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Incidence Estimation of Thyroid Cancer among Koreans

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The medical records of inpatients with diagnoses of either ICD−9 193(malignant neoplasm of the thyroid gland) or 226(benign neoplasm of the thyroid gland) in the claims sent in by medical care institutions throughout the country, to the Korea Medical Insurance Corporation(KMIC) during the period from January 1, 1986 to December 31, 1987 were abstracted. These records were abstracted in order to identify and confirm new cases of thyroid cancer among the beneficiaries of the KMIC. Using these data, the incidence rate of thyroid cancer among Koreans was estimated as of July 1, 1986 through June 30, 1987. The crude rates were estimated to be 0.76(95% CI : 0.63−0.87) and 3.87(95% CI : 3.60−4.14) per 100,000 in males and females, respectively, and the cumulative rates for the age spans 0−64 and 0−74 in males were 0.06% and 1.10%, respectively. In females, those were equally 0.35%. The age−adjusted rate for the world population was 0.93 per 100,000 in males, which is one of the lowest levels in the world. However, the adjusted rate in females was 3.96 per 100,000, which is an average level and very similar to that of the Chinese in Singapore and Shanghai. A similar tendency was shown in the case of the truncated rates for the age group of 35−64, which was 1.91 per 100,000 in males and 8.82 per 100,000 in females.

Key Words : *Thyroid cancer, Incidence rate, Korean*

INTRODUCTION

Representative data for the incidence rate of thyroid cancer has not been available yet for Koreans as a whole (Kim et al., 1989 ; Kim, 1988 ; Lee et al., 1988 ; Ministry of Health and Social Affairs, 1989 ; Yoo et al., 1988). The Korean government has been operating the 'central cancer registry' since July 1980. The results of the registration for a 5−year period from July 1982 to June 1987 show that the relative frequency of

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thyroid cancer among the total number of registered female cancer cases is 4.6%, which is 4th in rank. These data seem to indicate that thyroid cancer is a common malignancy among Korean females, but they cannot provide us with a nationwide incidence pattern of cancers among all Koreans, because only a small portion of the total incident cancer cases or some selected cancer cases have been registered through the cancer registry system (Ministry of Health and Social Affairs, 1989).

Recently, cancer incidence data for a rural area, Kangwha County, was reported (Kim et al., 1990). According to the report, the age-adjusted annual incidence rate of thyroid cancer per 100,000 population was 1.4 for males, 14th in rank among male cancers, and 6.7 for females, 4th in rank among female cancers, during the 5-year period of 1983-1987. However, these data are also not representative for Koreans as a whole, since the registry is based on a small number of cases(18 thyroid cancer cases in all) for a period of 5 years and only used a small study population (around 88,000).

However, series of nationwide incidence estimation studies of cancers among Koreans through specially designed surveys have been conducted by the authors since 1988. Some of the results, such as incidence estimation of primary liver cancer and of stomach cancer among Koreans, have already been reported (Ahn et al., 1989 and 1991). This study is another report in a series of studies presenting incidence pattern of thyroid cancer among Koreans by age, sex, and geographical region.

SUBJECTS AND METHODS

The study population of this investigation was comprised of the beneficiaries of the Korea Medical Insurance Corporation(KMIC) during the period of 1986-1987. As of December 31, 1986, the total number of beneficiaries, the insured and their dependents, was 4,328,850 which covered about 10 % of the whole Korean population (Korea Medical Insurance Corporation, 1986).

Potential cases of thyroid cancer were screened by sorting out all the admitted cases diagnosed as either malignant neoplasms of the thyroid gland (ICD-9 193) or benign neoplasms of the thyroid gland(ICD-9 226) in the claims sent in by medical institutions throughout the country during the period from January 1, 1986 to December 31, 1987. A total of 427 admitted patients (524 claims) were screened out as potential cases for thyroid cancer during the period.

Information for confirming the diagnosis and estimating the onset date was abstracted from the medical records of the potential cases in two different ways : one was by visitation and the other by mailing. For the visiting survey, abstractors were recruited among senior students of Seoul National University College of Medicine. For the mailing survey, abstracting formats were sent to the institutions where 5 or fewer cases had been claimed to be filled by the doctors who cared for the patients. Out of the total 427 cases, 342(80.1%) were abstracted by both a visiting survey of 73 medical institutions and a mailing survey on the 13 medical institutions.

