

## ASSESSMENT OF SEVERITY OF PERFORATED PERITONITIS USING MODIFIED APACHE II SCORE

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### ABSTRACT

Acute generalised peritonitis from gastrointestinal hollow viscus perforation is a potentially life threatening condition. It is a common surgical emergency in many general surgical units in the developing countries and it is often associated with high morbidity and mortality. Grading the severity of acute peritonitis has assisted in no small way in decision making and has improved therapy in the management of severely ill patients. Empirically based risk assessment for important clinical events has been extremely useful in evaluating new therapies, in monitoring resources for effective use and improving quality of care.

### MATERIAL AND METHODS

A prospective survey of patients with acute generalised peritonitis due to gastrointestinal perforation was carried out in general surgical wards of KIMS Hospital, Amalapuram during the period starting from July 2013-November 2016. The study population consisted of 50 consecutive patients who had laparotomy during the study period for acute peritonitis due to gastrointestinal perforation, after diagnostic conformation.

### RESULT AND DISCUSSION

The most common cause of peritonitis in our study was perforated duodenal ulcer (31 cases), followed by appendicular perforation (7 cases), followed by stomach perforation (7 cases). Despite delay in seeking treatment, the overall mortality rate (14%) was favourably comparable with other published series.

### KEYWORDS

Peritonitis, Perforation, APACHE Score.

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**INTRODUCTION:** Acute generalised peritonitis from gastrointestinal hollow viscus perforation is a potentially life threatening condition. It is a common surgical emergency in many general surgical units in the developing countries and it is often associated with high morbidity and mortality.<sup>1,2</sup> Grading the severity of acute peritonitis has assisted in no small way in decision making and has improved therapy in the management of severely ill patients.<sup>3</sup> Empirically based risk assessment for important clinical events has been extremely useful in evaluating new therapies, in monitoring resources for effective use and improving quality of care.<sup>4,5,6</sup>

The introduction of injury severity scale by Baker's et al<sup>7</sup> in 1974 and abbreviated injury scale<sup>8</sup> in 1981 successfully opened avenues from further development of severity grading systems. Many scoring systems have been designed and used successfully to grade the severity of acute peritonitis and abdominal sepsis.

The most widely used index APACHE (Acute Physiology and Chronic Health Evaluation) was developed from a mixed group of medical and surgical patients.

It has been successfully used to assess critically ill general surgical patients and also been compared with other scoring systems with good results.<sup>4,9,10,11,12</sup>

**AIM OF THE STUDY:** Assess the severity of generalised peritonitis from hollow viscus perforation using modified APACHE II Score. To study various sites of perforative peritonitis operated in KIMS Hospital and their progression. To find out the incidence of hollow viscus perforative peritonitis in relation to age group and sex of the patient. To analyse the various symptoms and signs of the diseases from the onset of hollow viscus perforation. Correlate morbidity and mortality patterns with the modified APACHE II Score and its significance on the outcome.

**MATERIALS AND METHODS:** A prospective survey of patients with acute generalised peritonitis due to gastrointestinal perforation was carried out in general surgical wards of KIMS Hospital, Amalapuram during the period starting from July 2013-November 2016. The study population consisted of 50 consecutive patients who had laparotomy during the study period for acute peritonitis due to gastrointestinal perforation, after diagnostic conformation. The case detection was done on the following criteria.

### Inclusion Criteria:

1. Adult patients with symptoms & signs of acute perforative peritonitis.

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2. Patient whose plain x-ray abdomen showed features of hollow viscera perforation peritonitis.
3. Patient with blunt or penetrating injury of the abdomen with signs of hollow viscus perforation.

**Exclusion Criteria:**

1. Patient who presented with features of peritonitis and had no evidence of perforation radiologically and preoperatively.
2. Patients with post-operative peritonitis.
3. Patient with iatrogenic perforation during laparotomy or endoscopy.
4. Patient with oesophageal perforation.
5. Perforative peritonitis in paediatric age group.

**METHODS:** All patients were evaluated clinically, haematological and biochemical investigations were carried out. Patients were resuscitated with intravenous fluids and correction of electrolyte imbalance as indicated by the results of the electrolytes and urea.

