

Incidence Estimation of Genitourinary Cancer in Korea

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A nation-wide study was performed to estimate the incidence of bladder, kidney, renal pelvis and ureter, prostate, testicular and other genitourinary cancer among Koreans in Korea using medical records of the inpatients of the beneficiaries of the Korea Medical Insurance Corporation (KMIC) from Jan. 1, 1989 to Dec. 31, 1989.

The crude incidence rate of bladder cancer (ICD-9 188) is estimated to be 4.43 and 0.98 per 100,000 in males and females, respectively. Around 1,093 new cases of bladder cancer (895 male and 198 female) are estimated to occur in a year. The adjusted rate for the world population is 7.76 in males and 1.19 in females which is similar to that of Japanese in Osaka and Chinese in Shanghai, but lower than in American whites and blacks. The crude incidence of kidney, renal pelvis and ureteral cancer (ICD-9 189) is estimated to be 1.61 and 0.87 in males and females, respectively. Around 507 new cases of kidney, renal pelvis and ureteral cancer (332 male and 175 female) are estimated to occur in a year. The adjusted rate for the world population is 2.69 in males and 1.04 in females. In the prostate (ICD-9 185), the crude incidence rate of cancer is estimated to be 1.36. Around 274 new cases of prostate cancer are occur in a year. The adjusted rate for the world population is 2.98 which is similar to the Chinese rate. The incidence of genitourinary cancer continuously increses with age.

Key Words: Incidence, Genitourinary cancer, Korea

INTRODUCTION

Patterns of cancer occurrence are variable according to time, region and ethnic group. The relative incidence by cancer sites is also variable. Cancers of the genitourinary tract in Korea are not uncommon diseases but the relative incidence is much lower than in digestive and female genital systems. It comprised about 4% of all registered cancer patients (Ministry of Health and Social Affairs, 1989) and 1.5% of total deaths due to

malignancies in 1990 (National Bureau of Statistics, 1991). Despite an urgent necessity to have reliable incidence data of various cancers, such data is scarcely available. Only recently have several incidence estimations of certain common cancers such as stomach (Ahn et al., 1989) and primary liver cancer (Ahn et al, 1989) been reported. We performed a nation-wide study to estimate the incidence of genitourinary cancers in Korea.

MATERIALS AND METHODS

The study population of this investigation was 4,489,675 persons enrolled in the Korea Medical Insurance Corporation (KMIC). The insured persons of the KMIC are government employees, pensioners, private school teachers and their families. About 11%

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of the whole Korean population are covered by KMIC and the age and sex distribution of KMIC beneficiaries is very similar to the whole Korean population.

All admitted cases with diagnoses of genitourinary cancer and possible genitourinary cancer were sorted out from the claims sent by medical care institutions during a two year period from July 1, 1988 to June 30, 1990. ICD-9 185 (malignant neoplasm of the prostate), 186 (testis), 187 (penis and urethra), 188 (bladder), 189 (kidney and ureter), 195 (ill-defined site), 222, 223 (benign neoplasm of genitourinary organ), 593, 596, 599 (other disorders of genitourinary organ) and 600 (benign prostatic hyperplasia) were included. One thousand four hundred and fifty two potential genitourinary cancer patients were sorted out and listed avoiding the overlapped cases by primary screening from a total of 9,028 admitted patients (10,058 claims) during the period. The medical records of each potential case were abstracted to the medical chart abstracting forms by the practising urologists in the 177 medical care institutions, including clinics, hospitals, general hospitals and university hospitals. Of 1,452 cases, 1,311 (90.1%) were abstracted. The criteria for confirming the diagnosis were pathologic documentation and evidence of genitourinary cancer in computerized tomographic, ultrasonic and endoscopic findings. Among the 1,311 abstracted cases, 602 were confirmed as genitourinary cancer. Of these 602, 298 cases whose date of onset was in a period of one year from January 1 to December 31, 1989 were sorted out. Finally, the total number of new cases of genitourinary cancer occurring during a one year period of 1989 has been estimated to be 330 (271 male, 59 female) by applying the correction factor of 1.11 (1.00/.901) to the 298 confirmed cases under the assumption that the

number of genitourinary cancers among the non-abstracted potential cases would be proportional to the abstracted cases.

