CPIRO Score as a predictor of mortality in patients with secondary peritonitis

Sekonder peritonitli hastalarda mortalitenin öngörülmesinde CPIRO skorunun yeri

Saurabh Pruthi, Karamjot Singh Bedi iD **, Shantanu Kumar Sahu**

Swami Rama Himalayan University, Himalayan Institute of Medical College, Department of General Surgery, Dehradun, Uttarakhand, India

Corresponding address: Dr. Karamjot Singh Bedi, kjbedi@gmail.com

ABSTRACT

Peritonitis is one of the major problems which is frequently encountered by the surgeons in their daily practice and the most common cause of peritonitis is hollow viscous perforation. There are various factors for perforation like those caused by H.pylori infection, NSAID's, enteric fever and several others.

Though we have newer technologies and advancements, but the mortality rates in case of perforation peritonitis is invariably high compared to other disease process.

Keywords: Peritonitis, CPIRO, SOFA.

ÖZET

Peritonit, cerrahların günlük pratiklerinde sıklıkla karşılaştıkları önemli sorunlardan biridir ve peritonitin en sık nedeni içi boş organların perforasyonudur. H.pylori enfeksiyonu, NSAID'ler, enterik ateş ve diğerleri gibi perforasyon için çeşitli faktörler vardır.

Daha yeni teknolojilere ve gelişmelere sahip olmamıza rağmen, perforasyon peritonit durumunda ölüm oranları diğer hastalık süreçlerine kıyasla her zaman yüksektir.

Anahtar kelimeler: Peritonit, SPIRO, SOFA.

INTRODUCTION

Gastrointestinal perforations are a major cause of mortality & morbidity. Peritonitis due to perforation is one of the commonest surgical emergencies attended by a general surgeon. Various scoring indices such as the Acute Physiology and Chronic Health Evaluation (APACHE) score. The Simplified Acute Physiology Score (SAPS). The Boy Score, the Multi Organ Failure (MOF) Score, Therapeutic Intervention Scoring System (TISS-28), Early Warning Score (NEWS) definitions of sepsis and the Mannheim Peritonitis Index (MPI) have been introduced to stratify the risk in such patients. There are newer scoring systems to assess about the severely complicated intra-abdominal infections/sepsis like CPIRO (Calgary Predisposition, Infection, Response, and Organ Dysfunction), WSESSSS (World Society of Emergency Surgery Sepsis Severity Score), quick SOFA (qSOFA) score of the Sepsis-3 International Consensus Definitions and Mannheim Peritonitis Index (MPI) (1,2).

This study was aimed to predict the mortality using the Calgary Predisposition, Infection, Response, and Organ Dysfunction (CPIRO) scoring system and also to assess its significance with respect to mortality (3).

MATERIAL and METHOD

The Observational study was conducted in the Department of Surgery, Himalayan Institute of Medical Sciences (HIMS), Swami Ram Nagar, Dehra Dun, over a period of 12 months from January 2019 to December 2019. This study was conducted with the ethical approval from the internal ethical committee.

All clinically diagnosed cases of perforation peritonitis with investigatory support and absence of evidence of primary or tertiary aetiology were included in the study with written informed consent.

Patients were studied on the basis of their age, different modes of presentation including signs and symptoms, the region of affection intraoperatively and the type of surgical procedure performed and its result. Details of history, examination and investigations of those patients were collected from the records. The Calgary Predisposition, Infection, Response, and Organ Dysfunction (CPIRO) scoring system were calculated based upon the SOFA Scoring and was used for predicting the mortality in patients of secondary peritonitis

Statistical analysis

The data was collected and entered in MS excel 2010. Different statistical analysis was performed using SPSS software version 22. The one-sample Kolmogorov – Smirnov Test was employed to determine whether the data sets differed from a normal distribution or not. Normally distributed data was analyzed using parametric tests and non-normally distributed data was analyzed using non-parametric tests. Descriptive statistics was calculated for qualitative variables. The categorical data was analyzed using Chi-Square test. Level of significant was $p < 0.05$.

RESULTS

In our study, there were 85 males followed by 16 females with total of 101 patients. COPD was highest among the co morbidity at 14.9 % followed by HTN (7.0%) , Pulmonary TB (3.0%) , HCV positive status (2.0%) and DM and CAD both at 1.0 % .

