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ORIGINAL ARTICLE

Surgery for colorectal cancer in elderly: a comparative analysis of risk factor in elective and urgency surgery

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Abstract
Introduction Colon cancer therapy is primarily surgical. Advanced age does not represent a contraindication to surgery. We analyse the results of surgery in ultra 75 patients undergoing surgery for colorectal cancer by examining the correlation between the comorbidity and any post-operative complications.
Materials and methods We surgically treated 66 patients for colorectal cancer, aged over 75. The examined subjects were compromised for various reasons. We have evaluated the different influences of risk factors in elective and urgency operation.
Discussion Several studies have shown that age alone is not a significant prognostic factor in survival after colonic surgery. The assessment of general conditions in elderly patients, as demonstrated by the literature, is a fundamental moment in the management of colorectal cancer.
Conclusions The surgical choice should be made case by case (custom-made), not based on age only.

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Keywords Elderly patients · Colorectal cancer · Urgency surgery · Elective surgery

Abbreviations

CRC	Colorectal cancer
COPD	Chronic obstructive pulmonary disease
SIOG	International Society of Geriatric Oncology
PN	Parenteral nutrition

Introduction

Colorectal cancers (CRCs) have a high incidence. Recent studies show a continuous increase in Western Europe, North America and New Zealand [1], and these tumours have the highest frequency and mortality in geriatric patients [2].

Colon cancer therapy is primarily surgical; the prognosis could be improved by the use of radiotherapy and chemotherapy in the pre- and post-operative period [3].

Even the treatment of rectal cancer is essentially based on surgery. In some people with serious diseases associated which did not recommend surgery local alternative therapies has been also proposed.

Surgical treatment is variable and may consist of interventions with radical or palliative intent, depending on the stage of disease. Palliative surgery is performed to avoid the occurrence of complications such as obstructions or perforations [3].

Although advanced age does not represent a contraindication to surgery, the data provided by the international literature show a lower incidence of colic resections in geriatric patients than younger ones [4–6]. This is related

to the opinion that surgery has a high risk of post-operative morbidity and mortality in elderly patients, compared to the benefits it brings.

Actually, the surgery performed electively with oncological intent offers the same life expectancy in elderly subjects compared to younger patients [7, 8].

The perforation and intestinal obstruction are more frequent in geriatric patients [9] because in this group of patients the diagnosis of rectal cancer is performed with delay [10]. The onset of these complications worsens morbidity and post-operative mortality.

In this paper, we analyse the results of surgery in ultra 75 patients undergoing surgery for colorectal cancer by examining the correlation between the comorbidity that was already present before surgery and any post-operative complications.

Materials and methods

In the period between January 2013 and December 2015, we surgically treated 281 patients for colorectal cancer: 66 of these patients were aged over 75.

All patients were subjected to tests to assess the extent of the disease and their general condition.

In many cases the examined subjects were compromised for various reasons:

1. For the progressive reduction of biological reserves (physical frailty);
2. For the lack of compensatory mechanisms of cardiac, renal, metabolic hormone and immune function.

We have then evaluated the different influences of risk factors in elective and urgency operation.

The group of patients operated on in the elective surgery included 47 subjects:

- 33 patients (70.1%) were suffering from cardiovascular diseases (previous infarction, electrocardiographic abnormalities, congestive heart failure).
- 23 patients (48.8%) were suffering from kidney disease (chronic renal failure, nephrolithiasis).
- 14 patients (29.7%) were suffering from metabolic alterations (diabetes).
- 11 patients (23.3%) were suffering from respiratory diseases (COPD, acute bronchopneumonia, previous lung resections).

All clinical imbalances were corrected, as far as possible, in the pre-operative period.

Instead, the group of patients operated in urgency included 19 subjects: of these 14 patients (74%) were operated in urgency for bowel obstruction, while 5 patients (26%) for intestinal perforation.

The analysis of the urgency group showed these data:

- 15 patients (78.8%) were suffering from cardiovascular diseases.
- 11 patients (57.8%) were suffering from metabolic alterations.
- 10 patients (52.6%) were suffering from kidney disease.
- 2 patients (10.5%) were suffering from respiratory diseases.

In this group, these diseases were decompensated at admission and were partially correct as needed to perform the surgery in urgency; also it was not possible to carry out an adequate bowel preparation.

