

## CLINICAL STUDY

## Perioperative cardiovascular and noncardiovascular risk in patients with colorectal cancer

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### Abstract

**Background:** One of the factors determining the success of colorectal cancer (CC) surgery is an appropriate stratification of perioperative risk.

**Objective:** To evaluate the prognostic significance of perioperative risk in patients with CC, a comparison of two groups of patients – surviving and non-surviving the CC surgery was performed. Cardiovascular and noncardiovascular risk factors, diseases and complications were compared between these two groups.

**Patients:** 60 patients (m:30, f:30), average age: 73 ys, surviving (38), non-surviving (22)

**Methods:** Following parameters were compared: risk factors (arterial hypertension, diabetes mellitus, hyperlipoproteinemia, smoking or alcohol consumption, malnutrition, obesity), cardiovascular diseases (history of coronary artery disease, heart failure, brain stroke, revascularisation, chronic venous insufficiency), noncardiovascular diseases (COPD, asthma, renal insufficiency, metabolic diseases, peptic ulcer disease, chronic hepatitis, pulmonary tuberculosis, bone or kidney tuberculosis, hepatopathy), complications and laboratory parameters.

**Results:** Comparison of the listed parameters in non-surviving/surviving patients: bronchopneumonia (36 %/4 %), perineal haemorrhage (36%/4%), hepatopathy (28 %/4 %), renal insufficiency (50%/16%), hypoalbuminemia (50 %/16 %), history of acute stroke (21 %/12.5 %), history of brain stroke (12.5 %/7 %).

**Conclusion:** Risk factors (bronchopneumonia, perineal haemorrhage, hepatopathy, renal insufficiency, hypoalbuminemia) are markers of worse prognosis. The cardiac markers (history of acute stroke and history of brain stroke) play a minor role (*Tab. 10, Ref. 3*). Full Text (Free, PDF) [www.bmj.sk](http://www.bmj.sk).

**Key words:** colorectal cancer, perioperative risk, bronchopneumonia.

The evaluation of perioperative risk plays an irreplaceable role in surgeon's operative decision. Operative interventions present a considerable burden for the patient (operative risk of tissue and heart ischemia, risk of heart-failure and hypotension). Patients with heart disease are at considerably higher risk than patients with normal cardiovascular findings. Preoperative examination and preparation by a general practitioner are supplemented by an internist, cardiologist or anaesthesiologist who is responsible for patient's safety and quality of anaesthesiological care. The type of preoperative examination and preparation is determined by AHA (American Heart Association) based on the patient's cardiovascular risk, operative risk and the functional state of the patient. The examination needs to be performed appropriately in order to exactly evaluate and diagnose cardiovas-

cular diseases and the results of these tests influence the preoperative preparation and care (1, 2, 3).

The conclusion of the examination and recommendations for lowering the perioperative risk are usually provided by a cardiologist or an internist (2, 3).

This study is focused on patients with colorectal cancer (CC). The aim was to define parameters (risk factors/markers) that classify patients into surviving and non-surviving group. All patients

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**Tab. 1. Risk factors.**

Parameters	Score (points)	
Arterial hypertension	controlled (0 p)	uncontrolled (1 p)
Diabetes mellitus	controlled (0 p)	uncontrolled (1 p)
Hyperlipoproteinemia	controlled (0 p)	uncontrolled (1 p)
Smoking	<20/d (1 p)	>20/d (1.5 p)
Malnutrition	easy, BMI <22 (1 p)	severe, BMI <18 (1.5 p)
Obesity	easy, BMI >30 (1 p)	severe, BMI >35 (1.5 p)

