THE IMPACT OF THE NUTRITIONAL STATE OF PATIENTS ON THE RESULTS OF THE SURGICAL TREATMENT OF ULCERATIVE COLITIS

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A variety of mechanisms have been proposed to explain the malnutrition and body mass loss in UC patients.

**The aim of the study** trial was a nutritional state assessment of 347 UC patients, admitted for surgical treatment, and the evaluation of the impact of this state on the postoperative course in this group of patients.

**Material and methods.** We referred the results of nutritional state assessment to the length of time of postoperative hospitalization of patients.

**Results.** Through application of the Kruskal-Wallis test we found statistically significant, but weakly expressed, differences between the values of nutritional state parameters and period of hospitalization of patients. The applied U Mann-Whitney test, with statistically significant results with p <0.05, showed statistically significant differences between cured and dead subgroups in: 1) loss of body mass in 6 months before hospitalization (p = 0.000033), 2) hemoglobin level (p = 0.006676), 3) total lymphocyte count (TLC) (p = 0.025242), 4) total serum protein level (p = 0.003485), 5) serum albumin level (p = 0.00165). Differences in BMI values were statistically negligible (p = 0.969397).

**Conclusions.** The body mass loss in 6 months before admission, total lymphocyte count and serum albumin level are the reference parameters of the nutritional state of UC patients on admission to surgery.

**Key words:** ulcerative colitis, nutritional assessment, undernutrition, surgery, length of stay

Ulcerative colitis (UC) and Crohn’s disease (CD) constitute the two major idiopathic inflammatory bowel diseases (IBDs). UC is a chronic diffuse colonic mucosal inflammation, that involves the rectum in about 95% of cases, and may extend proximally in a symmetrical, circumferential, and uninterrupted pattern to affected parts or all of the large intestine (1, 2).

The management of UC is determined by the extent of colitis, severity of illness, complications, and response of the individual patient to prior interventions (1, 2). Absolute indications for surgery are exsanguinating hemorrhage, perforation and documented or strongly suspected carcinoma. Other are severe colitis with or without a toxic megacolon, and the patient with less severe, but medically intractable symptoms or intolerable medication side effects (2).

As the emphasis on reducing health-care costs shapes the attitudes and practices of physicians today, surgeons will be urged to use preventative efforts to shorten length of hospitalization. As early as 1936, Studley recognized that malnutrition, in the form of undernutrition, significantly increased postoperative morbidity and mortality (3, 4). Identification of malnutrition is essential in surgical patients...
because not doing so not only increases costs, but also increases postoperative morbidity and mortality. As a result of the process of controlling the effectiveness of hospital treatment of patients, attempts to define parameters that could be used to recognize undernutrition in surgical patients preoperatively were made (3, 5).

Prevalence of malnutrition in UC

Malnutrition is a common problem in patients with IBDs. Fundamental differences in the pattern of malnutrition exist between CD and UC. Patients with UC tend to be relatively well nourished whilst in remission, but can develop precipitous nutritional deficiency during a hospital admission for a severe acute relapse (6).

Patients who require admission to a hospital as they qualify for surgical treatment, are usually after shorter or longer periods, unresponsive to medical therapy. The disease in itself along with previous medical treatment have a great influence on the general health state and nutritional state of patients with UC (2, 5, 6).

Applied medical therapy protocols (aminosalicylates, mesalamine, steroids, immunomodulatory agents, cytostatics, cyclosporine, antimetabolites, antibiotics, metronidazole, monoclonal antibodies etc.) increase all these mechanisms of malnutrition, which limit or make impossible normal feeding in the course of UC. All these factors cause different grades of nutrition state disorders in patients for whom surgical treatment is recommended (7).

Currently surgical treatment of UC is based on complete colon and rectum removal with ileal pouch creation in 2 or 3 stage procedures, with temporal ileostomy. It is rather a big surgical procedure, connected, especially in malnourished patients, with the high risk of postoperative complications. The risk of complications in this group of patients can be reduced by applying perioperative nutritional support in malnourished UC patients.

The aim of this prospective clinical trial is a nutritional state assessment of 347 UC patients, admitted to the Department to surgical treatment, and the evaluation of the impact of this state on the postoperative course in this group of patients.

