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# Analysis of Colon Cancer Features in Croatia

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## ABSTRACT

*Qualitative and quantitative parameters were evaluated in 186 colorectal cancer patients. Quality of life was evaluated in subgroup of 84 patients. Correlation between Dukes stage of disease and qualitative (gender, blood type, marital status, region of Croatia from where patients were coming) and quantitative biological parameters (age, body mass index) was analysed. There was no statistically significant difference considering distribution of the patients disease stage and gender, blood type, marital status, region of Croatia from where patients were coming and body mass index ( $p > 0.05$ ). Patients with Dukes D stage of colorectal cancer were statistically significantly younger in comparison to other stages ( $p < 0.05$ ). Quality of life was the best before surgery, significantly deteriorated immediately after and partially improved three months after the surgery without significant differences between investigated groups with different colorectal cancer stage and type of surgery.*

**Key words:** colon cancer, Croatia, qualitative parameter, quantitative parameter

## Introduction

Colon cancer represents an immense public health problem in Croatia as well as worldwide specially in developed western countries. Modern studies are conducted in order to recognize biological and demographic parameters characterizing people at high risk for colon cancer development. Colon cancer is one of the most common malignancies with troublesome pattern of increasing incidence. In 2004 in Croatia there were 1,800 newly diagnosed colon cancer cases, what represents 65,4 newly diagnosed cases on 100,000 inhabitants per year<sup>1</sup> and the average overall 5-year survival from colon cancer was 50%<sup>2</sup>.

Modern knowledges, besides genetic predisposition, point out biological parameters like age, gender, marital status, blood type and life style as well, specially diet to have possible role in colon cancer development. Diet containing high portion of fat with small content of fibres is more likely to contribute to colon cancer development as well as digestion products arising from some bowel bacteria enzyme activities. Low selen and calcium content in food, and heterocyclic amines are recognized as possible risk factors in colon cancer development<sup>3-8</sup>. Further-

more, some studies have shown that patients who have partners are more likely to have disease diagnosed at early stages<sup>9</sup>, whereas singles, patients without partner have significantly poorer and shorter survival then patients having partner<sup>10</sup>. One epidemiological study have shown that men without partner are more endangered then women with the same status<sup>11</sup>. Reviewing literature no connection was found between blood type distribution and colon cancer; although some studies have shown distinct influence of Rh status. Rh positive patients are more likely to have disease diagnosed at advanced stages then Rh negative patients<sup>12,13</sup>. Colon cancer patients are evenly distributed according to the gender, men and women (1,05:1) are evenly affected. Pounce of colon cancer incidence can be noted in patients older then 60 years old. This type of malignancy is most often diagnosed in patients between 60 and 65 years old<sup>14,15</sup>. Risk factors of colon cancer development are also adenomatous polyps, positive colon cancer family history<sup>16</sup>, inflammatory bowel disease, specially ulcerative colitis, diabetes mellitus, primary malignancy of other sites and different immune system disorders<sup>14,15</sup>.

Only 30–40% of colon cancer patients have bounded disease at the time of diagnosis. Surgery is the main treatment modality. Prognosis depends on stage (extent) of disease at the time of diagnosis. Experts highlight that early diagnosis would increase overall 5-year survival rate from less than 50% (as it is today) to more than 95%<sup>14,15</sup>.

The aim of our study was to correlate qualitative and quantitative biological features of the colon cancer patients and disease stage at the time of diagnosis. Investigated qualitative biological parameters comprised by this study were: gender, marital status, blood type, region of Croatia from where patients were coming (central, mountain area, Slavonia and Adriatic coast). The investigated quantitative biological factors were age and body mass index.

The aim of the study was:

- to correlate stage of disease at the time of diagnosis according to modified Dukes classification and qualitative biological parameters
- to correlate stage of disease at the time of diagnosis according to modified Dukes classification and quantitative biological parameters.

According to positive correlations established by this study between qualitative and quantitative biological parameters and disease stage according to modified Dukes classification, the high risk groups of people in general population in Croatia could be identified and closely followed in order to recognize disease in earlier disease stages.

Traditionally effectiveness of therapy and surgical treatment of malignant tumors was estimated by short- and long- term survival rates, recurrence rate and disease free survival. As global tendency is to transform malignant disease into chronic disease, quality of life became one of the most important segment when treating cancer patients. So the quality of life became one of the most important biological parameter in this group of patients<sup>17</sup>.

It is very well known that formation of colostomy negatively affects quality of life. Discomfort is consequence of stool incontinence, colon content discharge, unpleasant odours what limitates return to full activities: working, traveling and finally sexual functioning<sup>18</sup>.