Majority of the cases (44%) were observed with the CPIRO score as 0.0 followed by 18% cases (with CPIRO Score as 1.0). No cases were observed with the CPIRO score as 6.0, and 8.0.

Majority of the cases (22%) were observed with the SOFA score as 1 followed by score 2 (18%), Score 3 (14%), score 5 (14%) and score 6 (13%). Only one cases were observed with the CPIRO score as 0 and 11.

Table 1 shows the distribution of CPIRO score according to the outcomes. It was observed that the majority of the patients (with CPIRO score =0) had satisfactory outcomes whereas as the highest morbidity was observed in 6 cases (with CPIRO score =0). For the CPIRO score =4, the mortality was observed with highest frequency (30.8%).

CPIRO Score	Outcomes					
	Satisfactory outcome		Morbidity		Mortality	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
0	40	58.8	6	30	**0**	**0**
1	15	22.05	4	20	1	7.7
2	7	10.2	5	25	2	15.4
3	3	4.4	3	15	2	15.4
4	2	2.9	2	10	4	30.8
5	1	1.4	0	0	3	23.1
6	0	0	0	0	0	0
7	0	0	0	0	1	7.7
8	0	0	0	0	0	0
Total	68	100	20	100	13	100

Table 1: Distribution of CPIRO score according to morbidity and mortality.

Table 2 shows distribution of CPIRO score according to the outcomes. It was observed that the majority of the patients (with SOFA score=1) had satisfactory outcomes (35.3%) whereas there were

25% cases (with SOFA Score= 5) in which the highest morbidity was observed. The highest frequency of mortality was observed in 23.1% cases (with SOFA Score= 6 & 7). The outcomes of the study subjects undertaken the surgery. It was observed that there were 68 cases (68%) with satisfactory outcomes whereas the mortality was 13%. Total of 20 morbidities were seen maximum being the post op surgical site infection (10%)

Table 3 shows the outcomes of the study subjects undertaken the surgery. It was observed that there were 68 cases (67.3%) with satisfactory outcomes whereas the mortality was 12.8%. Total of 20 morbidities were seen maximum being the post op surgical site infection (9.9%).

The majority of the cases were observed with Respiratory dysfunction (32.7%) followed by Renal dysfunction (21%), Cardio Vascular Dysfunction (16%), Hypothermia (7%) and CNS dysfunction (3%).

The mean leukocyte count was 7.3546 +/- 2.69085 /cumm and mean T.Bil 1.4839 +/- .96197 mg/dl . Creatinine had mean of 1.3812 +/- .97815 mg/dl and Platelet Count 220.4849 +/- 115.78845/ cumm. Variables like Leucopenia , Age , hypothermia, CVS dysfunction, CNS dysfunction , Renal dysfunction and the respiratory dysfunction was statistically significant with the increasing CPIRO score (p value < 0.5). Even variables for SOFA score like GCS , T. Bil., PaO2/FiO2, MAP/Ionotropes, Platelet Count, Creatinine were found be were found to be significantly correlated with CPIRO score .

Mean CPIRO score was 3.74 and mean SOFA score was 6.15 among mortality case (n=13) which showed statistically significant results as show in Table 4. But on logistic regression analysis of the all the variables of SOFA score and CPIRO score weren't found to significantly correlated as independent factors. Both SOFA and CPIRO was found be statistically significant when compared to each other for satisfactory outcomes (p< 0.001 and r = 0.666) as well as morbidity also (p = 0.012 and r = 0.526).

The results predict better sensitivity , specificity, positive predictive value and accuracy of CPIRO Score when compared to SOFA score. CPIRO had a specificity of 56% when compared to 50% of SOFA score in predicting mortality and Positive Predictive Value was 15.38% and 7.69% respectively with accuracy of 45.71% and 37.14.

Table 2: Distribution of SOFA score according to morbidity and mortality.						
SOFA Score	**Satisfactory outcome**		**Morbidity**		**Mortality**	
	Frequency	**Percent**	**Frequency**	**Percent**	**Frequency**	**Percent**
0	1	1.47	0	0	0	0
1	24	35.3	3	15	0	0
2	15	22.1	3	15	0	0
3	9	13.2	2	10	2	15.38
4	5	7.3	0	0	0	0
5	6	8.8	5	25	2	15.38
6	5	7.3	4	20	3	23.07
7	1	1.47	2	10	3	23.07
8	0	0	0	0	2	15.38
9	1	1.47	1	05	1	7.69
11	1	1.47	0	0	0	0
Total	68	100	20	100	13	100

