Clinical Observations

SURVIVAL ANALYSIS OF CANCER CASES FROM QIDONG CANCER REGISTRY

CHEN Jian-guo 陈建国 [1], Sankaranarayanan R[2], SHEN Zhuo-cai 沈卓才 [1]
Black RJ[2], YAO Hong-yu 姚红玉, [1] LI Wen-guang 李文广, [1] Parkin DM[2]

[1]*Qidong Liver Cancer Institute, Jiangsu 226200, China*
[2]*International Agency for Research on Cancer, Lyon, France*

Abstract

Objective: 16,922 patients with cancers from 15 sites of Qidong population-based cancer registry in the period of 1982–1991 were analyzed for evaluation of cancer survival as well as different cancer control measures. Methods: Observed survival rate (OS) was computed by the Kaplan-Meier method using EGRET statistical software package. Relative survival (RS) which is the ratio of the OS to the expected rate was calculated by using Qidong life table with respect to sex, age and calendar period of observation. Results: The five-year OS for the 5 leading sites of cancers, liver, stomach, lung, oesophagus, and rectum were 1.8%, 11.6%, 3.0% 3.3%, and 19.9%, respectively. The five-year RS for the 5 sites were 1.9%, 14.0%, 3.6%, 4.2%, and 23.7%, respectively, in which, 1.7%, 14.8%, 3.4%, 4.2%, and 26.0% for males, and 2.7%, 12.7%, 4.1%, 4.0%, and 22.0% for females, respectively. Female patients with breast cancer and cervix cancer had 5-year RS of 54.6% and 33.0%. Conclusion: Cancer survival rates for all sites are poor, in which that of the liver is the lowest, while that of the breast, the highest. The survivals of cancers for all sites, especially for breast, cervix, and leukemia are seen to be lower than those of European countries except for oesophagus, pancreas and lung cancer which do not achieve improved survival both in developing and developed countries. There will be a long way to improve the total cancer survival, as well as the cancer treatment in the developing countries.

Accepted for publication: October 12, 1998
This work was supported by the Foundation of ICRETT (No. 221) by the International Union of Against Cancer.
Correspondence to: CHEN Jian-guo; Department of Epidemiology, Qidong Liver Cancer Institute, No. 785, Jianghai Zhong Road, Qidong, Jiangsu Province 226200, China; Fax: (0086-513)-3347081; Phone: (0086-513)-3346202; E-mail: qdigchen@163.net or qdlci@pub.nt.jsinfo.net

Key words: Neoplasm, Epidemiology, Mortality, Survival rate, Follow-up, Cancer registration.

This paper describes the survival experience from 15 selected sites of cancers according to data from a population-based cancer registry during the period of 1982–1991 for evaluation of cancer survival as well as different cancer control measures.

MATERIALS AND METHODS

Data Collection

Cancer data came from Qidong Cancer Registry, which has covered the whole region and all its residents and formed a data collection system since 1972 when the Qidong Liver Cancer Institute was established. All incident (died) cases of cancer in the catchment area were reported into this system monthly by cancer lists, and were checked at the end of each year by matching with death certificates in order to reduce omitting and to exclude duplicate registrations.

Follow-up

For cancer patients presumed still 'alive', active follow up with passive follow up were required for confirmation by repeated scrutiny of death certificate notifications (DCN) and by home visit in 1995 for those incident cases of 1982–1991. The index date for the computation of incidence and survival analysis in this study was the date of first diagnosis, and the deadline for the analysis was 31 December 1994. ICD-9 was used in the classification of cancer. A total of 17,331 incident cases among selected cancer sites were confirmed. Among them the proportion with histological verification (HV) was 29.3%. Some cases

registered on the basis of a death certificate only were called DCO cases,[1] whose information on date of diagnosis and on treatment were not available. The 59 DCO cases and 350 cases with no follow-up information were excluded for survival analysis, leaving 16,992 (97.6% of all incident cases) in which males were 11,069 and females 5,853, with a sex ratio of 1.89:1 (Table 1).

