ANALYSIS OF PROGNOSTIC FACTORS IN PATIENTS WITH ACUTE PERITONITIS

A.I. Shurma, F.V. Grynchuk

Bukovinian State Medical University, Chernivtsi, Ukraine

Key words: acute peritonitis; Complication; Prognostication; Prognostic Scale.

Resume. Prediction of postoperative complications (POC) is an important element in the choice of treatment tactics for acute peritonitis (AP). Many methods have been proposed for this. However, none of these methods have sufficient recognition. Most prognostic scales determine the risk of complications only after surgery. Therefore, the issue of developing an informative prognostic scale remains relevant.

The aim of the study was to evaluate prognostic factors in patients with acute peritonitis.

Materials and Methods. Retrospective analysis of the results of treatment of 212 patients with AP. 65 patients had POC. 22 patients died. Analysis of clinical, anthropometric data, laboratory examination results, criteria of MPI, PIPAS, WSES Sepsis Severity Score (WSSS), Charlson Comorbidity Index (CCI) was performed. Analysis of Variance (ANOVA) and Neural Network Bayesian Classifier were used to assess the influence of factors.

Results. None of the studied criteria is sufficient for prediction. MPI, PIPAS, WSSS have the greatest influence on the probability of POC occurrence in AP. But these indicators can be determined only after the operation. Therefore, we separately used a cumulative assessment of indicators that can be determined before surgery and after surgery. Multifactor ANOVA with preoperative parameters: diagnosis, clinical signs of AP, body temperature, CCI, systolic blood pressure (SBP) showed that since 5 P-values are less than 0.05, combination of these factors have a statistically significant effect on POC at the 95.0% confidence level. Multifactor ANOVA with indicators of diagnosis, body temperature, CCI, SBP, WSSS or PIPAS showed that since 5 P-values are less than 0.05, combination of these factors have a statistically significant effect on POC at the 95.0% confidence level.

Conclusions
1. Criteria MPI, PIPAS, WSSS have the greatest influence on the probability of POC occurrence in AP, but none of these criteria is sufficient alone.
2. The set of indicators of diagnosis, clinical signs of peritonitis before surgery, body temperature, CCI, SBP have a statistically significant effect on POC at the 95.0% confidence level before surgery.
3. The combination of indicators of diagnosis, body temperature, CCI, SBP, WSSS or PIPAS have a statistically significant effect on POC at the 95.0% confidence level after surgery.
4. The creation of a reliable prognostic scale is possible using a complex of the described factors.

АНАЛІЗ ПРОГНОСТИЧНИХ ФАКТОРІВ У ХВОРИХ НА ГОСТРИЙ ПЕРИТОНІТ

А.І. Шурма, Ф.В. Гринчук

Ключові слова: гострий перитоніт, ускладнення, прогностування, прогностична шкала.


Резюме. Прогнозування післяопераційних ускладнень (ПОУ) є важливим елементом у виборі тактики лікування гострого перитоніту (ГП). Для цього запропоновано багато методів. Однак жоден із цих методів не має достатнього визнання. Більшість прогностичних шкал визначають ризик ускладнень тільки після операції. Тому актуальним залишається питання розробки інформативної прогностичної шкали.

Мета дослідження – оцінити прогностичні фактори у хворих на гострий перитоніт.

Матеріал і методи. Ретроспективний аналіз результатів лікування 212 хворих на ГП. 65 пацієнтів мали ПОУ. Померло 22 хворих. Проведено аналіз клінічних, антропометричних даних, результатів лабораторних досліджень, критеріїв Мангаймського перитонітного індексу (MPI), PIPAS, WSES Sepsis Severity Score (WSSS), індекс коморбідності Чарлсона (ІКЧ). Для оцінки впливу факторів використовували дисперсійний аналіз (ДА) і Neural Network Bayesian Classifier.

43
Introduction. Prediction of postoperative complications (POC) is an essential element in the choice of acute peritonitis (AP) management which makes it possible to apply preventive measures [1-4]. For this purpose, many methods have been proposed based on various indicators [1,2,3,5-7]. However, none of these methods have gained sufficient recognition. Recognized scales are PIPAS [4], WSES Sepsis Severity Score (WSSS) [8], Mannheim Peritonitis Index (MPI) [9], Peritonitis Index Altona [10], Combined Peritonitis Score [11]. These scales assess only the degree of organ dysfunction, the severity of AP and the possibility of a patient’s death [12-17]. However, these scales do not assess the risk of certain complications. Most prognostic scales determine the risk of complications only after surgery [5]. It limits the possibility of justified prevention of complications already during preoperative preparation. Therefore, the problem of developing an informative prognostic scale remains relevant.

Aim of the Study. To evaluate prognostic factors in patients with acute peritonitis.