Quality of life nowadays became one of the most important aspect when considering different surgical treatment modalities. Although more and more sphincter preserving techniques are growing share, more and more patient end up with permanent colostomy. Sphincter saving procedures consider formation of extremely low anastomoses which are often associated with autonomic nervous system destruction what leads to fecal incontinence and deterioration of sexual functioning<sup>19</sup>. Colostomy can be temporary or permanent solution. Both of this treatment modalities disturb body image of the patients with colon cancer<sup>20</sup>.

Quality of life assessment comprises multidimensional complex of physical, psychological, social, cognitive

and every day functioning of the individuals. In abdominal surgery quality of life depends on extent of disease, comorbidity, type of surgery, age and gender of the patients. There are few types of quality of life questionnaires: standardized – health generalized (Short Form – SF 12), disease or special condition specific (Fecal Incontinence Quality of Life Scale) and authors' ad hoc type of questionnaires<sup>21,22</sup>.

Thus the other aspect of the conducted study was to evaluate influence of surgery with or without colostomy formation to the quality of life of patients with the same diagnosis and disease stage.

The aim of the study was also:

- to estimate quality of life of the patients with different colon cancer stage at the time of diagnosis according to the modified Dukes classification for the period six month prior to diagnosis, at the time of discharge from hospital after the surgery with or without formation of colostomy and three months after the undertaken surgery
- to estimate quality of life of the patients treated with different surgical treatment modalities with or without formation of colostomy for the period six month prior to diagnosis, at the time of discharge from hospital after the surgery with or without formation of colostomy and three month after the undertaken surgery

The above mentioned would enable choosing most appropriate type of surgery for the patients with clearly defined disease in order to preserve adequate quality of life of these patients.

## Patients and Methods

Prospective study was conducted and the patients treated in UHC Zagreb, from January, 2004 to March, 2006 were enrolled. The overall number of the patients enrolled in this study was 186 colon cancer patients. Patients were stratified according to disease stage at the time of diagnosis considering clinical and pathohistological data about disease extent. Stage of colon cancer was defined by modified Dukes classification (Dukes A, B, C and D). Patients with Dukes A colon cancer had disease localized to colon mucosa. Patients with Dukes B colon cancer had tumor extended through the colon wall penetrating mucosal basal membrane, with or without penetration of the colon serosa. Patients with Dukes C colon cancer had metastatic regional lymph node involvement not considering tumor extent in the colon wall. Patients with Dukes D colon cancer had clinically proven existence of distant metastases not considering pathohistological extent of primary tumor or regional lymph node involvement.

The study comprehended 45 patients with Dukes A colon cancer, 50 patients with Dukes B, 46 patients with Dukes C and 45 patients with Dukes D. Qualitative biological features of the patients including gender, marital status (married, widowed, single (never married), divorced), blood type, Croatian region from where patients

were coming which would reflect different type of diet, were correlated to the stage of disease at the time of diagnosis according to the modified Dukes classification. Patients coming from Adriatic Coast region are traditionally considered to have healthy Mediterranean diet, and patients coming from Slavonia (rural part of Croatia) were thought to have unhealthy diet with high content of fat and low content of fibres. Patients from Central Croatia and Croatian mountain region are thought to have intermediate type of diet, although diet of patients from Central Croatia is more alike Slavonian type of diet. Also an analysis of quantitative biological features including age and body mass index of the patients with different disease stage was done. Body mass index (BMI) is a popular tool for estimating optimal body mass for an individual. BMI can be easily calculated and is based on ratio of body mass and body height.

$$\text{BMI (kg/m}^2\text{)} = \text{body mass (kg)} / \text{body height}^2 \text{ (m}^2\text{)}.$$

Patients were, when considering BMI divided into four groups: thin, normal body mass, overweight and obese, by using different criteria for men and women.

Statistical analysis was done using  $\chi^2$  test, Yates correction, F-test, Student T-test and Cochran-Cox method.

When considering distribution of the men and women according to the age; it was observed that more men were in the subgroup of patients between 61 and 70 years old and more women were in the subgroup of patients between 51 and 60 and in the subgroup of patients older than 71 years; but without statistically significant difference in distribution ( $p > 0.05$ ). The average age of the men ( $64.24 \pm 10.43$ ) and women ( $64.82 \pm 10.63$ ) was almost the same, without statistically significant difference ( $p > 0.05$ ).

When considering distribution of men and women according to the BMI; it was observed that more men were in the subgroups of thin and normal BMI, whereas more women were in the subgroup of patients with BMI implying overweight and obese, but without statistically significant difference ( $p > 0.05$ ).

The average BMI of the male and female patients was almost the same ( $26.76 \pm 3.73$ ,  $27.85 \pm 5.16$ ; respectively) without statistically significant difference ( $p > 0.05$ ).