In most cases, compatible with the basic conditions of the patients, were performed radical resections with variable resection margins. In patients whose general medical condition or state of advanced disease did not allow performing radical interventions, we carried out palliative surgery-type derivative.

Analysing the types of surgery performed, the data show that in elective surgery the following were carried out:

- 10 anterior resection of rectum (21.2%),
- 7 abdominal-perineal resection (APR) (14.8%),
- 2 interventions according to Hartman (4.2%),
- 8 left hemicolectomy (17%),
- 6 right hemicolectomy (12.7%),
- 10 external derivative operations (21.2%),
- 1 internal derivative operation (3%),
- 3 exploratory laparotomy (6.3%).

In urgency group, we have carried out the following operations:

- 6 external derivative operations (31.5%),
- 5 left hemicolectomy (26.3%),
- 3 right hemicolectomy (15.7%),
- 2 interventions according to Hartman (10.5%),
- 1 abdominal-perineal resection (APR) (5.2%),
- 1 exploratory laparotomy (5.2%).

We have divided the post-operative complications into early (within 7 days), intermediate (between the eighth and the 30 days post-op) and late (more than 30 days after surgery) according to their occurrence in time after surgery.

Early complications in elective operations were: suppurating wound in 10 cases (21.2%), cystitis in 6 cases (12.7%), bronchopneumonia in 3 cases (6.3%), dehiscence of the intestinal suture in 2 cases (4.2%) and thrombophlebitis of the lower limbs in 1 case (2.1%).

Intermediate complications were subphrenic abscess in one case (2.1%). Finally, late complications were in 2 cases (4.2%) stenosis of stoma.

In patients undergoing urgency surgery, the early complications were suppurating wound in 11 cases (60%),