In order to confirm the diagnosis of thyroid cancer, the abstracted information was thoroughly reviewed by the endocrinologist(Dr. BY Cho). Confirming the diagnosis of thyroid cancer was based primarily on the results of aspiration cytology and needle or surgical biopsy, and secondarily on the findings of physical examination, as well as the results of the thyroid function test, ultrasonography, and thyroid scanning. The date of the onset was estimated to be the date the malignant thyroid cancer was first diagnosed by histological examination. Among the 342 abstracted cases, 235 were confirmed as thyroid cancer patients. Out of those 235, the dates of onset of 92cases were between July 1, 1986 and June 30, 1987. Finally, the total number of new cases of thyroid cancer occurring during the period from July 1, 1986 to June 30, 1987 has been estimated to be 115(19 for male and 96 for female) by applying a correction factor of 1.25(1.000/.801) to the 92 confirmed cases under the assumption that the number of thyroid cancer patients in the non-abstracted potential cases would be proportional to that among the abstracted cases. A detailed description of the study method may be found elsewhere (Ahn et al., 1991).

RESULTS

1. Distribution of thyroid cancer cases by sex, age, and residential area

The number of female cases was markedly larger than that of male cases, 96 and 19, respectively, and the female-to-male ratio was 5.1. The age distribution of the female cases was different from that of the male cases. In the male, the distribution of cases reached a peak in the age group of 45—49 years, which occupied 42.1% of the total cases. In the female, the distribution of cases showed two peaks : an early one, in the age group of 25—29, which was 16.7%, and a later one, in the age group of 50—54, constituting 15.6% (Table 1).

Male cases of thyroid cancer were identified in a few confined areas, which were Jeonnam Province including Kwangju(31.6%), Kyunggi Province including Seoul(26.3%), Kangwon Province(21.0 %), and Kyungnam Province including Pusan(15.8 %). However, female cases were identified throughout the whole country. About 41% of the total cases were identified in Kyunggi Province including Seoul. Female cases of both Kyungnam Province including Pusan, and Kyungbuk Province including Taegu, constituted 14.6% equally, and those of Jeonnam Province including Kwangju constituted 10.4%. Four other provinces except Jeju Province occupied similar levels, which were about 5% each (Table 2).

2. *Distribution of thyroid cancer cases by histologic classification*

Nearly 90% of the total incident cases of thyroid cancer were histologically classified as papillary and follicular type. Seventy-seven percent of the total cases were papillary type and 10.4% were

Table 1. Age Distribution of Thyroid Cancer Cases by Sex

Age	Male		Female		Total	
Group	No.	%	No.	%	No.	%
Under 19	0	0.0	3	3.1	3	2.6
20—24	1	5.3	6	6.3	7	6.1
25—29	1	5.3	16	16.7	17	14.8
30—34	0	0.0	5	5.2	5	4.3
35—39	3	15.7	13	13.5	16	13.9
40—44	1	5.3	6	6.3	7	6.1
45—49	8	42.1	8	8.3	16	13.9
50—54	0	0.0	15	15.6	15	13.1
55—59	1	5.3	11	11.5	12	10.4
60—64	0	0.0	10	10.4	10	8.7
65—69	0	0.0	0	0.0	0	0.0
70—74	3	15.7	0	0.0	3	2.6
75 and over	1	5.3	3	3.1	4	3.5
Total	19	100.0	96	100.0	115	100.0

Table 2. Geographical Distribution of Thyroid Cancer Cases by Sex

Area	Male		Female		Total	
	No.	%	No.	%	No.	%
Seoul, Kyunggi	5	26.3	39	40.6	44	38.3
Kangwon	4	21.0	5	5.2	9	7.8
Chungbuk	0	0.0	5	5.2	5	4.3
Taejeon, Chungnam	0	0.0	4	4.2	4	3.5
Jeonbuk	0	0.0	5	5.2	5	4.3
Kwangju, Jeonnam	6	31.6	10	10.4	16	13.9
Taegu, Kyungbuk	0	0.0	14	14.6	14	12.2
Pusan, Kyungnam	3	15.8	14	14.6	17	14.8
Jeju	0	0.0	0	0.0	0	0.0
Unknown	1	5.3	0	0.0	1	0.9
Total	19	100.0	96	100.0	115	100.0

follicular type. Anaplastic and medullary types were 1.7% and 0.9%, respectively.
The proportion of the papillary type between male and female was not different significantly($p>0.05$ by X^2-test). We were unable to find the results of histological examination in the medical records of 11 cases(9.6%) (Table 3).

