

## TOTAL PARENTERAL NUTRITION IN TREATMENT OF PATIENTS WITH INFLAMMATORY BOWEL DISEASE

**Grivceva Stardelova Kalina,<sup>1</sup> Misevska Petranka,<sup>1</sup> Zdravkovska Milka,<sup>2</sup>  
Trajkov Dimitar,<sup>1</sup> Serafimoski Vladimir<sup>1,3</sup>**

<sup>1</sup> *Gastroenterohepatology Clinic, Medical Faculty, Skopje, R. Macedonia*

<sup>2</sup> *Epidemiology Institute, Medical Faculty, Skopje, R. Macedonia*

<sup>3</sup> *Macedonian Academy of Sciences and Arts, Skopje, R. Macedonia*

**Abstract:** Patients with Inflammatory Bowel Disease (IBD) are exposed to nutritional risk. Malnutrition in Crohn's Disease (CD) and to a somewhat lesser in Ulcerative Colitis (UC) is very frequent. Depending on the severity of the disease, weight loss has been reported in 65% to 76% of those with CD and in 18% to 62% of those with UC.

The role of Total Parenteral Nutrition (TPN) is essential in very severe cases where enteral nutrition is not tolerated or standard drug therapy is not effective. Nutritional therapy is important for the correction of nutritional deficiency, especially in cases where elective surgical treatment is required.

This study examined the effects of preoperative TPN administration in patients with IBD. Since 1990, 29 pts, 13 (44.8%) male and 16 (55.2%) female with severe IBD; 16 (55.2%) with UC and 13 (44.8%) with CD were treated with TPN in our department in the preoperative period. Evaluation of this group was compared with a group which was not treated with TPN preoperatively: 61 pts, 34 (55.7%) male, 27 (44.3%) female; 50 (82%) with CD, 11 (18%) with UC.

Evaluation of this group was compared with the group of patients who were subjected to surgical procedure without prior TPN administration, in total a number of 61, of whom 34 (55.7%) were male and 27 (44.3%) female patients. In this group, the number of patients with CD and UC was 50 (82%) and 11(18%) respectively.

During the course of the study, the following parameters were examined: Body mass index (BMI), Disease Activity Index (CDAI/AI), laboratory parameters and the number of hospital days. The parameters were analysed before the surgical intervention, and one week and six months after the surgical intervention. The duration of the application of TPN was  $12.5 \pm 5$  days.

The analysis of these parameters has shown that there is no statistically significant difference in the number of hospital days in both groups, which was  $18.9 \pm 8.9$  in the intervention group and  $18.9 \pm 6.5$  days in the control group,  $p = 0.9808$ , but analysis of the Disease Activity (CDAI/AI) has shown that patients who were on TPN were in a more severe stage of the disease. In the TPN treated group of patients none, 0 pts (0%), of the pts had no Index of Activity, 1.7 pts (24.1%) had Index 2 and 22 (75.9%) had Index 3. In the other group 3 pts (4.9%) had Index 1; 39 pts (63.9%) had Index 2 and 19 pts (31.2%) had Index of Activity 3. During the monitoring period of six months the activity of the disease was lower in patients treated with TPN.

The BMI in the group of patients treated with TPN was lower in both sexes. It was lower than 18.4 in 7 males and 5 females; between 18.4 and 19.9 in 2 males and 4 females; between 19.9 and 25 in 3 males and 6 females; between 25 and 29.9 in 1 male and 1 female; there were no pts with BMI higher than 29.9. In the control non-TPN group, 5 males and 3 females had BMI  $\leq 18.4$ ; 2 males and 5 females had between 18.4 and 19.9; 23 males and 13 females had between 19.9 and 25; 3 males and 5 females had between 25 and 29.9 and 1 male and 1 female had BMI higher than 29.9. The BMI had an increasing trend in the postoperative period in both groups.

The laboratory parameters that we examined were: number of erythrocytes and sedimentation, number of leukocytes, haemoglobin levels, total number of lymphocytes, albumin level, C-reactive protein, orosomucoid, electrolytes; sodium, potassium, calcium and serum iron, the enzymes (AP, AST and ALT); level of bilirubin and urea and creatinine.

The results were analysed using the Tukey honest significant difference test (HSD), ANOVA and Student t-test. Statistically significant differences were observed between preoperative and postoperative period in both groups. The intergroup comparison showed significant differences in the level of albumin, AST, ALT and bilirubin.

