Survival of All Cancer Patients in Korea through 2-Year Follow-Up

Cancer is the most frequent cause of death in both developing and developed countries, including Korea. The aim of this study was to present survival rates of Korean cancer patients. Survival analysis was carried out with data collected under the Korea Central Cancer Registry Program, which included all cancer patients diagnosed from January 1, 1997 to December 31, 1997. We have analyzed the effects of age at diagnosis and sex on cancer survival from the cancer registry data of 64,240 Korean patients diagnosed of cancer in 1997. The overall survival rate of all Korean cancer patients (both men and women) was 67% at 1 yr and 57% at 2 yr. The 1- and 2-yr survival rates for all cancers in men were 58% and 47%, respectively, while those in women were 77% and 69%, respectively. Men had a lower survival rate than women in most malignancies. The pancreatic cancer was shown the lowest 1-yr survival rate.

Key Words : *Neoplasms; Survival; Korea*

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INTRODUCTION

Cancer is the most frequent cause of death in both developing and developed countries, including Korea (1). The necessities for studying survival in patients with cancer include monitoring the global effect of diagnostic and treatment improvements, establishing priorities for healthcare investment and research, and estimating the potentialities for further improvement (2). A report on population-based survival from cancer has not been published in Korea. However, there is a program called Korea Central Cancer Registry (KCCR) program, which has been collecting all cancer data on a routine basis from nation-wide, hospital-based cancer registries in various designated areas of the country since 1980 (3). Trends in cancer prevalence in Korea could be obtained from this database.

The aims of this study were to present survival rates in Korean cancer patients and to evaluate their age and gender differences utilizing data from the KCCR program.

MATERIALS AND METHODS

Study cohort

The KCCR Program began in 1980 at 47 resident-training general hospitals in Korea, and was expanded to 159 hospitals, including almost all university hospitals (3). These hospital-based reports were estimated to cover about 80 percent of newly diagnosed malignancies in Korea. Survival analyses were carried out with data collected under the KCCR Program, which included all cancer patients diagnosed from January 1, 1997 to December 31, 1997. We have analyzed the effects of age at diagnosis and sex on cancer survival from the cancer registry data of 64,240 Korean patients diagnosed of cancer in 1997, and compared them with the U.S.A. data (4). For each patient, date of birth, date of diagnosis, age at diagnosis, gender, address, primary site of cancer by ICD-O/2 (Oncology) code, histological verification, and morphology were recorded. Age at diagnosis was calculated based on the date of diagnosis in KCCR data and was classified into the following 5-yr age groups: 0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 74-79, and 80 or over. The cancers were microscopically confirmed in 85.1% of cases, and in cases of multiple tumors, only the initially diagnosed tumor was included. Registered cancer data were matched with vital status (alive/dead) from the national population files. The vital status of each registered case was verified until December 31, 1999. The follow-up of patients could be regarded as practically complete for cancer registry because we updated the vital status of patients through the national population files, such as the data from the Ministry of

Government Administration and Home Affairs.

Statistical methods

Cumulative observed survival rates (OSR) were calculated by the life table method. To estimate the relative risk (RR) of sex and age against survival rate, the data were analyzed by means of Cox's proportional hazard model using SAS release 6.12. And for the international comparison of survival rates, the relative survival rates at 1 and 2 yr from diagnosis were computed for patients (4). The relative survival rate (RSR) is defined as the ratio of the survival probability of a cancer patient to the survival probability for an individual from the general population having the same set of prognostic factors for death: sex, age, and time period (5). It was expressed by percents.

RESULTS

Overall Survivals

Fig. 1 shows the overall survival curve for men and women observed for 2 yr. Women showed a higher OSR than men throughout the period. The OSR of all cancer patients (both males and females) was 67% at 1 yr and 57% at 2 yr. The OSR was 58% in men and 77% in women at 1 yr from diagnosis. At 2 yr, the OSR decreased to 47% in men and 69% in women. The RR of dying within 2 yr for women was 0.49 when that for men were considered to be 1.0 (Table 1).

Overall survival rate showed some striking differences according to the primary sites of neoplasm (Table 2). Pancreatic cancer had the lowest 1-yr OSR of 24%, followed by malignancy of unknown origin (33%), gallbladder cancers