When reviewing collected data; it was observed that among comprehended colon cancer patients, most of the patients had blood type A (patients: 45.7%, general population: 40%), whereas in general population most of the people have type O (patients: 37.63%, general population: 45%), but this difference was not statistically significant ( $p > 0.05$ ). From the Table 1. it can be also seen that more women than men had blood type B (64.7%) but without statistically significant difference ( $p > 0.05$ ).

When considering region of Croatia from where the patients were coming; it was observed that among patients coming from Slavonia were more women than men (19:11), whereas among patients coming from Adriatic coast region were more men than women (23:12) but without statistically significant difference ( $p > 0.05$ ).

**TABLE 1**  
ASSESSMENT OF BMI

Men		Women	
<20,7	Thin	<19,1	Thin
20.7–27.8	Normal body mass	19.1–27.3	Normal body mass
27.9–31.1	Overweight	27.4–32.2	Overweight
>31.2	Obese	>32.3	Obese

When considering marital status of the patients, it was observed that significantly more women (39.7%) than men (14.65%) were among patients without partner not considering reason (never married, divorced or widowed) what was statistically significant ( $p < 0.05$ ).

When considering age distribution of the patients with different blood types; it was seen that more patients with blood type B are distributed in the older age groups whereas patients with blood type AB are more often in the younger age groups but without statistically significant difference.

**TABLE 2**  
DISTRIBUTION OF MEN AND WOMEN CONSIDERING AGE, BMI, BLOOD TYPE, REGION OF CROATIA FROM WHERE PATIENTS WERE COMING AND MARITAL STATUS

	Men	Women	Overall
Age			
50	12	10	22
51–60	16	22	38
61–70	40	25	65
71–80	26	29	55
81	2	4	6
BMI			
Thin	5	4	9
Normal	40	32	72
Overweight	32	29	61
Obese	19	25	44
Blood type			
A	44	41	85
B	6	11	17
O	39	31	70
AB	7	7	14
Croatian regions			
Central Croatia	46	46	92
Slavonia	11	19	30
Croatian mountain region	16	13	29
Adriatic coast region	23	12	35
Marital status			
Married	82	56	138
Divorced	1	2	3
Single (never married)	6	4	10
Widowed	7	28	35
Overall	96	90	186

**TABLE 3**  
DISTRIBUTION OF THE PATIENTS ACCORDING TO THE BLOOD TYPE CONSIDERING AGE, BMI, REGION OF CROATIA FROM WHERE PATIENTS WERE COMING AND MARITAL STATUS

	A	B	AB	0	Overall
<b>Age</b>					
50	10	0	2	10	22
51–60	17	4	5	12	38
61–70	28	7	4	26	65
71–80	27	5	3	20	55
81	3	1	0	2	6
<b>BMI</b>					
Thin	3	1	1	4	9
Normal	36	3	4	30	73
Overweight	25	5	7	24	61
Obese	21	8	2	12	43
<b>Croatian regions</b>					
Central Croatia	45	10	7	30	92
Slavonia	10	3	5	12	30
Croatian mountain region	14	3	2	10	29
Adriatic coast region	16	1	0	18	35
<b>Marital status</b>					
Married	61	13	13	51	138
Divorced	1	0	0	2	3
Single (never married)	4	1	0	5	10
Widowed	19	3	1	12	35
Overall	85	17	14	70	186

cant difference ( $p > 0.05$ ). When reviewing average age of the patients with different blood type; patients with blood type A were  $64.91 \pm 10.08$  years old, with blood type B  $67.35 \pm 7.71$ , with blood type 0  $63.91 \pm 1.67$  and with blood type AB were  $61.79 \pm 9.77$  years old. Considering average age the youngest were patients with blood type AB and the oldest were patients with blood type B, with no statistically significant difference ( $p > 0.05$ ).

Patients with different blood types were evenly distributed according to BMI. Among patients with blood type B, most were obese (47.06%), but with no statistically significant difference in comparison to other blood types ( $p > 0.05$ ). The average BMI of the patients was the following: blood type A  $27.08 \pm 4.21$ ; blood type B  $30.07 \pm 6.65$ , blood type 0  $26.79 \pm 4.03$ , and blood type AB  $27.00 \pm 4.72$ . The thinnest were patients with blood type 0 and the fattest with blood type B with statistically significant difference between these two groups ( $p < 0.05$ ).

Distribution of the patients with different blood type according to the region of Croatia from where they were coming was uniform, with no statistically significant difference ( $p > 0.05$ ).

Patients with different blood types were evenly distributed according to the marital status with no statistically significant difference ( $p > 0.05$ ). Although in the group of patients with blood type AB married patients

represented 92.86% what is in average 20% more than in other blood type groups.