**Key words:** Inflammatory Bowel Disease (IBD), Ulcerative colitis, Crohn's disease, Total Parenteral Nutrition, preoperative treatment.

### *Introduction*

Inflammatory Bowel Disease (IBD) is a general term for describing all diseases of the small intestine and colon associated with inflammation, regardless of etiology, pathogenesis, duration or clinical manifestation. Their main characteristic is inflammation of the intestinal wall and mucosal ulceration. Typically, the inflammatory infiltration involves the whole wall (transmural) and mycosis only in the case of Crohns Disease (CD) and Ulcerative Colitis (UC). In cases of active ulcerative colitis (UC) infiltration is mainly composed of polymorph nuclear neutrophiles that attack crypt (crypt abscesses), while in the case of CD the transmural infiltration, besides the presence of neutrophiles, is mainly composed of T and B lymphocytes, macrophages and plasma cells [48, 92, 95, 114].

It is generally accepted that patients suffer from either UC or CD, but not from the two forms of IBD at the same time.

IBD are diseases caused by more than one etiological mechanism.

Despite numerous attempts to identify a single causation for the occurrence of IBD, these attempts have been unsuccessful. Many theories have suggested bacterial, virus, neurogenic, nutritive or psychogenetic causations but, in general, every attempt to prove their significance has failed. Overall, it is considered that there are some common etiological components of both UC and CD such as genetic, exogenous factors, and primarily immunological disorders.

The duration of the disease, regardless of whether it is UC or CD, is due to the metabolic disturbances caused by the GIT inflammation, as well as the organ and tissue immunological response.

The treatment of IBD can be conservative or surgical, but in a large percentage of patients, especially with CD, these approaches cannot be separated [4, 10, 14, 43].

The aims of conservative treatment of IBD are: to achieve remission of the disease (corticosteroids and element-rich diet, polymeric formulas, TPN) and to maintain the remission state.

However, in severe IBD, when the disease is a medical emergency, hospitalization and intensive intravenous treatment are necessary. In cases where, despite intensive treatment, there is no improvement of the condition within 24 to 72 hours, or even worsening is detected, a surgical approach is necessary [6, 9, 40].

Enteral nutrition in the treatment of UC patients is empirical.

Total Parenteral Nutrition (TPN) has not been proven as a primary therapy for the disease, but its role has been established as routine in the treatment of patients where, due to the severity of the disease and the expected, planned and necessary surgical therapy it involves starvation of the patient for more than 7 days [17, 25, 29, 109].

Parenteral nutrition is the introduction of nutrition into the body by an intravenous route, for the replacement of the required energy and essential nutrients based on the needs and condition of the patient. This is required in cases when the patient is not able or does not want to consume any food through his/her digestive system, when the food quantity is insufficient or it is not adequately utilized/ absorbed.

The aims of parenteral nutrition are the prevention or correction of nutritional deficiencies and the malnutrition syndrome in conditions of the inadequate functioning of the digestive system [17, 25, 76].

The daily intake of energy and nutrients is necessary to provide the patient with optimal nutrition, as well as to offer him/her the best resistance to-

wards diseases (infections, burns, trauma, and surgical procedures). If the normal oral food intake is difficult or impaired, the essential nutrients should be introduced either through a feeding tube, or in cases when this too is impossible, by means of intravenous feeding. In order to apply it two principles have to be satisfied:

1. The Parenteral solutions, in content and size, should be identical to the particles of the nutritive substances that are absorbed by a natural pathway from the intestines into the blood flow.

2. The infusion should be injected slowly, in order to imitate the natural time-flow of absorption of the nutrients into the general blood stream.

TPN is indicated in all cases where the adequate intake of food through the digestive system is impossible (either by an oral or enteral pathway), when it is necessary to give Parenteral nutrition.

In its content structure, TPN should provide adequate replacement of energy (needed by the organism to cover the basic metabolism energy needs as well as for physical activities), specific dynamic activity, and other constitutive and protective nutrients.

The complete parenteral nutrition should contain water, amino acids, glucose and fats as well as six main electrolytes, nine minerals and 13 vitamins.

