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Mannheim Peritonitis Index: usefulness in a context with limited resources

Semevo Romaric Tobome[1], Salako Alexandre Allode[2], Montcho Adrien Hodonou[3], Thierry Kinnongni Hessou[1], Roberto Caronna[4]

[1]Department of General Surgery, Saint John of God Regional Hospital of Tanguiéta, BP 132 Godomey, Benin.
[2]Department of Surgery, University of Parakou, BP 123 Parakou, Benin.
[3]Department of Surgery, University of Parakou, BP 123 Parakou, Benin.
[4]Department of Surgical Sciences, Sapienza University of Rome, Viale Regina Elena 324. 00161, Rome, Italy.

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***Correspondence to**
Prof. Roberto Caronna
Department of Surgical Sciences, Sapienza University of Rome
Viale Regina Elena 324, 00161, Roma
E-mail: roberto.caronna@uniroma1.it
Tel.: +39-3391491098

ABSTRACT

Background:
The objective of the present study is to evaluate the Mannheim Peritonitis Index (MPI) usefulness for acute generalized peritonitis management in a clinical limited resources context.

Methods:
This is a prospective study from 1 January to 31 October 2019 including patients admitted to a sub-saharan hospital for acute generalized peritonitis. Perioperative variables and outcomes were considered.

Results:
70 patients were included. Mean age was 32.6 ± 14.6 years with a sex ratio of 1.33. The mean time to patients' hospital admission was 3.9 ± 2.1 days. Most patients had ileal and gastric perforations (27.1% and 18.6%). Twenty six patients (37.1%) developed complications and thirty-day mortality rate was 14.3%. Positive predictive value of MPI was 63.6% and negative predictive value was 83, 8%. Sensitivity of MPI ≥ 26 was 77.8%; Specificity of MPI < 25 was 72.1%.

Conclusion:
This experience shows that MPI is a good predictor of morbidity and mortality for patients with acute peritonitis even in a difficult context with few resources and many patients. Identifying the most critical patients, a more careful surgical staff involvement may improve patients outcome.

Keywords:
Mannheim Peritonitis Index, prognosis, acute peritonitis, low-income countries, bowel perforations.

Background

Acute generalized peritonitis (AGP) is a frequent lethal condition. Nowadays it is still a major problem facing physicians, surgeons and their patients worldwide. Prognosis and progression of AGP depend on several factors, including patient conditions, cause of peritonitis and treatment strategy[1]. In order to improve the quality of perioperative care provided to patients with acute generalized peritonitis the use of a prognostic score could have a useful impact[1-3]. Comparing with several score systems, Mannheim Peritonitis Index (MPI) has fewer biological parameters and is easier to calculate even in a context with limited resources as a sub-saharan peripheral hospital.

Several studies confirmed the accuracy of MPI to predict the peritonitis evolution, because an MPI >26 is related to high mortality[4-7].

This study was carried out in order to evaluate MPI usefulness in patients with acute generalized peritonitis admitted to a sub-saharan peripheral hospital. Epidemiological and clinical data, surgical features, patients morbidity and mortality were collected to investigate MPI feasibility, accuracy and potential benefit on perioperative management and outcome.

Methods

The study was carried out in the surgical department and in the emergency unit of Saint John of God Regional Hospital of Tanguiéta (SJGRHT), in Benin. This was a longitudinal, descriptive and analytical study with prospective data collection over a 10-month period from January 1 to October 31, 2019. The study population enrolled all patients, aged at least 15-year-old, who underwent surgery for AGP at SJGRHT during the study period with their informed consent.

This study has been approved by the Ethics Committee of General Surgical Department of SJGRHT.

Exclusion criteria were negative/white laparotomies, patient's death before laparotomy and localized acute peritonitis.

The collected variables included clinical data as age, sex, body mass index, abdominal pain onset and preoperative delay. About intraoperative features, we recorded all surgical findings to calculate MPI. Surgical procedures and outcomes were finally considered.

We couldn't perform microbiological tests because we haven't yet any equipment.

All patients were postoperatively followed for thirty days recording morbidity and mortality.