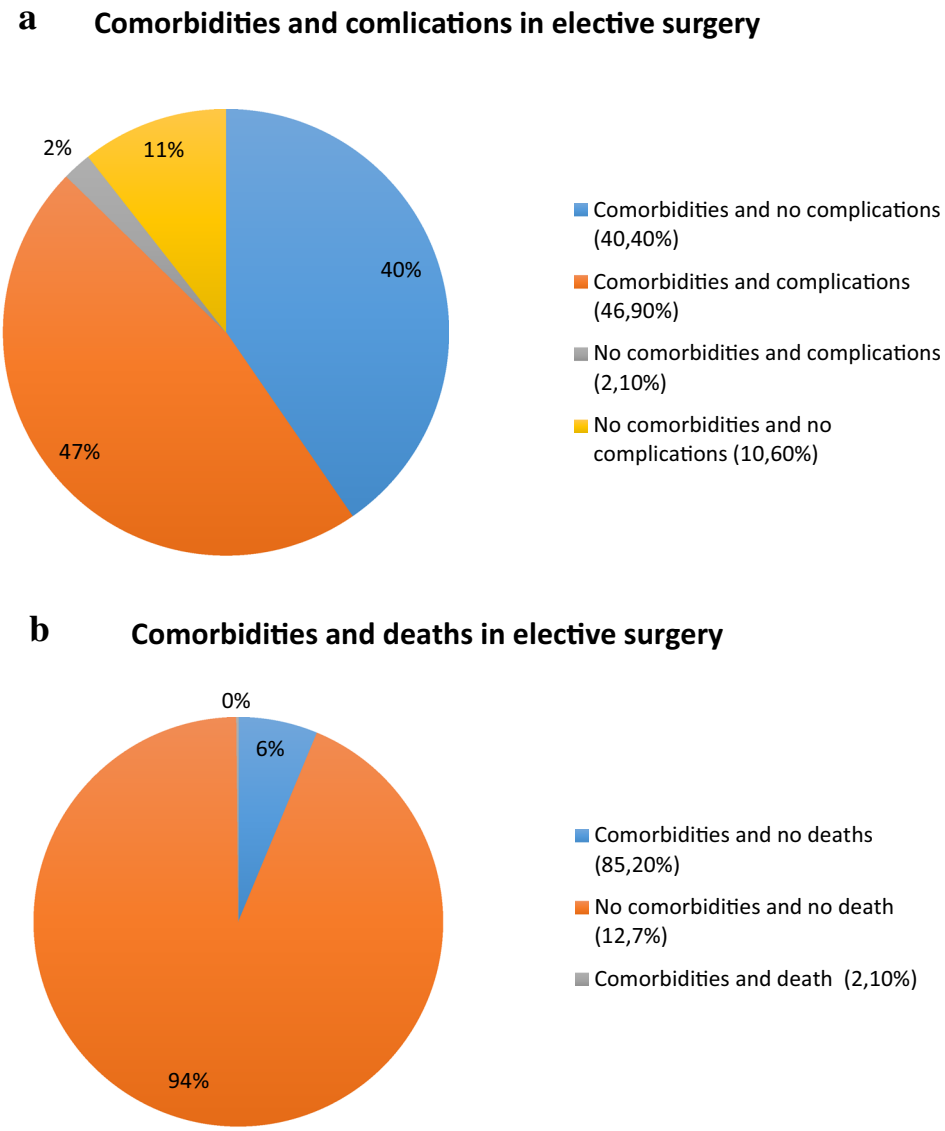

Fig. 1 **a**, **b** Correlation between comorbidity and complication/mortality in elective surgery

arrhythmias in 4 patients (21%) and acute renal failure in 1 case (5%). There were no intermediate and late complications.

In this study, we correlated pre-operative comorbidity and complications that have arisen in the first 30 days of post-operative period (Figs. 1, 2; Tables 1, 2).

In elective surgery, complications occurred in 2.1% when the comorbidity index was equal to 0 and 46.8% in the presence of comorbidity. However, in urgency surgery complications did not occur in the absence of comorbidity and were 57.8% in the presence of comorbidity.

The mortality rate in both elective and urgency procedures in the absence of comorbid conditions was zero. In the presence of associated diseases, instead the mortality rate was 2.1% in elective and 26.5% in urgency surgery.

We have also sought a possible correlation between single comorbidity and post-operative course:

1. In elective group, the more related comorbid diseases with post-operative complications and mortality were the renal tract diseases whereas cardiovascular diseases have proved to be only related to post-operative complications. Poorly significant was the correlation between the presence of metabolic and respiratory diseases prior to surgery and the onset of complications and mortality.
2. In urgency group, the more related comorbid with post-operative complications and mortality was cardiovascular ones. Renal disorders were related only to the occurrence of post-operative complications. Also in these cases the effect of metabolic and respiratory pre-operative diseases was barely significant.