3. Incidence rate of thyroid cancer among Koreans by gender

The pattern of age-specific annual incidence rates of thyroid cancer was quite different between genders. In the male the incidence rate had two peaks : a small peak in the age group of 45−49 years, with a rate of 6.05 per 100,000 and a higher in the age group 70−74 with a rate of 9.48 per 100,000. In the female, the incidence rate gradually increased with age, reaching a peak of approximately 13.00 per 100,000 in the age group of 60−64 years, and then decreased afterwards (Table 4).

The crude incidence rates of thyroid cancer among Koreans were estimated to be 0.76 and 3.87 per 100,000 in the male and female, respectively. And the cumulative rates for the age spans 0−64 and 0−74 in the male were 0.06% and 0.10%, respectively. In the female, those were equally 0.35%. The age-adjusted rates for the world population were 0.93 per 100,000 in the male and 3.96 per 100,000 in the female. The truncated

Table 3. Histological Classification of Thyroid Cancer Cases by Sex

Histological Classification	Male No.	Male %	Female No.	Female %	Total No.	Total %
Papillary	15	78.8	74	77.1	89	77.4
Follicular	1	5.3	11	11.5	12	10.4
Medullary	1	5.3	0	0.0	1	0.9
Anaplastic	1	5.3	1	1.0	2	1.7
Unknown	1	5.3	10	10.4	11	9.6
Total	19	100.0	96	100.0	115	100.0

Table 4. Age-specific Annual Incidence Rate of Thyroid Cancer Among Koreans by Sex, 1986−1987
(unite : per 100,000 population)

Age Group	Male	Female
Under 19	0.00	0.42
20−24	0.55	3.08
25−29	0.47	6.79
30−34	0.00	2.88
35−39	2.32	9.75
40−44	0.81	5.00
45−49	6.05	5.69
50−54	0.00	11.08
55−59	1.05	10.87
60−64	0.00	13.00
65−69	0.00	0.00
70−74	9.48	0.00
75 and over	3.47	4.81
Total 1)	0.76(0.63−0.87)	3.87(3.60−4.14)
2)	0.93	3.96
3)	1.91	8.82

1) Crude rate(95% confidence interval) for Korean population as of 1985
2) Age-adjusted rate for the world population
3) Truncated (35−64 years of age) rate for the world population

Table 5. Geographical Comparison of Thyroid Cancer Incidence within Korea by Indirect Standardization Method Using KMIC Beneficiaries

Geographical Area	Male			Female		
	Number of Cases			Number of Cases		
	observed	expected	SIR*	observed	expected	SIR*
Seoul, Kyunggi	5	7.2	.70	39	37.0	1.05
Kangwon	4	1.2	3.34	5	5.8	.86
Chungbuk	3	2.8	1.07	5	3.6	1.38
Taejeon, Chungnam	0	1.5	0.00	4	7.2	.56
Jeonbuk	0	1.1	0.00	5	5.5	.91
Kwangju, Jeonnam	6	1.9	3.14**	10	9.2	1.09
Taegu, Kyungbuk	0	2.3	0.00	14	11.8	1.18
Pusan, Kyungbuk	3	2.8	1.07	14	14.8	.95
Jeju	0	.2	0.00	0	1.2	0.00

*Standardized incidence ratio (number of observed/number of expected)
**$p<0.05$ by Poisson distribution

rates for the age group of 35−64 were 1.91 and 8.82 per 100,000 in the male and female, respectively (Table 4).

4. Geographical comparison of incidence rates of thyroid cancer within Korea

Based on the residential areas of the KMIC beneficiaries, a geographical comparison of the incidence rates of thyroid cancer was made by using indirect standardization. Table 5 shows the standardized incidence ratios(SIR) in each geographical area with their statistical significances($\alpha=0.05$). In males, the thyroid cancer incidence was higher in Jeonnam Province including Kwangju. However, in females, there were no significant difference in thyroid cancer incidence between the areas.