Analytical Methodology

Observed survival rates (OS) were calculated by the Kaplan-Meier method using EGRET software, i.e., $S(t)=\Pi(1-d_j/n_j)$, where $S(t)$ represents t year survival (probability of surviving after t), j is the time of death or censored time, d_j represents the number of observed deaths at time j, n_j represents number at risk just before time of death occurring in j. Relative survival rates (RS) is the ratio of the OS to the expected survival rate for a group of people in the general population [2] similar to the patient group with respect to age, sex and calendar period of observation, i.e., $S_c(t)=S_o(t)/S_e(t)$, where, $S_o(t)$ is OS at time t; $S_e(t)=\Sigma\ n_x S_{ex}(t)/\Sigma\ n_x$, where n_x is the number of subjects of age x at the beginning of follow-up; and $S_{ex}(t)$ is the probability of survival at time t for a subject with initial age x. Age standardized relative survival (ASRS)[3] was calculated for all age groups and for 0–74 group. Data processing was carried out at the Unit of Descriptive Epidemiology, International Agency for Research on Cancer (IARC), Lyon, France.

Table 1. Case numbers and data quality indices of major sites of cancer, Qidong, China, 1982–1991

Site	ICD-9	No. of cases registered	Data quality indices		Cases excluded from analysis		Cases included for survival analysis	
			% DCO	% HV	DCO	Others	No.	%
Nasopharynx	147	171	0.0	84.2	0	3	168	98.2
Oesophagus	150	979	0.1	22.0	1	12	966	98.7
Stomach	151	3861	0.2	44.8	9	98	3754	97.2
Small intestine	152	95	0.0	66.3	0	2	93	97.9
Colon	153	256	0.0	67.2	0	17	239	93.4
Rectum	154	831	0.1	75.8	1	21	809	97.4
Colon-rectum	153–4	1087	0.1	73.8	1	38	1048	96.4
Liver	155	5950	0.7	6.5	40	35	5875	98.7
Pancreas	157	689	0.0	28.6	0	18	671	97.4
Lung	162	2539	0.2	7.0	5	48	2486	97.9
Breast	174	644	0.0	86.7	0	48	596	92.5
Cervix	180	206	0.5	79.1	1	5	200	97.1
Urinary bladder	188	257	0.0	68.9	0	17	240	93.4
Brain, Nerv. Syst.	191–2	277	0.4	31.8	1	4	272	98.2
Multiple myeloma	203	134	0.0	51.5	0	3	131	97.8
All leukemia	204–8	442	0.2	69.9	1	19	422	95.5
Total	–	17331	0.3	29.3	59	350	16922	97.6

HV: Histologic verification DCO: Death Certificate Only

RESULTS

Cancer Survival from Leading Sites

The 1-year observation survival (OS) of over 50% is seen for cancers of nasopharynx, breast, and cervix. The survival outcomes for sites such as esophagus, liver, pancreas, lung, multiple myeloma and leukemia are poor, with 5-year OS less than 6%. For cancers of nasopharynx, stomach, colon-rectum, pancreas, lung, breast, and bladder, the 5-year ASRS is lower than RS; For esophagus, liver, cervix, multiple myeloma, and leukemia, RS is higher (Table 2).

Gender Differences in Five-year Survival

Five-year RS of female breast cancer and cervix cancer are 54.6% and 33.0%, respectively. Females experienced a higher 5-year survival than males for cancers of nasopharynx and intestine, and a lower survival for bladder cancer. There are minimal differences between the sexes in the 5-year survival for sites of esophagus, liver, pancreas, lung, multiple myeloma, and leukemia. Liver cancer has the lowest survival with a 5-year RS of 1.7% for males, and 2.7% for females. Second the liver cancer is multiple myeloma with a 5-year RS of 1.4% for males and 3.2

for females (Table 3).