Data processing and analysis were computerized with Epi info 7. Quantitative variables were expressed as mean and standard deviation. Qualitative variables were expressed in number and frequency. The level of significance was fixed at p-value <0.05. Variables were compared using Pearson's chi-square test or Fisher's exact test and t-Student test as appropriate. Risk Ratio and 95% confidence interval calculated for each group. Sensitivity, specificity and predictive performances of MPI were determined according to standard calculation formulas. MPI items were study using univariate analysis model.

Results

Seventy patients were enrolled according the inclusion criteria. The mean age of patients was 32.6 ± 14.6 years (range 15-76 years), 40 were males and 30 females and sex ratio was 1.33. The average body mass index was 20.2 ± 2.7 kg / m2, range 15.8-26.9 kg / m2. The mean time interval between onset of symptoms and patients hospitalisation was 3.9 ± 2.1 days, range 0-10 days. Half of patients were admitted after 48-96 hours since the onset of peritonitis symptoms.

Thirty five (50%) of patients were operated between 2 and 4 hours after admission (range 1-72 hours, median 3 hours).

The causes of the peritonitis and the surgical procedures are showed in *Table 1*. The mean MPI was 24.7 ± 6.4, range 16-39. MPI was ≤ 25 for 37 patients (52.9 %) and ≥ 26 for 33 patients (47.1 %).

The closure of the abdominal wall was immediate in 59 (84.3 %) patients and delayed (laparostomy) in 11 (15.7 %). The mean number of laparostomy revisions was 2.6, range 2-3 revisions by patient.

	Patients (%)
Causes of peritonitis	
Ileal perforation	19 (27.1)
Gastric perforation	13 (18.6)
Gynaecologic	12 (17.1)
Primitive	8 (11.4)
Appendicitis	6 (8.6)
Duodenal perforation	5 (7.1)
Mesenteric or intestinal necrosis	2 (2.9)
Postoperative	2 (2.9)
Jejunal perforation	2 (2.9)
Bladder wound	1 (1.4)
Procedures	
Washing + drainage	19 (27.1)
Ileal Suture + washing + drainage	18 (25.7)
Gastric suture + washing + drainage	13 (18.6)
Appendicectomy + washing + drainage	6 (8.6)
Pyloroplastic + washing + drainage	4 (5.7)
Ileal resection + ileo-ileum anastomosis + washing + drainage	4 (5.7)
Jejunum suture+ washing+ drainage	2 (2.9)
Gastro-jejunum anastomosis + washing + drainage	1 (1.4)

Table 1: Causes of peritonitis and surgical procedures (70 pts).

Out of 70, 26 patients (37.1 %) developed complications: operative site deep infection (15), hyperthermia (3), wound infections (5), anemia (2) and persistent shock (1). The combination of ampicillin and metronidazole was the most common antibiotic therapy (77.1 %).

The mean hospital stay was 9.4 ± 5.4 days, range 2-32 days. There were 10 deaths (mortality 14.3 %). Among 33 patients with MPI ≥ 26 there was 9 deaths (27,3%) and 1 death among 37 patients with MPI ≤ 25 (2,7%). The postoperative course according to MPI cut off of 26 is presented in *Table 2* and *Figure 1*.

MPI	Outcomes	
	Complications (%)	No complications (%)
≥ 26	21 (63.6)	12 (36.4)
≤ 25	6 (16.2)	31 (83.8)

Table 2: Outcomes according to MPI cut off of 26 (70 pts). p value=0.000047; RR=3.9; IC 95% (RR) : 1.8-8.5

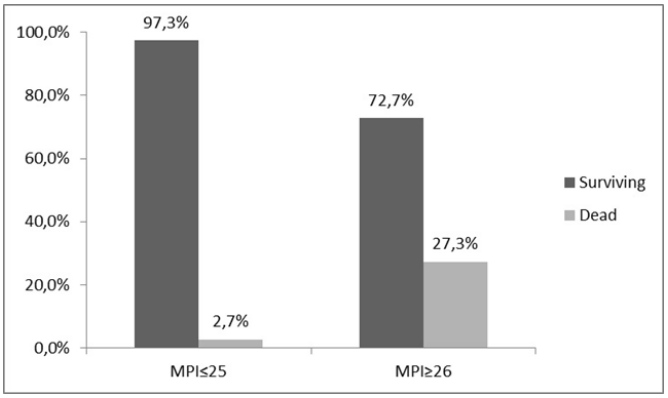

Figure 1:
Postoperative mortality according to MPI (70 pts).

