Index of Mannheim and mortality in sepsis abdominal

Índice de Mannheim y mortalidad en sepsis abdominal

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Abstract

Background: Abdominal sepsis represents the host's peritoneal inflammatory response to microbial invasion, which may be mild or severe, depending on the degree of contamination of the peritoneal cavity; with a reported mortality of 17%. The Mannheim peritonitis index is a clinical tool and a predictor of mortality in patients with peritonitis, with high sensitivity and specificity. **Objective:** To determine if there is a correlation between the score obtained by the Mannheim peritonitis index, and mortality, in patients with abdominal sepsis. **Method:** A retrospective, observational, cross-sectional study, during the period between July 2013 and January 2014, in patients diagnosed with abdominal sepsis, attended at the General Hospital of Mexico Dr. Eduardo Liceaga. **Results:** We included 177 cases, 85 of the female sex and 92 of the male sex. The average age was 43 years. The most common organ responsible for abdominal sepsis was the appendix. Mortality of 18 cases (10.2%). The cases were divided, according to the Mannheim index, in mild cases (< 25 points) and severe case (> 26 points). Of 27 severe cases, 8 (29.6%) died, while of the 150 mild cases 10 (6.7%) died (odds ratio: 5.895; 95% confidence interval: 2.071-16.77; $p < 0.05$). **Conclusions:** The Mannheim scale is a good predictor of mortality for patients with abdominal sepsis. The optimal cut-off point is 20.

KEY WORDS: Abdominal sepsis. Mortality. Mannheim peritonitis index.

Resumen

Introducción: La sepsis abdominal representa la respuesta inflamatoria peritoneal ante la invasión microbiana, con una mortalidad del 17%. El índice de peritonitis de Mannheim es una herramienta clínica y un predictor de mortalidad, con alta sensibilidad y especificidad. **Objetivo:** Determinar si existe correlación entre el puntaje obtenido mediante el índice de peritonitis de Mannheim y la mortalidad. **Método:** Estudio retrospectivo, observacional, transversal, durante el periodo entre julio de 2013 y enero de 2014, en pacientes con diagnóstico de sepsis abdominal, en el Hospital General de México Dr. Eduardo Liceaga. **Resultados:** Se incluyeron 177 casos, 85 de sexo femenino y 92 de sexo masculino. La edad media fue de 43 años. El órgano causante de la sepsis abdominal más frecuente fue el apéndice. Fallecieron 18 pacientes (10.2%). Se dividieron los casos, de acuerdo con el índice de Mannheim, en leves (< 25 puntos) y graves (> 26 puntos). De 27 pacientes graves, fallecieron 8 (29.6%), mientras que de los 150 leves fallecieron 10 (6.7%) (odds ratio: 5.895; intervalo de confianza del 95%: 2.071-16.77; $p < 0.05$). **Conclusión:** El índice de Mannheim es un buen predictor de mortalidad para los pacientes con sepsis abdominal. El punto de corte óptimo es 20.

PALABRAS CLAVE: Sepsis abdominal. Mortalidad. Índice de peritonitis de Mannheim.

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Background

Peritonitis is defined as inflammation of the serous membrane that delimits the abdominal cavity and the organs therein contained. Peritoneal cavity infection can occur through several routes: “spontaneous”, which mainly occurs through hematogenous dissemination; the infection that is introduced to the peritoneal cavity, predominantly observed in patients on peritoneal dialysis and that is also susceptible to treatment only with antibiotics, is called primary peritonitis; tertiary peritonitis refers to persistent or recurrent peritoneal infection that usually occurs in critical patients with secondary peritonitis, when the host defenses and antimicrobial therapy have failed and superinfection by resistant organisms, usually gram-negative bacilli or fungi, occurs; secondary peritonitis will have a clinical presentation with acute abdomen, and its diagnosis and initial treatment will necessarily be surgical; and the third route of infection of the peritoneal cavity is due to leakage of intestinal contents into it, it is polymicrobial by nature and occurs as generalized peritonitis (secondary peritonitis) or as a localized abscess¹.