Age-specific Survival

Patients at lower age groups have better survival outcomes than elder ones except for those with leukemia. There are almost no differences among all age groups for 5-year RS of liver cancer. Under age of 35 years, 5-year RS in cancers of nasopharynx, pancreas, and cervix are higher compared to other age groups. For male stomach cancer and bladder cancer, and female colon-rectal cancer and brain tumor, RS rates were comparatively higher at age of 35–44. Survival rates of male colon-rectal cancer and female breast cancer at ages among 45–54 are higher than in other age groups (Table 4).

Table 2. Cumulative observed and relative survival rates (%) for major cancer sites in Qidong, China, 1982–1991

Site	ICD-9	No. of cases	Observed survival			Relative survival			ASRS (5-yr)	
			1-yr	3-yr	5-yr	1-yr	3-yr	5-yr	All ages	0–74
Nasopharynx	147	168	54.8	32.7	24.2	55.9	34.7	26.7	24.0	24.3
Oesophagus	150	966	15.6	5.0	3.3	16.3	5.7	4.2	5.2	6.0
Stomach	151	3754	30.4	15.6	11.6	31.5	17.4	14.0	12.6	16.8
Small intestine	152	93	31.2	19.4	11.0	32.2	21.5	13.1	–	–
Colon	153	239	43.5	31.0	26.2	44.9	34.4	31.4	26.7	34.1
Rectum	154	809	47.6	26.9	19.9	49.1	29.7	23.7	18.8	27.4
Colon-rectum	153–4	1048	46.7	27.9	21.3	48.2	30.9	25.4	20.5	28.7
Liver	155	5875	9.7	2.9	1.8	9.8	3.0	1.9	2.1	2.0
Pancreas	157	671	10.0	5.1	4.6	10.4	5.7	5.6	4.4	6.0
Lung	162	2486	12.8	4.0	3.0	13.3	4.5	3.6	3.3	4.0
Breast	174	596	83.7	63.4	51.3	84.6	65.7	54.6	48.2	54.6
Cervix	180	200	56.5	36.5	28.3	58.1	39.9	33.0	36.8	41.0
Urinary bladder	188	240	51.7	36.7	30.0	53.7	41.5	37.3	32.2	42.8
Brain, Nerv. Syst.	191–2	272	19.5	10.3	7.0	19.7	10.7	7.5	–	–
Multiple myeloma	203	131	11.5	4.6	1.9	11.8	5.0	2.2	6.6	6.4
All leukemia	204–8	422	16.1	5.9	3.9	16.3	6.2	4.2	5.4	3.9

Table 3. Cumulative 5-year observed and relative survival rates (%) for major cancer sites by sex in Qidong, China, 1982–1991

Site	ICD-9	Male			Female		
		No.	OS	RS	No.	OS	RS
Nasopharynx	147	113	21.1	23.2	55	30.9	34.4
Oesophagus	150	653	3.3	4.2	313	3.2	4.0
Stomach	151	2423	12.1	14.8	1331	10.7	12.7
Small intestine	152	41	5.7	6.7	52	14.8	17.9
Colon	153	104	25.6	29.8	135	26.8	32.8
Rectum	154	355	21.5	26.0	454	18.7	22.0
Colon-rectum	153–4	459	22.4	26.9	589	20.6	24.5
Liver	155	4574	1.6	1.7	1301	2.6	2.7
Pancreas	157	374	4.8	5.8	297	4.3	5.2
Lung	162	1784	2.8	3.4	702	3.5	4.1
Breast	174	–	–	–	596	51.3	54.6
Cervix	180	–	–	–	200	28.3	33.0
Urinary bladder	188	177	34.8	43.2	63	17.1	21.3
Brain, Nerv. Syst.	191–2	156	6.6	7.1	116	7.5	7.9
Multiple myeloma	203	81	1.2	1.4	50	2.7	3.2
All leukemia	204–8	234	4.5	4.9	188	3.0	3.2

