Impact of comorbidity on survival by tumour location: Breast, colorectal and lung cancer (2000–2014)

Oleguer Parés-Badell[a,b,1], Marta Banqué[a,c,d,*,1], Francesc Macià[a,d], Xavier Castells[a,d,e], Maria Sala[a,d,e]

[a] Department of Epidemiology and Evaluation, IMIM (Hospital del Mar Medical Research Institute), Barcelona 08003, Spain
[b] Public Health Agency of Barcelona, 1 Pl. de Lesseps, Barcelona, 08023, Spain
[c] European Higher Education Area (EHEA) Degree Programme in Preventive Medicine and Public Health, Fundació Universitària del Bages (FUB), Manresa 08243, Barcelona, Spain
[d] Research network on health services in chronic diseases (REDISSEC), Madrid 28029, Spain
[e] European Higher Education Area (EHEA) Doctoral Programme in Public Health in Department of Paediatrics, Obstetrics and Gynaecology, Preventive Medicine and Public Health, Universitat Autònoma de Barcelona (UAB), Bellaterra, Barcelona 08193, Spain

ABSTRACT

Background: To assess the impact of comorbidity, measured by the Charlson Comorbidity Index (CCI), on survival in breast, colorectal and lung cancer.
Methods: We identified 3455 breast cancer, 3336 colorectal cancer and 2654 lung cancer patients through the Hospital del Mar cancer registry. The prevalence of comorbidities according to the CCI was calculated. Kaplan-Meier curves and the log-rank test were used to compare survival curves for each cancer location. Cox regression was used to calculate survival hazard ratios and 1-, 3- and 5-year mortality rate ratios adjusted by age, sex, CCI, place of first consultation, stage, treatment and period of diagnosis.
Results: The overall unadjusted 5-year follow-up survival proportion was 82.6% for breast cancer, 55.7% for colorectal cancer, and 16.3% for lung cancer. Overall survival was associated with CCI ≥ 3 in breast cancer (HR: 2.33 95%CI: 1.76–3.08), colorectal cancer (HR: 1.39; 95%CI: 1.13–1.70) and lung cancer (HR: 1.22; 95%CI: 1.06–1.40). In breast cancer, the higher the CCI, the higher the adjusted mortality rate ratio and differences were greater in 5-year than in 1-year follow-up survival.
Conclusions: Comorbidity is a significant predictor of overall survival in cancer patients; however, it has a stronger impact on survival in breast cancer than in colorectal and lung cancer.

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1. Introduction

The most commonly diagnosed cancers worldwide are lung cancer (1.82 million cases), breast cancer (1.67 million), and colorectal cancer (1.36 million). Lung cancer is also the most common cause of cancer death, causing 1.6 million deaths yearly. Because of their relatively favourable prognosis, colorectal and breast cancers rank as the fourth and fifth causes of death from cancer [1].

Just as the prevalence of cancer increases with age, so does that of chronic diseases [2]. As a result, a large proportion of cancer patients has one or more comorbid diseases, which may affect the timing of diagnosis [3,4], treatment options [5,6], prognosis and survival [7–9]. Medical care focused on the treatment of cancer may also be an obstacle to the care of comorbid diseases and may therefore increase overall mortality rates in cancer patients [10,11]. Comorbidity has been associated with increased overall mortality across most cancer sites [12], but the influence of comorbidity on survival may vary in different cancer locations.

Our main aim was to assess the impact of comorbidity, measured by the Charlson Comorbidity Index (CCI), on survival by comparing cancer locations. A secondary aim was to compare the impact of comorbidity on survival with the impact of stage, place of first consultation and treatment.

2. Material and methods

2.1. Study population

The study population was identified from the cancer registry of Hospital del Mar. This public hospital serves a population of approximately 300,000 inhabitants living in two (Ciutat Vella and Sant Martí) of the 10 municipal districts of Barcelona (Catalonia, Spain). A total of 8273 patients with breast, colorectal or lung cancer newly diagnosed at Hospital del Mar were included in a retrospective cohort analysis. Between January 1, 2000 and December 31, 2014 there were 3455 cases of female breast cancer, 3336 cases of colorectal cancer and 2654 cases of lung cancer.

2.2. Variables

We merged the registry data with data from the hospital electronic health records of discharged patients to obtain information on comorbidity. We excluded all individuals who did not have a hospital electronic health record. We excluded from the analysis 262 (7.58%) cases of female breast cancer, 666 (19.96%) cases of colorectal cancer and 244 (9,19%) cases of lung cancer. The comorbidity report of choice was the closest in date to the cancer diagnosis. Follow-up information is updated automatically at each hospital visit or admission. Information on the date and cause of death is obtained periodically through a record linkage procedure between the hospital cancer registry and the Catalan Mortality Registry.