RESULTS

Distribution of genitourinary cancer cases by sex, age group and area

Male patients were more numerous than female with a ratio of 4.5:1. Age distribution of genitourinary cancer patients in males and females was similar. The majority of male and female patients were aged over 50, com-

Table 1. Age and sex distribution of genitourinary cancer cases occurring among KMIC beneficiaries during one year of 1989

Age group	Male		Female		Total	
	Pts.	No. (%)	Pts.	No. (%)	Pts.	No. (%)
-19	3	1.1	2	3.4	5	1.5
20-24	3	1.1	1	1.7	4	1.2
25-29	1	.4	0	.0	1	.3
30-34	3	1.1	2	3.4	5	1.5
35-39	5	1.8	0	.0	5	1.5
40-44	9	3.3	2	3.4	11	3.3
45-49	13	4.8	3	5.1	16	4.8
50-54	14	5.2	6	10.2	20	6.0
55-59	43	15.9	6	10.2	49	14.8
60-64	28	10.3	6	10.2	34	10.3
65-69	47	17.3	11	18.5	58	17.6
70-74	38	14.0	7	11.9	45	13.7
75-	64	23.7	13	22.0	77	23.5
Total	271	100.0	59	100.0	330	100.0

Table 2. Geographic distribution of genitourinary cancer cases occurring among KMIC beneficiaries during one year of 1989

Area	Male		Female		Total	
	Pts.	No. (%)	Pts.	No. (%)	Pts.	No. (%)
Seoul, Incheon, Kyunggi	90	33.3	28	47.4	118	35.8
Kangwon	8	2.9	6	10.2	14	4.2
Chungbuk	13	4.8	1	1.7	14	4.2
Taejeon, Chungnam	31	11.5	3	5.1	34	10.3
Kwangju, Jeonnam	21	7.7	3	5.1	24	7.3
Jeonbuk	18	6.6	4	6.8	22	6.7
Taegu, Kyungbuk	31	11.5	8	13.5	39	11.8
Pusan, Kyungnam	57	21.0	6	10.2	63	19.1
Jeju	2	.7	0	.0	2	.6
Total	271	100.0	59	100.0	330	100.0

prising 86% and 81% of total patients, respectively (Table 1).

By residential area, 33.3% of male patients and 47.4% of female patients were from Seoul metropolitan area including Kyonggi province and Incheon City (Table 2).

Distribution of genitourinary cancer by organ and histology

Table 3 shows the percentage distribution of genitourinary cancer by organ. The bladder was the most common site of genitourinary cancer at 55.4%, followed by the kidneys 21.1% and prostate 16.1%. Transitional cell carcinoma was the most common (61.6%) in males followed by prostatic adenocarcinoma (19.2%) and renal cell carcinoma (12.6%). The histologic distribution of male and female patients is shown in table 4.

Table 3. Organ distribution of genitourinary cancer cases occurring among KMIC beneficiaries during one year of 1989

Organ	Male		Female		Total	
	Pts. No.	(%)	Pts. No.	(%)	Pts. No.	(%)
Kidney	49	17.7	22	36.7	71	21.1
Ureter	8	2.9	5	8.3	13	3.3
Bladder	154	55.8	32	53.3	186	55.4
Prostate	54	19.6	—	—	54	16.1
Testis	9	3.3	—	—	9	2.7
Penis	2	.7	—	—	2	.6
Urethra	0	.0	1	1.7	1	.3
Total	276	100.0	60	100.0	*336	100.0

* Six patients showed concomittant tumors.