Abdominal sepsis is the systemic response to an initially localized infectious process, represents the non-specific peritoneal inflammatory host response in the presence of microbial invasion and manifests itself with systemic symptoms such as fever, tachycardia, hypotension, tachypnea, leukocytopenia or leukocytosis, and high cardiac output; in severe cases, it can cause an important alteration of systemic perfusion with multiple organ failure².

Mortality in secondary peritonitis

Peritoneal infection and inflammation generate a complex systemic response that can be mild or serious, depending on the degree of contamination of the peritoneal cavity. This generalized inflammatory response generates vascular, cellular, immune and metabolic changes that, if persistent, can elicit ischemic effects at different places and trigger different organ failures (kidney, liver, lung, cardiovascular, etc. failure). The mortality rate generated by the main causes of secondary peritonitis has not changed in the last two decades, with mortality being reported at 17%³. In addition, overall mortality reported for appendicitis is 1%, and it increases up to 5% when there is perforation, with most deaths occurring in elderly patients. The most important prognostic factors in emergency

colorectal surgery are preoperative status, advanced age and presence of fecal peritonitis, which together have a mortality rate of up to 60%⁴.

Predictors of mortality in surgery

Different biomarkers and functional scales have been developed to predict morbidity and mortality in surgical patients. With no doubt, the most widely studied disease-severity physiological scoring model is Acute Physiology and Chronic Health Evaluation II scale (APACHE II)⁵, which is constructed taking the worst value obtained within the first 24 hours after admission based on 12 variables, with points added for age and chronic health, yielding a total score that ranges from 0 to 71. The APACHE II scale has been validated in various studies on surgical and non-surgical patients in intensive care units, with a mean score from 9 to 15 being observed among survivors and an average of 15 to 25 points among those who died⁶. With patients with secondary peritonitis being assessed with scores ranging from 11 to 15, APACHE II has shown a sensitivity of 100% and specificity of 73.8% to predict mortality, and in the group of patients with scores between 16 and 20, it has shown a sensitivity of 87.5% and specificity of 100%^{7,8}.

Mannheim peritonitis index

Mannheim Peritonitis Index (MPI) (Table 1) is a mortality predictor created in Germany by Wacha and Linder, which was based on the result of 1,253 patients with peritonitis, developed by discriminant analysis of 17 possible risk factors, out of which eight were significant in terms of prognostic value. It allows immediate classification in two groups: low and high mortality. The prognostic factors it includes are age, gender, organ failure, presence of cancer, colonic origin of contamination, generalized peritonitis and peritoneal fluid characteristics (citrate, purulent or fecal), with different numerical factors being assigned according to whether the results are favorable or adverse. A 0 to 47 score is obtained, with a cutoff point of 26, by means of which a mortality of 50% was established in patients, and in those with scores lower than 26, only 1 - 3%, with a sensitivity of 95.9% and specificity of 80%, positive predictive value of 98.9% and negative predictive value of 50%. Due to the large difference between both groups' prognosis, others have considered establishing three prognostic groups, with cutoff scores between them of less than 21

Table 1. Mannheim peritonitis index

Risk factor	Value if present
Age > 50 years	5
Female gender	5
Organ failure	7
Cancer	4
Peritonitis duration > 24 h	4
Non-colonic origin sepsis	4
Generalized diffuse peritonitis	4
Clear exudate	0
Citrine-purulent	6
Fecal	12

points, from 21 to 29 points and higher than 29 points, and mortality rates of 2.3, 22.5 and 59.1%, respectively; sensitivity and specificity are similar to those established for the groups with a 26-point cut-off⁹⁻¹³.

Abdominal sepsis due to secondary peritonitis is a common, serious condition with high mortality potential. There are useful tools to predict mortality of the patient with peritonitis, but a large part of them is based on biochemical parameters or uses calculators or special electronic systems for their application. MPI is a clinical tool that has been suggested as a mortality predictor in patients with peritonitis, and has been shown to be a highly useful, simple, highly sensitive and specific tool that is composed of clinical variables and trans-operative findings.

The purpose of this study was to determine if there is correlation between the MPI-obtained score and mortality in patients with abdominal sepsis due to secondary peritonitis who required surgical management.