All-cause survival time was calculated as the years between the date of histopathological diagnosis (beginning of follow-up) and the last contact or death of the patient. The last date of follow-up was December 31, 2014. *Comorbidity* was assessed according to the CCI [13]. The CCI provides a summary score based on the presence and severity of 19 individual diseases, which are assigned from one to six points each according to the adjusted risk of 1-year mortality validated in breast cancer patients [14,15]. We omitted the indicator for cancer metastases as we considered it an advanced stage of cancer rather than an independent comorbid disorder. We aggregated the presence of malignancy, leukaemia and lymphoma in one category. The presence of *multiple cancers* (synchronous or metachronous) was evaluated. CCI scores were categorised as 0, 1, 2 and equal to or greater than 3.

The demographic variables used included *age* at diagnosis, *sex* and *period of diagnosis*. Age at diagnosis was categorised in five groups (<50, 50–59, 60–69, 70–79 and >79 years). Period of diagnosis was categorised in three groups (2000–2004, 2005–2009 and 2010–2014). *Place of first consultation* was divided into screening programme, Women's healthcare programme, outpatient clinic and accident and emergency department. *Staging* was classified according to the anatomical study or tumour-node-metastases groups (in situ, I, II, III, IV or unknown). The categories of in situ and I were merged for the analysis. *Treatment* was

Table 1
Characteristics of cancer patients registered in the Hospital del Mar Tumour Registry by cancer location (2000–2014).

		Breast cancer		Colorectal cancer		Lung cancer	
		n (3193)	%	n (2670)	%	n (2410)	%
Sex	Female	3193	100.0%	1084	40.6%	401	16.6%
	Male	–	–	1586	59.4%	2009	83.4%
Age (mean; SD)		61	14	71	12	68	11
Age	49 or less	644	20.2%	130	4.9%	156	6.5%
	50 to 59	806	25.2%	342	12.8%	465	19.3%
	60 to 69	870	27.2%	614	23.0%	645	26.8%
	70 to 79	491	15.4%	926	34.7%	763	31.7%
	80 or more	382	12.0%	658	24.6%	381	15.8%
Charlson index score	CIS = 0	2094	65.6%	1382	51.8%	831	34.5%
	CIS = 1	498	15.6%	575	21.5%	674	28.0%
	CIS = 2	438	13.7%	419	15.7%	456	18.9%
	CIS ≥ 3	163	5.1%	294	11.0%	449	18.6%
Presence of other primary cancer	No	2743	85.9%	2251	84.3%	1902	78.9%
	Yes	450	14.1%	419	15.7%	508	21.1%
Type of first consultations	Screening programmeme	1038	32.5%	143	5.4%	–	–
	PSAD	500	15.7%	–	–	–	–
	Outpatient clinics	1492	46.7%	1492	55.9%	1227	50.9%
	Emergencies	162	5.1%	1034	38.7%	1173	48.7%
	Unknown	1	0.0%	1	0.0%	10	0.4%
Stage	In situ	329	10.3%	59	2.2%	12	0.5%
	I	1122	35.1%	392	14.7%	384	15.9%
	II	1013	31.7%	702	26.3%	136	5.6%
	III	406	12.7%	828	31.0%	567	23.5%
	IV	121	3.8%	540	20.2%	1146	47.6%
	Unknown	202	6.3%	149	5.6%	165	6.8%
Treatment	Radical intention (Surgery)	349	10.9%	1319	49.4%	303	12.6%
	Radical intention (Surgery ± QT ± RT)	2551	79.9%	526	19.7%	490	20.3%
	Not radical intention	171	5.4%	534	20.0%	914	37.9%
	Palliative/Symptomatic	66	2.1%	275	10.3%	660	27.4%
	Unknown	56	1.8%	16	0.6%	43	1.8%
Vital status at last contact	Alive	2523	79.0%	1620	60.7%	594	24.6%
	Dead	670	21.0%	1050	39.3%	1816	75.4%
Cause of death	Primary cancer	109	3.4%	461	17.3%	991	54.6%
	Unknown	478	15.0%	297	11.1%	593	32.7%
	Other known causes	83	2.6%	292	10.9%	232	12.8%
Period of diagnosis	2010 to 2014	1162	36.4%	1085	40.6%	924	38.3%
	2005 to 2009	1023	32.0%	937	35.1%	744	30.9%
	2000 to 2004	1008	31.6%	648	24.3%	742	30.8%

Abbreviations: CCI = Charlson Comorbidity Index, CT = chemotherapy, RT = radiotherapy.