**Tab. 2. Cardiovascular comorbids.**

Cardiovascular comorbids	Score (points)	
	no	yes
Coronary artery disease (CAD)		
prior stroke	0 p	1.5 p
angina pectoris	0 p	1 p
dyspnea	0 p	1 p
supraventricular arrhythmia	0 p	1 p
ventricular arrhythmia	0 p	1 p
Heart failure		
NYHA I-II	0 p	1 p
NYHA III-IV	0 p	2 p
oedema (pulmonary, peripheral)	0 p	1 p
S3 gallop	0 p	1 p
paroxysmal night dyspnea	0 p	1 p
pathological find in rtg thoracic (stasis)	0 p	1 p
Prior brain stroke	0 p	1 p
Revascularisation (PTCA, CABG, and others)	0 p	1 p

**Tab. 3. Noncardiovascular comorbids.**

Noncardiovascular comorbids	Score (points)	
	no	yes
Chronic venous insufficiency	0 p	1 p
Chronic obstruction bronchopulmonary disease, asthma bronchiale	0 p	1 p
Kidney disease	0 p	1 p
Chronical renal insufficiency kreatininemia	0 p	1.5 pts
>120 µmol/l in men		
>110 µmol/l in women		
Metabolic disease	0 p	1 p
Ulcus disease	0 p	1 p
Chronical hepatitis	0 p	1 p
Tuberculosis of bones, lungs or kidneys	0 p	1 p
Hepatopatia	0 p	1 p
Cholecystolithiasis	0 p	1 p
Carcinoma ventriculi,		
prior adenocarcinoma recti	0 p	1 p
Vertebrological syndroma	0 p	1 p
Dementia	0 p	1 p
Decubitus	0 p	1 p
Uterus myomatousus in women	0 p	1 p

**Tab. 4. Perioperative complications.**

Parameters	Score
decompensation on a small circle (subcompensation, fluidothorax) decompensation on a large circle	1.5 p
pulmonary arteria embolisation	1.5 p
diverticulitis sigmae	1 p
bronchopneumonia, empyema thoracis, bronchitis	1.5 p
Perineal haemorrhage adhesiones peritoneales	1 p
MODS	2 p
status ileosus	1 p
DIC+status hypocoagulation, haemorrhage	1.5 p
renal insufficiency	1.5 p
metabolic failure (acidosis, diabetes mellitus)	1.5 p
fistula enterocutaneus	1 p

**Tab. 5. Laboratory parameters.**

Parameters	Score (points)	
	no	yes
Ekg		
supraventricular fibrillation (if not to be evaluate before)	0 p	1 p
AV blocks >1°	0 p	1 p
fascicular blocks	0 p	1 p
severe arrhythmia (if not to be evaluate before) ventricular tachycardia, ventricular fibrillation	0 p	1 p
Electrolyts in serum		
abnormal Na+ increased or decreased	0 p	1 p
abnormal K+ increased or decreased	0 p	1 p
Hepatal tests		
abnormal AST, ALT (if not to be evaluate before)	0 p	1 p
^ bilirubin total or conjugate	0 p	1 p
hypoalbuminaemia	0 p	1 p
Glycaemia		
glycaemia (or Hb1ac) if it not to be a diabetic patient or patient with glucous tolerance dysfunction	0 p	1 p
Blood count		
erythrocytes, hematocrit	0 p	1 p
thrombocytes	0 p	1 p
leukocytes	0 p	1 p
Renal function (if not to be evaluate before)		
creatinine (or abnormal clearance of creatinine)	0 p	1 p
Rtg thoracis (if not to be evaluate before)		
lung stasis	0 p	1 p
pulmonary oedema	0 p	2 p
large heart	0 p	1 p
Echocardiography find		

underwent suregery at the 1st Department of Surgery, University Hospital, Bratislava.

## Material and methods

### Patients

From the 1st March 2005 to the 1st June 2005 medical records patients who underwent surgery for colorectal cancer were evalu-

ated, in total, 60 patients (mean age: 73 years), surviving (mean age 38–96 years) and non-surviving (mean age 43–95 years). The diagnosis was confirmed by biopsy.