When reviewing data in Table 3. it can be noticed that many patients from Slavonia (53.33%) and Adriatic coast region (37.15%) are younger than 61 years old. In those two groups of patients there were no patients older than 81 years old. Most of the patients from central Croatia region (75%) and Croatian mountain region (72.41%) were older than 61 years. This difference in distribution of the patients according to the Croatian region from where they were coming and age was statistically significant ( $p < 0.05$ ).

The average age of the patients from central Croatia was  $66.58 \pm 9.92$ , they were the oldest comparing to other regions. The average age of the patients from Croatian mountain region was  $64.79 \pm 12.23$ , from Slavonia  $61.50 \pm 9.70$  and the youngest were patients from Adriatic coast region with average age of  $61.49 \pm 10.21$ . There was statistically significant difference considering average age of the patients coming from central Croatia and Slavonia ( $p < 0.01$ ) and between patients from central Croatia and Adriatic coast region ( $p < 0.02$ ).

Considering region of Croatia from where patients were coming and patients' BMI, an even distribution was noted with no statistically significant difference ( $p > 0.05$ ).

Average BMI of the patients from central Croatia was  $27.96 \pm 4.40$  and they were the fattest, the average BMI of



**TABLE 4**  
DISTRIBUTION OF THE PATIENTS ACCORDING TO THE REGION OF CROATIA FROM WHERE THEY WERE COMING CONSIDERING AGE, BMI AND MARITAL STATUS

	Central Croatia	Slavonia	Croatian mountain region	Adriatic coast region	Overall
Age					
50	8	3	3	8	22
51–60	15	13	5	5	38
61–70	33	7	10	15	65
71–80	31	1	10	7	55
81	5	0	1	0	6
BMI					
Thin	3	2	3	1	9
Normal	28	11	15	19	73
Overweight	38	8	7	8	61
Obese	23	9	4	7	43
Marital status					
Marrried	62	23	22	31	138
Divorced	5	2	3	0	10
Single (never married)	1	0	0	2	3
Widowed	24	5	4	2	35
Overall	92	30	29	35	186

**TABLE 5**  
DISTRIBUTION OF THE PATIENTS ACCORDING TO THE BMI CONSIDERING AGE AND MARITAL STATUS

	Thin	Normal	Overweight	Obese	Overall
Age					
50	2	13	3	4	22
51–60	4	9	13	12	38
61–70	1	23	26	15	65
71–80	2	26	15	12	55
81	0	2	4	0	6
Marital status					
Marrried	8	57	41	32	138
Divorced	0	0	0	3	3
Single (never married)	1	3	5	1	10
Widowed	0	13	15	7	35
Overall	9	73	61	43	186

the patients from Slavonia was  $27.93 \pm 5.23$  and of the patients from Adriatic coast region was  $26.04 \pm 3.9$ . The thinnest, were patients from Croatian mountain region with average BMI  $25.70 \pm 4.19$ . There was statistically significant difference between average BMI between patients coming from Croatian mountain region (the thinnest patients) and central Croatia (the fattest patients), and between patients from Adriatic coast region and central Croatia ( $p < 0.05$ ).

There is no statistically significant difference in distribution of the patients coming from different Croatian regions considering their marital status ( $p > 0.05$ ); although most of the patients coming from Adriatic coast

region were married (88.6%), whereas less married patients were coming from central Croatia, in this region there was the highest percentage of widowed comparing to other regions.

Most of the patients who were according to their BMI members of the thin patients group were younger then 61 years old (66.6%) but without statistically significant difference ( $p > 0.05$ ).

Average age of thin patients was  $55.62 \pm 17.04$ , normal BMI group was  $64.85 \pm 11.08$ , overweight patients was  $65.79 \pm 9.13$  and obese patients was  $63.81 \pm 9.36$ . The youngest patients, according to the BMI were thin patients and the oldest were patients in the overweight group.

**TABLE 6**  
DISTRIBUTION OF THE PATIENTS ACCORDING TO THE MARITAL STATUS CONSIDERING AGE

Age	Married	Divorced	Single (never married)	Widowed	Overall
50	17	2	2	1	22
51–60	30	1	3	4	38
61–70	56	0	2	7	65
71–80	33	0	3	19	55
81	2	0	0	4	6
Overall	138	3	10	35	186

**TABLE 7**  
DISTRIBUTION OF THE PATIENTS WITH DIFFERENT DUKES STAGE AT THE TIME OF DIAGNOSIS CONSIDERING GENDER, BLOOD TYPE, MARITAL STATUS, AGE, BMI AND CROATIAN REGION WHERE THE PATIENTS WERE COMING FROM

