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Alimentary Tract

No effect of comorbidities on the association between social deprivation and geographical access to the reference care center in the management of colon cancer

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ABSTRACT

Backgound: Patients with colon cancer in France exhibit one of the steepest socioeconomic survival gradients in Europe. Among the putative causes for this situation, comorbidities are frequently incriminated but evidence of this is lacking.
Aims: Measure the influence of social deprivation and geographical access to the reference care center for the management of colon cancer, and the putative role of associated comorbidities.
Materials and methods: The study population comprised all 1383 resected colon cancer cases diagnosed between 2005 and 2010 in the area covered by the "Calvados Registry of Digestive Tumors". Social environment was assessed by using the European Deprivation Index and travel time to the reference care center and comorbidities by using Charlson's comorbidity index.
Results: Our results confirm the existence of socioeconomic or geographical inequalities at each step of colon cancer management, but without any role of associated comorbidities. The effect of deprivation is mainly explained by age at diagnosis, while travel time to the reference care center is an independent predictor of cancer management.
Conclusion: We found no effect of comorbidities on the association between socioeconomic factors and the management of colon cancer in this French department.
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1. Introduction

With 42,152 new cases in 2012, colorectal cancer is in France the second most frequent cancer in women and the third in men. With nearly 17,722 deaths in 2012 (12% of deaths by cancer), it is the second most deadly cancer after lung cancer. Five-year net survival for patients diagnosed between 1989 and 2004 was estimated to be 56% (10-year net survival: 50%) [1]. As reported by the CONCORD study [2], France has the second-best survival rate in women worldwide and the fifth in men. According to the EUROCARE 5 study [3], five-year survival in France was higher for patients diagnosed between 2000 and 2007 than in 23 other European countries (59.7% vs 57%).

Incidence of cancer varies according to the socio-economic status of patients [4]. However, data are accumulating to show that whatever the cancer location, the most disadvantaged patients have an excess of mortality and die more quickly [5], but the reasons for this are poorly understood. As highlighted in a review by Woods et al. [6] the underlying causes of this survival deprivation gap can be broken down into three categories: factors relating to the tumor, to the health care system and to the patient.

In colon cancer, stage at diagnosis is the main prognostic factor of cancer survival. While the explanation of a deprivation gap in survival by a differential stage at diagnosis according to deprivation status is attractive, the gap remains significant in most countries even after adjustment for stage at diagnosis. The relationship is unclear, even when the so-called "Will Rogers" phenomenon, leading to underestimating stage in the most deprived patients, is taken into account [7].

Regarding care-related factors, studies have shown that the most deprived patients receive less surgery [8], and that when they

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do, it is more technically invasive and less curative, with more permanent stoma in rectal cancer [9] and with less access to adjuvant therapy [10]. Geographic access to care could also be an independent predictor of adjuvant chemotherapy use, especially in France compared to the UK [11]. Unfortunately, the results are inconsistent depending on the resolution of the data used and even the country. The main difficulty for such studies is having detailed data and a homogeneous population, so that changes in influencing factors can be measured with precision. In this context, specialized cancer registries provide reliable and relevant data, thereby allowing every step of disease management to be studied: admission mode, assessment of extension, surgery type, number of lymph nodes examined and chemotherapy use.

Concerning patient-related factors, comorbidities and health-related behaviors are putative pathways to explain the difference in survival according to socioeconomic status. In 2009, two studies found that lifestyle and principally comorbidities explained the excess of 30-day mortality inherent in socioeconomic inequalities [12], and that these two factors explained a part of the survival gap between the most and the least deprived [13]. This hypothesis remains to be studied and confirmed with full population-based data.

The aim of this study was to measure the influence of deprivation and geographical access to the reference care center on the management of colon cancer, and to measure the impact of comorbidities on such inequalities of care in Calvados, a department in North-West France.

