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Assessment of severity of peritonitis due to hollow viscous perforation- using APACHE II score

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ABSTRACT

Introduction: Acute widespread peritonitis caused by a perforated hollow viscus is a potentially fatal illness. It's a common surgical emergency in many developing-country general surgical departments, and it's often associated with substantial morbidity and mortality. Grading the severity of acute peritonitis has greatly aided decision-making and improved the therapeutic success in the management of critically ill patients. Empirically based risk assessment for major clinical events has proven to be tremendously valuable in evaluating new medicines, monitoring resource utilisation, and improving care quality.

Material and Methods: A hospital based prospective observational study was conducted on patients operated on emergency basis for hollow viscus perforation admitted to the hospital, the study was conducted from OCT 2014 – SEP 2016 at Kamineni institute Medical sciences & hospital, Narketpally, Telengana. A series of 100 cases was compiled for this study during this period. The accuracy in outcome prediction of APACHE–II system was assessed by means of receiver operating characteristic curve and Pearson correlation coefficient. The Analytical data obtained was compared and discussed with the data available in the literature.

Results: A total of 100 patients were studied. Out of which there were 86(86%) survivors and 14(14%) non-survivors. Mean APACHE–II score of the study population was 9.80 with a range of 1-30. The predicted death rate for the study population was 16% and observed death rate was 14%. Mean APACHE–II score in survivors was 8.03 where as in non-survivors it was 20.64. The area under the curve using receiver operating characteristic curve analysis was found to be 0.985. The association between the APACHE-II score and the predicted death rate was flawless, with r = 0.99 and P0.001. In patients with peritonitis caused by hollow viscus perforation, an APACHE-II score of 11-20 was found to be a stronger predictor of mortality risk. In patient groups with APACHE-II scores of 0-10 and scores > 20, predicted death did not match observed mortality.

Conclusion: APACHI-II scoring system can be used for assessment of group out come in patients with peritonitis due to hollow viscus perforation. However, it does not provide sufficient confidence for outcome prediction in individual patient.

1. Introduction

Peritonitis is an inflammation of the parietal and visceral walls of the abdominal cavity, which can affect one or both sides. Any abdominal disease, such as trauma, infection blockage, or tumour, can lead to secondary peritonitis. Peritonitis is caused by a perforation in the gastrointestinal tract wall that allows free flow of luminal contents into the peritoneal cavity and develops connection between the lumen of the viscus and the surrounding peritoneal

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cavity. Scoring systems provide an objective technique of assessing disease severity and outcome. The patients that are hospitalised to critical care are a diverse group. They differ in a variety of ways, including age, previous health status, cause for admission, and sickness severity. Scoring systems have been established to quantify all elements that influence the patient's prognosis. Multivariate evaluations generate a cumulative score based on the combined contribution of numerous data points, which reflects the total risk and, as a result, the outcome.[1] The chronic health evaluation is the second portion of the score. This assesses the patient's health before to admission by analysing the medical history for information on functional status, productivity, and medical treatment received in the six months prior to admission. The patient is classified into one of four chronic health groups, A through D, based on the answers to various questions. APACHE is the acronym for the combination of the two assessments.

Although this scoring system was not developed for the purpose of evaluating patients with severe surgical Infection a modest number of such patients were included in its initial trial. The APACHE system has since been tested in a large number of hospitals both in US and in France and has been shown to reliably describe the mortality risk for population of ICU patients.[2,3] There is a clear cut inverse correlation between APACHEII scores and survival. Higher score sharply increases mortality.

The modified APACHE II Score was used to determine the severity of widespread peritonitis caused by hollow viscus perforation. The goal of this study is to look into the many types of peritonitis that can emerge as a result of a hollow viscus perforation and how they progress. To determine the incidence of peritonitis caused by a perforated hollow viscus in relation to the patient's age and gender. From the commencement of perforation, examine the numerous symptoms and indicators of the disorders. Examine the relationship between morbidity and mortality patterns and the modified APACHE II Score's impact on the result.

2. Materials and Methods

This is a prospective observational study of patients with acute generalized peritonitis due to hollow viscus perforation in general surgical wards of Kamineni institute Medical sciences & hospital, Narketpally for a period of 2 years starting from OCT 2014 – SEP 2016. A total of 100 patients who underwent laparotomy for acute peritonitis due to hollow viscus perforation were enrolled in the study.

