JOURNAL OF GERIATRIC ONCOLOGY 5 (2014) 133–140

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# The influence of age on the outcome of treatment of elderly patients with colorectal cancer

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ARTICLE INFO

*Article history:*
Received 8 May 2013
Received in revised form
22 August 2013
Accepted 31 December 2013
Available online 15 January 2014

*Keywords:*
Elderly

ABSTRACT

*Objectives:* We investigated factors associated with post-operative mortality rates in those aged ≥60, and in particular, the relative survival of age bands within this group.
*Methods:* Secondary analysis of a large comprehensive cohort of the elderly treated for colorectal cancer in the North of England during 1998–2003. We investigated seven risk factors associated with 30-day and 6-month post-operative mortality from colorectal surgery.
*Results:* 6083 patients aged ≥60 underwent colorectal cancer surgery. Approximately 8% had died within 30 days of surgery and 17% had died within 6 months. Thirty-day mortality was greater in the elderly (80 years+) compared to the young-old (60–69 years) (adjusted OR: 3.2, 95% CI 2.4 to 4.4). There was neither a significant difference between the proportions offered curative resections across the age-groups, nor was there a significant association between intent of surgery and 30-day mortality. Six-month mortality rose with age, but the association was stronger in those having curative surgery (adjusted OR: 3.8, 95% CI 2.8 to 5.2) than palliative surgery (adjusted OR: 1.5, 95% CI 1.1 to 2.1). Mortality from emergency surgery at 6-months was particularly high in elderly females.
*Conclusions:* This large population study adds more weight to the findings that age itself is a major risk factor in the outcome of colorectal surgery in elderly and that 30-day mortality underestimates the longer-term outcome in this age group. There was no significant association between radical resections and 30-day mortality in elderly patients compared to the younger age groups; however, a disproportionately higher mortality at 6 months was seen in elderly female patients.



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http://dx.doi.org/10.1016/j.jgo.2013.12.005

## 1. Introduction

Life expectancy in the western world is increasing: in the UK, the general population grew by 8% between 1971 & 2006 but the population aged over 65 years grew by 31%.[1] The incidence of colorectal cancer also increased by 30% between 1971 & 1997.[2] The UK has one of the highest incidences of colorectal cancer in the world[2] where it is the second most common cancer, and the most common cancer in elderly non-smokers.[3] More than 70% of colorectal cancer occurs in those aged over 65[2,4,5] and the median age of patients at diagnosis is 70 years.[6] However, the age-standardised mortality rates have declined since 1950[2,7].

Colorectal cancer can be treated by surgery, chemotherapy and radiotherapy but the only curative treatment is surgery.[8,9] Chemotherapy and radiotherapy are reserved for either metastatic or residual disease or for downsizing the tumour. A systematic review of 28 studies worldwide on surgery for colorectal cancer in elderly patients,[10] despite being 13 years old, is used as the main guide for treating elderly patients with colorectal cancer. The quality of other studies has suffered mostly because of either a small number of elderly patients, a wide geographic variation, or a lack of adjustment for key confounding factors. Even larger studies which were done in tertiary or specialised units were exposed to selection bias. This systematic review concluded that 'the elderly were more likely to present with later-stage disease' and an increased number of elderly patients underwent emergency surgery, while the chances of being offered elective curative surgery diminished.[10] However, when the elderly did receive elective curative surgery, the outcomes, according to the available literature, were comparable with those of the younger age group. On the other hand, some more recent studies[11–16] suggest that there has been an upward trend in elective and curative surgery for the elderly and yet the outcomes are not the same for all elderly patients. While some elderly patients do very well after curative surgery, others do not. It is quite clear from the literature that the risks and benefits of surgery for colorectal cancer in the elderly have not been clearly defined yet. The systematic review[10] concluded that more data was needed and larger studies were required to draw better conclusions. There were problems in the varying definitions of 'elderly' and in the ways of reporting outcomes and in the quality of evidence. For instance, only 3 out of the 28 studies which were included in this review documented the progress of all cases from within a geographical area.[10] There is, therefore, still no common consensus on how actively we should treat the elderly and when not to push them into unnecessary surgery, which could lead to severe functional impairment and diminished quality of life.

This paper reports a secondary analysis of the results of a prospective population-based audit of colorectal cancer cases seen in all the treatment centres in the former Northern Region of England conducted by the Northern Region Colorectal Cancer Audit Group (NORCCAG). The main aim of this study was to investigate the factors associated with mortality rates in those aged 60 and over, and in particular, the relative survival of age bands within this group {young-old (60–69 years), older-old (70–79 years) and elderly (80 years & above)}. Given the accuracy, the completeness and the size of this dataset, the analyses are an attempt to clarify some of the ambiguities in the literature.

## 2. Methods

### 2.1. Data Source

NORCCAG was established in 1998 to audit the surgical management of colorectal cancer in the Northern Region of England with a population of approximately 3.1 million. It collects data prospectively from all hospitals in the region (17 acute hospitals & 3 cancer treatment centres).

### 2.2. Study Population

In the period covered by this paper, NORCCAG collected data on all patients who were operated on for colorectal cancer, but not all those who did not have an operation. There were 8218 patients who were included in the audit between Jan 1998 and December 2002, of whom 7411 underwent surgery for colorectal cancer. Occasionally the operation took place in 2003, even though the audit date was within 2002 (N = 111): these patients were included in the analyses.

Because the main interest in this analysis was the outcome of older patients, our analyses concentrated on those patients who were aged 60 years or above. This was because the vast majority of colorectal cancer occurs in this age band (83% of our cohort) and because colorectal cancer in the younger ages differs in characteristics, presentation, and incidence [17–19].

### 2.3. Variables

We chose seven variables for comparison within this cohort (Table 1). These variables include: age group at diagnosis, sex of the patient, mode of surgery (elective/emergency), intent of surgery (curative/palliative), tumour site (rectum, right colon & left colon), stage of the disease (modified Dukes' A, B, C or D) and co-morbidities in the form of ASA grade. We chose to compare the relative survival of older patients to those in the 60–69 years age group. Those aged 60 or above were divided into three age groups [young-old = 60–69 years (N = 2027), older-old = 70–79 years (N = 2783) and elderly = 80+ years (N = 1273)]. The main outcomes considered in this paper were mortality within 30 days and 6 months (183 days) post-operation.

### 2.4. Statistical Analysis

Statistical analysis was performed using STATA version 12 software. Differences between the univariate distributions of patients' characteristics across age groups were performed by chi-squared tests. These variables of interest were used in a logistic regression model to predict 30-day and 6-month mortality. If the value of a factor was unknown, then a category of 'missing' was added to that variable in the model, to make sure that all patients were included in the analysis. Interaction terms were included in the model if significant at the 1% level. It was found that there was a significant interaction between age-group