Table 4. Histologic distribution of genitourinary cancer cases occurring among KMIC beneficiaries during one year of 1989

Histology	Male		Female		Total	
	Pts. No.	(%)	Pts. No.	(%)	Pts. No.	(%)
Transitional cell carcinoma	167	61.6	31	52.5	198	60.0
Renal cell carcinoma	34	12.6	20	33.9	54	16.4
Prostatic adenocarcinoma	52	19.2	—	—	52	15.8
Squamous cell carcinoma	5	1.8	4	6.8	9	2.7
Other*	13	4.8	4	6.8	17	5.1
Total	271	100.0	59	100.0	330	100.0

* Seminoma in 3, embryonal carcinoma in 3, teratocarcinoma in 2, rhabdomyosarcoma in 3, Wilms' tumor in 2, adenocarcinoma of renal pelvis, ureter or bladder in 4 patients.

Age specific incidence rate of genitourinary cancer among Koreans

Genitourinary cancer is very rare among Koreans under 29 years of age in both sexes. The incidence rate increases markedly with age in both sexes after 29 years of age. In males, the incidence rate increases by three to four fold every 10 years of age. The peak incidence was noted at the age group of 70 or more as 140.91 per 100,000. In females, the incidence rate also increases by two fold every 10 years of age. The peak incidence was noted at the age group of 70 or more as 14.94 per 100,000. The incidence rate in females is markedly lower than in males. The crude incidence rate of genitourinary cancer among Koreans in Korea was estimated to be 7.82 per 100,000 (95% confidence interval: 7.43-8.21) in males and 1.87 (95% confidence interval: 1.69-2.07) in females. About 1,957 new cases of genitourinary cancer (1,582 male and 375 female) are estimated to occur in a year in Korea. The adjusted rates for the world population are 13.77 in males and 2.23 in females.

Malignant neoplasm of the bladder

Malignant neoplasm of the bladder (ICD-9:188) was diagnosed in 186 patients which comprised 56.4% of all genitourinary cancers occurred during a one year period of 1989 among KMIC beneficiaries. There were 154 male and 32 female patients. Transitional cell carcinoma was the most common tumor (95.7%), followed by squamous cell carcinoma, adenocarcinoma and rhabdomyosarcoma in order. The age distribution was similar to that of all genitourinary cancer patients. The majority of male and female patients were aged over 40, comprising 98.7% and 93.4%, respectively.

Table 5. Age-specific incidence rate of genitourinary cancer per 100,000 Koreans, 1989

Age group	Male	Female	Total
-19	.39	.28	.34
20-29	.96	.22	.58
30-39	2.41	.58	1.48
40-49	8.66	2.01	5.53
50-59	24.72	4.87	14.47
60-69	59.46	10.51	31.96
70-	140.91	14.94	59.15
Total 1)	7.82 (7.43-8.21)	1.87 (1.69-2.07)	4.85 (4.64-5.07)
2)	13.77	2.23	6.92

1) crude incidence rate for the Korean population as of 1985.

2) age adjusted rate for the world population

Table 6, shows age specific incidence rate of malignant neoplasm of the bladder among Koreans. Under 39 years of age, bladder cancers are very rare in both sexes. After that, the incidence rate increases by two fold every 10 years of age. The peak incidence was noted at the age group of 70 or more as 63.55 per 100,000 in males and 10.46 in females. The incidence rate in females is about one fifth that of males. The crude incidence rate of bladder cancers among Koreans in Korea was estimated to be 4.43 per 100,000 (95% confidence interval: 4.16-4.75) in males and 0.98 (95% confidence interval :0.86-1.14) in females. Around 1,093 new bladder tumors (895 male and 198 female) are estimated to occur in a year in Korea. The adjusted rates for the world population are 7.76 in males and 1.19 in females.

Malignant Neoplasm of the kidney, renal pelvis and ureter

Eighty one patients were known to have malignant neoplasm of the kidney, renal pelvis and ureter (ICD-:189), which comprised 24.5% of all genitourinary cancer occurring during a one year period of 1989 among KMIC beneficiaries. Fifty five patients (68%) were male and 26(32%) were female. Renal cell carcinoma was the most common (67.1%) tumor, followed by transitional cell carcinoma (26.8%), Wilms' tumor and squamous cell carcinoma. The age distribution was similar to that of all genitourinary cancer patients. The majority of male and female patients were aged over 45, comprising 92.7% and 81.5%, respectively.