2.1. Inclusion criteria

1. Patients with features of peritonitis due to hollow viscus perforation.
2. Patient with blunt or penetrating injury of the abdomen with signs of hollow viscus perforation.

2.2. Exclusion criteria

1. Patients who had symptoms of peritonitis but no evidence of perforation on radiological or surgical examination.
2. Patients suffering peritonitis following surgery.
3. Patient who experienced an iatrogenic perforation during a laparotomy or an endoscopy.

2.3. Methods

All patients were evaluated with clinically, haematological, biochemical and radiological investigations. Intravenous fluids and electrolyte balance adjustment were used to resuscitate the patients. At the time of admission, the acute physiological parameters of APACHE II were examined and recorded. These were graded using the APACHE II chart, with the irregularity being assigned a high or low score. On either side of the normal value, the scores ranged from 0 to 4. The number zero denotes normal readings, whereas the number four denotes the extremes of high and low aberrant values.

Parameters represent the acute physiological scores (APS): Age points for Adult patients were 44=0,45-54=2, 55-64=3, 65-74=5, 75=6.

If the patient has a history of organ system insufficiency or immune deficient situations, a chronic ill health value was applied as previously discussed. The overall APACHE II Score is the sum of the APS, Age point, and chronic health values. All of the criteria were entered into the previously mentioned APACHE-II score charts.

Statistical analysis was done using software SPSS 17.0. Mean, Standard deviation, Chi square test, descriptive statistics, ROC curves have been studied between groups. Any death of the patient during the period of stay in the hospital is considered as mortality.

3. Results

Demographic details: 100 patients with peritonitis due to hollow viscus perforation ranging in age from 16 years to 82 years comprised the study group. Most patients were in the age spectrum of 41-50 years (mean age is 45.07 years) and highest incidence is seen in the 5th decade of age. In our study, Male: female ratio is 2.03:1 (67 men, 33 women), there is male preponderance. Out of 100 cases 14 (14%) did not survive, 10 are males and 4 are females.

Time of presentation after development of symptoms for maximum number of cases is after 48 hours i.e 34%. 14 cases presented before 6 hours (14%), 8 cases presented between 6-12 hours (8%), 16 cases presented between 12-24 hours (16%), 28 cases presented between 24-48 hours (28%) and 34 cases presented after 48 hours (34%).

The most common etiology for perforation is Duodenal ulcer 43%, Gastric ulcer 15%, 1% had malignant Gastric perforation, enteric perforations 6%, Tuberculosis 4%, Blunt Trauma abdomen 8%, Gangrenous bowel 10%, Appendicular perforations 11%, 1% had malignant Colonic perforation, Post MTP bowel perforation 1%, out of 14 Ileal perforations 4 cases were due to trauma and I case due to enteric fever. 6 patients had jejunal perforation in this study of that 2 were due to trauma. Among the 14 Non survivors, 7 patients (50%) had peptic perforation, I patient (7.14%) had Tuberculosis, 3 patients (21.42%) had blunt trauma, 2 patients (14.28%) had bowel gangrene, 1 patient (7.14%) had malignant colonic perforation. The most common site of perforation is Duodenum 36%, Stomach 16%, Jejunum 6%, Ileum 14%, Appendix 23% and Colonic perforation 5%.

Abdominal pain is the commonest symptom. Vomiting bilious in nature was present in 88 patients. Tenderness was present in all cases 100%. Liver dullness was obliterated only in 53% of cases. Absence of bowel sounds was seen in 78% of patients.

In the present study 27 patients had comorbidities. Adult respiratory distress syndrome in 5 cases, Portal hypertension 1 case, Pulmonary koch's 8 cases, Chronic obstructive pulmonary disorder 7 cases, Ischaemic heart disease 3 cases, Congestive liver disease I case, Hepatitis 1 case and Cirrhosis 1 case.

A total of 33 patients developed local complications.13 cases (39.4%) had Wound infection & dehiscence, 3cases (9.1%) had developed Intra abdominal abscesses, 5 cases (15.2%) had Anastomotic leak, 4cases (12.1%) developed Faecal fistula and 8 cases (24.2%) had Faecal peritonitis. A total of 25 patients developed systemic complications, ARDS in 8cases (32%), Acute renal failure in 2 cases (8%), Septicaemia in 12cases (48%) and Cardiac failure in 3 cases (12%). Complications were present only in cases that had APACHI II score of 7 and above.

