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A Retrospective Study of Resource Utilisation in the Treatment of Advanced Colorectal Cancer in Europe

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An estimation of resource utilisation in the treatment of advanced colorectal cancer has been carried out by the European Organization for Research and Treatment of Cancer. Data on resource utilisation were collected retrospectively from 10 European centres, examining 20 consecutive patient files in each centre. Data from eight centres are reported in this paper. 160 patients were included in the sample, followed up for a median of 530 days. All patients were hospitalised and almost all underwent surgery. Fifty-four per cent received chemotherapy, and most visited the hospital as an outpatient. Including hospital stay and outpatient visits, patients spent almost 10% of their time in hospital or associated travelling. The most common diagnostic tests were chest X-ray, electrocardiogram and abdomen ultrasound. There was considerable variation between hospitals in resource utilisation, both within and between countries. Surgical procedures, chemotherapy, hospitalisation, diagnostic tests and outpatient visits are major cost determinants in the treatment of colorectal cancer. The variation in resource utilisation suggests that efficiency could be improved. Copyright © 1996 Elsevier Science Ltd

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INTRODUCTION

IN RECENT years, one of the most striking cost-control measures in all European countries has been the shift of budgetary responsibility towards hospital administrators and doctors. More and more, doctors must act as gatekeepers, standing between their department's limited budget and the patient's need for the best treatment. Therefore, they might increasingly feel the need for a technological assessment or, more specifically, applied cost-effectiveness analysis to clarify the economic consequences of treatment choices and the difficult relationship between the associated costs and outcomes.

The aim of economic evaluation is to elicit the costs and benefits for treatments and to compare these treatments according to, for example, their incremental cost per life year gained. Budgets can then be allocated in such a way that total benefits for society (e.g. number of lives saved) are optimised within the available budgetary means.

One way to carry out economic evaluations, which is considered increasingly as the gold standard, is to integrate them in large, multicentre, prospective clinical trials. A recent advisory report by the European School of Oncology [1] has promoted this approach in the cancer field and raised, at the same time, a number of concerns and points of discussion.

Before economic evaluations can be applied on a large scale and their results taken into account in daily hospital decision-making, a number of methodological issues must be clarified. Even more importantly, good databases are needed to gain a basic understanding of all the potential economic consequences of various treatment strategies.

The discussion of economic aspects in the treatment of colorectal cancer has, until now, been relatively limited. Moertel [2] has reviewed the reported efficacy and drug costs of three chemotherapy regimens for the treatment of advanced colorectal cancer based on a combination of 5-fluorouracil (5-FU) and leucovorin. While all three were found to be equally effective, the drug costs varied from $545 to $7005. A comparison in the same review of four adjuvant regimens showed a range of estimated drug costs from $545 with the cheapest regimen, to $13 540 with the most expensive. However, focusing on drug costs alone is not sufficient. Buroker and associates [3], comparing two 5-FU/leucovorin regimens, showed that considerable costs are associated with the treatment of chemotherapy-related side-effects, and need to be taken into account in any economic evaluation. Other studies have assessed the costs associated with specific diagnostic procedures [4] or the overall costs associated with the treatment of colorectal cancer in particular countries or centres [1, 6]. Interesting methodological exercises related to costing of care for colorectal cancer patients have been carried out by Whynes and Walker [6, 7]. These and other aspects of the economic evaluation of colon and rectal cancer have been reviewed by Heine and Rothenberger [8].

No study known to us has attempted to report a detailed stage-specific breakdown of costs beyond the setting of one

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Table 1. Summary of the sample population and resource utilisation in the retrospective study

Number of patients	160
Stage III	84
Stage IV	76
Median follow-up (days)	530 (range 441–891)
Median age (years)	64 (range 55–71)
Surgery (number of patients)	
Colectomy	61
Rectal resection	84
Rectum and colon resection	11
Bowel resection	7
Mean hospitalisation (days)	42
Chemotherapy (number of patients)	86 (54%)
Radiotherapy (number of patients)	43 (27%)
Outpatient visits (number of patients, mean visits per patient)	
For specialist visits	149 (10)
For chemotherapy	52 (30)
Diagnostic tests (number of patients, mean procedures per patient)	
Electrocardiogram	138 (2.4)
X-ray (all sites)	150 (4.6)
Chest X-ray	147 (3.8)
Ultrasound (all sites)	150 (5.1)
Abdomen ultrasound	91 (3.3)
CT scans	124 (3.0)
Endoscopy	130 (2.5)
Barium enema	78 (1.3)

particular centre, or covering more than one country. However, in order to be able to assess the cost-effectiveness of specific treatment strategies in the future, such stage-specific data, which take into account differences between centres and between countries, are needed. Moreover, since costs do differ both because of differences in relative prices and differences in resource utilisation, any useful description of the variation in costs should start from a description of the variation in resource utilisation.