X-ray – Plain X-Ray Abdomen Erect, Plain X-ray chest PA View done.

The following Acute physiological parameter of APACHE II were assessed and recorded at the admission point preoperatively.

- Temperature (Degrees Centigrade).
- Mean Arterial Blood Pressure (mmHg).
- Heart Rate.
- Respiratory Rate (Non-ventilated), Serum Sodium (mmol/L).
- S. Potassium (mmol/L).
- S. Creatinine (mg/100 mL), Haematocrit (%).
- White blood count (total/cm<sup>3</sup>).
- HCO<sub>3</sub> (mmol/L).

No patient had arterial pH or partial pressure of oxygen (PO<sub>2</sub>) due to lack of facility.

These were scored in accordance with the Modified APACHE II chart, scoring the abnormality high or low levels. The scores ranged from 0 to 4 on each side of normal value. Zero represents normal values and increase to 4 indicating the extreme end of high or low abnormal values. These parameters represent the acute physiological scores (APS). Included in this study as part of APS was the serum urea. This was scored using the parameter similar to that of serum creatinine.

Age points are as follows for adult patients. 44=0, 45-54=2, 55-64=3, 65-74=5, 75=6.

Chronic ill health value was added if the patient has history of organ system insufficiency or is immunocompromised, points are assigned as discussed earlier. The Sum total of the APS, Age point and chronic health values is the total modified APACHE II Score. All the parameters were entered in the Modified APACHE II Table as discussed earlier.

**Abdominal Paracentesis done and Specimen Sent for Culture and Sensitivity:** After proper clinical assessment, the patients were actively resuscitated with intravenous fluids, nasogastric aspiration, antibiotics, analgesics. A combination of ampicillin, gentamycin & metronidazole were used initially in all cases. Antibiotics were later changed according to the culture and sensitivity report. The bladder was catheterised to monitor the urine output.

After stabilising the general condition, the patients were taken up for surgery. Surgery in the form of laparotomy was done under general or epidural anaesthesia in the majority of cases. The incision used depended on the suspected site of pathology. Most of the cases, midline incisions were used, viscera were inspected carefully, the site of lesion located and the appropriate surgical procedure was performed. Peritoneal toilet and lavage with normal saline were carried out and the peritoneal cavity drained. The abdomen was closed in layers or by mass closure using No. 1 Prolene.

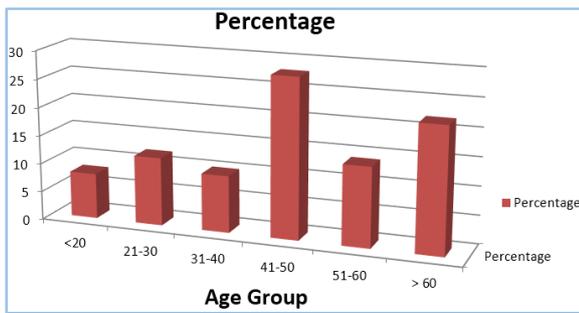
Postoperatively, nasogastric aspiration, antibiotics were continued, nutrition and electrolyte balance were maintained with intravenous fluids. Daily patients were assessed for recovery and complaints if any were recorded. A separate proforma for each case, containing all the relevant particulars were maintained and all cases were followed up throughout the postoperative period. Specific instruction was given to each patient on discharge, to come for periodical review regularly.

**OBSERVATIONS AND RESULTS:** The study was of 50 consecutive patients having acute perforative peritonitis admitted in general surgical wards during the period of July 2013 To November 2015. Clinical diagnosis was made from history, physical examination and investigations. Depending on the general conditions of the patient, the line of management was planned. Exploratory laparotomy was instituted in all cases. Preoperative resuscitation was done before laparotomy was attempted in all cases and primary causes treated accordingly. Out of 50 patients, 50 underwent laparotomy.

**Age and Sex Distribution:** Table 1 shows that perforation was common in 41-50 in our study, especially due to duodenal ulcer perforation. Male to Female ratio was 2.5:1.