#### *Aims*

In the last decade, discoveries about the immunological reactions in inflammatory intestinal diseases have contributed to a better understanding of the pathogenesis of both Crohn's Disease and Ulcerative Colitis, thus anticipating new treatment modalities. The digestion disorders in patients with IBD are so common that they have already been described as part of its clinical manifestation, whereas UC patients have fewer difficulties and are rarely severely undernourished, while in children the most significant effects are on growth, as compared with CD patients. The deficiency of certain minerals, vitamins and trace elements is equally observed in both entities. The role of nutrition is to correct the undernourishment, to cure the specific nutritional deficiencies, and in children to provide for normal growth and development, as well as hormonal maturation. In Crohn's Disease, certain types of nutrition can be used as the main therapeutic approach, i.e. can induce remission as the sole treatment, without additional medicament therapy.

All nutritive deficiencies are more present in patients with an inflammation of the small intestine and over a greater length, due to which, at the time of diagnosis, undernutrition is observed in  $\frac{3}{4}$  of children with CD and  $\frac{1}{3}$  with

UC, while in adults the loss of body mass ranges from 65-75% in CD and in 18-60% in UC patients [91].

Since the share of malnutrition is considerable in the increased morbidity and mortality of the hospitalized patients, TPN has a significant role in the treatment of the IBD patients as a standard treatment, especially in the active phase of the disease. Enteral nutrition, in which the natural method of food intake has been partially preserved, shows fewer complications than TPN application. Enteral application is equally effective in the improvement of the nutritional status and in the diminution of the activity of the disease. With the introduction of such a type of nutrition, Parenteral nutrition remains as the last resort for severe cases where enteral nutrition is not tolerated or where the standard medicament given as treatment does not produce adequate results. Thus its role is clear and of great significance in the preoperative treatment of IBD patients, through which post-operative complications are reduced [98, 3, 9, 17].

The motivation of this paper is further justified by the young age of the IBD patients, their seriously degraded quality of life, the direct endangerment of life due to numerous and very severe complications, and the possibility of taking an active approach to the disease. The above-mentioned suggests the need for a controlled study of the IBS problem associated with nutrition.

The complex and still unknown etiology of IBD, as well as the impossibility of forming a rigid doctrine regarding the treatment, especially in the case of the need for surgical intervention, about the length of preoperative preparation with TPN, is a remarkable and strong challenge for doing this research.

The available data for the use of TPN in IBD, especially in patients prepared for surgical procedure, shows an average length of between 5 and 28 days. It has been determined that malnourished patients (who despite the initial changes during the first week of application of TPN manifested loss of body weight and increased plasma albumin levels) have significantly reduced post-operative complications. The existing experience shows that in patients who did not show such reactions, the average duration of TPN until recovery is longer, 3-4 weeks.

The study represents an attempt to combine treatment in patients where, according to our experience, surgical treatment with TPN is necessary in order to contribute to a better understanding and eventual clarification of a part of this problem, as well as to trace possible directions for an up-to-date and rational treatment of IBD patients.

In the course of the work, the following objectives have been set:

1. To determine the therapeutic efficiency of preoperative intervention with TPN in IBD patients.
2. To determine the optimal duration of TPN in preoperative preparation of IBD patients.

3. To establish a protocol for TPN in complicated cases of IBD as a standard preoperative treatment.

### *Patients and Methods*

This is a retrospective-prospective study in which all IBD patients undergoing surgical treatment in the period from 1992 to 2003 have been examined.

The study included all surgically treated patients with confirmed IBD, based on clinical, biochemical, morphological, laboratory and pathological findings.

The grouping of the patients was made based on following criteria:

1. Patients who had been surgically treated without preoperative application of TPN were placed in the group of patients treated with the standard surgical protocol, i.e. the established therapeutic approach
2. Patients on whom TPN had been used in the preoperative period, as a preparation for the surgical procedure

For an objective assessment of the severity of the disease, the following elements were used: sex and age; body-mass index – BMI (ratio of body height in metres and body weight in kilograms); index of the severity of disease (CDAI in CD), i.e. index of activity of the disease in UC, based on clinical signs and symptoms, objective findings and subjective feelings of the patient, with which a numerical value is obtained, giving the level of activity of the disease.

CDAI is calculated according to one formula (Best WR *et al.*, 1979 [67]), and the index of the activity of the disease in UC according to another (Seo M, Okada M. *et al.*) (102–105).

The haematological status in IBD is usually characterized by increased sedimentation of the red blood cells, even though the normal values are not always associated with stable remission of the disease. The haemoglobin levels are usually reduced in the more severe cases (due to hidden bleeding, chronic iron deficiency, vitamin B 12 deficiency as result of the impaired absorption in the terminal ileum). The level of thrombocytes is increased in the acute episodes of inflammatory bowel disease, as is the number of leukocytes.