The Mortality were very high in the group of APACHE II score of 15 and above. Among the100 patients the mortality was 14 cases, 6 cases of duodenal ulcer perforations, 2 case of gastric perforations, 3 cases of jejunal perforation, 2 cases of ileal perforation and 1 in colonic perforation had expired. Causes for mortality were mostly septicemia and electrolyte imbalance.

The hospital stay in the total study population (n=100) ranged from 5 days to 30 days. Mean 12.48 and standard deviation is 4.834. The ICU stay ranged from 1 day to 11 days. Mean is 3.31 and standard deviation is 1.739. The hospital stay in the survivors (n=86) is ranged from 9 days to 30 days. Mean 13.00 and standard deviation is 4.680. The ICU stay ranged from 1 day to 11 days. Mean is 3.14 and standard deviation is 1.702. The hospital stay in the non survivors (n=14) is ranged from 5 days to 20 days. Mean 9.26 and standard deviation is 4.681. The ICU stay ranged from 2 days to 7 days. Mean is 4.36 and standard deviation is 1.646. Average length of ICU stay was 3.31 days and the Average length of hospital stay in all cases was 12.48 days. Average length of hospital stay and ICU stay in survivors was 13.00 & 3.14 days respectively, where as in non survivors it was 9.29 and 4.36 days respectively**.**

The mean APACHE II score at the time of admission (day zero) in all cases was 9.80. The mean score in survivors was 8.03 where as in non survivors it was 20.64. On day of admission 28 cases the APACHE II score was 0-5, 32 cases it was 6-10 and all of them survived. On day of admission 27 cases it was 11-15 and 26 0f them survived and one expired. 5 cases the APACHE II score was 16-20 and 8 cases it was >20 all of them did not survive.

As the score grew, so did the number of complications and deaths. Survivors and non-survivors were compared in terms of age, gender, aetiology, length of hospital stay, and APACHE-II score. Non-survivors had a considerably higher mean APACHE-II score, which was associated with a higher anticipated death rate. In this study, it was discovered that survivors with severe postoperative complications such as intraperitoneal abscess, faecal fistula, and wound dehiscence have higher mean APACHE-II scores. This study helps to identify high risk groups where severe morbidity can be expected. Higher APACHE II scores statistically influenced mortality in all the patients irrespective of etiology with $p < 0.001$, which is statistically significant.

The mean age in survivors was 43.62 and Non survivors was 54.00. The male: female ratio was 3:1 in survivors and 5:1 in non survivors. Mean hospital stay was 13.00 in survivors and 9.29 in non survivors. Mean ICU stay was 3.14 in survivors and 4.36 in non survivors. The Mean APACHE II Score was 8.03 in survivors and 20.64 in non survivors.

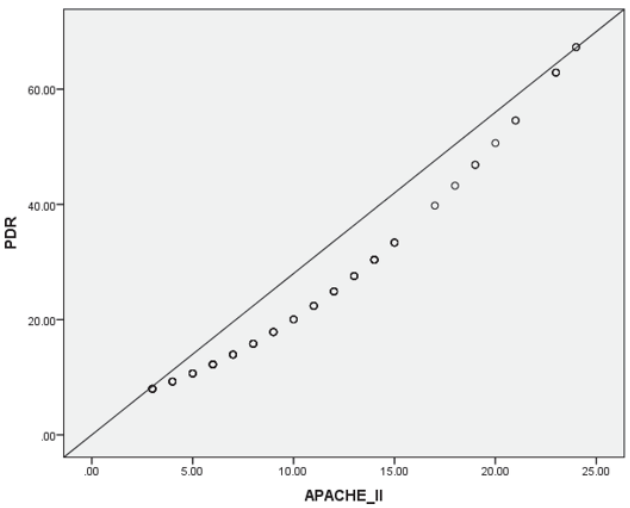

Fig. 1: Correlation of APACHE II score and PDR

Table 1: Analysis of symptoms in relation to aetiology (n = 100)

Site of Perforation	Total no of cases	Symptoms in relation to etiology				
		Abdominal pain	Vomiting	Fever	Diarrhea	Constipation
Duodenum	36	36	34	29	3	33
Gastric ulcer	16	16	15	11	5	11
Jejunum	6	6	4	5	2	4
Ileal	14	14	11	12	5	9
Appendicular	23	23	21	22	5	18
Colonic	5	5	3	2	2	3
Total	100	100	88	81	22	78