### Methods

All patients had CC confirmed by biopsy and were operated on at the 1st Surgical Department of the University Hospital in Bratislava.

The analysis was performed retrospectively, the time period: up to discharge from the hospital.

The risk of perioperative morbidity/mortality was evaluated using two methods: 1) a global score index (the sum of points given to risk-parameters: demographic, cardiovascular or noncardiovascular risk factors and diseases, comorbidities, perioperative complications and laboratory parameters), in each patient (higher number means higher operative risk) (Tables 1–5), and 2) a comparison of the two present (mentioned) parameters (demographic, cardiovascular or noncardiovascular parameters and diseases, comorbidities, perioperative complications and laboratory parameters), in two subgroups of patients - surviving patients and non-surviving.

Points by age: <60 years (0 points), 60–69 ys (1 point), 70–79 ys (1.5 points), ≥80 ys (2 points),

### Results

Two groups of patients were compared: surviving and not surviving the operative intervention.

Global Score Index: surviving subgroup (mean 11 points, range 5–16, 5 points) and non-surviving subgroup (mean 19 points, range 16–21).

Comparison of risk factors in surviving and non-surviving subgroups is showed in Table 5: hypertension achieved about 50–55 % of points in both subgroup, diabetes mellitus type 2 about 20–25 % in both subgroup and hypercholesterolemia about 8–15 % (non-surviving differences in all three risk factors). Hypoalbuminemia was three times more frequent in non-surviving patients (50 % vs 16.6 %,  $p < 0.01$ ), also smoking was (but not significantly) more frequent in non-surviving patients (14.2 % vs 4.1 %).

Comparison of comorbidities in the two subgroups is shown in Table 6.

Complications in these two subgroups are shown in Table 7.

Contribution of cardiovascular diseases to (non) survival is analysed in Table 8.

Laboratory parameters in these two subgroups are shown in Table 9.

Contribution of metastatic processes is shown in Table 10.

### Discussion

The prognosis of patients with colorectal cancer is not good. This disease more often affects men (65 % do not survive vs 35 % survive). Operative treatment is necessary for two main reasons: (a) for radical resolution of the disease (if possible, in

**Tab. 6. Results – comorbidities.**

Comorbidities	surviving (%)	nonsurviving (%)	p	
chronic renal insuficience	16.6	49.9	0.00606	$p < 0.01$
ulcus disease, dyspepsia	16.6	28.4	NS	
hepatopathy	4.1	28.4	0.00701	$p < 0.01$
tuberculosis of bones, lungs or kidneys	4.1	21.3	0.0355	$p < 0.05$
carcinoma ventriculi	–	21.3		$p < 0.001$
vertebrological syndroma	–	21.3		$p < 0.001$
cholecystolithiasis	–	7.1		$p < 0.001$
dementia	–	7.1		$p < 0.001$
uterus myomatosus	–	7.1		$p < 0.001$
chronic venosus insuficiencia (varices lower extremities)	20.8	–		$p < 0.001$
metabolic disease	4.1	–		$p < 0.001$
chronic hepatitis	4.1	–		$p < 0.001$
chronic obstructive bronchopulmonary disease, asthma bronchiale	4.1	–		$p < 0.001$

**Tab. 7. Results – complications.**

Complications	surviving (%)	nonsurviving (%)	p	
decompensation on a small circle (subcompensation, fluidothorax)				
decompensation on a large circle	12.3	35.5	0.0329	$p < 0.05$
bronchopneumonia, empyema, bronchitis	4.1	35.7	0.00118	$p < 0.005$
status ileosus	–	28.4		$p < 0.001$
DIC+status hypocoagulation, haemorrhage	–	28.4		$p < 0.001$
perineal haemorrhage	4.1	21.3	0.0355	$p < 0.05$
decompensation on a large circle	–	21.3		$p < 0.001$
pulmonary arteria embolisation	4.1	7.1		NS
diverticulitis sigmae	4.1	7.1		NS
MODS	–	7.1		$p < 0.001$
prerenal azotemia	–	7.1		$p < 0.001$
metabolic split	–	7.1		$p < 0.001$
fistula enterocutaneus	–	7.1		$p < 0.001$