Age Group	No. of Patients	Percentage (%)
<20	4	8
21-30	6	12
31-40	5	10
41-50	14	28
51-60	7	14
> 60	11	22

**Table 1: Age Distribution**

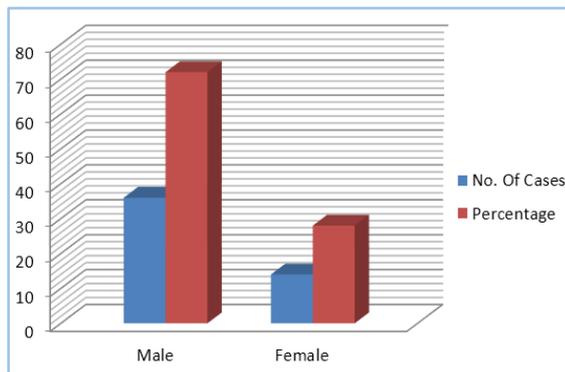


**Fig. 1: Age Distribution**

Perforation was common in 40-50 years age group in our study.

Sex	No. of Cases	Percentage (%)
Male	36	72
Female	14	28

**Table 2: Sex Incidence**



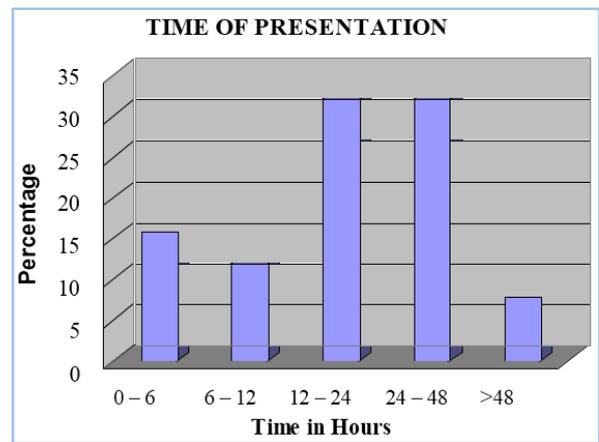
**Graph 2: Sex Incidence**

Majority of patients were males with Male: Female ratio of 2.5:1.

Time in hrs.	No. of Cases	Percentage
0 – 6	8	16
6 – 12	6	12
12 – 24	16	32
24 - 48	16	32
>48	4	8

**Table 3: Time of Presentation**

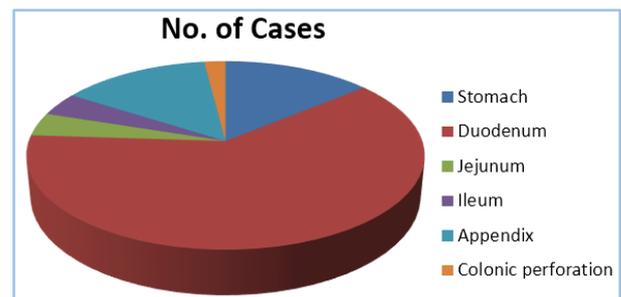
Only 8 patients got admitted within 6 hours.



**Graph 3**

Site of Perforation	No. of Cases	Percentage
Stomach	7	14
Duodenum	31	62
Jejunum	2	4
Ileum	2	4
Appendix	7	14
Colon	1	2

**Table 4: Site of Perforations**



**Graph 4**

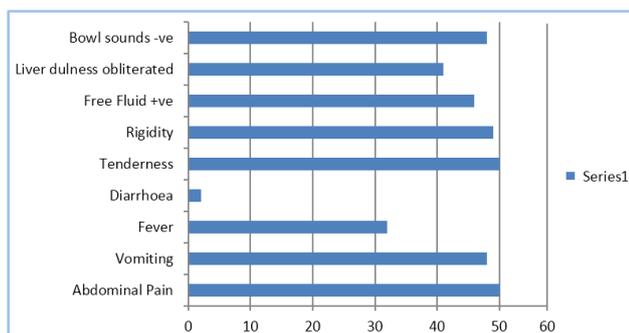
Commonest site of perforation was in the 1st part of duodenum. Duodenal ulcer constitutes the most common cause of gastrointestinal perforation. 75% of duodenal ulcer patients give a history of previous peptic ulcer diseases. Ileal perforations were 2 due to enteric fever which was subsequently proved by investigations. 2 patients had jejunal perforation in this study. Appendicular perforations were seen in 7 cases. Appendix was found to be gangrenous in all cases. In the study, there was one case of colonic perforation.