Table 3: Outcomes of the study subjects.		
Outcome	**Frequency**	**Percent**
Satisfactory outcome	68	67.3
Anastomotic leak	1	0.09
Burst abdomen	8	7.9
Low output fistula	1	0.09
SSI	10	9.9
Mortality	13	12.8

Total	101	100.0

Table 4: Comparison mortality among SOFA and CPIRO scores.				
Score	**n**	**Mean**	**Std. D**	**p value**
CPIRO	13	3.742	2.4718	0.001 (S)
SOFA	13	6.15	1.6222	

DISCUSSION

This study was conducted in patients admitted for cases of perforation peritonitis in Himalayan Institute of Medical Sciences (Swami Rama Nagar, Dehradun). Around 100 patients were recruited for the present study. Kemparaj and Narasimhaiah had 82% males for perforation which was similar to our study which had 84.2 % males (4). Bali et al had Majority of patients as males (68.5%) with Male to female ratio was 2.1:1 (5). More than 70 % patients had COPD and was the most common preexisting comorbidity seen in 6.1% patients with GI perforation (6). Rathour showed the COPD was significantly associated in predicating moratilty (7).

Age greater than 65 years and the presence of comorbid conditions have been described by Moreno et al and Rello et al (8,9). Shin et al had similar 12.8% mortality in 117 patients who underwent surgery for an intestinal perforation (10). Mortality in study by Kemparaj et al was 53 patients (14%) which higher than our overall mortality of 13% (4).

In the study by Tolonen et al in 2018 the mortality rate by CPIRO score was 37.6% for a CPIRO of 4 and 54.7% for a CPIRO of 5 but the mortality decreased from CPIRO 4 to 5 by 30.8 % to 23.1% in our study which was inverse. Where as the highest frequency of mortality was observed in 23.1% cases with SOFA Score 5 and 6 (3).

Initially The PIRO score performed well as 28-day mortality prediction tool in Community acquired pneumonia patients (CAP) and SOFA score as independent predictors of death and SOFA is a superior prognostic tool for predicting mortality and organ failure .But in our study we used to GI perforation where CPIRO and SOFA score were significant in predicting mortality and even the morbidity (9,11,12).

No one scoring system behaves perfectly, and all appear to be largely dominated by organ dysfunction. Organ dysfunction variables significantly associated with mortality in univariate analysis in study by Rathour were systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), prothrombin time (PT), activated partial thromboplastin time (APTT), serum creatinine, PaO_2 /FiO_2 ratio, urinary output in first two hours of emergency presentation, vasopressor use and GCS ≤9 (3,7).

All the variables of the SOFA score was found to have a significant correlation with CPIRO score as well for mortality. Posadas-Calleja JG et al in the study of CPIRO score in abdominal sepsis had hypothermia in higher 24.9 % of cases but on anaylsis of CPIRO parameters in our study hypothermia was present in 6.9 % while Respiratory dysfunction was highest (32.7%) in our study which was again lower than 51.6% in study of abdominal sepsis .CNS dysfunction was seen in only 3% of our cases as compared to 8% cases. Even CVS dysfunction was lower with 15.8% . This could be due the reason that perforation takes some time to develop into intra abdominal sepsis. Thus early management has better outcome. Thus overall mortality is 13% in our study with respect 21.3% which nearly half (13). Shakya et al has 18% wound complication which is similar to our study if we combined both SSI and burst abdomen together (14).

CPIRO score showed consistent mortality discrimination outperforming SOFA. Even in our study CPIRO proved to be superior (13). Thus CPIRO is a well established predictor for Septic shock , pneumonia , intra abdominal sepsis and our study proves that it can be used for perforation peritonitis as well for predicting mortality (9,15-17). Thus CPIRO score is useful tool for predicting mortality based on both pre operative as well as post operative outcomes.

The limitation of the study was small sample size, morbidities not well assessed by use of any standard protocol like Clavien Dindo classification, other prarameters beside CPIRO and SOFA should be assessed, site of perforation is variable, type of procedure is variable and no long term follow up for both mortality or morbidity.

