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Examination of prognostic factors in patients undergoing surgery for colorectal perforation: A case controlled study

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ABSTRACT

Objective: To determine if the POSSUM, SOFA, MPI, and SAS scores provide a better measure of severity for patients with prognostic factors undergoing surgery for colorectal perforation.**Subjects:** Fifty-nine patients who underwent surgery between 1996 and 2012.**Methods:** We retrospectively reviewed background factors, blood and physiological test results, and intraoperative findings of patients who survived and those who died. We also compared the POSSUM, SOFA, MPI, and SAS scores. Multivariate analysis was performed for factors that were significant by univariate analysis, and selected factors were used to produce a predictive prognostic model.**Results:** Univariate analysis revealed significant differences in age, anticoagulant/steroid administration, serum creatinine level, PF ratio, base excess (BE), chest radiography, pulse rate, and severity of peritoneal soiling. Age, serum creatinine level, pulse rate, and severity of peritoneal soiling were selected for multivariate analysis; only pulse rate was significantly different. There were significant differences between the two groups in POSSUM PS, OSS, SOFA, and MPI scores, and a comparison in terms of the ROC curve showed that our model had the highest peak; the area under the curve was 94.8% compared with 70–80% for the other systems, suggesting that our model is better than those systems.**Conclusions:** POSSUM and SOFA are valid methods of evaluating risk from colorectal perforation, but our study revealed addition risk factors: (1) the PF ratio and BE, which are not included in POSSUM; (2) the pulse rate and severity of peritonitis, which are not included in SOFA; and (3) anticoagulant/steroid hormone administration.

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1. Introduction

Colorectal perforation has a high mortality rate and may easily lead to bacterial peritonitis and progress to sepsis, disseminated intravascular coagulation (DIC), and multiple-organ failure [1]. To improve the survival rate, it is important to accurately assess patients' general condition, appropriately apply surgical indications and choices of procedure, and subsequently provide intensive care. In many cases, however, treatment is ineffective and leads to death. Obtaining informed consent from patients and their families before and immediately following surgery is therefore critical to avoid problems. Therefore, a simple method of risk evaluation is required to provide an adequate explanation for the necessity of surgery and the patient's subsequent anticipated condition. A range of methods

for evaluating severity and predicting prognosis have been previously reported, including the Physiological and Operative Severity Score (OSS) for the quantification of mortality and morbidity (POSSUM) [2], the Sepsis-related Organ Failure Assessment (SOFA) [3], the Mannheim Peritonitis Index (MPI) [4], and the Surgical Apgar Score (SAS) [5].

The objective of this study was to investigate preoperative and intraoperative factors affecting the prognosis of patients undergoing surgery for colorectal perforation; compare their prognostic value with that of POSSUM, SOFA, MPI, and SAS; and investigate whether they provided a more accurate severity score.

2. Methods

The study subjects comprised 59 patients with colorectal perforation who underwent emergency surgery in our hospital between 1996 and 2012. The parameters investigated were all the

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items included in POSSUM, SOFA, MPI, and SAS as well as body mass index (BMI), presence of underlying conditions (conditions requiring treatment were judged as present), presence of anticoagulant therapy or steroid therapy, site of perforation, cause of perforation, and surgical method. Patients were divided into 2 groups: surviving patients (Group A) and dead patients (Group D) (all deaths occurred in the hospital). Physiological tests included all the tests covered by the POSSUM; the central nervous system was evaluated using the Glasgow Coma Scale (GCS); chest radiography findings for chronic obstructive pulmonary disease (COPD) were evaluated according to a 4-point scale (normal, mild, moderate, and fibrosis); and electrocardiogram findings were categorized as normal or atrial fibrillation or other arrhythmias. The severity of peritoneal soiling was scored according to POSSUM as follows: no soiling, minor soiling, local pus, and free bowel content with pus or blood.