Aetiology	Clinical Features				Total No. of Cases
	Abdominal Pain	Vomiting	Fever	Diarrhoea	
Gastric Ulcer	7	3			7
Duodenal	31	25	20		31
Jejunal	2	2	2		2
Ileal	2	2	2		2
Appendicular	7	6	7	2	7
Colonic	1		1		1
<b>Total</b>	<b>50</b>	<b>48</b>	<b>32</b>	<b>2</b>	<b>50</b>

**Table 5: Analysis of Symptoms in Relation to Aetiology**

Aetiology	Clinical Features					Total No. of Cases
	Tenderness	Rigidity	Free Fluid +ve	Liver Dullness Obliterated	Bowel Sounds -ve	
Gastric Ulcer	7	7	7	6	7	7
Duodenal	31	31	31	31	30	31
Jejunal	2	2	1	1	2	2
Ileal	2	2	2	1	2	2
Appendicular	7	6	4	1	6	7
Colonic	1	1	1	1	1	1
<b>Total</b>	<b>50</b>	<b>49</b>	<b>46</b>	<b>41</b>	<b>48</b>	<b>50</b>

**Table 6: Analysis of Various Signs in Relation to Aetiology**



**Graph 5**

The table 5 and 6 gives various symptoms and signs in relation to aetiology. Abdominal pain is the commonest. Table gives various signs in relation to aetiology. Rigidity was found in 98% of cases. Liver dullness was obliterated in 72% of cases. Absence of bowel sounds was seen in 86% of patients.

**INVESTIGATIONS:** Since the diagnosis of peritonitis was many a time clinically obvious and the stage at which they reached the hospital gave very little time for investigations, the spectrum of investigation was limited. But all the routine basic investigations were done. Ultrasound abdomen was done in very few cases with suspicion of localised collection of fluid intra-abdominally. Contrast study was not done in any of our patient. The most rewarding investigation was plain x-ray abdomen erect view which showed the following findings, gas under the diaphragm, ground glass appearance, distended bowel loops. Gas under diaphragm was present in 74% of cases, especially gastric, duodenal and colonic perforation. It is not a reliable investigation in appendicular perforation.

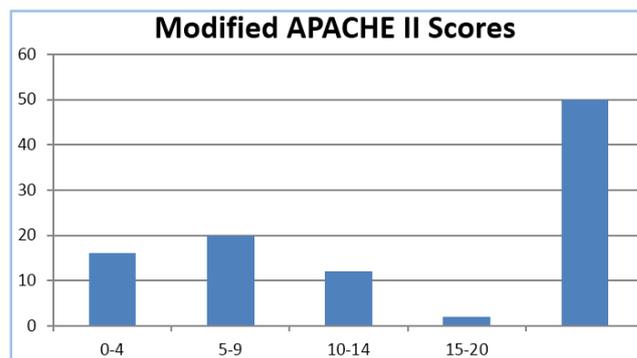
Bacteria Isolated	No. of. Cases	Percentage
Escherichia coli	7	14
Proteus	2	4
Klebsiella	1	2
Staphylococci	1	2
Sterile	39	78

**Table 7: Bacterial Isolates**

1. Positive culture isolated – obtained in 22% cases.
2. Negative culture isolated – obtained in 78% cases.

Aetiology	Modified APACHE II Scores				Total Cases
	0-4	5-9	10-14	15-20	
Gastric	-	3	4	0	7
Duodenal	15	10	4	2	31
Jejunal	-	1	1	-	2
Ileal	-	1	1	-	2
Appendicular	1	5	1	-	7
Colonic	-	-	1	-	1
<b>Total</b>	<b>16</b>	<b>20</b>	<b>12</b>	<b>2</b>	<b>50</b>