Conclusion

There are numerous scoring for assessment of both morbidity as well as mortality in gastro intestinal perforations. Both SOFA and CPIRO score depend upon the organ dysfunction and has been found to significantly correlated. Most common dysfunction that was found was respiratory and renal which accounted to more than 50% combined. CPIRO score having fewer variables when compared to SOFA score thus CPIRO is a better tool for assessment. It has been observed to be a very simple and appropriate scoring system for clinical practice which may allow a surgeon to perform a rapid analysis of the patient's condition and may help in predicting mortality rate in all types of GI perforations.

Declaration for the study

REFERENCES

1. Rapsang AG, Shyam DC. Scoring systems in the intensive care unit: A compendium. Indian J Crit Care Med 2014;18(4):220-228.
2. Ersumo T, W/Meskel Y, Kotisso B. Perforated peptic ulcer in Tikur Anbessa Hospital; a review of 74 cases. Ethiop Med J 2005;43:9-13.
3. Tolonen M, Coccolini F, Ansaloni L. Getting

the invite list right: a discussion of sepsis seve-rity scoring systems in severe complicated intra-abdominal sepsis and randomized trial inclusion criteria. World J Emergency Surgery 2018;13:17-23.

4. Kemparaj T, Narasimhaiah NK. Our experience in gastrointestinal perforations: a retrospective study. Int J Surg 2017;4(2):593-597.

5.

6. Bali RS, Verma S, Agarwal PN, Singh R, Talwar N. Perforation peritonitis and the deve-loping world. ISRN Surg 2014;2014:105492.

7. Meena LN, Jain S, Bajiya P. Gastrointestinal perforation peritonitis in India: A study of 442 cases. Saudi Surg J 2017;5:116-21.

8. Rathour S, Kumar S, Hadda V, Bhalla A, Sharma N, Varma S. PIRO concept: staging of sepsis. J Postgrad Med 2015;61(4):235-242.

9. Moreno RP, Metnitz B, Adler L, Hoechtl A, Ba-uer P, Metnitz PG; SAPS 3 Investigators. Sepsis mortality prediction based on predisposition, in-fection and response. Intensive Care Med 2008;34(3):496-504.

10. Rello J, Rodriguez A, Lisboa T, Gallego M, Lu-jan M, Wunderink R. PIRO score for commu-nity- acquired pneumonia: a new prediction rule for assessment of severity in intensive care unit patients with community-acquired pneumonia. Crit Care Med 2009;37(2):456-462.

11. Shin R, Lee SM, Sohn B, Lee DW, Song I, Chai YJ, et al. Predictors of morbidity and mortality after surgery for intestinal perforation. Ann Co-loproctol 2016;32(6):221-227.

12. Hynninen M, Wennervirta J, Leppäniemi A, Pettilä V. Organ dysfunction and long term out-come in secondary peritonitis. Langenbeck's Arch Surg 2008;393(1):81-86.

13. Khwannimit B, Bhurayanontachai R, Vattana-vanit V. Comparison of the performance of SOFA, qSOFA and SIRS for predicting morta-lity and organ failure among sepsis patients ad-mitted to the intensive care unit in a middle-in-come country. J Critical Care 2018;44:156-160.

14. Posadas-Calleja JG, Stelfox HT, Ferland A, Zu-ege DJ, Niven DJ, Berthiaume L, et al. Deriva-tion of a PIRO score for prediction of mortality in surgical patients with intra-abdominal sep-sis/severe sepsis/septic shock. Am J Crit Care 2018;27(4):287-294.

15. Shakya VC, Ram A, Shrestha M. Perforation Peritonitis: An Observational Study at Tertiary Centers in Central Nepal 2018;6:1-5.

16. Nguyen HB, Van Ginkel C, Batech M, Banta J, Corbett SW. Comparison of Predisposition, In-sult/Infection, Response, and Organ dysfunc-tion, Acute Physiology And Chronic Health Evaluation II, and Mortality in Emergency De-partment Sepsis in patients meeting criteria for early goal-directed therapy and the severe sepsis resuscitation bundle. J Critical Care 2012;27(4):362-369.

17. Khwannimit B, Bhurayanontachai R. Validation of predisposition, infection, response and organ dysfunction score compared with standard seve-rity scores in predicting hospital outcome in sep-tic shock patients. Minerva Anestesiologica 2013;79(3):257-263.

18. Furtado GH, Wiskirchen DE, Kuti JL, Nicolau DP. Performance of the PIRO score for predic-ting mortality in patients with ventilator-associ-ated pneumonia. Anaesth Inten Care 2012;40(2):285-291.