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Mini Review

Assessing the severity of intraabdominal Infections; the value of APACHE II Scoring System

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Abstract

Intra -abdominal infection continues to defy advances in surgical care with considerable mortality. It is characterized by a spectrum of presentations of varying disease severity. The need to ensure standards for comparing studies and antibiotic trials on intraabdominal infection led to the emergence of several scoring systems. There is paucity of information on this subject in local literature, even though a Nigerian scientist pioneered one of the earliest stratification systems. This is a review of literature on one of the scoring systems that has made an impact in the standardization of intraabdominal sepsis:the APACHE II scoring system. This study will review the genesis, bedside application, uses, limitations and alternatives as a scoring system for intraabdominal infection. Over two decades of use, it is simple and continues to be a reliable indicator of severity of intraabdominal infection.

Introduction

Intraabdominal infection may be defined as clinical peritonitis with operative and microbiological proof of infection[1, 2]. It consists of a spectrum of pathologies namely, primary, secondary and tertiary peritonitis and, intraabdominal abscess. In spite of innovations in operative and antimicrobial therapy, and intensive care, mortalities of 5-40% are being reported[1-9]. In our environment., peritonitis is a common cause of nontraumatic death in emergency unit with the scourge of typhoid perforation, late presentations of appendicitis and strangulated bowel being the key reasons[10-12]. Literature reports have tended to address these causative diseases rather than intraabdominal infection itself.

The Genesis of Scores

In the 1980s, it was observed that some new publications promising better treatment only brought conflicting results. Interpretation and comparison of results were made difficult by variable diagnostic criteria, ungraded severity of disease and unclear outcome measures[1, 13-15]. Meakins and associates aptly summarized the situation by showing the gross disparity between published mortality rate of 3.5% for antibiotic trials and rates up to 60% for intraabdominal infection associated with organ failure[13]. They concluded that under the umbrella of "serious intraabdominal infections", different diseases, processes and patients were being studied. Attempt to remedy this situation has led to the proliferation of scoring systems for intraabdominal infection [table 1].

The Grading of Sepsis by Elebute and Stoner[16]

This is one of the earliest scoring systems. It takes into account the local effects of tissue infection, temperature, secondary effects of sepsis and laboratory data. The pilot study applied to 15 patients showed correlation with mortality. The score is simple to apply but ambiguity with some variables and absence of prognostically important cardiovascular and respiratory data are obvious limitations.

The Sepsis Severity Score by Stevens[17]

This score includes variables from major body systems; respiratory, cardiovascular, renal, hepatic, renal, hematological, gastrointestinal and nervous. Applied to 30 patients, the scores reflected prognosis. Like the system by Elebute and Stoner, i t was criticized for lack of clear definitions, objectivity and validation in a large patient population.

The Mannheim Peritonitis Index[18]

The Mannheim peritonitis index emerged as a reliable marker for assessing the severity and prognosis of intraabdominal infection with sensitivity and specificity comparable to APACHE II score which has been adopted as the gold standard by Surgical Infection Society. The score designed specifically for peritonitis, combines preoperative and operative data and is easy to apply.

Table 1
Scoring Systems for Intraabdominal Infection
Non- specific:
[May also apply to other acute systemic illnesses]
Re-operation Index.
[a] Non ICU-dependent (i) APACHE II (ii) Simplified Acute Physiologic Score[SAPS]
[b] ICU-dependent (i) Multiple Organ Failure Score [Goris Score] (ii) Sequential Organ Failure Assessment Score [SOFA](iii)APACHE III
Specific:
[a] Sepsis (i) The Grading of Sepsis [Elebute and Stoner] (ii)The Sepsis Severity Score by Stevens
[b] Peritonitis (i) Mannheim Peritonitis Index [MPI] (ii) Peritonitis Index Altona [PIA]
[c] Septic Focus (i) Left Colonic Peritonitis Severity Score [PSS] (ii)Jabalpur Index for Peptic Ulcer Perforation.
[d] Predicting the need for planned relaparotomy (i) The Prognostic Peritonitis Model (ii) The Abdominal

Table 2: The Apache II Severity Of Disease Classification System[19]

	Abnormal Range (High)						Abnormal Range (Low)		
Physiologic variable	**+4**	**+3**	**+2**	**+1**	**0**	**+1**	**+2**	**+3**	**+4**
Temperature - rectal (˚c)	≥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-mm Hg	≥160	130-159	110-129		70-109		50-69		≤49
Heart Rate (ventricular response)	≥180	140-179	110-139		70-109		55-69	40-54	≤39
Respiratory Rate- (non ventilated or ventilat ed)									
Oxygenation: A. a DO_2 or PaO_2 (mm Hg) a. $FIO_2 \geq 0.5$ record A. a DO_2 b. $FIO_2 < 0.5$	≥500	350-499	200-349		≤200				
					PO_2 <70	$PO_2$6 1-70		PO_2 55-60	PO_2<55
Arterial p^H	≥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)	≥7	6-6.9		5.5-5.9	3.5-5.4	3-3.4	2.5-2.9		≤2.5
Serum Creatinine (Mg/100 ML) (Double point score for acute renal failure)	≥3.5	2-3.4	1.5-1.9		0.6-1.4		0.6		

White Blood Count (total/mm^3) (in. 1000)	≥40	20-39.9	15-19.9	3.1-4.9	1.2.9		≤
Glasgow Coma Score (GCS) : Score = 15 minus actual GCS							
Total Acute Physiology Score (APS) Sum of the 12 Individuals Variable Points							
SERUM HCO_2 (venous mMol/L) (Not preferred, use if no ABGs)	≥52	41-51.9	32-40.9	22-31.9	18- 21.9	15-17. 9	≤15