The total number of lymphocytes – important for the assessment of the immunological status – is gained by calculation using a formula.

Serum albumin (if the hepatic diseases are excluded, gives same data as visceral proteins with shorter half-life, and it is simpler to determine); normal values 35 g/l.

Serum transferrin (plays a role in the iron metabolism and can be calculated from the total binding capacity – TIBC), according to a formula.

C-reactive protein (CRP) and orosomucoid (alpha 1 acid glycoprotein) are two of the more sensitive proteins in the acute phase of the disease. In patients with repetitive acute inflammation, the local cell process and inflammatory cascade lead to a rapid increase in their values, which are then rapidly returned to normal values once the inflammation has been contained. The levels are higher in Crohn's Disease than in Ulcerative Colitis, but sometimes normal values have been determined even in patients with a clear clinical diagnosis of the disease.

There is a correlation with the degree of inflammation, enteral loss of proteins and the levels of albumins.

Electrolyte status: Na, K, Ca are important in the regulation of osmotic pressure, acid-basic balance, neuromuscular transmission, coagulation.

Enzyme status (AP, AST, and ALT) and bilirubin serve as indicators of the functioning of the gall bladder and liver.

Degradation products: urea, creatinine in the serum and 24-hour urine for determination of the creatinine index, according to the previously mentioned formula, which indicate a disorder in the somatoprotein status.

The study excluded patients who could not be appropriately monitored during the predetermined check-ups (for control of the selected parameters), as well as patients who had terminated in the course of less than six months after the surgical intervention (two patients in each group).

The assessment of the condition and determination of the nutritive needs of all patients were carried out at the Gastroenterohepatology Clinic.

The therapy was applied through a central venous catheter (CVC), inserted into the *v. subclavia* and *v. jugularis externa* by an anaesthetist in the Anaesthesiology, Reanimation and Intensive Care Clinic (KARIL).

The infusion therapy was administered at the Gastroenterohepatology Clinic, in some patients the infusion was administered using the gravity infusion method, while in others an infusomat was used.

BMI-Body Mass Index was determined with the following formula:  $BMI = BW/BH^2$ .

The body weight of patients (in kilograms) and the body height (in metres) were measured at the Gastroenterohepatology Clinic.

The activity of illness indices, both for UC (AI) and CD (CAI) was determined, using formulas, at the Gastroenterohepatology Clinic.

In all criteria for the assessment of the therapeutic efficiency, the algorithm with the following parameters was used:

1. Biochemical parameters,
2. CAI/AI,
3. BMI, and its change.

The starting point for measurements in patients who had only undergone the surgical procedure was the period immediately preceding surgery. The group of patients that had been peroperatively treated with TPN had their measurements taken in the period prior to the administration of TPN. In both groups, the control date was the seventh day after surgery, which is the earliest possible time. Further control measurements were taken six months after the initial measurement.

*Statistical analysis:* All values obtained were analysed using the following statistical methods: according to the statistical series according to the defined variables and their tabular and graphic representation; analysis of the structure of the statistical series using the central tendency and dispersion measures (average and standard deviation); determination of ratio coefficients, proportions and rates, testing of the statistical significance of the differences between three and more arithmetical means with ANOVA (variance analysis) and the Tukey Honest Significant Difference test (testing the significance of the differences between two arithmetical means and between two proportions with Student t-test).

The data were processed using commercially available statistical software (SAS, SPS, Statistical).

### *Results*

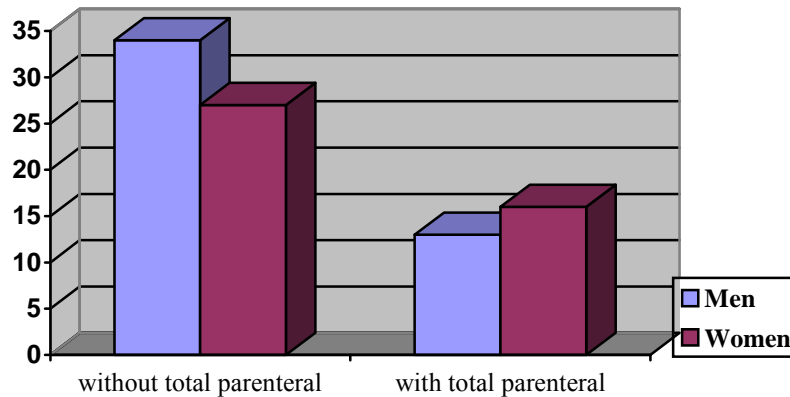
In the course of examination, a total number of 90 patients with CD and UC were examined. In 29 of the patients TPN was administrated preoperatively, while 61 were submitted to surgical procedure without TPN administration. The distribution of the examined patients by sex is given in Graph.1.