MATERIAL AND METHODS

Between 1988 and 2010, 515 patients (259 women and 256 men) with IBDs were treated at the Department of General, Gastroenterological Oncology and Plastic Surgery of the Karol Marcinkowski University of Medical Sciences in Poznań. In that group 347 (67.4%) patients had diagnosis of UC and 168 (32.6%) patients were diagnosed as CD. 347 patients with UC were in the age range between 14 and 79, mean 39 ± 15; 53% of them established were women, with an age range from 14 to 72, mean 38 ± 16.4 but 47% of UC group were men in the age from 16 to 79 years, mean 39 ± 15.4. On admission all UC patients underwent assessment of both the severity of the UC grade and nutritional state. Table 1 contains the parameters of severity of UC, with ranges of their values anticipated for mild, moderate, severe and fulminant grade of the disease. Table 2 shows the number and the percentage of patients in separated grades of severity of UC in the examined group of patients. The number of patients in different forms of severity of UC depended on the fact, that in a majority of patients:

| Table 1. The parameters and their ranges of value for different grades of severity of ulcerative colitis |
|---------------------------------|---------|---------|---------|---------|
| Parameter                      | Mild disease | Moderate disease | Severe disease | Fulminant disease |
| Stools / 24h                   | <4       | 4-6      | 6-10     | >10      |
| Pulse (beats / min.)           | <90      | 90-100   | >100     | >110     |
| Hematocrit (%)                 | 30-40    | normal   | <30      | <25      |
| Loss of body weight (%)        | 0        | 1-10     | >10      | >10      |
| Temperature (gr. C)            | normal   | 37-38    | >38      | >38 or <38 |
| EST* (mm/h)                    | normal   | 20-30    | >30      | >30 or <30 |
| Albumin (g/l)                  | normal   | 30-35    | <30      | <25      |

* erythrocytes’ sedimentation rate
Table 2. The number and percentage of patients in different grade of severity of ulcerative colitis

<table>
<thead>
<tr>
<th>Grade of severity of UC</th>
<th>Number of patients</th>
<th>% patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>83</td>
<td>24</td>
</tr>
<tr>
<td>Moderate</td>
<td>191</td>
<td>55</td>
</tr>
<tr>
<td>Severe</td>
<td>63</td>
<td>18</td>
</tr>
<tr>
<td>Fulminant</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>347</td>
<td>100</td>
</tr>
</tbody>
</table>

1) mucosal changes occupied at least half of colon length (fig. 1),
2) patients had a history of at least several months of medical therapy (fig. 2),
3) there was steroid therapy in the preceding medical treatment (fig. 3), and
4) no long-term remissions were observed after medical treatment.

The severity of illness assessment and complementary diagnostics (if needed) were the basis of the decision to perform surgery.

All patients underwent the nutritional state assessment at the same time. It was based on data from recent history of the disease within anthropometric and laboratory parameters. All nutritional state assessment factors are presented in tab. 3, with their range values typical for the proper nutritional state and mild, moderate and severe forms of undernutrition (7).

319 (92%) patients were operated on, in 28 (8%) patients we desisted from surgical treatment. The number of different surgical procedures applied to patients operated on is included in tab. 4. The time of hospitalization ranged from 4 to 72 days, mean 21.7 days ± 9.5 days.

We referred the results of nutritional state assessment to the time of postoperative hos-
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Prolonged hospitalization of patients assuming that the last expresses, to some extent, the proper or complicated course of surgical treatment. Thus, according to the time of hospitalization we divided all patients into three subgroups:

1) from 0 to 9 days, in that time 21 (6%) of patients were treated,  
2) from 10 to 29 days, there were 247 (79%) patients in that division,  
3) over 30 days, such a period saw the treatment of 52 (15%) patients.

We applied Kruskal-Wallis test for two-sided comparisons of all examined parameters of nutritional state of patients and independent (grouping) variable, for which we took the time of postoperative hospitalization of patients. For analysis of nutritional state assessment parameters in subgroups of cured and dead patients we used U Mann-Whitney test.