	Dukes A	Dukes B	Dukes C	Dukes D	Overall
Gender					
Men	23	26	23	24	96
Women	22	24	23	21	90
Blood type					
A	22	21	20	22	85
B	4	5	7	1	17
AB	2	4	2	6	14
0	17	20	17	16	70
Marital status					
Married	35	35	33	36	138
Divorced	0	1	1	1	3
Single (never married)	0	3	4	3	10
Widow/er	10	11	8	6	35
Age					
<50	2	3	8	9	22
51–60	8	10	9	11	38
61–70	18	15	14	18	65
71–80	14	19	15	7	55
>80	3	3	0	0	6
BMI					
Thin	1	0	2	6	9
Normal	14	27	18	14	73
Overweight	21	15	14	11	61
Obese	9	8	12	14	43
Croatian regions					
Central Croatia	22	22	23	25	92
Slavonia	3	10	9	8	30
Croatian mountain region	11	9	5	4	29
Adriatic coast region	9	9	9	8	35
Overall	45	50	46	45	186

There was statistically significant difference between average age of the thin and patients with normal BMI ( $p < 0.05$ ), and thin and overweight patients ( $p < 0.05$ ).

There was no statistically significant difference in BMI (younger then 50 years old:  $25.71 \pm 5.49$ , between 51 and 60 years old:  $27.92 \pm 5.14$ , between 61 and 70 years

old:  $27.78 \pm 3.96$ , between 71 and 80 years old:  $27.07 \pm 4.23$ , and older then 80 years old was  $25.28 \pm 2.96$ ) of the patients distributed to different age groups ( $p > 0.05$ ).

Patients in different BMI groups were evenly distributed when their marital status was taken into account without statistically significant difference ( $p > 0.05$ ). The

**TABLE 8**  
DISTRIBUTION OF THE PATIENTS WITH DIFFERENT DUKES STAGE OF DISEASE AT THE TIME OF DIAGNOSIS  
CONSIDERING TYPE OF SURGERY THEY UNDERWENT

Surgery	Dukes A	Dukes B	Dukes C	Dukes D	Overall
with colostomy	2	9	8	9	28
without colostomy	8	28	17	3	56
Overall	10	37	25	12	84

**TABLE 9**  
AVERAGE QUALITY OF LIFE OF PATIENTS WITH DIFFERENT DUKES STAGES AT THE TIME OF DIAGNOSIS; 6 MONTHS PRIOR  
TO DIAGNOSIS, AT DISCHARGE FROM HOSPITAL AFTER THE SURGERY AND THREE MONTHS AFTER THE SURGERY

QoL	Dukes A	Dukes B	Dukes C	Dukes D
6 months prior to diagnosis and surgery	7.9±2.1	8.1±1.3	8.3±1.6	8.0±1.1
Discharge after the surgery	6.4±2.4	6.9±1.5	7.4±1.0	7.2±1.1
3 months after the surgery	7.3±1.9	8.0±1.5	7.6±1.3	7.5±1.6

**TABLE 10**  
AVERAGE QUALITY OF LIFE OF THE PATIENTS WITH DIFFERENT SURGICAL TREATMENT MODALITY (CONTAINING OR NOT  
CONTAINING COLOSTOMY) 6 MONTHS PRIOR TO DIAGNOSIS, AT DISCHARGE FROM HOSPITAL AFTER THE SURGERY AND THREE  
MONTHS AFTER THE SURGERY

	6 months prior to diagnosis and surgery	At the time of discharge after surgery	3 months after the surgery
Patients with colostomy	8.0±1.6	7.3±1.6	7.3±1.5
Patients without colostomy	8.2±1.4	6.9±1.4	7.9±1.5

average BMI of married patients was  $27.21 \pm 4.49$ , of divorced was  $30.48 \pm 6.33$ , of single, never married was  $26.20 \pm 4.01$ , and of widowed was  $27.53 \pm 4.58$ . The average age of all patients without partner (single, divorced, widowed) was  $27.44 \pm 4.57$ , with no statistically significant difference ( $p > 0.05$ ) comparing to the married.

When considering age distribution of the patients with different marital status; it was observed that all divorced patients were younger than 60, whereas even 85.7% of the patients in the group of widowed were older than 60, this difference is statistically significant ( $p < 0.025$ ).

The average age of the married patients was  $63.40 \pm 9.62$ , whereas the average age of all patients without partner (never married, divorced, widowed) was  $67.42 \pm 12.38$ , and difference was statistically significant ( $p < 0.05$ ). The average age of divorced patients was  $50.00 \pm 6.24$  so they were the youngest, the oldest were widowed with average age of  $71.34 \pm 8.32$ . The average age of single, never married patients was  $58.90 \pm 16.99$ . The married patients were statistically significantly younger than widowed ( $p < 0.01$ ), and statistically significantly older than divorced ( $p < 0.02$ ). The widowed were statistically significantly older than single, never married ( $p < 0.05$ ) and divorced patients ( $p < 0.01$ ).