The average age of the patients undergoing surgery without TPN (N = 61) was  $40.1 \pm 11.13$  years (min. 18, max. 66). Male patients in this group were of average age  $39.3 \pm 11.3$  years (min. 18, max. 66) and female patients  $41.1 \pm 10.9$  years (min. 23, max. 61)

The average age of the patients in the group that was administered TPN prior to the surgical procedure (N = 29) was  $32.9 \pm 8.7$  years (min. 17, max. 62). Male patients in this group were of average age  $34.8 \pm 9.5$  years (min. 25, max. 62) and female patients  $31.3 \pm 7.9$  years (min. 17, max. 42).

Analysis using the Student t-test showed that the difference in the average age values is statistically significant for  $p = 0.0028$ . Thus, the examined patients with TPN were statistically younger than those without TPN.

The average hospital stay of the patients without TPN was  $18.9 \pm 6.5$  days (min. 6, max. 60) and of those with TPN was  $18.9 \pm 8.9$  days (min. 6, max. 41). With regard to hospitalization, there is no statistically significant difference,  $p = 0.9808$ .



*Graph. 1 – Distribution of examined patients by sex  
Графикон 1 – Дистрибуција испред њол*

The average duration of TPN in the examined patients was  $19.1 \pm 18.5$  days.

The presence of UC was statistically significantly higher in patients with TPN,  $p = 0.0086$ .

The CD was statistically significantly higher in patients without TPN,  $p = 0.0041$ .

The analysis of severity of the disease was made through the disease activity indices, CDAI in CD and AI in UC.

In the first measurement, according to CDAI/AI, first degree disease activity was determined in only 4.9 % patients without TPN. Second degree was determined in 63.9% pts without TPN, and in only 24.1 % of pts with TPN. The difference is statistically significant,  $p = 0.0007$ . Third degree disease activity was determined in 31.2% of the pts without TPN and in 75.9% of the pts with TPN, where the difference is statistically significant,  $p = 0.0001$ . Based on this, we can conclude that the patients submitted to TPN were in a significantly more severe condition, according to CDAI/AI.

In the second measurement/assessment of the severity of the disease, no statistically significant differences were observed between patients in the two groups ( $p > 0.05$ ), which means that the recovery of the patients with TPN takes place much faster.

In the third measurement, in relative (percentage) terms, the condition of the patients subjected to TPN was better. According to Student t-test of proportions, there was no statistically significant difference ( $p > 0.05$ ) most probably due to the size of the sample.

Table 1 – Табела 1

*Distribution of the examined groups by BMI*  
*Дисјурibuција сјоред BMI*

BMI	Without TPN			With TPN		
	I	II	III	I	II	III
BMI < 18.4	8 (13.1%)	11 (18%)	8 (13.1%)	12 (41.4%)	12 (41.4%)	2 (6.9%)
18.4 < BMI < 19.9	7 (11.5%)	7 (11.5%)	7 (11.5%)	6 (20.7%)	7 (24.1%)	7 (24.1%)
19.9 < BMI < 25	36 (59%)	39 (63.9%)	31 (50.8%)	9 (31%)	8 (27.6%)	14 (48.3%)
25 < BMI < 29.9	8 (13.1%)	3 (4.9%)	13 (21.3%)	2 (6.9%)	2 (6.9%)	4 (13.8%)
BMI > 29.9	2 (3.3%)	1 (1.6%)	2 (3.3%)	0 (0%)	0 (0%)	2 (6.9%)
Total	61 (100%)	61 (100%)	61 (100%)	29 (100%)	29 (100%)	29 (100%)

In the group of patients with TPN, the number of undernourished patients is higher; in the first measurement, 41.4% of the patients had a BMI lower than 18.4, as opposed to 13.1% in the group of patients without TPN; the percentage of undernourished male patients (with BMI lower than 18.4) was higher, with 53.8% in the group with TPN, as opposed to 31.25% in the group without TPN. When comparing the consecutive measurement (one week after and six months after surgical procedure), an improvement of BMI was observed in all classified subgroups in both groups, but its increase was higher in the group of patients who had been administered TPN.