RESULTS

From descriptive statistics we know, that loss of body mass in 6 months before hospitalization in the examined group of patients was extended from 0 kg to 14 kg, mean 6.4 kg ± 3.9 kg. Taking loss of body mass as the only criterion of the nutritional state of patients, we recognized in 187 (54%) patients severe undernutrition, in 87 (25%) patients moderate undernutrition, in 7 (2%) patients mild undernutrition. 66 (19%) patients had a proper nutritional state.

BMI in UC group amounted from 16.4 kg / m² to 26.9 kg / m², mean 22.3 kg / m² ± 1.6 kg / m². Presuming BMI as the single factor of nutritional state assessment, 308 (89%) patients presented the proper nutritional state, 14 (4%) were overweight, 18 (5%) mild undernutrition, 4 (1%) moderate undernutrition and 3 (1%) severe undernutrition.

In all patients the hemoglobin level raised from 10.2 g / dl to 13.9 g / dl, mean 12.4 g / dl ± 0.75 g / dl. Thus, assuming that the hemoglobin level would be the only index of patients’ nutritional state, 177 (51%) of patients were properly nourished, 149 (43%) were mildly undernourished, 16 (5%) were moderately undernourished and no patient was severely undernourished.

Total lymphocyte count (TLC) in UC patients extended from 960 to 2200, mean 1362.9 ± 192.2. Taking this parameter as the only

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</thead>
<tbody>
<tr>
<td>Loss of b. m. in last 6 months%</td>
<td>normal</td>
<td>mild</td>
<td>moderate</td>
<td>severe</td>
<td>normal</td>
</tr>
<tr>
<td>BMI kg / m²</td>
<td>0</td>
<td>1.5</td>
<td>&gt; 5</td>
<td>&gt; 10</td>
<td>20-25</td>
</tr>
<tr>
<td>Hemoglobin g/dl</td>
<td>1500-4000</td>
<td>&lt; 1500</td>
<td>&lt; 1200</td>
<td>&lt; 800</td>
<td>12.5-14.5</td>
</tr>
<tr>
<td>Total protein level g/l</td>
<td>&gt; 66</td>
<td>62-66</td>
<td>60-62</td>
<td>&lt; 60</td>
<td>&gt; 66</td>
</tr>
<tr>
<td>Serum albumin level g/l</td>
<td>35-50</td>
<td>30-35</td>
<td>25-30</td>
<td>&lt; 25</td>
<td>&gt; 35</td>
</tr>
</tbody>
</table>

a Body Mass Index  
b total lymphocyte count
We found no patients with severe undernourishment, 63 (18%) properly nourished, 239 (69%) mildly and 45 (13%) moderately undernourished.

Total protein level oscillated from 54 g/l to 74 g/l, mean 66.76 g/l ± 0.36 g/l; taking this parameter as the single nutritional state factor, the level of undernourishment in 7 (2%) patients we would appreciate as severe, in 63 (18%) as mild, in 31 (9%) as moderate, and 246 (71%) patients were defined as properly nourished.

The serum albumin level in the examined group of patients fluctuated from 24 g/l to 39 g/l, mean 32.79 g/l ± 0.27 g/l. As an isolated criterion of the nutritional state of patients it qualified 7 (2%) of patients as severely undernourished, 201 (58%) of patients as mildly undernourished, 49 (14%) of patients as having a moderate grade of undernutrition, and 90 (26%) of patients as being in a normally nourished subgroup.

Table 5 presents the allocation of patients to different subgroups of undernutrition according to the single parameter of nutritional state assessment.

Applying the Kruskal-Wallis test we found statistically significant, but weakly expressed, differences between the values of nutritional state parameters and period of hospitalization of patients. For loss of body mass in the 6 months before admission p = 0.033 in subgroups of > 30 days of hospitalization versus (vs) 0-9 days, for BMI p = 0.04 in subgroups of > 30 days of hospitalization versus 10-29 days, and for serum albumin level p = 0.0043 in subgroups of > 30 days of hospitalization versus 0-9 days and in subgroups of > 30 days of hospitalization versus 10-29 days.