Quality of life was estimated in the subgroup of 84 out of 186 patients applying visual analogue scale. Visual analogue scale had range 1 to 10, value 1 characterized unbearable (intolerable) quality of life and value 10 charac-

terized extremely good, excellent quality of life. In the subgroup in which quality of life was estimated, patients were divided considering disease stage according to modified Dukes classification. Patients were also divided in subgroups according type of surgery conducted, with or without formation of colostomy. Analysis of quality of life was conducted before surgery with the regard of quality of life for past six months prior to diagnosis, at the time of discharge from hospital after the surgery and three month after the surgery. Every time patients were asked to estimate their quality of life by appliance of visual analogue scale. Average quality of life grade was estimated for six months period before surgery, at the time of discharge from hospital after surgery and three months after surgery for each subgroup of patients considering disease stage and type of surgery conducted.

## Results

Patients with different Dukes stage of colon cancer at the time of diagnosis were evenly distributed considering gender ( $p > 0.05$ ).

Patients with different Dukes stage considering blood type were also evenly distributed. Patients with blood type B had more often disease diagnosed at early stages and only in one patient (5.88%) disease was diagnosed when the metastases occurred. On the other hand, patients with blood type AB more often had advanced disease at the time of diagnosis, even 42.86% of the patients



with blood type AB had disseminated disease at the time of diagnosis, this difference, although, was not statistically significant ( $p>0.05$ ).

When considering marital status of patients with different Dukes disease stage it was observed that in the group of single (never married) (66.6%) and divorced (70%) patients significant percentage had advanced disease stages (Dukes C and D), whereas this percentage in married patients was 49.3% and in the widowed was 40%, but without statistically significant difference between groups ( $p>0.05$ ).

When analysing age of the patients with different Dukes disease stages it was observed that in younger age groups significantly more patients have advanced stages of colon cancer (Dukes C and D), in the group of patients younger than 50 years 77.3%, and in the group between 51 and 60 years 52.6%, whereas none of the patients older than 81 years had Dukes C or D. This difference was not statistically significant ( $p>0.05$ ).

When considering average age, the youngest were patients with Dukes D  $59.38\pm 11.49$ , and the oldest with Dukes B  $67.44\pm 8.93$ , this difference was statistically significant ( $p<0.01$ ). The average age of the patients with Dukes A was  $67.20\pm 9.38$  and with Dukes C was  $63.76\pm 10.39$ . The difference in average age was statistically significant between patients with Dukes A and D ( $p<0.01$ ) and marginally significant between Dukes C and D ( $p=0.05$ ), between patients with Dukes A and C and Dukes B and C was not statistically significant ( $p>0.05$ ).

There was no statistically significant difference in distribution of the patients with different Dukes stages considering BMI ( $p>0.05$ ).

The average BMI of the patients with Dukes A was  $27.82\pm 4.49$ ; with Dukes B was  $27.19\pm 4.13$ , with Dukes C was  $27.39\pm 4.53$  and with Dukes D was  $26.75\pm 4.93$ , without statistically significant differences between groups ( $p>0.05$ ).

When correlating Croatian regions from where patients were coming with colon cancer stage it was observed that patients from Central Croatia and Adriatic coast region were evenly distributed, whereas most of the patients from Slavonia had more advanced disease stages (Dukes C and D) (56%), and most of the patients from Croatian mountain region (68.9%) had disease in earlier stages (Dukes A and B), although all the mentioned differences were not statistically significant ( $p>0.05$ ).

Quality of life was investigated, in the subgroup of 84 patients surgically treated for colon cancer with or without formation of colostomy.

The patients who were surgically treated with or without formation of colostomy were distributed according to the Dukes disease stage. In all disease stages most of the patients were treated surgically without formation of colostomy, except for the patients with Dukes D who were more often treated with formation of colostomy. There was statistically significant difference in distribution of the patients with different disease stages consid-

ering surgical treatment modality with or without formation of colostomy ( $p<0.05$ ).

Reviewing Table 9. it was seen that the highest average quality of life was recorded for the period six months prior to diagnosis in all disease stages. In all colon cancer stages the average quality of life was deteriorated after the surgery and this difference was statistically significant for all stages ( $p<0.05$ ) but Dukes D ( $p>0.05$ ). Three months after the surgery there was an increase in average quality of life which was statistically significant only in the group of patients with Dukes B ( $p=0.001$ ), but not significant in patients with Dukes A, C and D ( $p>0.05$ ). Although, the average quality of life three months after the surgery was poorer in comparison to the time before the surgery, this difference was statistically significant only in patients with Dukes C ( $p=0.049$ ), but not in other disease stages (Dukes A, B and D) ( $p>0.05$ ).