Table 2 – Табела 2

*Overview of p-value of difference in average values of examined laboratory parameters between groups*

*Приказ на p-вредносѝа на разликајѝа на ѝросечниѝе вредносѝи на исѝиѝуваниѝе лабораторијориски ѝпараметѝри ѝомеѝу двеѝе ѝруѝи*

Parameters	Without TPN preoperative	With TPN preoperative	T-test p
Sedimentation	33.75	32.4	0.8232
Erythrocytes	4.18	3.9	0.0786
Haemoglobin	119.15	120.6	0.7591
Leukocytes	8.80	8.4	0.7685

Parameters	Without TPN preoperative	With TPN preoperative	T-test p
Tot. lymphocytes	1.61	1.5	0.2563
Albumin	36.14	31.9	0.0088*
CRP	15.36	25.7	0.1171
Orozomukoid	1.65	1.98	0.2423
Na	139.64	137.8	0.2816
K	4.24	4.2	0.7308
Ca	2.16	2.1	0.3661
Fe	8.76	8.8	0.9717
AP	84.76	80.2	0.6570
AST	25.55	36.4	0.0204*
ALT	24.37	38.9	0.0341*
Bilirubin	11.08	14.7	0.0348*
Urea	4.68	5.3	0.1161
Creatinine	72.8	74.9	0.5758

The Student t-test showed that, between the two examined groups, statistically significant differences exist in the values of the following parameters: albumin, AST, ALT and bilirubin. With respect to other laboratory parameters, the differences are not considered significant, since they can be ascribed to unintentionality in our samples ( $p > 0.05$ ).

### *Discussion*

Since the first applications of parenteral nutrition there have been many problems, especially regarding the numerous complications that may be caused. There have been repeated attempts to determine the therapeutic effect and benefit from resting the intestines in CD. Meta analysis of 16 prospective randomized studies has shown that the frequency of clinical remission after treatment with steroids was 80%, compared to 60% after treatment with elementary and polymeric formulas alone. Also, it cannot be said that the resting of the intestines in UC indicates a clinical remission of the disease and avoids colectomy. With the development of enteral nutrition, scientists have faced the problem of which of these two is the better approach. In time, immunonutrition, growth factors and pharmaconutrients have become a point of interest to the scientists, while the place of parenteral and enteral nutrition in the treatment of these diseases is already clearly established. But despite this there are frequent discussions regarding the benefits and drawbacks of TPN, especially in patients with IBD. For example, Rombeau, in his study of 1991 [96], concludes that, despite the proven advantages, the use of TPN in the preoperative period in patients

with IBD is becoming more restricted, especially in the case of patients with UC. Due to the apparent enterotrophic effect, reduced costs and benefit compared to that of TPN, the use of preoperative enteral nutrition has been increased. The authors emphasize the importance of the use of glutamine and short-chain fats as part of the enteral nutrition and their positive effect on the small intestine and the colon.

Marik and Pinski in their study carried out in 2003 [87] look at all the negative aspects of TPN, concluding that TPN fulfills all possible criteria for being a poison, explaining this by the numerous possible complications after TPN administration.

But Drum W., in his 2003 analysis [32] of the article "Death by parenteral nutrition" by Marek and Pinski [87], argumentedly concludes that the administration of TPN requires more knowledge and education, and that it should be accepted that TPN and EN are not competitive types of supplement of the nutrition, but rather are complementary to each other.

Reminding us of Paracelsus' famous saying that "all things are poison and nothing is without poison, only the dose permits something not to be poisonous", he explains that the water solution of sodium chloride can cause serious and lethal complications if it is not adequately administered, which also applies to all other Parenteral formulas, and that the role of TPN is clearly very important in the conditions where it represents the only possible supplemental nutrition.

Jeejebhoy in 2001 [55] also analysed whether TPN is curative or poisonous, concluding that besides the changed concept of the role of TPN in the past 40 years, TPN does not cause atrophy of the mucosa or increased bacterial translocation; it does not increase the possibility of the occurrence of sepsis, the complications of the increased caloric intake are not significant, while, on the other hand, it is equally effective as EN. TPN still has a primary role in the treatment of conditions where EN is not tolerated or in cases where there is a severe impairment of the gastrointestinal tract, when its application is lifesaving.