DISCUSSION

Population-based survival data are useful for the evaluation of cancer control program, but they are not easy to obtain, especially in the developing countries. In European counties where the cancer registration

has long history, cancer registries that cover national territory may be only seen in Denmark, Estonia and Finland, most other countries have one or more regional registries.[4] In mainland China, cancer incidence data have long been available from Shanghai (since 1963), Qidong (since 1972) and Tianjin (since 1978) where population-based cancer registries are functioning for at least 20 years, and cancer incidence data from these sources have been published in the IARC scientific publications "Cancer Incidences in Five continents".[3,5]

Cancer patterns are different from country to country, race to race, and even varied from region to region within a country. The total cancer survival, therefore, must be different from area to area because first, the proportion of each site of cancer is different, in which each site of cancer may experience its own clinical course and prognosis. Second, facilities for cancer treatment may aim at a special site, liver cancer in one region, for instance, and aim at color-rectum in another region. Even within a community, survival of patients treated at differential hospitals are rather different.[6] Hence, for comparison among regions, cancer survival should be compared using population-based data, and by site. Although direct comparison of survival rates from same sites among areas is reasonable, relative survival will be a more favorable indicator for the comparison. For eliminating the impact from age structures, age standard relative survival (ARSR) is valuable to use.[1]

Table 4. Five-year cumulative relative survival rates by site, age, Qidong, China 1982–1991

Site	ICD-9	0–34	35–44	45–54	55–64	65–74	75+
Nasopharynx	147	56.2	21.6	33.9	14.2	15.4	23.0
Oesophagus	150	–	–	9.7	3.6	3.9	3.1
Stomach	151	17.0	21.6	21.6	17.2	11.1	3.4
Small intestine	152	25.2	22.6	11.6	21.6	6.7	13.0
Colon	153	44.2	48.0	29.2	35.7	30.3	16.1
Rectum	154	16.1	32.0	35.5	29.8	22.0	6.4
Colon-rectum	153–4	23.9	35.3	33.7	31.1	23.5	8.7
Liver	155	2.3	2.0	1.5	2.2	2.2	–
Pancreas	157	11.9	6.8	4.3	4.8	7.1	1.8
Lung	162	9.5	1.0	4.8	4.3	3.4	1.9
Breast	174	59.8	59.0	61.3	45.0	51.9	22.8
Cervix	180	50.3	42.2	43.8	41.7	28.0	6.9
Urinary bladder	188	50.5	68.2	39.3	43.1	38.3	17.1
Brain, Nerv. Syst.	191–2	8.8	12.0	7.7	3.7	8.2	–
Multiple myeloma	203	7.2	–	–	–	3.5	7.3
All leukemia	204–8	4.2	1.7	5.0	4.1	3.7	11.3

In our series for analysis, liver cancer is ranked first of all cancers that accounted for 34.7%, and from the second to fifth were stomach (22.2%), lung (14.7%), oesophagus (5.7%), and rectum (4.8%), respectively. Together these five sites contributed to 82.1% of all sites during the period of 1982–1991. What is worth mention is that liver cancer is a typical malignancy of developing countries as being well known in Asia and Africa. In EUROCARE Study that included all European cancer registries so far, most majority sites of cancer were studied and calculated for survival, but no data on liver cancer was available.[4] A recent report from Estonia shows that the 5-year RS for liver cancer was only 0.9% in males and 0% in females during the period of 1983–1987,[7] which was estimated from less than 320 cases and may be the only available population-based liver cancer survival from European countries. Our result for liver cancer shows that survival from liver cancer is quite poor with a 5-year RS of 1.9% (1.7% in males and 2.7% in females), and ASRS for both sexes of 2.1% based on 5875 cases' observation, suggesting the treatment for this cancer remains a medical poser today. No doubt many clinical reports have demonstrated the better results for early or small liver cancer resected, the 5-year survival rates are 50.7%[8] and of 35%,[9] for example. However the proportion of early stage liver cancer or those received effective resection was too limited to influence the population-based survival.