It is interesting to observe how the graphical presentation of particular parameters of nutritional state with reference to the time of hospitalization appears, according to established division, by means of “box & whisker” diagrams. Figure 4 presents that diagram for the variable of body mass loss; the smallest loss in the range of 25-75% was observed in a subgroup of the patients, who were treated for the shortest length of time, and the biggest loss of body mass in the same range was reported in a subgroup hospitalized for over 30 days. Figure 5 presents the diagram for the BMI variable; the largest values of BMI in the range of 25-75% were observed in the subgroup treated from 0 to 9 days. The same diagram for the variable hemoglobin level is presented in fig. 6; the highest values of hemoglobin in the same ranges were observed in the 0-9 days of treatment subgroup and the lowest in the subgroup treated for over 30 days. The variable

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range of values</th>
<th>Mean values ± SD</th>
<th>Number and% of UC patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Properly nourished</td>
<td>Mildly undernourished</td>
<td>Moderately undernourished</td>
</tr>
<tr>
<td>Loss of b. m.a kg / last 6 months</td>
<td>0-14</td>
<td>6.4 ± 3.9</td>
<td>66</td>
</tr>
<tr>
<td>BMIb kg / m²</td>
<td>16.4-26.9</td>
<td>22.3 ± 1.6</td>
<td>308</td>
</tr>
<tr>
<td>Hemoglobin g / dl</td>
<td>10.2-1.399</td>
<td>12.4 ± 0.75</td>
<td>177</td>
</tr>
<tr>
<td>TLC c cells / mm³</td>
<td>960-2200</td>
<td>1362 ± 192.2</td>
<td>63</td>
</tr>
<tr>
<td>Total protein level g/l</td>
<td>54-74</td>
<td>66.76 ± 0.36</td>
<td>246</td>
</tr>
<tr>
<td>Serum albumin level g/l</td>
<td>24-39</td>
<td>32.79 ± 0.27</td>
<td>90</td>
</tr>
</tbody>
</table>

| a Body Mass Index  |
| b total lymphocyte count |
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Figure 4. “Box & whisker” diagram presenting the body weight loss with reference to 3 intervals of hospitalization of ulcerative colitis patients.

Figure 5. “Box & whisker” diagram presenting the BMI with reference to 3 assumed periods of hospitalization of ulcerative colitis patients.

Figure 6. “Box & whisker” diagram presenting hemoglobin level with reference to 3 different periods of hospitalization of ulcerative colitis (UC) patients.

Figure 7. “Box & whisker” diagram presenting the total lymphocyte count (TLC) with reference to 3 intervals of hospitalization of ulcerative colitis patients.

In the two-sided tables method we calculated what percentage of patients in different nutritional states had been present in 3 subgroups of patients according to the time of hospitalization. The most important was the period of hospitalization for the undernourished subgroups. With the criterion of body mass loss in 6 months before hospitalization, patients with severe undernutrition amounted to 54% of the 10-29 days of hospitalization subgroup and 70% of patients treated for over 30 days. According to the BMI criterion properly nourished patients constituted 93% of the 10-29 days subgroup and 80% of patients hospitalized for longer than 30 days. After using the hemoglobin level criterion, 42% patients from the 10-29 days subgroup and 65% from the above 30 days of treatment patients re-
vealed mildly undernourished. For the TLC criterion, mildly undernourished patients amounted to 72% of the 10-29 days subgroup and 70% of the longer than 30 days subgroup. Along with a total plasma protein level at 73% of the 10-29 days subgroup and 55% of the above 30 days of hospitalization patients were properly nourished. And finally with the serum albumin level criterion, mild undernourished patients constituted 62% of the 10-29 days subgroup and 60% of the longest treated subgroup of patients.

A different criterion of the nutritional state influence on the course of treatment is the analysis of deaths. We applied the U Mann-Whitney test, with statistically significant results with $p < 0.05$. It showed statistically substantial differences between cured and dead subgroups in:

1) loss of body mass in 6 months before hospitalization ($p = 0.000033$),
2) hemoglobin level ($p = 0.006676$),
3) TLC ($p = 0.025242$),
4) total protein level ($p = 0.003485$),
5) serum albumin level ($p = 0.00165$).

Differences in BMI values between dead and cured subgroups of patients were statistically negligible ($p = 0.969397$).