**Tab. 8. Results – cardiovascular disease.**

Cardiovascular disease	surviving (%)	nonsurviving (%)	p
Coronary artery disease	83.3	85.7	NS
Arrhythmies (supraventricular fibrillation, ventricular extrasystolic disease, supraventricular tachycardia, supraventricular extrasystolic disease)	48.7	52.7	NS
Prior myocardial infarction	12.5	21.3	NS
A-V blocks gr. I-II	–	14.2	$p < 0.001$
Prior brain stroke	12.5	7.1	NS

**Tab. 9. Laboratory parameters.**

Laboratory parameters	surviving (%)	nonsurviving (%)	p
erythrocytes, hematocrit	50.0	64.2	NS
leukocytes	20.8	50.0	0.01896 p<0.05
creatinine	25.0	42.8	NS
thrombocytes	–	35.7	p<0.001
bilirubin total	12.5	28.4	NS
hypocaliemia	8.3	21.3	NS
AST, ALT	12.5	21.3	NS
glycaemia	12.5	21.3	NS
hyponatriemia	4.1	14.2	NS
hypercaliemia	–	7.1	p<0.001
hypermnatremia	–	–	

**Tab. 10. Results – metastatic process.**

Metastases	surviving (%)	nonsurviving (%)	p
liver	33.3	35.7	NS
lymphoid ganglions	16.6	7.1	NS
lungs	–	7.1	0.0 p<0.001
spleen	4.1	–	0.0 p<0.001

many cases it can be a benefit for the patient following oncological treatment), (b) for moderate resolution (the disease is an advanced stage, threatens for example the development of status ileosus).

The characteristics of a total of 60 patients (30 men and 30 women) with this disease were analysed and perioperative risk in both groups of patients – surviving and nonsurviving was evaluated. Also the characteristics of these patients from the viewpoint of postoperative survival were evaluated.

The Global score enables us to clearly divide the group of surviving patients and nonsurviving patients. The evaluation score of patients takes little time, if history, physical examination and laboratory examinations are consistently performed.

Between risk factors of survival a considerable factor is the presence of hypoalbuminemia (50 % in group of nonsurviving patients and „only“ 16.6 % in surviving patients). It is a sign of malnutrition and exhaust during the disease. Nonsurviving patients are often smoker and also alcohol consumers (14 % vs 4 % in group of surviving patients), which may also be the cause of malnutrition and a decrease in the healing ability.

Among nonsurviving patients comorbidities often appeared. The main variable is chronic renal insufficiency in 50 % of nonsurviving patients (vs 16.6 % in surviving patients), also hepatopathies (28 % vs 4 % in surviving) and more often the occurrence of cholelithiasis (7 % vs 0 %) in the group of nonsurviving patients. The renal and liver dysfunction prognosis is very bad in both groups of patients.

Many postoperative complications determine the prognosis of the patients. Cardiac decompensation appears probably three-

times more often (mainly in a small circle) among nonsurviving patients. Pulmonary artery embolisation occurs probably twice as often (7 % vs 4 %) in the group of nonsurviving patients as in the surviving patients group.

The respiratory tract complications have a very good prognosis, bronchopneumonia with bronchitis/empyema appears nine-times more often in the group of nonsurviving patients (36 % vs 4 % in surviving patients).

Also local complications have a very good prognostic value: sigmoidal diverticulitis occurred about two times as often in nonsurviving patients (7 % vs 4 % in surviving), perineal haemorrhage about nine-times as often (36 % vs 4 %) in nonsurviving patients, ileus occurred only in the group of nonsurviving patients (28 %) and also enterocutaneous fistula (7 %).