**Table 8: Modified APACHE II Scores Observed in our Study**



**Graph 6**

**Treatment:** All patients were taken up for laparotomy after adequate resuscitation with intravenous fluids, nasogastric suction, etc. Laparotomy was done either through midline incision. Peritoneum was found to be thickened and there was increased amount of fluid in the peritoneal cavity. The nature of fluid varies according to the aetiology, site of perforation, and time interval between perforation and laparotomy. The cases which reached the hospital early had only minimal collection in the peritoneal cavity. All collections in the peritoneal cavity was sucked out and debridement of necrotic materials was done.

The essential mode of treatment in peptic ulcer perforation was by simple closure, either with live omental patch or with island omental patch. The perforation was closed with 2-0 Vicryl in a single layer. Whereas small bowel perforation was closed with two layers, inner all coat layer with absorbable suture material and outer seromuscular layer using nonabsorbable material.

Care was taken to avoid tension along the suture line. Since colonic perforations were due to malignancy, right hemicolectomy was done in one. After closure of perforation, complete peritoneal lavage was done with 2-3 litres of normal saline. No antibiotic solution was used for lavage at the time of surgery. The abdomen was closed in layers with a drain in the flank.

In very high risk patients, peritoneal lavage was done by introducing Malecot catheter in both flanks. In appendicular perforation, appendectomy was done in all

the cases. In one case, appendectomy was done by retrograde method.

**Post-Operative Complications:** Respiratory infection was found in 10 patients. Wound infection in 16, intraperitoneal abscess in 3, faecal fistula in 2, wound dehiscence in 2.

No.	Aetiology	Respiratory Infection	Wound Infection	Intra peritoneal abscess	Faecal Fistula	Wound Dehiscence	Total No. of. Cases
1	Duodenal	8	8	1		1	18
2	Gastric	1	1				2
3	Jejunal	1				1	2
4	Ileal		2	1	2		5
5	Appendicular		4	1			5
6	Colonic		1				1
	<b>Total</b>	<b>10</b>	<b>16</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>33</b>

**Table 9: Post-Operative Complications**

Post-operative Complications	APACHE Scores				Total No. of Cases
	0-4	5-9	10-14	15-20	
No. of. Cases with Complications	6	14	8	5	33

**Table 10: Modified Apache II Score and Post-Operative Complications**

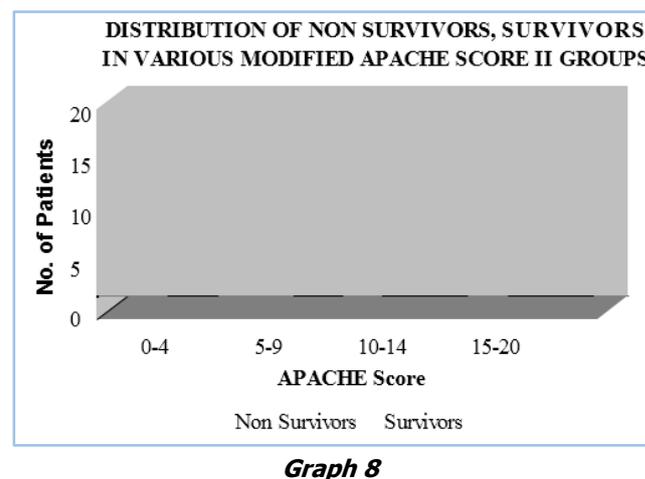
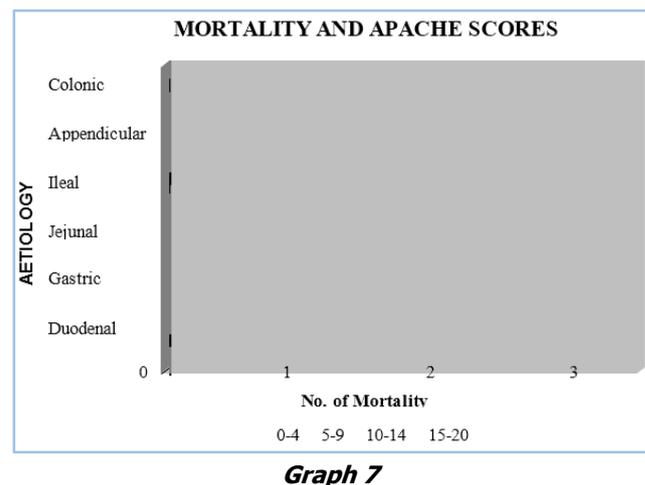
The mean number of days for hospital stay in patients with postoperative complications were higher. The complications were treated according to the nature of the complications.