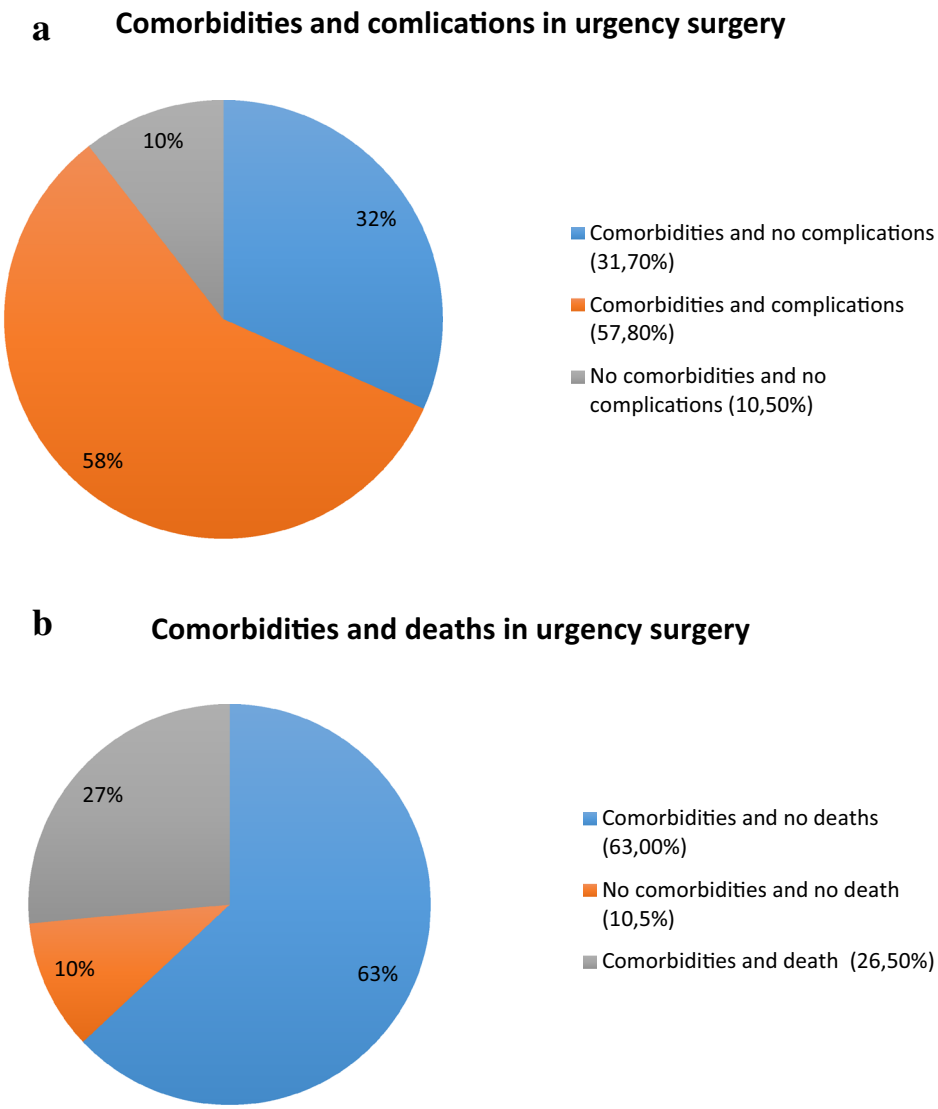

Fig. 2 **a**, **b** Correlation between comorbidity and complication/mortality in urgency surgery

Table 1 Correlation between comorbidities and post-operative course in elective surgery

Comorbidities		Post-operative			
		No complications	Complications	Alive	Death
Kidney diseases	No	15 (31.9%)	9 (19.1%)	24 (51%)	0 (0%)
	Yes	9 (19.1%)	14 (29.7%)	22 (46.7%)	1 (2.1%)
Respiratory diseases	No	20 (42.5%)	16 (34%)	35 (74.4%)	1 (2.1%)
	Yes	4 (8.5%)	7 (14.8%)	11 (23.3%)	0 (0%)
Cardiovascular diseases	No	8 (17%)	6 (12.7%)	13 (27.6%)	1 (2.1%)
	Yes	16 (34%)	17 (36.1%)	33 (70.1%)	0 (0%)
Metabolic alterations	No	16 (34%)	17 (36.1%)	33 (70.2%)	0 (0%)
	Yes	8 (27%)	6 (12%)	13 (27.6%)	1 (2.1%)

Discussion

The colorectal cancer manifests itself with an acute abdomen characterized by occlusion in 15–20% of cases and perforation in 3–8% of cases [11–14].

These events are characteristic in geriatric age; in fact, while the higher frequency of surgical interventions for colorectal neoplasms, carried out in elective, is for patients with ages between 60 and 70, the incidence of most surgical interventions in urgency is for patients aged over 70 [15].

Table 2 Correlation between comorbidities and post-operative course in urgency surgery

Comorbidities		Post-operative			
		No complications	Complications	Alive	Death
Kidney diseases	No	6 (31.5%)	3 (15.7%)	7 (36.8%)	2 (10.5%)
	Yes	2 (10.5%)	8 (42.1%)	7 (36.8%)	3 (15.7%)
Respiratory diseases	No	7 (36.8%)	10 (52.6%)	13 (68.4%)	4 (21%)
	Yes	1 (5.2%)	1 (5.2%)	1 (5.2%)	1 (5.2%)
Cardiovascular diseases	No	4 (21%)	0 (0%)	4 (21%)	0 (0%)
	Yes	4 (21%)	11 (57.8%)	10 (52.6%)	5 (26.2%)
Metabolic alterations	No	4 (21%)	4 (21%)	7 (36.8%)	1 (5.2%)
	Yes	3 (15.7%)	8 (42.1%)	7 (36.8%)	4 (21%)

Although in recent years, thanks to the use of staplers, the prognosis of colorectal carcinoma is significantly improved for elective operations, for those in urgency it remains poor [16–20].