Table 2: Analysis of signs in relation to aetiology (n = 100)

Site of perforation	Total no of cases	Signs in relation to etiology				
		Tenderness	Rigidity	Free fluid +ve	Liver dullness obliterated	Bowel sounds absent
Duodenal	36	36	34	35	15	33
Gastric ulcer	16	16	15	13	8	11
Jejunum	6	6	6	5	3	4
Ileal	14	14	14	11	10	9
Appendicular	23	23	21	18	15	18
Colonic	5	5	5	4	2	3
Total	100	100	95	86	53	78

Table 3: Mortality and APACHE II scores

Etiology	Death and APACHE II scores					Total Deaths
	0-5	6-10	11-15	16-20	>20	
Duodenal	-	-	-	2	4	6
Gastric	-	-	-	1	1	2
Jejunal	-	-	1	1	1	3
Ileal	-	-	-	1	1	2
Appendicular	-	-	-	-	-	-
Colonic	-	-	-	-	1	1
Total	-	-	1	5	8	14

Table 4: APACHE II score and complications

APACHE II Score	Total(n)	Complications		Deaths(n)	Total(n)
		Local(n)	Systemic(n)		
0-5	28	0	0	0	0
6-10	32	14	8	0	22
11-15	27	19	17	1	37
16-20	5	0	0	5	5
21-25	8	0	0	8	8

Table 5: Observed and predicted death and mortality (n = 100)

APACHE IIscore range	Mean APACHE II score	No. of cases	Observed death & mortality %	PredictedDeath & mortality %	Standardmortality ratio
0-10	5.83	60	0 (0%)	9.9(18.5%)	0
11-20	14.00	32	6(18.8%)	5.1(51.3%)	0.37
>21	22.75	8	8(100.0%)	1.00(60.0%)	1.67
0-23 (overall)	9.80	100	14(14.0%)	16(16%)	0.87

Table 6: Sensitivity and specificity of apachi II with respect to mortality (n=100)

Criteria	Sensitivity (%)	Specificity (%)	100-specificity
1+	100.0	0.0	100
2+	100.0	33.3	66.7
3+	100.0	73.8	26.2
4+	87.5	100.0	0
5+	37.5	100.0	0

Pearson Correlation coefficient and its significance test was applied to investigate whether the difference between sample correlation coefficient and zero is statistically significant. It showed perfect correlation of APACHE II score and predicted death rate. [r=0.99, p<0.001]. The second degree polynomial was able to correlate perfectly with predicted death rate with R2=0.9993.

4. Discussion

Despite advances in surgical procedures and critical care treatment, peritonitis remains a hot topic among surgeons around the world. Age, sex, duration, site of perforation, amount of peritonitis, and delay in surgical intervention have all been linked to a high rate of morbidity and mortality. Early surgical intervention and source management are essential for a successful outcome. To detect the risk and predict morbidity and death in those patients, various approaches and scoring systems were applied. However, none of the existing scoring systems have met all of the requirements. Only the APACHE II score contributes independently to outcome prediction and has garnered the greatest attention globally, making it highly validated in practise. It has the benefit of being straightforward to use, and the test parameters can be easily measured in any institution that cares for very ill patients.

Our patient population had an overall mean APACHE-II score of 9.80 which is higher compared to Moshe Schein study (8.75)[3] and lower when compared to other workers [14.2 in US,[4] 14.7 in Japan,[5] 16.5 in Canadian[6] 17.9 in UK,[7] and 20.1 in Hong Kong[8] studies].

The present study the incidence was high in the fifth decade which is similar similar to that observed by vishvani et al, ramachandra ML et al[9] and Jhobta RS[10] et al. The male: female ratio is 2.03:1 similar to that of Afridi SP et al[11] 2.1 Where as Jhobta RS et al[12]reported a male:female ratio of 5.25:1.

The most common cause of perforation in this study was perforated duodenal ulcer which is similar to that of Rajender Singh Jhobta et al[10]57%), Mathkere LR et al[12](64%), Khanna et al[13] (50%), Afridi SP et al[11] (43.6%), Chen et al[14](57%), whereas others Dorairajan et al[15] (32%),Qureshi et al[16](21.6%), Noon et al (36%) found the common cause is penetrating trauma particularly western countries.