DISCUSSION

Three major points from these results require further discussion. The first refers to the validity of the KMIC data as a source of the incidence estimation of thyroid cancer among Koreans. The second point is the method used for case identification and the representativeness of the confirmed cases. The last point refers to the obtained findings which need to be interpreted and compared with data from other countries.

Regarding the first point, as it has already been discussed in the other report (Ahn YO et al., 1989 & 1991), it was concluded that the KMIC beneficiaries are not a biased population for cancer incidence estimation among Koreans.

Secondly, the case finding procedures used in this study are basically same as those of population-based cancer registration. Instead of voluntary notification by hospitals and general practitioners, field clerks (senior medical students) collected relevant information by means of medical record abstraction. Certain claims of medical insurance, like a reportable list in hospital registry, were used as the primary source of case identification. Potential cases were used as the primary source of case identification. Potential cases were selected from the inpatients list in the data-base file of the KMIC computer system, and diagnosis-confirming criteria for thyroid cancer in this study was primarily focused on pathological diagnosis. We assumed that almost all the potential thyroid cancer cases would admit themselves to medical facilities for confirming diagnosis or receiving proper therapy. The assumptions are based on several reasons. One is the characteristic sign of thyroid cancer, that is, a mass on the anterior neck which is usually the first sign that makes a patient visit a medical institution for diagnosis and treatment. Another reason is that they can use medical facilities easier than other non-insured persons because they are beneficiaries of the KMIC, which has been operating for nearly 10 years.

Of the target numbers, 80.1% were completed by medical records abstracting. The main reasons for non-abstractions were that some medical records could not be found in medical institutions during the visiting survey and also that medical institution did not mail back the completed forms of the abstracted formats, even after the formats were mailed three times to them. However, the abstracting rates of each age group in both genders were not different significantly($p>0.05$ by X^2 test) (Table 6). This supports the fact that the failure of abstracting medical records does not occur selectively. Therefore, the assumption that the correction factor of 1.25(1.000/0.81) can be applied to the number of confirmed thyroid cancer cases in order to estimate the total number of thyroid cancer cases among the potential cases is acceptable.

The false negative cases could have occurred if thyroid cancer cases visited primary care medical institutions where special laboratory tests, including histological diagnosis, could not be performed for them. The authors have observed that many patients have visited several other medical institutions, including secondary or tertiary medical institutions, for further diagnosis when they have been diagnosed at primary care units as having cancer. According to such medical behavior, the information for confirming diagnosis could be found at one of the secondary or tertiary medical institutions they visi-

Table 6. Medical Records Abstraction Rates* from Potential Cases of Thyroid Cancer by Sex and Age

Age Group	Male			Female		
	Target	Abstracted		Target	Abstracted	
	No.	No.	%	No.	No.	%
<30	15	11	73.3	64	49	76.6
30−49	31	25	80.6	143	109	76.2
>=50	31	26	83.9	143	121	84.6
Total	77	62	80.5	350	279	79.7

* The abstracted rates by age and sex were not different significantly ($p>0.05$ by X^2−test).

Table 7. Comparison of the Age-standardized and Cumulative (0−64, 0−74) Incidence Rates of Thyroid Cancer Among Some Selected Races and Areas