The pragmatic study by Woodcook *et al.* 2001 [133], that analyses the nutritive and psychological status, the methods of feeding, the adequacy of nutritional intake, condition of the gastrointestinal function, sepsis-caused morbidity and mortality from other causes, came to the same conclusions: the two modalities of nutritional supplementation are not mutually exclusive. Their recommendations regarding the use of TPN as opposed to EN are the same as Jeejebhoy [61] and many other authors, as well as recommendations of the associations for enteral and Parenteral nutrition (ESPEN, ASPEN, BAPEN) [3, 9].

The study by Eisenberg *et al.* conducted in 1993 [34] is quite different, since it deals with the problem of treatment costs of the patients, and whether and how TPN can be reduced. This economic analysis is very interesting, especially with the general trend towards reduction of the cost of hospital treatment.

Taking into consideration the costs of the laboratory examination necessary for the application of TPN, the costs of solutions, catheters, the complications and the cost of the nursing care for the patient, the authors suggest that despite certain disadvantages that may have an influence on the interpretation of the results, TPN increases the cost of hospital treatment; the authors also quote other authors' results showing that the reduction of postoperative complications and the complications of the treated diseases as a result of application of TPN are lifesaving. Their conclusion is that enteral and Parenteral nutrition are essential in cases where the indication for their application is well established.

Phinney *et al.* in their study of 1996 [89] analysed TPN in clinical medicine, paying attention to the cost of TPN. Their conclusions are that, despite the high cost of TPN, certain aspects should be taken into consideration, such as in the case of the short bowel syndrome, where TPN extends the life of the patient by a day for every day of administration of TPN; in such cases, the annual cost of TPN administration is comparable with the annual cost of dialysis and erythropoietin treatment. In cases where the outcome of surgical procedure can be variable, such as in CD, including obstructions or enterocutaneous fistula, the application of TPN for avoiding surgical intervention is cost-effective, especially if it is administrated at a patient's home.

Even though it is very difficult to demonstrate the advantages of TPN in the preoperative period in real terms, it is considered that the major practical benefit of the preoperative treatment of IBD patients is enormous in the sample analysed. Taking into consideration three important parameters: the level of disease activity, the number of days of hospital care, and BMI, it is obvious that TPN was applied to patients at a more severe stadium of the disease, with a lower BMI, who spent an equal time in hospital as the patients with a less severe stage of the disease and a higher BMI; it can be concluded that the application of TPN in the preoperative period had a positive effect of the number of days of hospital care, and despite the high cost of the hospitalization for the purposes of TPN administration, still the overall costs for hospitalized care of these patients were reduced, further emphasizing the role of the expensive TPN in the preoperative period of IBD patients.

### *Conclusions*

The conclusions of this study are not different from the conclusions obtained from many other studies: in general, it is very difficult to demonstrate the benefit of preoperative TPN, based on the results of the surgical intervention of undernourished patients. Undernourished patients who are awaiting surgical operation have a greater risk of postoperative mortality and morbidity than well-nourished patients.

It is our estimation that the duration of the effective parenteral route should be at least 7 to 14 days. The importance of the nutritive treatment is considerable in the correction of the nutrition deficit, especially as a part of the elective surgery. At this time, the need for a cost-benefit analysis of TPN in IBD treatment is becoming more important. Despite the many advantages of enteral nutrition, the role of TPN in the preoperative period in patients with IBD is still a very important one.

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## Резиме

**ТОТАЛНА ПАРЕНТЕРАЛНА ИСХРАНА ВО ТРЕТМАН  
НА ПАЦИЕНТИ СО ИНФЛАМАТОРНИ ЦРЕВНИ ЗАБОЛУВАЊА**

**Гривчева Старделова Калина,<sup>1</sup> Мишевска Петранка,<sup>1</sup> Здравковска Милка,<sup>2</sup>  
Трајков Димитар,<sup>1</sup> Серафимоски Владимир<sup>1,3</sup>**

<sup>1</sup>*Клиника за гастроентерохејатологија, Медицински факултет,  
Скопје, Р. Македонија*

<sup>2</sup>*Институт за епидемиологија, Медицински факултет,  
Скопје, Р. Македонија*

<sup>3</sup>*Македонска академија на науките и уметностите, Скопје, Р. Македонија*

Пациентите со ИБД се изложени на нутритивен ризик. Малнутрицијата кај Кроновата болест (ЦД) и улцерозниот колитис (УЦ) е честа. Во зависност од тежината на болеста, губиток во тежина е рефериран во 65 до 78% кај ЦД и од 18 до 62% кај пациенти со УЦ.