Method

Retrospective, observational, cross-sectional study of patients treated at General Hospital of Mexico "Dr. Eduardo Liceaga" during the period between July 2013 and January 2014, who had been diagnosed with acute abdominal pain and in whom abdominal sepsis due to secondary peritonitis was found during surgery.

Results

The sample is composed of 177 cases, 85 (48%) of the female gender and 92 (52%) of the male gender.

Table 2. Classification by severity

Severity indicator	Mild	Severe
APACHE II	< 14	> 15
Mannheim peritonitis index	< 25	> 26

Average age was 43.38 years. The most common organ causative of abdominal sepsis was the appendix, followed by the gallbladder, small intestine and colon. Among the entire sample, there was 10% of mortality.

The cases were divided, according to the MPI score (Table 2), into mild (< 25 points; 150 patients, 84.8%) and severe (> 26 points; 27 patients, 15.2%). When the cases were divided according to APACHE II scale-assessed severity, 42 cases (23.7%) were found to be severe and 135 (76.3%) were mild.

Of the 27 patients classified in the severe group according to MPI, eight died (29.6%), while of the 150 patients classified in the mild group according to MPI, 10 died (6.7%), and when the chi-squared statistic is applied to these observations a p-value < 0.05 is obtained (odds ratio: 5.895; 95% confidence interval: 2.071-16.77).

When the ROC curve for MPI was analyzed with regard to its relationship with mortality, we obtained an area under the curve of 0.84, with a cutoff point of 20, for a sensitivity of 83% and specificity of 77% (Fig. 1).

Discussion

Abdominal sepsis due to secondary peritonitis is a pathology with high mortality and economic costs due to prolonged hospital stay and the therapeutics used at the intensive therapy unit. The importance of the systemic inflammatory response syndrome secondary to abdominal pathology can show evidence of organ failure limited to one or two organs or develop an exaggerated inflammatory response that rapidly progresses to death, few days after initial trauma, secondary to multiple organ failure¹⁴. Mortality with multiple organ failure is proportional to the number of systems involved and ranges from 30% with single organ failure to 100% with five compromised organs¹⁵.

Various studies have devised scoring systems to predict morbidity and mortality in emergency surgery. The APACHE II score is used in the intensive care unit and requires 12 physiological parameters over a 24-hour period to be calculated and, for this reason, using it in

Figure 1. Area under the curve of 0.84, with a cutoff point of 20, for a sensitivity of 83% and specificity of 77%.

emergency surgery is not possible. In patients with surgical pathology due to abdominal sepsis, in addition to the APACHE II score other systems have been developed, such as MPI, the multiple organ failure score and the sepsis score¹⁶. In comparative studies, the APACHE II scale and MPI offer a better prediction of mortality in patients with abdominal sepsis. The combination of MPI and APACHE II improves specificity, but they are mainly used when assessing the outcomes of surgical patients admitted to intensive care units after surgery. MPI is simple to calculate and useful in the prediction of mortality, with a sensitivity of 83% and specificity of 77%. In our study, we analyzed the MPI using a standardized international cutoff point, and our result corroborates that MPI directly correlates with mortality in our sample. When this result was obtained, we plotted a ROC curve in order to have a better discrimination point to determine mortality, and this curve reports a score of 20 points with an area under the curve larger than 80, sensitivity of 83% and specificity of 77%. Thus, we can assume that the higher the MPI score, the higher the mortality (Fig. 2). This result will be taken into consideration in future prospective studies in order to standardize our cutoff point.

Currently, secondary peritonitis is common in general surgery. After initial laparotomy, the doubt arises regarding a second intervention due to patient post-surgical evolution. There are parameters, such as heart rate, hemoglobin, body temperature, presence of bowel movements, the extent of contamination at

Figure 2. The higher the Mannheim index score, the higher the mortality.

first surgery and the need of inotropics, which increase the risk of a second intervention. However, an ideal mortality scale that is accurate, easy to calculate and reproducible, both in the preoperative and post-operative periods, and that allows assessing the response to the surgical management employed, has not yet been designed.

Conclusion

MPI is a good mortality predictor for patients with abdominal sepsis due to secondary peritonitis. In our population, the optimal cutoff point to determine the severity of abdominal septic patients using the MPI is 20 points.

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Conflicts of interests

There are no conflicts of interest.

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