The positive predictive value of MPI (probability of poor prognosis: MPI ≥ 26) was 63.6 % and its negative predictive value (probability of good prognosis: MPI ≤ 25) was 83.8 %.
Patient's likelihood with an unfavorable postoperative outcome to have MPI ≥ 26 (sensitivity of MPI) was 77.8 % and with favorable postoperative course to have MPI ≤ 25 (MPI specificity) was 72.1% (p value=0.000047, RR=3.9, IC 95% : 1.8-8.5). Organ failure and malignancy were mostly present in patients with unfavorable outcome.
Univariate analysis results are in *Table 3*. We observed that the organ failure (p=0.001) and the presence of cancer (p = 0.02) are related to a poor prognosis with a Risk Ratio of 6.2 and 10.2 respectively.

Parameters	Unfavorable outcome	Favorable outcome	N. of patients	*p*	RR (IC 95%)
Age > 50 years old	5	5	10	0,36	1,40 (0,70-2,90)
Female sex	13	17	30	0,35	1,33 (0,73-2,44)
Organ failure	22	11	33	**<0.001**	6,20 (2,37-16,05)
Malignacy	5	1	6	**0,02**	10,24 (1,12- 93,29)
Preoperative duration of peritonitis > 24 h	26	44	70	-	-
Origin of sepsis not colonic	1	3	4	0,52	0,66 (0,12-3,71)
Diffuse generalized peritonitis	26	44	70	-	-
Exsudate				0,37	0,80 (0,41- 1,56)
Clear	0	0	0		
Cloudy	19	35	54		
Fecal	7	9	16		

Table 3: Univariate analysis results (70 pts).

Discussion

Acute generalized peritonitis (AGP) is a common condition at SJGRHT. A study performed in 2013 at the same hospital highlighted a mortality of 21.2 % for ileal perforations of typhoid origin[8]. Small bowel perforation is one of the most common causes of AGP, as shown by the present study and by others[9]. Mortality of 14.3 % and morbidity of 37.1 % reported in this study are similar to those showed by Muralidhar VA et al. (India): 14 % and 38 % respectively[9]. Many authors agree about relationship between high MPI and high mortality[10, 11].
In our experience MPI was ≥ 26 in 47.1 % of patients. A patient whose MPI is ≥26 at the SJGRHT has a risk ratio of complications of 4 comparing to a patient with a MPI < 25 (p = 0.00004). Others reported similar results[12, 13]. The sensitivity and specificity of MPI coupled with its simplicity make this score a reliable tool and adoptable even in developing countries. Others reported a sensitivity and specificity close to our rates[5, 9].
With univariate analysis we observed that the organ failure (p=0.001) and the presence of cancer (p = 0.02) are related to a poor prognosis with a Risk Ratio of 6.2 and 10.2 respectively (*Table 3*).
In this study age was not a significant risk factor. However others observed that age ≥80 years was strongly related to high mortality rates and that it should be taken into account together with MPI in surgical approach planning and the post-operative care[14, 15].
About body mass index (BMI), we hypothesized that when it is normal, it would be a favorable condition. But the size of our study population as well as the exclusion of the children did not allow us to gain a statistical evidence.
This study confirms the MPI is a useful tool for a careful assessment and perioperative management of patients with AGP and should be adopted in order to improve the quality of care. The unfavorable evolution of AGP is directly proportional to MPI. Routine use of MPI is advisable and may allow a better surveillance of patients at higher risk of complications or death even in unfavorable contexts with few resources and many patients.

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Contributors
SRT and RC: substantial contributions to study conception and design, SRT and TKH: acquisition of data, SRT, SAA and MAH: analysis and interpretation of data, SRT and RC: drafting the article, SAA, MAH and TKH: revising it critically for important intellectual content, SRT, SAA, MAH, TKH and RC: final approval of the version to be published.

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Competing interests
The authors declare that they have no competing interests.

Availability of data and materials
The data that support the findings of this study are available from Saint John of God Regional Hospital of Tanguiéta, Benin but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request.

Ethics approval
The study was approved by the Ethics Committee of

Saint John of God Regional Hospital of Tanguiéta, Benin.

Provenance and peer review
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