Улогата на ТПИ е значајна кај тешките случаи каде што ентелалната исхрана не се толерира или стандардната медикаментозна терапија потфрла. Нутритивната терапија е важна во корекција на нутритивниот дефицит, особено кога е потребен елективен хируршки третман.

Во студијата ги проучивме ефектите на преоперативната ТПИ кај пациенти со ИБД. Од 1990 година на нашиот оддел беа третирани 29 пациенти, од кои 13 мажи (44,8%) и 16 (55,2%) жени со ТПИ предоперативно. Од нив 16 (55,2%) беа со ЦД, а 13 (44,8%) со УЦ. Евалуацијата на оваа група беше споредена со група на оперирани пациенти со ТПИ кај кои не е аплицирана ТПИ во предоперативниот период, вкупно 61 ПТС, од кои 34 (55,7%) беа мажи, а 27 (44,3%) жени. Заболени со ЦД беа 50 (82%), а со УЦ 11 (18%).

Во текот на следењето на пациентите беа анализирани следниве параметри: Body Mass Index (BMI), Disease Activity Index (CDAI/AI) – индекс на активноста на болеста, лабораториски параметри како и бројот на хоспиталните денови. Параметрите беа анализирани пред операцијата, една недела и шест месеци по операцијата. Траењето на ТПИ изнесуваше  $12,5 \pm 5$  дена.

Анализата на параметрите покажа дека нема статистичка разлика помеѓу бројот на хоспиталните денови во двете групи, кој изнесуваше  $18,9 \pm 8,9$  дена за првата и  $18,9 \pm 6,5$  дена за втората група,  $p = 0,9808$ , но со анализата на индексот на активноста на болеста (CDAI/AI) се покажа дека пациентите кои беа третирани со ТПИ преоперативно биле со потешка форма на заболување. Во групата со ТПИ ниту еден (0%) од пациентите немаше индекс на активноста 1; 7 пациенти (24,1%) беа со индекс 2, а 22 (75,9%) имаа индекс на активност 3, додека кај другата група 3 пациенти (4,9%) беа со индекс 1; 39 (63,9%) со индекс 2 и 19 (31,2%) со индекс на активност 3. Во

текот на следењето од шест месеци индексот на активност на болеста беше помал кај пациентите со ТПИ.

БМИ во групата со ТПИ беше понизок кај двата пола. Поголем индексот на активност од 18,4 беше кај 7 мажи и 5 жени, помеѓу 18,4 и 19,9 беше кај двајца мажи и 4 жени, помеѓу 19,9 и 25 беше кај 3 мажи и 6 жени, помеѓу 25 и 29,9 беше кај еден маж и една жена, немаше пациенти со БМИ поголем од 29,9. Во групата без ТПИ 5 мажи и 3 жени беа со БМИ помал од 18,4; помеѓу 18,4 и 19,9 имаше двајца мажи и 5 жени; помеѓу 19,9 и 25 имаше 23 мажи и 13 жени, помеѓу 25 и 29,9 беа 3 мажи и 5 жени, а индекс поголем од 29,9 имаа еден маж и една жена предоперативно. Во постоперативниот период нивото на БМИ беше во пораст во двете групи.

Лабораториските иследувања кои ги следевме беа: бројот на еритроцитите, седиментацијата, бројот на леукоцитите, висина на хемоглобинот, тотален број на лимфоцити, ниво на серумски албумин, ц-реактивниот протеин, орозомикоид, електролитите: натриум, калиум, калциум, серумско железо, ензимите: алкална фосфатаза, АСТ, АЛТ, нивото на вкупниот билирубин и вредности на уреа и креатинин.

Резултатите беа анализирани со Tukey honest significant difference test (HSD), ANOVA, Student t-test. Статистички разлики се покажаа во двете групи во предоперативниот и постоперативниот период. Споредбата на групите покажа сигнификантни разлики кај нивото на серумскиот албумин, АСТ, АЛТ и билирубинот.

**Клучни зборови:** воспалителни цревни заболувања, улцерозен колитис, Кронова болест, тотална парентерална исхрана, предоперативен третман.

**Corresponding Author:**

**Kalina Grivceva Stardelova**  
**Gastroenterohepatology Clinic,**  
**School of Medicine,**  
**Ss Cyril and Methodius Univ.**  
**Vodnjanska 17,**  
**1000 Skopje, Republic of Macedonia**  
**mobile: + 389 70 335 307**

**E-mail: [kstardelova@yahoo.com](mailto:kstardelova@yahoo.com)**