Table 7. shows the age specific incidence rate of malignant neoplasm of kidney, renal pelvis and ureter among Koreans. Under 39 years of age, the incidence was very low in both sexes, but it increased exponen-

Table 6. Age-specific incidence rate of bladder cancer per 100,000 Koreans, 1989

Age group	Male	Female
-19	.00	.14
20-29	.00	.00
30-39	.60	.29
40-49	7.09	1.58
50-59	16.92	1.22
60-69	38.85	5.57
70-	63.55	10.46
Total 1)	4.43 (4.16-4.75)	.98 (.86-1.14)
2)	7.76	1.19

1) crude incidence rate for the Korean population as of 1985.

2) age adjusted rate for the world population

Table 7. Age-specific annual incidence rate of kidney, renal pelvis and ureteral cancer per 100,000 Koreans, 1989

Age group	Male	Female
-19	.29	.16
20-29	.00	.25
30-39	.33	.32
40-49	1.74	.54
50-59	7.21	2.70
60-69	10.54	5.48
70-	22.95	4.96
Total 1)	1.61 (1.43-1.80)	.87 (.77-1.07)
2)	2.69	1.04

1) crude incidence rate for the Korean population as of 1985.

2) age adjusted rate for the world population

tially. The peak incidence was noted at the age group of 70 or more as 22.95 per 100,000 in males and 60 or more as 5.48 in females. The crude incidence rate was estimated to be 1.61 per 100,000 (95% confidence interval: 1.43-1.80) in males and 0.87 (95% confidence interval: 0.77-1.07) in females. Around 507 new malignant neoplasms of kidney, renal pelvis and ureter (332 male and 175 female) are estimated to occur in a year in Korea. The adjusted rates for the world population are 2.69 in males and 1.04 in females.

Malignant neoplasm of the prostate

Malignant neoplasm of the prostate was confirmed in 54 patients, which comprised 16.0% of all genitourinary cancers occurring during a one year period of 1989 among KMIC beneficiaries. Most of the patients had adenocarcinoma (96.3%) and were more than 60 years of age. Under 60, it is very rare. The peak incidence was noted at the age group of 70 or more as 49.73 per 100,000. The crude incidence rate of malignant neoplasm of the prostate among Koreans in Korea was estimated to be 1.36 per 100,000 (95% confidence interval: 1.18-1.50). Around 274 new malignant neoplasms of the prostate are estimated to occur in a year in Korea. The adjusted rate for the world population is 2.98 (Table 8.).

Table 8. Age-specific annual incidence rate of prostate cancer per 100,000 Koreans, 1989

Age group	Incidence rate
-19	.00
20-29	.24
30-39	.00
40-49	.00
50-59	.43
60-69	8.72
70-	49.73
Total 1)	1.36 (1.18-1.50)
2)	2.98

1) crude incidence rate for the Korean population as of 1985.
2) age adjusted rate for the world population

Malignant neoplasm of testis

Malignant neoplasm of the testis (ICD-9:186) was diagnosed in 9 patients, which comprised 2.7% of all genitourinary cancers occurring during a one year period of 1989 among KMIC beneficiaries. Three patients had seminoma, 3 embryonal carcinoma, 2 teratocarcinoma and one rhabdomyosarcoma histologically.

Most of the patients were less than 40 years of age. The crude incidence rate of malignant neoplasm of the testis among Korean in Korea was estimated to be 0.45 per 100,000. Around 91 new malignant neoplasms of the testis are estimated to occur in a year in Korea. The adjusted rate for the world population is 0.38.

Comparison of the incidence rates of transitional cell carcinoma of the bladder, renal cell carcinoma and prostatic adenocarcinoma.

