores and the mortality.

POST-OPERATIVE OUTCOMES:

WOUND INFECTION:

The most common postoperative complication was wound infection. Wound infection was seen in 54 patients (40%) in the present study (patients who died were excluded). Wound infection was 34% among patients who scored 0-4, whereas 54% in those who scored 5-9, 68% in those who scored 10-14, and 33% in patients who scored >14.

SCORE	WOUND INFECTION			
	PRESENT		ABSENT	
	NO.	%	N0.	%
0 – 4	20	34	39	66
5 – 9	19	54	16	46
10 – 14	13	68	6	32
> 14	2	33	4	77
TOTAL	54	-	65	
x^2= 2.03				
p = 0.1538				

There was no statistically significant association between the modified APACHE II scores and the wound infection.

WOUND DEHISCENCE:

Overall incidence of wound dehiscence was 11% (13 patients). Patients with wound dehiscence had a mean score of 6.69 ± 4.46. Wound dehiscence was 7% among patients who scored 0-4, whereas 14% in those who scored 5-9, 16% in those who scored 10-14, and 17% in patients who scored >14.

SCORE	WOUND DEHISCENCE			
	PRESENT		ABSENT	
	NO.	%	N0.	%
0 – 4	4	7	55	93
5 – 9	5	14	30	86
10 – 14	3	16	16	84
> 14	1	17	5	83
TOTAL	13	-	106	-
x^2= 0.3054				
p = 0.22				

Wound dehiscence does not have significant association with modified APACHE II scores (p=.22)

RESPIRATORY COMPLICATIONS:

The respiratory complications were pneumonia, atelectasis, pleural effusion,etc. In this study, 19 patients had respiratory complications (16%); and the mean score was 7.26 ± 4.15. Respiratory complication was 10% among patients who scored 0-4, whereas 23% in those who scored 5-9, 26% in those who scored 10-14, and nil in patients who scored >14.

SCORE	RESPIRATORY COMPLICATIONS			
	PRESENT		ABSENT	
	NO.	%	N0.	%
0 – 4	6	10	53	90
5 – 9	8	23	27	77
10 – 14	5	26	14	74
> 14	-	-	6	100
TOTAL	19		100	
x^2= 0.1				
p = 0.3637				

Modified APACHE II score does not have statistically significant association with the postoperative respiratory complications.

INTRA-ABDOMINAL ABSCESS:

Intra-abdominal abscess/sepsis was seen in 16 patients (13%). The mean score was 8.88 ± 4.5. Intra-abdominal abscess was 5% among patients who scored 0-4, whereas 26% in those who scored 5-9, 21% in those who scored 10-14, and 33% in patients who scored >14.

SCORE	INTRA-ABDOMINAL ABSCESS			
	PRESENT		ABSENT	
	NO.	%	N0.	%
0 – 4	3	5	56	95
5 – 9	7	26	28	80
10 – 14	4	21	15	79
> 14	2	33	4	67
TOTAL	16		103	
x^2= 1.99				
p = 0.0839				

There is no statistically significant association between the intra-abdominal abscess and the modified APACHE II scoring.

ENTERO-CUTANEOUS FISTULA:

Entero-cutaneous fistula was seen in 4 patients (3%); and their mean score was 7.8 ±5.69. Entero-cutaneous fistula was 2% among patients who scored 0-4, whereas 9% in those who scored 5-9, 5% in those who scored 10-14, and nil in patients who scored >14.

SCORE	ENTERO-CUTANEOUS FISTULA			
	PRESENT		ABSENT	
	NO.	%	N0.	%
0 – 4	1	2	58	98
5 – 9	3	9	32	91
10 – 14	1	5	18	95
> 14	-	-	6	100
TOTAL	4		114	
x^2= 0.25				
p = 0.7178				

No statistically significant association was seen between the entero-cutaneous fistula and the modified APACHE II scores.

HOSPITAL STAY:

The duration of the hospital stay ranged from 7 – 60 days, with the mean duration ranging from 10 -14 days.

There is no statistically significant association between the modified APACHE II scoring and the duration of hospital stay, which is an important indicator of postoperative morbidity.

DISCUSSION

Acute generalized peritonitis is a common surgical emergency in many surgical units in the developing countries. It is often associated with high morbidity and mortality. Mortality following acute generalized peritonitis is around 16-40% with many having to face with severe wound infection and wound dehiscence. Mortality rate of 15% was recorded in this study.

Males were predominantly affected in this study, and male: female ratio 6.4:1. The commonest age group affected was 36-45 years, as compared to the studies in the west, where the mean age group is between 45 – 60 years.

In majority of the cases the presentation to the hospital is late with well established generalized peritonitis with purulent of fecal contamination and varying degrees of septicemia. The signs and symptoms are typical and it is possible to make a clinical diagnosis of peritonitis in all patients.

The perforation of proximal gastrointestinal tract were five times as common as perforations of distal gastrointestinal tract as has been noted in earlier studies from India, which is in sharp contrast to studies from developed countries, which revealed that distal gastrointestinal tract perforations were more common.

The most common cause of peritonitis in our study was perforated duodenal ulcer (95 cases) followed by ileal perforation (12 cases), appendicular perforation (9 cases), gastric perforation (9 cases). Despite delay in seeking treatment, the overall mortality rate (15%) was favorably comparable with other published series though the overall morbidity (46%) was unusually high.