Therefore, given the need for economic evaluations and the measurement of economic parameters in prospective, multicentre, randomised clinical trials, it was felt that there is a need for additional insight into the overall costs of treatment for colorectal cancer, taking into account the following prerequisites:

- information on the overall treatment history
- cost data should be stage-specific
- cost data should cover different centres and different countries
- data on quantities or resource utilisation should be reported separately from data on costs (which include a price element)
- it should be possible to relate cost information to relevant clinical and other patient characteristics.

Such information will, *inter alia*, help establish where and how new treatments are likely to affect overall resource utilisation and costs. The objectives of a study carried out by the European Organization for Research and Treatment of Cancer (EORTC) Health Economics Unit, in collaboration with centres belonging to the EORTC Gastrointestinal (GI) Tract Cancer Cooperative Group were: to identify overall resource utilisation for treatment and to recognise the key cost drivers and the economic context of new treatments; to gain insight into the variation of resource utilisation; and to identify areas in which efficiency can be improved and to see how this can be examined alongside future clinical trials. Preliminary results are reported in this paper.

MATERIALS AND METHODS

To meet the aforementioned objectives, our study was designed in three parts, only the first of which is reported here. This consisted of retrospective collection of resource utilisation in 10 centres (all members of the EORTC GI tract cooperative group) across Europe (Italy, UK, Germany, Belgium and France), examining 20 consecutive patient files in each centre.

Patients were selected on the basis of a new diagnosis of either stage III or stage IV colon or rectal cancer, starting in January 1992. Data were retrieved from the patient's case notes and verified with other sources whenever they were available. Data included resource consumption from the date of diagnosis to the date of death or the date on which the patient was last seen and known to be alive. Detailed data were obtained with respect to hospital admissions (including other centres when information was available), length of stay in various wards, 1-day hospitalisation, outpatient visits, type and duration of surgery, type, dosages and administration schedules of chemotherapy and radiotherapy, diagnostic procedures, laboratory examinations and transfusions. All data were entered on site in a spreadsheet program and transported to SAS™ for analysis.

In the second step, a prospective study will focus on those questions which remain unresolved in the retrospective study, particularly indirect and direct costs incurred by the patients outside the study hospital. In the third step of the study, unit costs will be estimated, from various perspectives, in order to estimate overall treatment costs for colorectal cancer. These are not reported here.

RESULTS

Description of the patient sample

160 patients were included in the sample reported here; 84 had initial stage III colorectal cancer and 76 had initial stage IV colorectal cancer (Table 1). Overall, patients were balanced between colon and rectal cancer. Of the patients with stage III cancer, 31 (37%) progressed to stage IV during the study follow-up. Of all patients, 53 (33%) were, at some point during their treatment, included in clinical trials, mainly chemotherapy trials. The follow-up of all patients, from the date of the initial diagnosis onwards, was a median of 530 days, ranging from a median of 441 in one hospital to a median of 891 in another hospital (Table 1). The median age of the patients was 64 years (ranging from a median of 55 in one hospital to a median of 71 in another) (Table 1). One-year survival could be assessed for 135 patients (84%). For initial stage III patients, 1-year survival was 93%, compared with 73% for initial stage IV patients. Two-year survival could be assessed for 107 patients (67%) and was 73% for stage III patients compared with 27% for stage IV patients.

Clearly, differences in distribution of clinical stage and age of patients, as well as differences in participation in clinical trials, will determine differences in overall resource utilisation.

Resource utilisation

Resource utilisation is summarised in Table 1. Almost all patients in the study underwent surgery after diagnosis of advanced colorectal cancer (Table 1). Patients underwent, on average, two surgical procedures including stomy or anastomosis

Table 2. Variation in resource utilisation

	Lowest resource use per 20 patients	Second lowest resource use per 20 patients	Second highest resource use per 20 patients	Highest resource use per 20 patients
Hospital days	598	619	1036	1264
Outpatient specialist visits	94	109	272	278
Outpatient chemotherapy visits	59	60	314	373
CT scans	18	29	61	85
X-rays	58	61	111	129
Ultrasounds	21	36	146	157
Endoscopies	21	26	54	58
Electrocardiograms	16	31	56	64

procedures, treatment of metastases, catheter procedures and diagnostic procedures under anaesthesia.

All patients were hospitalised and spent a mean of 42 days (median 32) in hospital during the period covered by the retrospective study. A quarter of the patients spent more than 56 days in hospital. Of all the hospital days documented in the study, 15% were spent in a hospital other than the study hospital. It is possible that the number of days spent in a hospital other than the study hospital is underestimated due to the retrospective design of the study. More accurate collection of these data is a challenge for prospective economic evaluations. Of all the days spent in the study hospital, the vast majority (78%) were in a surgery ward while 12% were in an internal medicine department and 3.3% in intensive care.