The age-specific incidence rates of three major genitourinary cancers, transitional cell carcinoma of the bladder, renal cell carcinoma and prostatic adenocarcinoma, are shown in Table 9. The incidences of all three tumors were very low in patients under 39 years of age. The peak incidence was noted in the age group of 70 or more as 64.26 per 100,000 in males and 8.22 in females in transitional cell carcinoma of the bladder. The crude incidence rate was estimated to be 4.35 per 100,000 in males and 0.79 in females. The adjusted rates for the world population are 7.66 in males and 0.95 in females. In renal cell carcinoma, the peak incidence was 12.43 per 100,000 in males and 3.71 in females. The crude incidence rate was estimated to be 1.03 per 100,000 in males and 0.62 in females. The adjusted rates for the world population are 1.69 in males and 0.75 in females. In prostatic adenocarcinoma, the peak incidence rate was estimated to be 1.36 per 100,000 and the adjusted rate for the world population is 2.98. In males, transitional cell carcinoma is the leading malignant disease followed by prostatic adenocarcinoma and renal cell carcinoma. The incidence of prostatic adenocarcinoma comes close to that of transitional cell carcinoma of the bladder and exceeds renal cell carcinoma by a big margin in the age group of 70 years or more.

DISCUSSION

Although clinical impressions suggest that the incidence and mortality rate of the genitourinary cancers are increasing, exact data to support this has not been available. We can only guess the incidence rate of the various cancers according to the hospital based statistics, incomplete cancer registries, survey reports of small populations and data from foreign countries. There are several reports of incidence estimations of stomach and primary liver cancer (Ahn *et al.*, 1989) through nationwide surveys. We carried out a nationwide survey on genitourinary cancers adopting the same study population. The beneficiaries of the KMIC comprise 11% of the whole Korean population, have

Table 9. Age-specific annual incidence rate of TCC of the bladder, RCC and prostatic adenocarcinoma among Koreans, 1989

Age group	Bladder		Kidney		Prostate
	Male	Female	Male	Female	
-19	.00	.00	.13	.00	.00
20-29	.00	.00	.00	.22	.00
30-39	.67	.29	.30	.29	.00
40-49	6.54	1.19	1.57	.54	.00
50-59	16.33	1.22	3.90	1.62	.48
60-69	38.63	3.71	5.55	3.71	8.72
70-	64.26	8.22	12.43	2.99	49.73
Total 1)	4.35	.79	1.03	.62	1.36
2)	45.93	6.11	8.38	3.53	22.78
3)	7.66	0.95	1.69	.75	2.98

1) crude incidence rate for the Korean population as of 1985.

2) crude incidence rate for over 60 year olds in the Korean population, 1985

3) age adjusted rate for the world population

Table 10. Comparison of age-standardized incidence rates of genitourinary cancers

Race/Area	Year	Bladder tumor		Renal cell ca.		Prostate tumor
		M	F	M	F	
Korean/Korea	'89	7.76	1.19	1.69	0.75	2.98
/L.A.	'78-'82	13.8	2.9	3.3	1.3	11.7
Japanese/Osaka	'79-'82	7.7	1.9	2.3	1.4	5.1
/Hawaii	'78-'82	9.6	3.8	4.8	1.6	31.2
/L.A.	'78-'82	6.7	3.0	2.7	0.9	22.8
Chinese/Shanghai	'78-'82	7.1	1.7			1.8
/Singapore	'78-'82	7.8	2.2	2.4	1.2	6.6
/L.A.	'78-'82	10.7	3.0	3.0	1.3	16.9
/Hawaii	'78-'82	13.5	1.4	2.7	0.7	25.2
Colombia/Cali	'77-'81	9.6	2.7	2.1	1.8	30.6
White/Connecticut, US	'78-'82	25.2	7.4	7.5	3.4	46.8
/Iceland	'78-'82	15.2	5.1	9.0	6.5	36.2
Black/Connecticut, US	'78-'82	10.1	4.3	10.2	4.0	72.3

Source of data: International Agency for Research on Cancer (IARC), Cancer Incidence in Five Continents, Volume V, Lyon, 1987.

similar socioeconomic conditions with the whole population and are the most stable. The characteristics of this group and the whole population in terms of age, sex, geographic distribution were similar and comparable (Fig. 1, 2). We screened all potential cancer patients including benign tumor or other selected disorders to detect misidentified cancers. And the survey period was extended for 6 months both before and after to obtain more accurate numbers. Finally we confirmed

the diagnoses by objective criteria such as pathologic, radiologic and endoscopic findings abstracted from the individual records.