For statistical analysis, we first performed univariate analysis of individual factors to isolate significant factors. Subsequently, we performed logistic multivariate analysis via the stepdown procedure and the likelihood ratio test using the significant factors from the univariate analysis as inputs. The selected factors were used to develop a predictive prognostic model based on our experience with the current cases. This model was used to evaluate the fit of the model and the cutoff point was set at 50%. Following this, the POSSUM, SOFA, MPI, and SAS scores for our cases were calculated, and the values of individual factors and total scores as predictive prognostic methods for patients undergoing surgery for colorectal perforation were calculated and compared with the value of our model. The χ^2 test, Fisher's direct method, Mann–Whitney test, logistic multivariate analysis by the stepdown method, likelihood ratio, and ROC curve were used for statistical analysis, with values of $p < 0.05$ considered significant. The statistical software used was SPSS II for Windows.

3. Results

3.1. Background factors

The median age of the patients was 65 years in Group A and 75 years in Group D, and the elderly patients had a significantly poorer prognosis ($p = 0.011$). Group A included 25 men and 20 women; Group D included 7 men and 7 women, with no significant difference ($p = 0.766$). A comparison of perforations of the right and left

colon showed that perforations of the left colon had a tendency for higher mortality, but that this difference was not significant ($p = 0.084$). The most common causes of perforation were ischemia and diverticulitis, but their effect on prognosis was not significantly different. There were no significant differences in the time from onset to surgery, time from presentation at hospital to surgery, BMI, and the presence of underlying disease. In the presence of anticoagulant/steroids administration, mortality was greater among patients administered anticoagulants or steroids ($p = 0.046$) (Table 1).

3.2. Blood and physiological test findings

The blood tests showed that the white blood cell count tended to be higher in survivors, but this difference was not significant ($p = 0.055$). Among all factors, serum creatinine level in Group A ($p = 0.001$), PaO₂/PaCO₂ oxygenation index (PF ratio) in Group A ($p = 0.009$), and BE in Group A ($p = 0.025$) showed significant differences. There were no significant differences in other factors.

There was no significant difference in the GCS score. Chest radiography findings showed that COPD was significantly more common in Group D ($p = 0.048$), and there were no significant differences in electrocardiographic findings. In terms of circulatory tests, there was no significant difference in mean arterial pressure (MAP). The pulse rate was significantly lower in Group A (93/min) than in Group D (111/min) ($p = 0.001$). Median body temperature was 37.6 °C in Group A and 37.0 °C in Group D; however, this difference was not significant ($p = 0.082$) (Table 2).

3.3. Surgical factors

There was no significant difference in terms of the history of laparotomic surgery, intraoperative hemorrhage, minimum intraoperative MAP, minimum intraoperative pulse rate, or surgical procedure. In terms of peritoneal soiling, a significantly higher number of patients in Group A had local pus or serous fluid ($p = 0.016$) (Table 3).

3.4. Multivariate analysis

Univariate analysis showed that there were significant differences in age, presence of anticoagulant/steroid administration, serum creatinine, PF ratio, BE, severity of COPD, pulse rate, and severity of peritoneal soiling. Using these factors, logistic

Table 1
Patient background.

	A Group			D Group			p-value
Age	65	36	90	75	55	89	0.011
Median minimum maximum							
Gender (cases)	25:20			7:07			0.766
Man:Woman							
Site (cases)	15:30			1:13			0.084
Right:Left							
Course (Cases)	2:7:4:13:12:4:3			0:4:1:4:5:0:0			0.464
UC:Cancer:Ischemia:Diverticulum:Ideopasic:Trauma:Iatrogenic							
Course2 (cases)	7:38			4:10			0.432
Malignant:Benign							
Time from onset to surgery (hours)	10.0	2.0	124.0	10.8	4.0	79.0	0.743
Median minimum maximum							
Time from presentation at hospital to surgery (hours)	4.0	2.0	120.0	4.5	2.0	24.0	0.755
Median minimum maximum							
BMI	21.4	14.5	29.4	19.7	15.6	26.4	0.256
Median minimum maximum							
Underlying condition (cases)	20:25			4:10			0.361
Yes:No							
Anticoagulants/steroids (cases)	11:34			8:06			0.046

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