In our study, the average length of stay in the hospital was 13 days. The survivors' average hospital stay was 17.8 days, which is comparable to Bohnen et al[17] (18 days). In this series, wound infection (25%) was the leading cause of postoperative morbidity, followed by wound dehiscence (15.2%), septicemia (11%), and faceal fistula (2.7%). In a study by Rajender Singh Jhobta et al,[10] wound infection (25%) was the leading cause of postoperative morbidity, followed by wound dehiscence (9%) and septicemia (18%). Patients with a higher APACHE – II score had a greater incidence of surgical problems, according to Adesunkanmi et al.[18] Patients with a higher APACHE – II score had a higher incidence of postoperative complications, according to the current study with a 54 percent incidence.

The observed mortality was 14% is higher than that of Afridi et al(10.6%), Jhobata et al[10](10%) and Dorairajan et al[23](9.2%). In the present study the mean APACHE II score among survivors was 8.03is same as that of Mosheschein et al[3] and the mean APACHE II score among non survivors was 20.64 is higher than that of Mosheschein et al(14.5).[3]

Comparision of mortality between 2 studies according to APACHE II SCORE showed similar 0-10 mortality rates and in patients with APACHE II score of 11-20 and >20 did not correlate to Moshe schein study groups.

In the present study the patients were divided into 3 main groups according to APACHE-II score. The first group consisted of patients with APACHE-II scores<10. Mean APACHE-II score was 5.83, with a PDR of 18.5 %. None of the 60 patients as scored died (Observed death rate=0), implying over estimation of mortality risk by APACHE-II scoring for this group of patients. The second group of patients had APACHE-II score between 11-20. In 32 patients as scored mean APACHE-II score was 14.00 and PDR was 51.3% which correlated very closely with observed death rate of 18.8%. The third group included patients with APACHE-II score of >20, with a mean APACHE- II of 22.75. PDR was 60.0% and observed death rate was 100% as none of the 8 patients as scored survived. SMR was 1.67 implying poor correlation between PDR and ODR for patients with APACHE-II score of >20. The ROC curve and Pearson correlation coefficient, as well as its significance test, revealed that the APACHE-II system was accurate in predicting group outcomes. The current study's patients have an area under the curve of 0.985, according to the ROC curve analysis. This score is higher than

Table 7: Postoperative complications

Study	Total	SSI(%)	WD(%)	FF(%)	PA(%)	SA(%)
Afridi SP et al [11]	300	126(42)	78(26)	5(2)	60(20)	60(20)
Jhobta RS et al [10]	504	126(25)	44(9)	34(7)	143(28)	90(18)
Ramchandra ML et al [9]	50	19(38)	-	3(6)	-	-
Present study	100	13(13%)		4(4%)	8(8%)	12(12%)

Table 8: Comparision of mortality between two studies according to APACHE II score (n = 100)

Score	Present study			Mosche schein study [11]		
	(n)	Mortality Rate	%	(n)	Mortality rate	%
0-10	60	0	0	108	0	0
11-20	32	6	18.75	52	17	30.5
>21	8	8	100	4	3	75

those discovered by previous researchers that looked at the APACHE-II scoring system in ICU patients, encompassing both surgical and medical patients. The Pearson correlation coefficient and its significance test were used to analyse the capacity of the APACHE-II system to correctly predict group prognosis. It revealed a perfect association between the APACHE-II score and the probability of death (r=0.37, p 0.001). The second-degree polynomial (R2–0.995) was able to perfectly correlate with PDR.

5. Conclusion

In terms of mortality prediction, the sensitivity and specificity of APACHE-II scoring were better in the group of patients with an APACHE-II score of 11-20. Despite an increase in observed and anticipated hospital mortality with increasing APACHE-II score, predicted mortality for patients with A-II scores of 0-10 and > 20 did not correspond with observed mortality. The first group's mortality risk was overestimated, while the third group's mortality risk was underestimated (A II = >20). The APACHE-II system was found to be a good predictor of group prognosis in patients with peritonitis caused by hollow viscus perforation in this study. It can be used to measure outcomes in populations with similar characteristics. However, it is insufficiently reliable for predicting outcomes in individual patients. The APACHE II score predicts death, which is important regardless of the cause. APACHE II Scores are a simple and effective way to identify people who are at high risk of needing extensive treatment. The APACHE II Scores can be utilised in surgical audits and research to improve the quality of intensive care, especially in rural hospitals.

6. Conflict of Interest

None.

7. Source of Funding

None.

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