**Mortality:** The total mortality was 7 among 50 patients. Three in duodenal ulcer perforations, 2 in small bowel perforations, and one in colonic perforation. The mortality was very high in the group of 10-14 and 15-20 range of modified APACHE scores.

No.	Aetiology	Death and APACHE SCORE				Total
		0-4	5-9	10-14	15-20	
1	Duodenal			2	2	4
2	Gastric					0
3	Jejunal					0
4	Ileal			1	1	2
5	Appendicular					0
6	Colonic			1		1
	<b>Total</b>			<b>4</b>	<b>3</b>	<b>7</b>

**Table 11: Mortality and Apache Scores**

Causes for mortality were septicaemia and electrolyte imbalance.



**ANALYSIS:**

**Methodology:** Mean and standard deviation of the total modified APACHE II Score was compared for each of the complication and mortality for the study. 't' – test was used to compare the statistical significance of the mean values, p value < 0.05 was considered as statistically significant. P value calculated by Bonferroni test.

Post-operative Outcome	Mean		Standard Deviation	't' values	'p' values <
	-VE	+VE			
Resp. Infection	-VE	8.00	3.64	0.911	0.367
	+VE	6.80			
Wound Infection	-VE	7.70	3.62	-0.40	0.968
	+VE	7.75			
Intra peritoneal abscess	-VE	7.675	3.7	-0.299	0.767
	+VE	8.333			
Fecal fistula	-VE	7.58	3.66	-1.109	0.274
	+VE	10.50			
Wound dehiscence	-VE	7.58	3.53	-1.109	0.274
	+VE	10.500			
Death	-VE	7.7209	3.64055	-5.799	0.001
	+VE	16.1429			

**Table 12: Statistical Analysis**

Modified APACHE II score ranged from 3-20.

**In Morbidity Parameter:** For Respiratory infection, mean having infection 6.8+3 not having resp. infection 8.00+3.64, p <0.367. Wound infection mean for positives was 7.75+3.78 negatives was 7.70+3.62, p <0.968. In the abdominal abscess mean for positives was 8.33+3 negative was 7.675+3.7, p <0.767. Faecal fistula mean for positives was 10.50+2.12 negative 7.58+3.66, p <0.274.

Wound dehiscence mean for positive was 10.50+6.36 negatives was 7.58+3.58, p <0.274. The mean APACHE II Score for survivors was 7-72±3.6, Non-survivor was 16.1429+2.9 p <0.001

In this study it was observed that there is a increase in mean APACHE scores for patients having severe post-operative complications like intra peritoneal abscess, faecal fistula and wound dehiscence. This study helps to identify high risk groups where severe morbidity can be expected.

Higher modified APACHE II scores statistically influenced mortality in all the patients irrespective of aetiology with p <0.001 which is statistically significant.

**DISCUSSION:** Acute generalised peritonitis is a common surgical emergency in many surgical units in the developing countries. It is often associated with high morbidity and mortality. In majority of the cases the presentation to the hospital is late with well-established generalised peritonitis with purulent faecal contamination and varying degrees of septicaemia. The symptoms and signs 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 (31 Cases) followed by appendicular perforation (7 Cases) followed by stomach perforation (7 Cases). Despite delay in seeking treatment, the overall mortality rate (14%) was favourably comparable with other published series. Duodenal ulcer perforations were more common, in the age group 41-50, in our study when compared to Devitt Taylor and DeBakey's above 60 years and 50-60 years respectively. Males were predominantly affected in this study.