The objective evaluation of severity, therapeutic approach and effectiveness of treatment of acute generalized peritonitis is hampered by lack of precise classification in this environment. Crude morbidity and mortality data for the purpose of medical audit is often misleading. Early prognostic evaluation is desirable to be able to select high risk patients for more aggressive treatment especially in severe peritonitis.

APACHE II scores have been shown to have a stronger relationship to the outcome than previous groupings such as anatomy, causes, age and chronic ill health without consideration for systemic effect of the intra-abdominal sepsis, thus its use in this study. APACHE II score is very popular and has been used in both surgical and non-surgical patients; it has also been validated using many patients over several years in many centers in the developed countries.

Of the present prognostic scoring systems, APACHE II appeared to be the most widely used and had a general acceptance in assessing the critically ill patients for its easy applicability and ability to predict outcome. Many of the patients have associated high APACHE II scores with poor outcome as previously documented and confirmed by this study.

The present study confirmed the ability of modified APACHE II score to predict mortality in acute peritonitis sepsis. The study also showed that it could be easily applied to grade the severity of acute generalized peritonitis in centres like ours, despite inadequate facilities, with some degree of effectiveness. There was no death among the patients who scored 0-4; whereas mortality was 10.25% in patients who scored 5-9; 26.9% in patients who scored 10-14; 60% in patients who scored >14. This study thus showed the significant association of the modified APACHE II score and the prediction of mortality.

The major cause of postoperative morbidity was wound infection seen in 40% patients. The incidence of surgical site infection increases with the degree of contamination; therefore, surgical site infection occurs at much higher rates after operations for peritonitis and peritoneal abscess. Surgical site infection may be expected if wound is closed in the setting of gross abdominal contamination. Perioperative systemic, antibiotics, the use of

wound protector devices, and lavage of the wound at the end of therapy do not reliably prevent this complication. These wounds should be left open and be treated with wet-to-dry dressing changes several times a day or VAC dressing should be applied.

Other than wound infection, the most common abdominal complication is wound dehiscence in FORREST'S view, and in this study next to wound infection is wound dehiscence. Wound dehiscence is the reflection of both the high incidence of infection and debility of the patients. Unacceptably high incidence of wound dehiscence (12%) in the present series was multifactorial due to delayed presentation, gross contamination of the peritoneal cavity and septicaemia. Just like dehiscence, the development of fecal fistula is catastrophic and should be addressed aggressively. This complication was seen in 5 patients (3%).

Respiratory complication was the second most common complication in this study. It was present in 19 patients. The duration of hospital stay, which is one of the indicators for morbidity, ranged from 7 to 60 days. The mean duration of hospital stay was 10-14 days. There was no significant association of the various postoperative complications and the hospital stay duration. Thus the ability of modified APACHE II scores to predict the postoperative morbidity could not be confirmed by this study.

CONCLUSION

- Among the patients studied, duodenal ulcer perforation was the commonest cause for generalized peritonitis.
- Predominance of male over female in acute generalized peritonitis with the ratio of 6.4:1
- People in the age group of 3rd and 4th decade were commonly involved in generalized peritonitis.
- Overall mortality in patients with generalized peritonitis was 15%.
- Modified APACHE II scores predicted the mortality in the patients with acute generalized peritonitis.
- Modified APACHE II scores could not predict the incidence of postoperative complications

In this study, we conclude that modified APACHE II score would be an easy grading for the evaluation of disease severity in patients with acute generalized peritonitis.

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PROFORMA

Name: Age / Sex:
Occupation: IP No:
Address:

Date of admission:
Date of surgery:
Date of discharge:

CLINICAL FEATURES:

Pain Abdomen: hrs / days

Drug intake : Yes / No

H/O Smoking / Alcohol intake

Associated systemic illness: Yes / No

(DM / HT / CAHD / COPD / Malignancy / renal failure / liver disorder)

Peritonitis: - diffuse and generalized

- localized rigidity

PARAMETERS OF MODIFIED APACHE II SCORING

ACUTE PHYSIOLOGICAL SCORES:

NO	***PARAMETERS***	**VALUES**	**SCORING**
1.	Temperature (*C)		
2.	Heart rate		
3.	Respiratory rate		
4.	Mean arterial pressure (mmHg)		
5.	Haematocrit (%)		
6.	WBC count (total / mm3)		
7.	Serum sodium (mMol / L)		
8.	Serum potassium (mMol /L)		
9.	Serum bicarbonate (mMol /L)		
10.	Serum creatinine (mg / 100ml)		
11.	Serum urea (mg / 100ml)		

AGE SCORE _____

CHRONIC ILL HEALTH SCORE _____

TOTAL SCORE _____

OTHER INVESTIGATIONS:

- Blood Hb :
- Blood sugar :
- Blood G&T :
- Imaging :

- Others :

TREATMENT:

- Procedure done: Simple Omental Patch Closure / Bilateral flank drainage / Bilateral flank drainage followed by surgery.
- Time interval between admission and intervention:
- FINDINGS:

POST-OPERATIVE OUTCOME:

- Wound infection
- Wound dehiscence
- Residual intra-abdominal abscess
- Respiratory complications
- Enterocutaneous fistula
- Hospital stay
- Death
- Others