Table 1. Overall survival rates (OSR, %) according to sex and age categories

Age (yr)	Male					Female				
	No.	%	1-yr SR	2-yr SR	RR (95%CI)	No.	%	1-yr SR	2-yr SR	RR (95%CI)
0-4	226	0.64	83	74	1.0	164	0.57	82	74	1.0
5-9	124	0.35	78	71	1.15 (0.75-1.76)	109	0.38	83	75	0.75 (0.46-1.22)
10-14	131	0.37	81	–	1.12 (0.73-1.71)	109	0.38	84	80	0.71 (0.43-1.18)
15-19	210	0.59	76	67	1.46 (1.03-2.07)	208	0.72	85	76	0.82 (0.55-1.23)
20-24	216	0.61	69	62	1.82 (1.30-2.55)	399	1.17	88	84	0.52(0.35-0.78)
25-29	367	1.04	71	64	1.74 (1.27-2.37)	820	2.84	89	85	0.53 (0.38-0.74)
30-34	616	1.74	68	60	1.88 (1.41-2.52)	1,608	5.56	89	84	0.56 (0.41-0.77)
35-39	1,251	3.54	68	60	1.94 (1.47-2.57)	2,694	9.32	91	86	0.49 (0.36-0.67)
40-44	1,844	5.22	66	57	2.14 (1.63-2.81)	2,958	10.23	89	84	0.59 (0.44-0.79)
45-49	2,480	7.02	62	51	2.50 (1.91-3.28)	2,785	9.63	85	79	0.75 (0.56-1.01)
50-54	3,550	10.05	61	51	2.57 (1.96-3.35)	2,793	9.66	82	75	0.95 (0.71-1.28)
55-59	5,768	16.33	60	49	2.69 (2.06-3.51)	3,379	11.69	78	70	1.19 (0.88-1.59)
60-64	6,145	17.39	58	46	2.90 (2.22-3.78)	3,387	11.72	73	65	1.41 (1.06-1.90)
65-69	5,140	14.55	55	43	3.16 (2.42-4.12)	2,976	10.29	66	57	1.84 (1.37-2.47)
70-74	3,844	10.88	52	40	3.46 (2.64-4.51)	2,293	7.93	59	49	2.36 (1.76-3.17)
75-79	2,318	6.56	46	35	3.97 (3.04-5.20)	1,412	4.88	52	40	2.93 (2.18-3.95)
80-	1,099	3.11	41	30	4.65 (3.54-6.11)	877	3.03	41	32	3.85 (2.86-5.20)
Total	35,239	55.00	58	47	1.0*	28,911	45.00	77	69	0.49*(0.48-0.51)

*The relative risk of dying within 2 yr for women was calculated with the reference value of 1.0 for men.
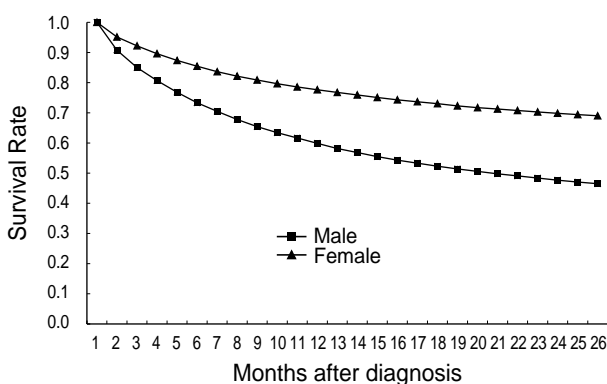

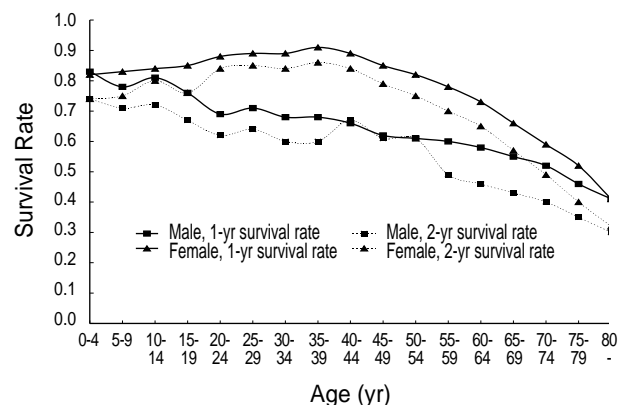**Fig. 1.** Overall 2-yr survival rates for all cancers in Korean men and women between 1997-1999.

Fig. 2. Overall 1- and 2-yr survival rates for all cancers in Korean men and women by age and sex between 1997-1999.

Table 2. Overall survival rates (OSR, %) according to the primary sites of neoplasms