Comparison with EUROCARE study of cancer survival,[4] the OS and RS from European countries are listed at Table 5. For stomach cancer from our observation, the 5-year OS is 12%, and RS, 14%. It is slightly lower than that of 13% (OS) and 18% (RS) from the EUROCARE study, but may better than the results from British and Poland. The 5-year RS rates of other sites of cancers are seen to be lower than that of European countries for all sites, except for oesophagus, pancreas, and lung cancer while do not

achieve improved survival not only in developing countries but also in developed countries in the past years. Treatment for cancers such as stomach, rectum, and leukemia has been improved though the prognosis of these cancers is still relatively poorer. However in our series the prognosis of leukemia, for example, is extremely lower with a 5-year RS of 4% compared with that of 27% in Europe.

Survival of breast cancer is at the highest end of the range in all sites of the cancer with the RS of 55% in Qidong's observation, and 67% in European data. In a population-base breast cancer screening study from Italy, the 5-year rate was 75%,[10] and according to data from Swiss Cancer Registry the 5-year RS was up to 84% . In a ten-year follow-up of early detection for breast cancer carried out in the UK, the mortality of the cancer has been proven to be reduced by 20%.[11] For cervix cancer the RS is 33% in our series being rather lower than that in Europe and in USA.[12] In a latest report, 5-year RS was up to 95% for the white, and more than 90% for the American Indians showing almost all of the patients have been cured. This implies a good future for the treatment of this cancer. The early diagnosis and early treatment for cervical cancer and breast cancer, therefore, should be emphasized in this region.

Table 5. The OR and the RS of some selected sites of cancers from EUROCARE Study

Regions	Stomach		Lung		Osop.		Rectum		Colon		Pancr.		Breast		Cervix		Nasop.		Leuk.	
	OS	RS	OS	RS	OS	RS	OS	RS	OS	RS	OS	RS	OS	RS	OS	RS	OS	RS	OS	RS
Denmark	10	14	5	7	4	5	29	39	29	39	1	2	60	69	58	63	38	44	19	24
Dutch	16	21	10	12	5	7	35	44	40	50	4	5	65	72	58	63	45	50	27	34
English	6	9	5	6	5	6	27	36	26	35	2	2	54	63	52	57	28	33	16	21
Estonia	14	18	6	8	4	6	28	36	30	38	1	1	54	60	51	57	14	16	29	36
Finland	14	18	8	10	6	8	34	44	37	48	2	2	66	75	53	60	45	51	20	25
French	16	21	10	12	4	5	32	42	35	46	3	4	64	72	58	64	29	32	32	41
German	17	22	7	10	5	6	32	41	34	45	4	5	60	68	56	61	33	39	22	27
Italian	15	20	7	8	3	4	28	35	34	44	3	4	65	72	61	66	48	55	21	26
Polish	9	12	6	8	0	0	17	21	18	22	5	6	41	46	50	54	25	28	11	14
Scotland	6	9	5	7	4	6	25	33	27	36	3	4	54	62	49	54	20	24	17	22
Spanish	15	19	6	7	...		28	35	36	44	...		58	64	37	41	50	52	14	15
Swiss	19	25	11	14	6	7	42	53	42	54	2	3	78	84	57	64	75	84	31	38
European	13	18	7	8	4	5	29	38	32	42	3	4	60	67	54	59	32	38	22	27

For sites of liver, all age groups reflects a poor survival with almost the same rates around 2%, although survival from clinical observations showed younger patients had better prognosis than elders. Age-specific rates were generally better for those at age before 55. These sites include nasopharynx, stomach, breast, cervix, and bladder. In a study from Italy,[10] women with breast cancer younger than 35 years of age showed a high 5-year survival while poorest in age over 70. A recent study showed that age was a risk factor for the prognosis of cervical cancer.[13] Colon cancer was also demonstrated the better 5-year survival for those under age of 60.[14]