Bladder cancer is the most common genitourinary cancer in Korea where the relative incidence of prostatic cancer is much lower than in western countries. Bladder cancer shows a male preponderance in Korea as in western countries. In males, incidence of bladder cancer in Switzerland is 27.8 (highest) and that in In-

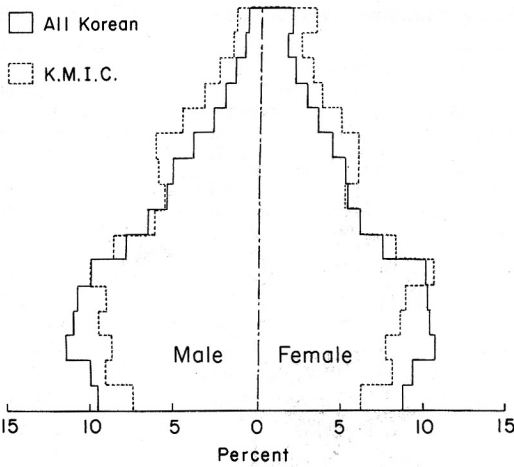


Fig. 1 Comparison of age and sex distribution between K.M.I.C. beneficiaries and the whole Korean population.

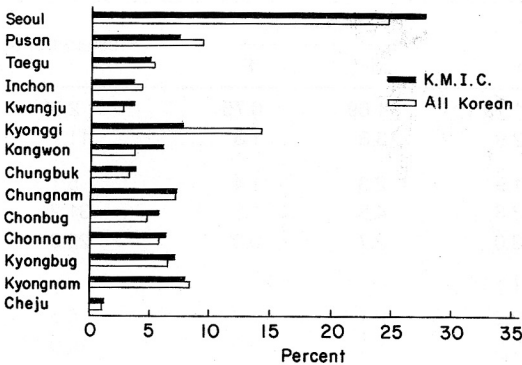


Fig. 2 Geographic distribution of K.M.I.C. beneficiaries and entire Korean population.

dia is 1.7 (lowest) (IARC, 1987). Our adjusted rate of 7.76 is apparently close to the lower figure. The incidence rates of bladder cancer in Oriental countries are all similarly low. However, the incidence rate among Korean migrants to Los Angeles was 13.8 which is 2-fold higher than the current figure of 7.76 and showed a tendency to move toward the rate of 25.3 among American whites (IARC, 1987). International variation and migrant patterns of the cancer incidence are all known and these facts reflect the fact that environmental factors such as lifestyle, habit and the degree of industrialization must play a very important role in the development of cancers.

We have a vague impression that prostatic cancer

among Koreans is rare but there is a tendency to gradual increase. This impression is shared by many colleagues in Japan and China. The current incidence rate of prostatic cancer among Koreans is 2.98 which is comparable to the level among Chinese (1.8) and Japanese (5.8). The incidence rate of prostatic cancer is highest in American blacks. The incidence of this cancer is 30-fold higher in them than it is in Koreans. It is interesting to note that the incidence of prostatic cancer is 6-fold higher in American blacks than in Nigerian blacks (Jackson, 1977). Korean born migrants to Los Angeles showed a higher incidence of 11.7 as compared with the current incidence of 2.98 (IARC, 1987). We do not have any concrete data to determine whether prostatic cancer incidence is increasing or not. The variation in prostatic cancer incidence over time is reported by many authors. Prostatic cancer incidence increased to 76.3 in 1984 from 45.0 in 1950 among American whites (Devesa et al., 1987). We can easily predict that prostatic cancer incidence in Korea will increase substantially in the future on the basis of an increasing tendency to an older population, improved detection and changes in environmental factors. Comparison of age-standardized incidence rates of genitourinary cancer among Koreans in Korea with those of other countries are summarized in Table 10.

The incidence data we obtained are not the most accurate and complete date possible, however they are the result of the best available methods and a representative study population. We plan to study the incidence pattern of genitourinary cancers among Koreans continuously every five years, so that more accurate and complete data can be collected.

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