Materials and Methods. Retrospective analysis of the treatment results of 212 patients with AP. The age of the patients was from 17 to 86 years. There were 102 females, 110 males. Causes of AP: small bowel perforation – 2, large bowel perforation – 2, postoperative peritonitis – 3, acute cholecystitis – 4, acute mesenteric ischemia – 5, gynecological diseases – 5, acute large intestinal obstruction – 8, strangulated hernias – 12, acute small intestinal obstruction – 23, perforated gastroduodenal ulcer – 34, acute appendicitis – 110 (acute perforated appendicitis – 24). Local peritonitis (LP) was present in 88 patients, diffuse peritonitis (DP) was present in 59 patients, general peritonitis (GP) was present in 65 patients.

65 patients had postoperative complications (POC): inflammation of the postoperative wound – 15, suppuration of the postoperative wound – 16, erosion - 3, intra-abdominal abscess – 5, suture failure – 5, postoperative peritonitis – 22. 22 patients died. 123 patients had concomitant diseases.

Analysis of clinical, anthropometric data, laboratory examination results, MPI, PIPAS, WSSS, Charlson Comorbidity Index (CCI) [18] was performed.

For mathematical processing, complications were evaluated as follows: 0 – no complications, 1 – wound inflammation, 2 – suppuration of the wound, 3 – erosion, 5 – intra-abdominal abscess, 7 – suture failure, 8 – postoperative peritonitis. The presence of clinical signs of peritonitis (pain on palpation, stiffness of the abdominal wall, rebound pain) before the operation was evaluated as follows: LP – 1, DP – 2, GP – 3.

Analysis of Variance (ANOVA) and Neural Network Bayesian Classifier (NNBC) were used to assess the influence of factors. The Statgraphics Centurion 18 program (Statgraphics Technologies, Inc.) was used for analysis.

Results and Discussion. According to One-Way ANOVA, there were no gender differences in the frequency of POC (F-Ratio=2.97, P-Value=0.0864). According to One-Way ANOVA, POC distribution was statistically significantly dependent on age (F-Ratio=1.97, P-Value=0.0004). According to NNBC, the percentage of training cases correctly classified was 65.093%.

According to One-Way ANOVA, the distribution of POC indicators statistically significantly (F-Ratio=3.97, P-Value=0.0000) depended on the diagnosis. The distribution of POC was statistically significant (F-Ratio=23.48, P-Value=0.0000), dependent on clinical signs of peritonitis before surgery. According to NNBC, the percentage of training cases correctly classified was 69.3396%. The POC distribution was statistically significant (F-Ratio=4.24, P-Value=0.0000), dependent on the CCI indicator. According to NNBC, the percentage of training cases correctly classified was 67.9245%.
POC indicators did not depend on body temperature indicators (F-Ratio=1.52, P-Value=0.0578). But, according to NNBC, the percentage of training cases correctly classified was 71.7514%.

According to One-Way ANOVA, POC distribution was statistically significantly (F-Ratio=2.04, P-Value=0.0020) dependent on heart rate. But according to NNBC percentage of training cases correctly classified was only 11.5183%.

According to One-Way ANOVA, POC distribution was statistically significantly (F-Ratio=2.85, P-Value=0.0004) dependent on systolic blood pressure (SBP). According to NNBC, the percentage of training cases correctly classified was 69.6335%.

According to One-Way ANOVA, POC distribution did not depend on the number of leukocytes (F-Ratio=1.03, P-Value=0.4411). Instead, according to NNBC, the percentage of training cases correctly classified was 60.5911%.

According to One-Way ANOVA, POC distribution did not depend on the amount of glucose in plasma (F-Ratio=0.72, P-Value=0.9259). Instead, according to NNBC, the percentage of training cases correctly classified was 67.7419%.

According to One-Way ANOVA, POC distribution did not depend on the amount of total plasma’s protein (F-Ratio=0.4076). But according to NNBC, the percentage of training cases correctly classified was 62.8415%.

According to One-Way ANOVA, POC distribution did not depend on the amount of total plasma’s bilirubin (F-Ratio=1.34, P-Value=0.0839). But according to NNBC, the percentage of training cases correctly classified was 63.0682%.

According to One-Way ANOVA, POC distribution was statistically significantly dependent on the amount of plasma’s urea (F-Ratio=1.34, P-Value=0.0839). According to NNBC, the percentage of training cases correctly classified was 67.7966%.

According to One-Way ANOVA, POC distribution was statistically significantly dependent on the amount of plasma’s creatinine (F-Ratio=2.24, P-Value=0.0269). According to NNBC, the percentage of training cases correctly classified was 58.5586%.