MODS occurred only in the group of nonsurviving patients, in 7 % of cases, as well as prerenal azotaemia and metabolic decompensation. DIC occurred only in the group of nonsurviving patients (28 % cases). This means that evaluation of the complications occurring during the operation has in patients with colorectal cancer a great prognostic significance. In future it may be interesting to analyse whether it is possible to prevent these complications or whether an intensive treatment may influence the subsequent prognosis of patients. This analysis can not be performed retrospectively.

In our opinion exhaustion of the organism is the main cause for an increase in the appearance of tuberculosis of bones, lungs and kidneys in the group of nonsurviving patients (21 % vs 4 % in surviving), for example stress may be the main cause of peptic ulcer disease in nonsurviving patients (28 % vs 16 % in surviving). Occurrence of gastric carcinoma (21 %) in nonsurviving patients causes immune system deficiency in the group of nonsurviving patients with a tumor.

The presence of some cardiovascular diseases affects the prognosis in patients with colorectal cancer. Acute stroke in history occurred two-times more often in nonsurviving patients (21 % vs 12.5 %). A-V blockades grade I–II occurred (14 %) only in the group of nonsurviving patients. Coronary artery disease (CAD) was observed in 80–85 % of the patients, and more often than brain stroke in the patients history (12.5 % vs 7 %) in surviving patients. Arrhythmias (supraventricular fibrillation, ventricular extrasystoles, supraventricular tachycardia, supraventricular extrasystoles) were very frequent (in both groups in 50 % of the patients).

The cause of the increased occurrence of vertebral syndrome is unknown, maybe it is the result of metastatic processes. The immunity deficiency may possibly lead to decreased threshold of pain and so in this aged category vertebrogenic pain syndrome is more common. Also dementia syndrome (7 %) appears only in the group of nonsurviving patients.

Some laboratory parameters in postoperative period have a considerable prognostic value. Hyponatraemia appears three-times more often in nonsurviving (14 % vs 4 %), kalaemia split occurs more than three-times more often in nonsurviving patients (28 % vs 8 %). Increased values of transaminases are seen twice as often in the nonsurviving patients (21 % vs 12 %), likewise is

the hyperglycaemia. Hyperbilirubinaemia occurs more than twice as often in nonsurviving (28 % vs 12.5 %), which means that compensatory ability of many organs (kidneys, pancreas or liver) in the group of nonsurviving patients have limited powers which might result in worsened prognosis in these patients.

Anaemia is frequent in the nonsurviving patients, serum thrombocytopenia (36 %) occurs only in nonsurviving patients, an increased value of leukocytes occurs more than two-times frequently in nonsurviving patients (50 % vs 21 %). An increased value of creatinine in serum is almost two-times more frequent in nonsurviving patients (43 % vs 25 %).

Some laboratory parameters are also related to each other, for example renal insufficiency and anaemia, although anaemia may be also caused by the oncological disease, stage during the operation and other haemorrhage in the gastrointestinal tract. The observed degree of bone marrow insufficiency was expected as a result of the oncological diagnosis.

Among the appearance of metastases is a prognostic value which is related to survive lungs metastases (7 %, only in nonsurviving patients).

This short publication is a retrospective analysis of the prognosis of patients with colorectal cancer who were operated on with this diagnosis. Some data were very difficult to find from the medical records, but they might be found during subsequent physical examination of the patient.

## Conclusion

The evaluation of perioperative risk of patients with colorectal cancer is a very serious task. The risk can be evaluated using a global score (the sum of scores for particular risk parameters) and the presence of these parameters in both groups of patients – surviving and nonsurviving. It was clearly demonstrated that it is necessary to separate these two groups of patients according to the survival prognosis.

Primary mortality risk factors during the operative treatment of colorectal cancer are bronchopneumonia, perineal hemorrhage, hepatopathy, renal insufficiency and hypoalbuminaemia. Furthermore cardiac diseases (history of acute stroke and brain stroke) play an additional role.

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