A.	**B.**	**C.**	**APACHE II**
Age[Yrs] Points	**Chronic health points**	**Cardiovascular**:	**SCORE:**
≤44 0	With history of severe organ insufficiency or immunosuppression assign points as follows:	New York Heart Association Class IV.	Sum of (A)+(B)
45-54 2	a. Nonoperative or emergency postoperative -5 points	**Respiratory**: Chronic restrictive, obstructive or vascular disease resulting in severe exercise restriction, i.e., unable to climb upstairs or perform household duties; or documented chronic hypoxia, hypercapnia, secondary polycythemia, severe pulmonary hypertension [.40mmhg], or respiratory dependency.	(+C)
55-64 3	b. Elective postoperative -2 points.		A: APS points
65-74 5	**Definitions**		B: Age points
≥75 6	Organ insufficiency or immunocompromised state must have been evident prior to this hospital admission and conform to following criteria: Liver Biopsy proven cirrhosis and documented portal hypertension, episodes of upper GI bleeding or prior episodes of hepatic failure/encephalopathy/coma	**Immunocompromised**: the patient has received immunosuppressive therapy [chemotherapy, radiation long term or recent high dose steroids] or has disease that is sufficiently advanced to suppress immunity e.g. AIDS, Lymphoma, leukemia.	C: Chronic Health points

APACHE II Score

In 1983 Knaus while leading a team of critical care experts [20] developed a scoring system based on 32 variables, named acute physiologic and chronic health evaluation, APACHE, for patient stratification in the intensive care unit. Meakins and associates[13] applied it to patients with intraabdominal infection and found strong correlation with mortality. The original APACHE score did not enjoy widespread popularity because it was too dependent on intensive care facilities[21].

In1985, APACHE II, a less ICU- dependent version, with 12 variables, age and chronic health status [table 3], was developed, without loss of effectiveness[19]. In 1987, the Surgical Infection Society [SIS] adopted APACHE II the standard for stratification of intraabdominal infection ahead of scores designed specifically for sepsis, because, at that time, it had been prospectively validated in large patient populations[1, 2]. Modifications such as the mode of score implementation, standard definition criteria and

outcome measures for intraabdominal infection were approved by SIS.

Clinical Application of APACHE II Score

Admission APACHE II score provides an objective assessment of severity of intraabdominal infection and prognosis at the bedside. The score value can be translated to a mortality risk level that compares favorable with observed mortality. A prediction accuracy of 84-90% has been reported[1, 14, 22-23]. Serial postoperative scores may assist monitoring of the patient to recovery. Kopena and Schulz have shown the value of using an initial score of 20 with other criteria to identify patients prone to persisting intraabdominal infection despite initial surgery so that planned relaparotomy can be commenced within 48 hours of first exploration for maximal benefit[24]. APACHE II score may assist therapeutic decisions like transfer of patients to intensive care unit and the choice of more effective but expensive antibiotics. By comparing expected against observed outcome the score can be used for auditing the quality of patient care.

APACHE II score is most effective when applied to patient groups. The inclusion makes studies more objective, with precise inclusion criteria, patient description and outcome measures. It has been recommended as a precondition for clinical studies on intraabdominal infection to allow meaningful interpretation of results and comparability[1, 25].

Scoring the patient:

The APACHE II chart is self explanatory. The score is obtained from the sum of three components, the acute physiologic score of 12 variables, age and chronic health points. The data for acute physiologic score is obtained from the worst observation of each variable over a 24 hour period. The creatinine level can be converted from mmol\l to mg\dl by multiplying with a factor of 0.011.

Many hospitals may not have facilities for arterial blood gas analysis. Studies done with the alternative test, the bicarbonate level from venous blood have shown reliable results[26]. Similarly, Adesunkanmi have shown how the score can be modified for use on children with acute peritonitis[26].

Limitations

APACHE II score has over two decades outlasted earlier criticism of not being specific enough for grading intraabdominal infection. This should not be surprising as it has been shown consistently that the outcome peritonitis is often determined by the extent of derangement of systemic physiology appropriately addressed by the score[9, 27-29]. However no score can ideally be a substitute to sound clinical judgment at the bedside and the weakness of APACHE II score in this regard has been clearly documented[1, 2, 5,6,25]

Bosscha compared various scores and concluded that only APACHE II score and Mannheim Peritonitis Index [MPI} were independent predictors of prognosis in multivarious analysis[30]. Ohman and Hau have suggested the combination of APACHE II score and MPI for assessing severity at the early stage, while addition of the Prognostic Peritonitis Model and the Abdominal Re-operation Predictive Index will aid selection of patients for aggressive surgical management[31]. Because the variables contributing to the Acute Physiologic score easily stabilize in the intensive care unit, some authors have found the Goris score more useful for monitoring patients with peritonitis in ICU[24, 32, and 33].

Other Prognostic Indicators

The presence of organ dysfunction, age over 50 years and co-morbidity are well document independent risk factors[3,4,5,6,9,27-29]. Wahl and associates have rated diffuse peritonitis with mortality of 47%, a most unfavorable factor[4]. Ten to fifteen percent of patients may need re-exploration for persistent or recurring sepsis and mortality in this group is considerable[2,8,9,24,34] The significance of the septic focus was highlighted by Bohnen who showed that colonic perforation is high risk while appendix perforations has good recovery rate[3]. A new scoring system, 'The Left Colonic Peritonitis Severity Score' [PSS] was developed to address the specific risk posed by left colonic perforation[35].

Conclusion

The multiplicity of scores for assessing severity of intraabdominal infection is an indication that none is ideal. APACHE II score has over two decades proven to be a reliable guide for grading peritonitis and prognosis. It is universally accepted, easy to apply and is recommended for the management of our patients and local literature on intraabdominal infections

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