When comparing average quality of life of the patients with different disease stages at the mentioned three time points, no statistically significant difference was observed ( $p>0.05$ ).

When comparing quality of life of the patients with or without formation of colostomy at three time points (six months prior to colon cancer diagnosis, at the moment of discharge from hospital after the surgery and three months after the surgery) the following can be observed. In the both patients' groups (with and without formation of colostomy) average quality of life six months prior to diagnosis was almost identical, with no statistically significant difference ( $p>0.05$ ). No statistically significant difference in average mark of quality of life was observed at the time of discharge from hospital after surgery between two groups of patients with or without formed colostomy ( $p>0.05$ ). At this point of time quality of life in both patients' groups was deteriorated in comparison to the time before surgery, which was statistically significant in patients treated by surgery without formation of colostomy ( $p=0.000$ ), and not statistically significant in patients treated by surgery with formation of colostomy ( $p>0.05$ ). Three months after the surgery quality of life of the patients who underwent surgery without formation of colostomy was statistically significantly improved ( $p=0.000$ ), whereas quality of life of the patients with formed colostomy was almost identical to the quality at the time immediately after the surgery ( $p>0.05$ ). At this point of time also, there was no statistically significant difference in quality of life of the patients with or without colostomy ( $p>0.05$ ).

## Discussion

In our study we did not find any difference in gender distribution of the patients considering stage of disease at the time of diagnosis ( $p>0.05$ ), whereas Woods et al. (2006) found that colon cancer in women is more often diagnosed in more advanced disease stages<sup>23</sup> and Zinsman et al. (2006) found that alcohol consuming, smoking and male gender is positively correlated with colon can-

cer development in younger age and in distal part of the bowel<sup>24</sup>.

When analysing blood type distribution of the patients with different disease stages in our study, no statistically significant difference was found. ( $p > 0.05$ ). Slater (1993) also did not found any statistically significant difference in blood type distribution according to the disease stage at the time of diagnosis, but found that Rh positive patients are more likely to have advanced disease at the time of diagnosis<sup>12</sup>. The similar finding had Halvorsen (1986) who found that Rh negative patients are more likely to have bounded disease at the time of diagnosis in comparison with Rh positive patients (66% vs 46%), and that Rh positive patients more often have regional lymph node metastases<sup>13</sup>.

In our study we did not found statistically significant difference in distribution of the patients' marital status considering disease stage at the time of diagnosis ( $p > 0.05$ ); whereas Nayeri (1992) found that married individuals are more likely to have early stages of disease at the time of diagnosis<sup>9</sup>. Johansen (1998) found after follow-up of 22 to 26 years, that married colon cancer patients had statistically significantly longer overall survival (RR 0.85; 95% CI 0.78–0.93)<sup>25</sup>. Kato (1992) also found that married colon cancer patients had longer survival than singles.<sup>11</sup>

When considering disease stage at the time of diagnosis in our study, no statistically significant difference in distribution of the patients according to the region of Croatia from where they were coming was not found ( $p > 0.05$ ). So, the patients who were coming from Adriatic coast region and who are thought to have protective Mediterranean diet did not have disease diagnosed in earlier stages in comparison to the other Croatian regions. This is probably consequence of amended inhabitants structure what happened during the last decade of the twentieth century following war on the former Yugoslavia territories when a lot of refugees immigrated to this area and brought their own culture and dietary habits.

When considering age distribution of the patients with different Dukes stages of disease it can be observed that in younger age groups more patients have advanced disease (Dukes C and D) at the time of diagnosis but without statistically significant difference ( $p > 0.05$ ).

When considering the average age of the patients it can be noted that the youngest were patients with Dukes D ( $59.38 \pm 11.49$ ) and the oldest were patients with Dukes B ( $67.44 \pm 8.93$ ) with statistically significant difference between them ( $p < 0.01$ ). Patients with Dukes A were only slightly younger than patients with Dukes B ( $67.20 \pm 9.38$ ) and were statistically significantly older than patients with Dukes D ( $p < 0.01$ ). Patients with Dukes C ( $63.76 \pm 10.39$ ) were only older than patients with Dukes D ( $p = 0.05$ ). In comparison, Campbell et al. (2001) have found that middle age individuals are statistically more likely to have colon cancer diagnosed at advanced disease stages ( $p < 0.05$ ), what is comparable to our results<sup>10</sup>.