The high mortality reported in urgency interventions [21] underlines the need for careful pre-operative assistance aimed at the correction of associated diseases and special deficit conditions also due to colorectal cancer (state of anaemia and malnutrition).

Manceau et al. stated that older patients with rectal cancer undergoing surgery should receive the same treatment as the younger patients but with a modified therapy in the case of comorbidity, limited physiological reserves and urgency surgery [22]

The International Society of Geriatric Oncology (SIOG) recommended that CRC patients >65 years of age requiring surgery should undergo a pre-operative whole patient evaluation of the most common physiological side effects of ageing, physical and mental ability, and social support [23].

Several studies have shown that age alone is not a significant prognostic factor in survival after colonic surgery [24].

Several authors have tried to quantify the correlation between comorbidities and post-operative mortality or morbidity [25–27].

Physical frailty increases the risk of major complications following surgery [odds ratio (OR) 4.1 (1.4–11.6)] in patients ≥75 (range 75–93) years [28] and is predictive for both complications and survival in patients ≥70 years following surgery [29, 30].

Masera also [31] proposed a scale in which the increase in concomitant diseases increases the risk of mortality: a comorbidity corresponds to a risk of 6%, two comorbidities are a risk of 21%, three comorbidities are a risk of 49%, and four pre-operative defects are a mortality risk of 76%.

Finally, it must be remembered that malnutrition, which is a frequent epiphenomenon of colorectal cancer, leads to an increase in post-operative mortality and morbidity. For this reason, it is necessary to bring the patient to the intervention in the best possible nutritional conditions also through the use of PN or enteral diets [32, 33].

Therefore, it can be said that based on current knowledge and on our personal experiences there are no reliable data that may suggest that colorectal cancer in old age has different characteristics from those of youth.

Thanks to more accurate pre-operative care and to technological advances in surgery, we can provide the geriatric patient the same oncologic radicality as that of the younger patient, thus abandoning the palliative conducts very frequent in the past.

However, with regard to the prognosis, the discrepancy remains significant for urgent surgery between geriatric subjects and younger; this is related to the impossibility of making an adequate pre-operative preparation.

The importance of making an accurate correction of associated diseases [34] has also emerged from the results of our study, where there was in urgency surgery a significant correlation between cardiovascular comorbidities and post-operative morbidity and mortality.

This association was also reported by Tardio [35] who carried out a retrospective study of 144 septuagenarian patients undergoing surgery for colorectal cancer.

In fact, with increasing age there is a natural decay of cardiovascular function. In elderly heart rate and ventricular compliance decrease [36–39], so in case of volume depletion (haemorrhage, dehydration, excessive urination) the geriatric patient is more vulnerable than younger.

A history of angina or myocardial infarction represents a significant risk factor for the development of post-operative complications. In fact, the post-operative acute myocardial infarction is complicated by a mortality rate of 50–60% and relapse in 30% of patients operated on after a recent heart attack [40].

Moreover, elderly patients may be defined as frail patients, meaning a condition characterized by a multisystem reduction in reserve capacity to the extent that a number of physiological systems are close to, or past, the threshold of symptomatic clinical failure [41]. For these reasons, the

assessment of cardiac function in elderly patients, as demonstrated by the literature, is a fundamental moment in the management of elderly patients suffering from colorectal cancer in order to be able to perform radical surgery [42].

In these recent years, the use of minimally invasive surgery access is the preferred treatment for cancer in some centres [43–56], but data about urgency surgical oncology treatments are not disposable [43, 57, 58].

Conclusions

Comorbidities influence significantly the post-operative mortality and morbidity. Elective resection of colonic carcinoma in the elderly has the same safety and efficacy as in younger patients. The older age alone should not be an indication for a less aggressive therapy. In urgency treatment often it is not possible to correct the comorbidities before surgery, and the post-operative mortality is higher than younger patients. For these reasons, in these cases, the surgical choice should be made case by case (custom-made).

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Compliance with ethical standards

Conflict of interest All authors listed have contributed sufficiently to the project to be included as authors, and to the best of our knowledge, no conflict of interest, financial or other exists.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed consent Informed consent to the radiological procedure and to the processing of own personal data was obtained from each individual study participant. In accordance with Italian Drug Agency (AIFA) guidelines, observational studies using retrospective data or materials do not require formal approval by the local ethics committee.

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