Therefore, in the summed two-value tables for the loss of body mass in 6 months criterion 100% of deaths were in the severely undernourished subgroup, for the BMI criterion 80% of deaths were in the properly nourished subgroup, for hemoglobin level classification 100% of deaths appeared in mildly and moderately undernourished patients, for total protein level criterion 80% of deaths were developed in mildly, moderately and severely undernourished subgroups, and for the serum albumin level classification 100% deaths appeared in patients with mild, moderate and severe undernutrition. Attention should be paid to the limited accuracy of analysis of nutritional state parameters in dead and cured subgroups of patients, because of comparing groups with a great difference in the number of patients (dead 13 patients – 3.7%, cured 334 patients – 96.3%).

**DISCUSSION**

Clinicians should have a high degree of suspicion of malnutrition in both in- and out-patients with IBDs. The reported prevalence of protein-calorie malnutrition in IBDs is in the range 20-85% (6, 8, 9). The consequences of protein-calorie undernutrition in patients with IBDs are numerous. Decreased immunocompetency secondary to nutrition state disturbances may be important in controlling disease activity (5, 10, 11). Body mass loss is found in 18% to 62% and hypoalbuminaemia in 25% to 50% of patients with ulcerative colitis (5, 6). There is a lack of consensus as to whether the basal metabolic rate is increased in IBDs, which has been observed by some investigators but not others (6). To what extent undernutrition affects the morbidity and mortality associated with IBDs is not entirely clear. An analysis of
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The literature indicates that malnutrition (undernutrition) is an independent risk factor in many diseases and its treatment may improve the patients' prognosis (5, 6, 8, 10). However, it is frequently ignored since it is considered as a complication of the disease process, with little bearing on the prognosis and little possibility for therapeutic intervention (12). As a consequence, data about nutritional status is missing in many patients' charts. Nutritional assessment entails a combination of history-taking, clinical examination (using anthropometric parameters) and laboratory tests. Many variables are helpful in identifying protein-calorie undernutrition, but no single variable has been predictive of a patient's outcome. However, combining several parameters has been indicated as more predictive (5, 6). According to a prognostic nutrition index for example, patients with a serum albumin of < 35 g/l, recent weight loss of > 10% in addition to any two decreased anthropometric parameters are malnourished. It was instilled into clinical practice as a simple method of determining malnutrition in patients undergoing elective surgery for benign GI diseases (3, 5).

According to the presented results of nutritional state assessment of patients with UC and descriptive statistics of assumed parameters of the nutritional state of patients we can conclude that the most rigorous parameter was loss of body mass in the 6 months before admission. This loss of body mass was found at a level of over 10% of usual body mass in 54% of patients, qualifying them as severely undernourished UC patients. The other parameters indicated only single patients as being severely undernourished. The grouping of moderately or mildly undernourished patients with UC sensitivity revealed the serum albumin level, TLC, hemoglobin level and total protein level. BMI rates were definitely insensitive in detecting undernutrition in UC patients. BMI didn't indicate any form of undernutrition, even in patients in whom two or more other parameters intensively supposed it. Application of the Kruskal-Wallis test analysis was statistically significant, though it weekly expressed differences between all parameters of the nutritional state of patients among patients from subgroups formed on the basis of the length of stay in hospital.

These differences were statistically best expressed when combined with the serum albumin level among different length of stay subgroups. “Box & whisker” plots showed the correlation between normal values of nutritional state parameters of patients with a certain length of stay in hospital, mainly in terms of body mass loss, total lymphocyte count, and hemoglobin and serum albumin levels. In the two-value tables method we found body mass loss, total lymphocyte count and the serum albumin level to be the most discriminating parameters in detecting severely undernourished patients with UC. In the U Mann-Whitney test analysis of deaths in turn, only BMI showed a statistically insignificant difference between cured and dead subgroups. And the final summed two-value tables analysis has limited accuracy of analysis of nutritional state parameters in these subgroups of UC patients because of the great difference in the number of patients in cured and dead subgroups. From the analysis of this group of UC patients we can suggest body mass loss in 6 months before admission, total lymphocyte count and serum albumin level as reference parameters of the nutritional state of patients on admission to surgery. BMI, a widely used index of body mass, has its value ranges, which are not sensitive for undernutrition in UC surgical patients. This is perhaps because of the fact that the range of normal values of BMI are too restricted to the normal population in our country, and because many UC patients are overweight before or at the beginning of the disease.

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