Race/Area,	Year	World		Truncated		0−64*		0−74*	
		M	F	M	F	M	F	M	F
Korean/South Korea,	'86	0.9	4.0	1.9	8.8	0.06	0.35	0.10	0.35
" /Los Angeles,	'78−82	0.7	4.2	−	11.3	0.04	0.38	0.04	0.38
Japanese/Osaka,	'79−82	1.0	2.5	1.4	4.1	0.06	0.16	0.10	0.26
" /Hawaii,	'78−82	5.3	6.0	6.0	9.4	0.25	0.39	0.64	0.51
" /Los Angeles	'78−82	1.6	5.7	3.7	13.4	0.15	0.51	0.15	0.51
Chinese/Shanghai,	'78−82	1.2	3.3	2.3	6.2	0.09	0.26	0.12	0.39
" /Singapore,	'78−82	1.5	4.3	2.4	6.5	0.10	0.29	0.15	0.42
" /Hong Kong	'78−82	1.4	4.8	2.2	8.4	0.10	0.35	0.15	0.47
" /Los Angeles,	'78−82	2.4	6.7	5.6	9.2	0.20	0.49	0.20	0.60
" /Hawaii,	'78−82	8.8	5.5	11.5	10.7	0.50	0.40	1.07	0.58
White/Los Angeles,	'78−82	2.6	5.8	4.4	10.0	0.20	0.44	0.24	0.52
" /Hawaii,	'78−82	2.2	5.9	4.2	10.7	0.16	0.42	0.23	0.51
" /Iceland,	'73−82	5.6	13.3	8.6	24.4	0.34	0.98	0.59	1.35
" /Denmark,	'78−82	0.9	1.9	1.2	2.8	0.05	0.12	0.09	0.19
" /Hamburg,	'78−79	0.8	1.8	1.4	2.0	0.05	0.11	0.07	0.15
" /UK, Engl, Wales	'79−82	0.6	1.5	1.0	2.5	0.04	0.10	0.07	0.15
Black/Los Angeles,	'78−82	1.4	2.8	2.4	4.7	0.09	0.20	0.16	0.30

* The cumulative rates denote the number per 100, while the age-standardized(world and truncated) rates per 100,000.
Source of data : International Agency for Research on Cancer(IARC), Cancer Incidence in Five Continents, Volume V, Lyon, 1987.

ted. Conclusively, even though underrepresentation cannot be refuted, it is not critical in calculating the thyroid cancer incidence patterns in Korea.

Regarding the third and last point on incidence patterns of thyroid cancer in Korea, papillary carcinoma has been reported to be the lowest malignant type of all the histologic variants of thyroid cancer, constituting about 40% to 70%. Follicular carcinoma is next in prevalence and accounts for 10% to 40% and its prognosis is known to be quite good. Anaplastic carcinoma constitutes between 5% to 25% of all the thyroid cancers and is reported to be highly malignant (Ron et al., 1982). The distribution of histological classification of total thyroid cancer cases, similar to the Hong's report(1990), shows that papillary and follicular carcinoma constitute larger than 95%, including those histologically unknown cases, while anaplastic carcinoma constitutes less than 2%, which implies that the prognosis of Korean thyroid cancer cases as a whole may not be poor. The proportion of the papillary carcinoma cases including some histologically unknown, may be larger than 85%. This fact is compatible with the report that paillary carcinoma is predominant in high iodine intake areas like Japan and other countries with predominant coastal areas(Heitz et al., 1976).

The level of thyroid cancer incidence among Korean males in Korea is one of the lowest in the world, although among Korean females the level is average(Table 7). Icelanders show one of the highest incidence levels in both genders, where the age-standardized incidence rate in the male is 5.6 per 100,000 and that in the female is 13.3 per 100,000. White males in Denmark, West Germany, and the United Kingdom show a low incidence level(0.6—0.9 per 100,000) similar to the Korean males. However, white females in these areas show less than half(1.5—1.9 per 100,000) of the incidence level of the Korean females. The Far East area including Japan and China was reported to have incidence patterns in both genders similar to ours, where the age-standardized incidence rates are 0.9—1.4 per 100,000 in the male and 2.5—4.8 per 100,000 in the female, and the truncated incidence rates are 1.4—2.4 per 100,000 in the male and 4.1—8.4 per 100,000 in the female (International Agency for Research on Cancer, 1987).

The results showed little variation in incidence of thyroid cancer by area within Korea, except Jeonnam Province including Kwangju, which showed a significantly high incidence rate in the male. An interpretation, however, should not be made at this time because we have no further information on the residential history of the study popultion. It can only be suspected that the differences in environmental exogenous factors within Korea may not have strong etilologic implications on thyroid cancer. Tabel 7 shows that the thyroid cancer incidences of some races vary greatly by residential areas, for example, in the cases of the Japanese and the Chinese. The incidence rate of thyroid cancer in Hawaii is the highest, followed by that in Los Angeles, and the rate in the native country is the lowest one. Further investigationson the risk factors of thyroid cancer should be called for, especially on the regional differences through multi-ethnic migrant study.

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