Site	ICD-10	No.	%	1-yr SR	2-yr SR
Oral cavity & pharynx					
	C00-C14	1,269	2.1	75	61
Tongue	C02	172	-	79	66
Mouth	C03-C06	246	-	72	57
Pharynx	C10-C13	459	-	70	56
Esophagus	C15	1,254	2.1	44	30
Stomach	C16	13,632	22.9	67	57
Colon	C18	2,646	4.4	78	69
Rectum	C20	2,618	4.4	82	71
Liver & intrahepatic bile duct					
	C22	7,347	12.3	39	29
liver cell	C22.0	6,279	-	41	31
Gallbladder	C23	794	1.3	35	29
Pancreas	C25	1,304	2.2	24	17
Larynx	C32	750	1.3	84	73
Bronchus & lung	C34	7,399	12.4	40	26
Bone & cartilage	C40-C41	358	0.6	78	70
Hematopoietic & reticular					
	C42	1,662	2.8	59	47
Skin	C44	763	1.3	86	78
Breast	C50	3,853	6.5	96	91
Cervix uteri	C53	6,083	10.2	95	92
Ovary	C56	1,037	1.7	84	76
Prostate	C61	752	1.3	84	71
Kidney	C64	897	1.5	78	71
Bladder	C67	1,459	2.4	84	76
Brain	C71	718	1.2	64	53
Thyroid	C73	1,938	3.3	96	95
MUO*	C80	1,073	1.8	33	24

*Malignant neoplasm with Unknown Origin.

Table 3. Overall survival rates (OSR, %) according to the primary sites of neoplasms and sex

Site	ICD-10	Male		Female	
		1-yr SR	2-yr SR	1-yr SR	2-yr SR
Oral cavity & pharynx					
	C00-C14	73	57	83	74
Tongue	C02	80	65	73	65
Mouth	C03-C06	67	33	87	78
Pharynx	C10-C13	66	53	86	69
Esophagus	C15	44	30	38	29
Stomach	C16	67	56	68	58
Colon	C18	78	69	77	69
Rectum	C20	82	69	83	74
Liver & intrahepatic bile duct					
	C22	39	28	42	31
liver cell	C22.0	41	30	46	34
Gallbladder	C23	37	31	34	28
Pancreas	C25	24	17	24	17
Larynx	C32	83	72	88	83
Bronchus & lung	C34	39	24	43	30
Bone & cartilage	C40-C41	78	71	75	68
Hematopoietic & reticular					
	C42	58	46	60	49
Skin	C44	83	75	89	83
Breast	C50	95	82	96	91
Cervix uteri	C53	-	-	95	92
Ovary	C56	-	-	84	76
Prostate	C61	84	71	-	-
Kidney	C64	77	70	78	72
Bladder	C67	85	78	79	68
Brain	C71	63	52	66	55
Thyroid	C73	93	90	97	96
MUO*	C80	29	22	38	27

*Malignant neoplasm with Unknown Origin.

Table 4. Relative survival rates (RSR, %) of first year in Koreans according to the primary sites of neoplasm and sex

Site	ICD-10	Male		Female	
		RSR	(95% CI)[†]	RSR	(95% CI)[†]
All	C00-C97	61.7	(61.2, 62.3)	78.8	(78.3, 79.3)
Head & Neck	C00-C14	76 .0	(73.1, 78.9)	85.2	(81.1, 89.2)
Esophagus	C15	48.0	(45.0, 50.9)	43.4	(33.4, 53.3)
Stomach	C16	70.4	(69.4, 71.4)	70.2	(68.8, 71.6)
Colo-rectum*	C18-20	84.1	(82.7, 85.5)	83.1	(81.6, 84.7)
Liver	C22.0	43.1	(41.7, 44.5)	47.3	(44.5, 50.0)
Pancreas	C25	26.8	(23.5, 30.0)	26.7	(23.0, 30.4)
Bronchus & lung	C34	43.4	(42.0, 44.7)	46.1	(43.6, 48.6)
Breast	C50	-		96.9	(96.3, 97.5)
Cervix uteri	C53	-		96.2	(95.7, 96.7)
Prostate	C61	91.9	(89.2, 94.6)	-	
Kidney	C64	90.8	(88.8, 92.7)	83.1	(77.9, 88.3)
Thyroid	C73	94.8	(92.0, 97.6)	97.6	(96.8, 98.5)

*Age-trucated 0-84, [†]95% Confidence Interval of Age-adjusted RSR.

(35%), liver cancer (39%), lung cancer (40%), and esophageal cancer (44%). These cancers comprised 32.1% of all cancers. The 2-yr OSR was similar in order except for the fact that lung cancer showed a slightly worse survival (26%) than liver and gallbladder cancers (29% for both).

Age-related differences

The 1- and 2-yr OSR for men and women in 5-yr age groups are given in Table 1. The OSR showed different results between men and women (Fig. 2). With reference value of 1.0 for the 0-4 yr age group, the 2-yr survival rate generally decreased with age in men. But in women, the OSR began to increase around the 20-24 yr-age group, remained relatively steady thereafter, and started to decrease around the age of menopause (after 45).

Gender-related differences

Table 3 shows the OSR of tumor-specific deaths at 1 and 2 yr from the time of diagnosis for both men and women. Considering the overall age-adjusted survival, the risk of dying was similar in men and women for most malignancies, except for cancers of the esophagus, larynx, bladder, breast, and skin.