When BMI of the patients with different Dukes stages was taken into account an uniform distribution was ob-

served with no statistically significant difference ( $p > 0.05$ ). There was also no statistically significant difference between average BMI of the patients with different Dukes stages ( $p > 0.05$ ). Meyerhardt et al. (2004) have found that male patients with increased BMI are more likely to develop local recurrence and that obese male and female patients are more likely to tolerate adjuvant chemotherapy with less toxic side effects<sup>26</sup>. In 2003 the same author had found that obese female patients with colon cancer stage II and III have shorter overall survival and statistically more chances to develop disease recurrence<sup>27</sup>. Similar observation found Digman (2006) that BMI  $> 35$  at the time of diagnosis is connected with higher recurrence rate and shorter overall survival<sup>28</sup>. Doria-Rose (2006) found that female patients with extreme BMI (thin and obese) are more likely to have shorter survival in comparison with the female patients with normal BMI<sup>29</sup>. To compare our results with literature further follow-up is needed.

Patients whose quality of life was estimated were distributed according to the Dukes disease stage and most of the patients, except for patients with Dukes D, were treated surgically without formation of colostomy, with statistically significant difference in distribution of the patients with different disease stages considering surgical treatment modality ( $p < 0.05$ ). For all disease stages average quality of life was of best quality prior to surgery. At the time of discharge from hospital after the surgery, quality of life deteriorated in all groups of patients with different Dukes stages; this deterioration was statistically significant in patients with Dukes A, B and C ( $p < 0.05$ ). Three month after the surgery quality of life of all patients' groups improved, statistically significant only in patients with Dukes B ( $p = 0.001$ ). In all patients' groups quality of life three months after surgery was deteriorated in comparison to the time before diagnosis of malignant disease, this deterioration was statistically significant only in patients with Dukes C ( $p = 0.045$ ).

When considering average quality of life of the patients with or without formation of colostomy, their quality of life was almost equal in both groups prior to diagnosis ( $p > 0.05$ ). After the surgery quality of life was more deteriorated in the group of patients who had surgery without formation of colostomy, and in this group deterioration was statistically significant ( $p = 0.000$ ), but without statistical difference between groups ( $p > 0.05$ ). Three month after the surgery, quality of life statistically significantly improved in patients without formed colostomy ( $p = 0.001$ ), but in patients with formed colostomy, quality of life was almost the same as at the time of discharge from hospital after the surgery, at this point of time there was also no statistically significant difference between groups ( $p > 0.05$ ).

Camilleri-Brennan (2001) also measured quality of life in patients with colon cancer at the same points of time as we did and the findings were similar. Quality of life is significantly deteriorated in early postoperative period, and is improving afterwards<sup>30</sup>.

Those results are completely comparable to ours. The preoperative quality of life could be valuable prognostic factor of one year postoperative survival<sup>30</sup>.

Arndt (2004) investigated quality of life of colon cancer patients one year after the diagnosis and compared it to the general population. Deficiency in emotional and social functioning, specific limitations in physical functioning and financial problems, deteriorated patients'

quality of life what mostly affected younger patients<sup>31</sup>. The same author in 2006 investigated quality of life also three years after the diagnosis, and observed no changes in quality of life except for less problems with colostomy, less financial problems and more optimism<sup>32</sup>. In order to estimate future problems of our patients affecting their quality of life longer follow up is needed.

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## OBILJEŽJA RAKA DEBELOG CRIJEVA U HRVATSKOJ

### S A Ž E T A K

Istraživani su kvalitativni i kvantitativni parametri kod 186 bolesnika s rakom debelog crijeva. Kvaliteta života bila je određivana u podskupini od 84 bolesnika. Ispitivana je povezanost stadija bolesti prema Dukesu i kvalitativnih (spol, krvna grupa, bračni status, regija Hrvatske iz koje bolesnici dolaze) i kvantitativnih (dob, indeks tjelesne mase) obilježja bolesnika. Nije uočena statistički značajna razlika u distribuciji stadija bolesti u odnosu na spol, krvnu grupu, bračni status i indeks tjelesne mase bolesnika te regiju Hrvatske iz koje bolesnici dolaze ( $p > 0,05$ ). Uočeno je da su bolesnici sa stadijem bolesti Dukes D bili statistički značajno mlađi u odnosu na bolesnike s bolešću u ostalim stadijima ( $p < 0,05$ ). Kvaliteta života bolesnika bila je najbolja prije kirurškog zahvata, a značajno pogoršana neposredno nakon kirurškog zahvata, dok se tri mjeseca nakon kirurškog zahvata djelomično poboljšala bez statistički značajne razlike između ispitivanih skupina bolesnika s različitim stadijima bolesti koji su bili podvrgnuti različitim oblicima kirurškog liječenja.