86 patients (54%) received some form of chemotherapy. All except 1 received 5-FU while 68 patients (43%) received leucovorin. There was a large variation in the dose of these drugs, which contributes to the variation in cost of therapy. A small number of patients received other chemotherapy including levamisole (7 patients), mitomycin (11 patients), cisplatin (6 patients), carboplatin (8 patients), interferon (11 patients) and a number of other regimens (less than 3 patients each). 43 patients also had visits for radiotherapy (mean, 23 visits), both as inpatients and outpatients.

A mean of 10 outpatient visits/patient (median 7) to specialists was documented for 149 patients. In addition, 52 patients (33%) had a mean of 30 outpatient visits/patient for chemotherapy (median 25). 19 patients had "1-day hospitalisations" (mean 2.2, median 1), while 5 patients were visited at home to receive chemotherapy (a mean of 27 times). Taking into account hospital stay and outpatient visits, patients spent a mean of almost 10% of their time in hospital or travelling to and from hospital.

The most common diagnostic test was the chest X-ray, with a total of 558 performed in 147 patients, followed by the electrocardiogram (331 performed in 138 patients) and abdomen ultrasound (291 performed in 91 patients). Including all body sites, a total of 150 patients underwent a mean of 5.1/patient ultrasound examinations and a mean of 4.6/patient X-ray examinations. CT scans of various body sites were performed a mean of 3 times/patient in 124 patients and endoscopies 2.5 times/patient in 130 patients. A mean of 1.3 barium enemas/patient were administered to 78 patients. Other diagnostic procedures often used were scintigraphy, angiography, MRIs, urographies, echocardiographies and respiratory tests.

Variation in resource utilisation

Table 2 summarises the total hospital days, outpatient visits and specific diagnostic tests, for the two hospitals using the lowest and highest resource. The numbers represent the total use of each resource in 20 patients during the period covered by the retrospective study. A similar variation was found for chemotherapy. Use of chemotherapy varied, being given to 2 and 7 patients in the two hospitals with the lowest use of chemotherapy, and to 16 and 20 patients in the two hospitals with highest use. This is confounded somewhat by the fact that chemotherapy clinical trials were carried out in some of the hospitals.

DISCUSSION

There was considerable variation in resource utilisation, for which there are a number of possible reasons. Explaining variability is extremely difficult. Differences in resource utilisation can be related to differences in patient case mix, differences in life expectancy of patients (which itself can be influenced by resource utilisation), the degree of participation in clinical research, differences in the economic environment (e.g. budgetary restrictions, relative prices of treatment inputs) and, finally, differences in efficiency (i.e. the degree of input in obtaining a certain outcome). In addition, patients can seek treatments outside the study hospital and resource utilisation related to such treatment is often not reported in the files of the study hospitals. Some hospitals may substitute specific diagnostic tests with other tests, thereby scoring high for one test and lower for another. There is also a clear trade-off between outpatient visits and inpatient visits. Overall, the hospitals which were among the top four with respect to total number of hospital days were among the bottom four with respect to outpatient visits and vice versa. However, although there was a general tendency for hospitals which were relatively high users of one resource to be also relatively high users of another resource, no hospital was consistently either the highest or lowest user of resources (data not shown).

The data also suggest that differences between centres within one country are at least as important as the differences between countries (data not shown). This implies that multinational, prospective economic evaluations should include a representative sample of hospitals within each country.

We have documented retrospectively resource utilisation for treatment of patients with advanced colorectal cancer. This exercise will be extended with a prospective study, which will also include patient issues. The findings from these studies will

give useful information on the determinants of the cost-effectiveness of existing treatment patterns and the potential cost-effectiveness of new, emerging treatment strategies. They will also improve the understanding of which elements should be considered in prospective, comparative clinical trials of new treatments. It is clear that surgical procedures, chemotherapy, hospitalisation, diagnostic tests and outpatients visits are major cost determinants in treating advanced colorectal cancer.

In this article we have not considered utilisation of laboratory tests, concomitant medication, antibiotics and parenteral nutrition. These data have been extensively collected from two Italian centres and will be reported separately. Nor have we discussed the costing of the reported resource utilisation, which is also the subject of a separate exercise. Resource utilisation for two Belgian hospitals is currently being collected. When finalised, all findings will be discussed with the clinicians who treated the patients in our study, and extensive multivariate analysis will be carried out, including an analysis of how costs occur over time within the whole follow-up period.

The variation in resource utilisation found in the retrospective study might suggest that efficiency in treatment of advanced colorectal cancer patients can be improved. Improvement of efficiency is indeed the main objective of economic analysis and can lead to more benefits for more patients within the existing budgetary framework.

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