Table 5. Relative survival rates (RSR, %) of second year in Koreans according to the primary sites of neoplasm and sex

Site	ICD-10	Male RSR	Male (95% CI)[†]	Female RSR	Female (95% CI)[†]
All	C00-C97	50.7	(50.2, 51.2)	71.8	(71.2, 72.3)
Head & Neck	C00-C14	60.7	(57.5, 63.9)	76.9	(72.1, 81.7)
Esophagus	C15	32.1	(29.4, 34.8)	32.8	(23.5, 42.0)
Stomach	C16	60.3	(59.2, 61.3)	60.9	(59.4, 62.3)
Colo-rectum*	C18-20	74.8	(73.1, 76.4)	74.6	(72.8, 76.4)
Liver	C22.0	32.4	(31.1, 33.7)	35.6	(33.0, 38.3)
Pancreas	C25	18.3	(15.5, 21.1)	18.6	(15.4, 21.8)
Bronchus & lung	C34	26.9	(25.8, 28.1)	32.3	(30.0, 34.6)
Breast	C50	-		92.5	(91.6, 93.4)
Cervix uteri	C53	-		92.8	(92.1, 93.5)
Prostate	C61	83.7	(80.3, 87.2)	-	
Kidney	C64	85.3	(82.8, 87.7)	74.8	(68.8, 80.8)
Thyroid	C73	93.0	(89.7, 96.4)	97.0	(96.0, 98.0)

*Age-trucated 0-84, [†]95% Confidence Interval of Age-adjusted RSR.

Relative survivals

Table 4 and 5 shows RSR estimated at 1 and 2 yr, respectively, for each cancer sites in Korea and U.S.A. For all cancers combined, the 1-yr RSR of men and women in Korea was 61.7% and 78.8%, respectively. The 2-yr RSR was 50.7% and 71.8 % for Korean men and women, respectively.

DISCUSSION

Monitoring the survival trends of cancer patients is an essential component of the evaluation of progress against cancers (6). This study might have some limitations because data from the KCCR Program were hospital-based rather than population-based. The typical biases of clinical survey, particularly the 'case selection bias' could have been a limitation. The second was that the cases registered through death certificates only (DCO) were not included in the analysis because the KCCR Program is not a type of the population-based cancer registry. The third question might be that whether or not KCCR program data could represent the whole population (7, 8). However, the number of patients included in these nation-wide, hospital-based reports was estimated to represent about 80 percent of newly diagnosed malignancy patients in Korea (3). And follow-up could be regarded as practically complete, since the record linkage was based on personal identification numbers and complete national registers on population. Thus, it seems reasonable to conclude that this study provides useful information regarding cancer control in Korea.

In the present, women had significantly better survival rates than men at both 1 yr and 2 yr from the diagnosis of cancer. Women generally have a much longer life expectancy than men. Several earlier observations suggested that this female advantage is also present in cancer patients, even after adjust-

ing for competing mortality (9). It is possible that behavioral, environmental, and genetic factors and their complex interrelations, which may influence the cancer prognosis, play a role in determining the survival differences between the genders found in this study. For all cancers combined, women had a much better prognosis than men with a RR of death within 2 yr of cancer diagnosis of 0.49. However, whether the females actually survive cancer better than males remains to be determined. Part of the female advantage was explained by the higher frequency of the smoking-related cancers (e.g., lung, pancreas, and esophagus), which have poor prognosis, in men (9). Other fatal malignancies such as stomach and liver cancers are also more common in men (10). However, in our study, only lung cancer revealed a significant difference. Furthermore, different histotypes and sub-site distributions between men and women were considered to be the factors contributing to the sex-related differences in survival of patients with cancers at certain sites (9). In our study, the risk of death for women was significantly lower for cancers of the oral cavity and pharynx, larynx, skin, and breast. In contrast, for bladder cancer, the risk of death was significantly higher for women. As mentioned above, these results might be explained by gender differences in sub-site distributions (oral cavity, pharynx, and larynx) and by the differences in the stage at diagnosis (presumably breast, skin, and bladder). The longer survival for bladder cancer among men could be explained by a higher frequency of non-invasive cancers in men than in women (9).

There was a decreasing tendency of overall survival rate with increasing age both at 1 and 2 yr from diagnosis in male patients. These findings are consistent with other population-based reports on a large number of cases (11). The risk of death is likely to depend on the stage distribution of cases at diagnosis, and other studies have shown that the proportion of advanced cancers increases with age (12). In female patients, there was a different trend. The survival rates slowly increased from the 20-24 until 45-49 age group, and started to decrease thereafter. This pattern suggests a correlation between female sex hormones and the survival from cancer. It was suggested that female sex hormones might be able to prevent the establishment of distant metastases in certain malignant diseases (9). It may also be due to the fact that the distribution of primary sites of cancer with prognostic variations is different between the young age group and the old age group.

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