2. Materials and methods

2.1. Population

All 1383 patients diagnosed in Calvados with a resected colon cancer (including rectosigmoid adenocarcinoma (C18-C19; ICDO-3)) [14] between 01/01/2005 and 12/31/2010 were included in this study. Calvados is a department in Normandy, in North-West France. The registry covers a population of 678,000. Registration began in 1978 and the databases are declared to the National Commission on Information Technology and Civil Liberties (CNIL). Information was actively collected by the cancer registry staff from multiple sources: Calvados has a university hospital, a regional comprehensive cancer center, 12 public or private general hospitals (two with radiotherapy facilities), and five pathology laboratories.

The cancer registry is part of the French network of cancer registries (FRANCIM). Data quality and completeness of the registry are assessed by the CER (Comité d'Évaluation des Registres) and by the International Agency for Research on Cancer (IARC). Site, morphology, gender, age, diagnosis date, Charlson's comorbidity index and number of lymph nodes examined were collected by the registry. Age at diagnosis is separated in classes – below 50 years old (reference), 50–59 years old, 60–69 years old, 70–79 years old and over 80. Among patients with stage IV cancer (25%), there are disparities in the number and the location of metastases and in the treatment of these. Registry data did not allow distinguishing between these various groups, nevertheless, it seemed important to include these patients in our study of the impact of comorbidities on the social and territorial inequalities of care. Due to the heterogeneity of this group, analyzes were carried out with and without stage IV patients (n = 1039).

2.2. Charlson's comorbidity index (CCI)

The CCI was constructed to predict 1-year mortality in 559 breast cancer patients as well as 10-year mortality rates for death attributable to comorbid diseases among 685 breast cancer patients. The index encompasses 19 medical conditions weighted 1–6, depending on the risk of dying associated with each one, with total scores ranging from 0 to 37 [15]. The CCI was divided into three classes in this study: no comorbidities (CCI = 0; reference), one comorbidity, more than one comorbidity.

2.3. High-resolution registry data

2.3.1. Admission mode

Emergency admission was defined as every patient presenting with at least one of the following symptoms: occlusion, subocclusion or perforation.

2.3.2. Assessment of extension (research of metastasis)

A complete assessment corresponded to a CT-scan or chest X-ray combined with abdominal ultrasound.

2.3.3. Chemotherapy

Chemotherapy was defined as every type of chemotherapy (conventional or targeted). Analyses were made for a subpopulation which included, according to French recommendations, stage II with less than 12 examined lymph nodes or admitted in emergency (optional), and stages III and IV (recommended) (n = 867) [16]. As the main indication of adjuvant chemotherapy includes patients with stage III, use of chemotherapy was analyzed also for stage III patient's only (n = 351).

2.3.4. Stage

Stage was defined according to the 7th edition of the TNM classification [17], with "T" the degree of invasion of the intestinal wall, "N" the number of invaded lymph nodes, and "M" the presence of metastasis, using the data collected after tumor resection.

2.4. Surgical approach and resection quality

All medical operative reports were examined by a digestive surgeon (AA) and the type of resection was classified as laparotomy (invasive), coelioscopy (micro-invasive), converted coelioscopy (micro-invasive) and other (polypectomy). In this study, examination of 12 or more lymph nodes was considered as an indicator of surgery good quality, as recommended by guidelines for colon surgery.

2.5. Social environment

Place of residence was known for all patients and was allocated to an IRIS (Ilôts Regroupés pour l'Information Statistique), a geographical unit defined by INSEE, the French national statistics agency [18]. For each of these IRIS, the aggregated deprivation score used was the European Deprivation Index [19]. This score was then separated into national quintiles, the first representing the most affluent patients, and the last the most deprived. In this study, the first three quintiles were grouped together (reference), the latter two representing the poorest subjects.

2.6. Travel time to reference care center

For each patient, travel time to the reference hospital center was calculated according to their place of residence. To minimize travel time and not distance, estimations were made using a Geographical Information System (ArcGIS 10.5® – Esri France) associated with a roadmap database (Navstreets®, provided by HERE and Esri France) according to the legal speed for the different road classes. Travel times were as follows: less than 10 min (reference), 10–20 min, 20–30 min, 30–40 min and more than 40 min.

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