Male: Female ratio was 2.5:1 in our study.

Study	M : F
Andrew M Desmond	6 : 1
Rodney Maingot	6 : 1
Our Study	2.5 : 1

**Table 13**

Compared to Western studies Crawford and Ellis (1985),<sup>13</sup> it was found that large bowel perforations in our study are lower compared to Western population. Our study had similar distribution that of previous Indian studies Kachroo et al<sup>14</sup> and Sharma et al<sup>15</sup> which showed common aetiology being duodenal ulcer, ileal and appendicular perforation in order of frequency. E. coli was the predominant organism in culture in our study. Morbidity was observed in 66 percent of patients, mortality was 7 in 50 i.e., 14% which is accepted mortality. Maingot et al (10-40%).

Aetiology wise duodenal ulcer patients had very low mortality 4 out 31, whereas colonic perforation and enteric perforation had high mortality. APACHE II parameters have been shown to have stronger relationship to the outcome, then previous grouping such as anatomy, causes, abnormality, age and chronic ill health without consideration for systemic effects of the intra-abdominal sepsis.<sup>16</sup> Thus, its use in this study. The APACHE II score is very popular and has been used in both surgical and nonsurgical patients, it has also been validated using many patients over several years in many centres in the developed countries.<sup>1,4,5,6,17,18</sup>

The modified APACHE II score for the morbidity for the patients having severe complications like abdominal abscess, faecal fistula, wound dehiscence, were higher but were not statistically significant. This may be due to the cross-sectional nature of our study and the sample size. They helped to identify high risk groups where higher complications can be expected.

Study	Modified APACHE II SCORES	
	Survivors	Non Survivors
Adesunkanmi et al <sup>1,18</sup>	7.6+4	9.4+2
Our Study	7.72+3.6	16.14+2.96

**Table 14: Mortality and Mean Apache II Scores**

In mortality, higher APACHE II Scores were noted. There was no death in scores ranging from 0-4, 5-9, 42% percent mortality in 10-14 groups and 57.2% percent in 15-20 groups. Scores for survivors was a mean of 7.72 and a standard deviation of 3.6, and for non-survivors, mean of 16.14 and standard deviation of 2.96.  $p=5.79$ ,  $p < 0.001$  which is statistically significant which compares with earlier studies by Adesunkanmi ARK, Badmus TA, Agbakwuru EA,<sup>1,13</sup> in adult African patients. Hence higher score indicates a need for concentration of medical services and expediting resources in treating those set of patients to reduce the morbidity and mortality.

Preoperative modified APACHE II scores are simple and effective method for assessing disease severity which is observed by our study. Early prognostic evaluation is desirable to be able to select high risk patients for more aggressive treatment especially in severe peritonitis.

Modified 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. Modified 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 centres in the developed countries.

Of the present prognostic scoring systems, modified 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 associated with high modified 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 generalised peritonitis in centres like ours, despite inadequate facilities, with some degree of effectiveness. There was no death among the patients who scored 0-4 & 5-9 whereas mortality was higher in patients who scored 10-14 & >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, 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 dressings. Other than wound infection, the most common abdominal complication is wound dehiscence in Forrest's view, and in this study it is less compared to respiratory infection and wound infection. Wound dehiscence is the reflection of both the high incidence of infection and debility of the patients.

Wound dehiscence in the present series was multifactorial due to delayed presentation, gross contamination of the peritoneal cavity and septicaemia. Just like dehiscence, the development of faecal fistula is catastrophic and should be addressed aggressively. This complication was seen in 2 patients (4%). Respiratory complication was the second most common complication in this study. It was present in 10 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.

**CONCLUSION:** Modified APACHE II scoring predicts mortality which was significant irrespective of the aetiology. Higher mean scores predicted serious morbidity outcomes. Modified APACHE II scores can be used easily and effectively to identify high risk patients for intensive therapy. Modified APACHE II scores can be used as a tool for surgical audit and research for improving the quality of intensive care in a hospital like ours.

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