According to One-Way ANOVA, POC distribution was independent of prothrombin time (F-Ratio=0.98, P-Value=0.5304). But according to NNBC, the percentage of training cases correctly classified was 68.9873%.

According to One-Way ANOVA, POC distribution did not depend on the amount of plasma’s fibrinogen (F-Ratio=1.19, P-Value=0.2163). But according to NNBC, the percentage of training cases correctly classified was 65.4088%. According to One-Way ANOVA, POC distribution did not depend on hematocrit (F-Ratio=1.24, P-Value=0.1712). But according to NNBC, the percentage of training cases correctly classified was 60.3896%.

According to One-Way ANOVA, the distribution of POC was statistically significantly dependent on the MPI indicator (F-Ratio=4.77, P-Value=0.0000). According to NNBC, the percentage of training cases correctly classified was 69.3396%. According to One-Way ANOVA, the distribution of POC was statistically significantly (F-Ratio=20.26, P-Value=0.0000) dependent on the PIPAS indicator. According to NNBC, the percentage of training cases correctly classified was 69.3396%.

According to One-Way ANOVA, the distribution of POC was statistically significantly (F-Ratio=10.08, P-Value=0.0000) dependent on the WSSS indicator. According to NNBC, the percentage of training cases correctly classified was 70.283%.

Therefore, the overall analysis shows that none of the criteria is sufficient. MPI, PIPAS, WSSS have the greatest influence on the probability of POC occurrence in AP. But these indicators can be determined only after the operation. Therefore, we separately used a cumulative assessment of indicators that can be determined before surgery and after surgery.

Multifactor ANOVA with parameters determined before surgery indicated that a specific model could not be established. When analyzing the indicators of diagnosis, clinical signs of peritonitis before surgery, body temperature, CCI, SBP, it was found that since 5 P-values are less than 0.05, a combination of these factors has a statistically significant effect on POC at 95.0% confidence level (table 1).

Multifactor ANOVA with indicators of diagnosis, body temperature, CCI, SBP, MPI showed that MPI is a linear combination of other factors. Therefore, the analysis is impossible. Multifactor ANOVA with indicators of diagnosis, body temperature, CCI, SBP, WSSS showed that since 5 P-values are less than 0.05, combination of these factors have a statistically significant effect on POC at the 95.0% confidence level (table 2).

Multifactor ANOVA with indicators of diagnosis, body temperature, CCI, SBP, PIPAS showed that since 5 P-values are less than 0.05, combination of these factors have a statistically significant effect on POC at 95.0% confidence level (table 3).

---

**Table 1**

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F-Ratio</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis</td>
<td>56,1659</td>
<td>11</td>
<td>5,10599</td>
<td>2.13</td>
<td>0.0221</td>
</tr>
<tr>
<td>Peritonitis</td>
<td>53,0058</td>
<td>2</td>
<td>26,5029</td>
<td>11.05</td>
<td>0.0000</td>
</tr>
<tr>
<td>Cci</td>
<td>69,9272</td>
<td>12</td>
<td>5.82727</td>
<td>2.43</td>
<td>0.0068</td>
</tr>
<tr>
<td>Temperature</td>
<td>209,261</td>
<td>32</td>
<td>6.53941</td>
<td>2.73</td>
<td>0.0000</td>
</tr>
<tr>
<td>Sbp</td>
<td>162,826</td>
<td>17</td>
<td>9.57802</td>
<td>3.99</td>
<td>0.0000</td>
</tr>
<tr>
<td>Residual</td>
<td>328,62</td>
<td>137</td>
<td>2.39869</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (corrected)</td>
<td>1481,03</td>
<td>211</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2**

<table>
<thead>
<tr>
<th>Source</th>
<th>Sum of squares</th>
<th>Df</th>
<th>Mean square</th>
<th>F-ratio</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

Multifactor ANOVA with indicators of diagnosis, body temperature, CCI, SBP, WSSS showed that since 5 P-values are less than 0.05, combination of these factors have a statistically significant effect on POC at 95.0% confidence level (table 3).
Therefore, the analysis shows that it is advisable to use separate scales before and after surgery to predict the probability of POC development in AP. To create such scales, it is advisable to use indicators of clinical signs of peritonitis before surgery, body temperature, CCI, SBP, WSSS, or PIPAS have a confidence level before surgery.

Prospects for further research. Creation of a prognostic scale for acute peritonitis taking into account the obtained data.

References

Information about the authors
Shurma Andriy Ihorovych – graduate student of the Department of Surgery № 1, Bukovinian State Medical University, Chernivtsi, Ukraine.
Grynchuk Fedir Vasyliovych – Doctor of Medical Sciences, Professor, Professor of the Department of Surgery № 1, Bukovinian State Medical University, Chernivtsi, Ukraine.