There is little stage information from any population-based cancer registries including European countries except for some clinical trials.[4] Only has a report for the information on TNM stage for the colon-rectal cancer from a population-based cancer registry been showed by Roncucci et al.[14] The survival analyses by stage for cancer registry hence is worth carrying out in the future. There are a few areas with lower coverage in cancer incident registration in China; but report on population-based cancer survival is few. From this study we may find that cancers of the liver, the esophagus, the stomach, and the pancreas which have poor outcomes are almost the same in developing and developed countries. The large differences are to be seen in such sites as breast, cervix and leukemia for which the outcome was much better through effective treatment in developed countries. So, it is possible to improve the cancer survival in developing countries through current medical and technical means. But the task is a heavy responsibility and we must embark on a long journey for its accomplishment.

Acknowledgments

This work was carried out at Qidong Health Care Network at which many medical staff have contributed their efforts for years without them the data collection would not be possible. The authors thank the International Union of Against Cancer (UICC) for its found support (ICRETT No. 221) to Dr Chen Jianguo by a fellowship grand to enable him for calculating and analysis of the data hosted at the

Unit of Descriptive Epidemiology, International Agency for Research on Cancer (IARC), Lyon France.

REFERENCES

[1] Parkin DM, Chen VW, Ferlay J, et al. Comparability and Quality Control in Cancer Registration. IARC Tech Rep No. 10. Lyon: IARC, 1994: 1–119.

[2] Chen JG, Li WG, Yao HY, et al. An analysis of expectancy life in Qidong. Chin J Health Stat 1996; 13:37.

[3] Parkin DM, Muir CS, Whelan SL, et al. Cancer incidence in five continents, Volume VI. IARC Sci Pub No. 120. Lyon: IARC, 1992: 432–447.

[4] Berrino F, Sant A, Verdecchia A, et al. Survival of cancer patients in Europe: the EUROCARE study. IARC Sci Pub No. 132. Lyon: IARC, 1995: 1–463.

[5] Parkin DM, Whelan SL, Ferlay J, et al. Cancer incidence in five continents, Volume VII. IARC Sci Pub No. 143. Lyon: IARC, 1997: 1–1240.

[6] Tanaka H, Hiyama T, Hanai A, et al. Interhospital differences in cancer survival: magnitude and trend in 1975–1987 in Osaka, Japan. Jpn J Cancer Res 1994; 85:680.

[7] Thomson H, Rahu M, Aareleid T, et al. Cancer in Estonia 1968–1992: incidence, mortality, prevalence, survival. Tallinm (Estonia): Institute of Experimental and Clinical Medicine, 1996: 30–31.

[8] Tang ZY, Yu YQ, Zhou ZD, et al. Subclinical hepatocellular carcinoma: an analysis of 391 patients. J Surg Oncol Suppl 1993; 3:55.

[9] Stuart KE, Anand AJ, Jenkins RL. Hepatocellular carcinoma in the United States: prognostic features, treatment outcome, and survival. Cancer 1996; 77: 2217.

[10] Barchielli A, Paci E, Balzi, et al. Population-based breast cancer survival: Mammographic screening activities in central Italy. Cancer 1994; 74:3126.

[11] UK Trial of Early Detection of Breast Cancer Group. Breast cancer mortality after 10 years in the UK trial of early detection of breast cancer. The Breast 1993; 2:13.

[12] Sugarman JR, Dennis LK, White E. Cancer survival among American Indians in western Washington state (United States). Cancer Cause Control 1994; 5: 440.

[13] Wolfe CDA, Tilling K, Bourne HK, et al. Variations in the screening history and appropriateness of management of cervical cancer in South East England. Eur J Cancer 1996; 32A:1198.

[14] Roncucci L, Fante R, Losi L, et al. Survival for colon and rectal cancer in a population-based cancer registry. Eur J Cancer 1996; 32A:295.