

^{99m}Tc-Pertechnetate Thyroid Scan Findings of Thyroid Cancer

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== 국문초록 ==

갑상선암의 갑상선주사 소견

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1983년 1월 부터 1987년 12월까지 5년간 부산의 세곳 대학병원(부산의대, 고신의대, 인제의대)에서 병리조직학적으로 확진된 갑상선암 629예중 병력지 관찰이 가능하였던, 478예를 분석하여 1988년 보사부에서 발행한 Five Years' Report for Cancer Registry Programmme in Republic of Korea(1982 7.1~1987 6.30)의 발생빈도와 비교하였으며, 478예중 311예의 갑상선주사 소견을 분류하여 다음과 같은 결과를 얻었다.

- 1) 전체 악성암에 대한 갑상선암의 발생빈도는 2.54% (629/24.749)이었으며 이는 한국인에 있어서의 발생빈도와 거의 같았다(2.5%).
- 2) 여자에서 5배 이상 발생하여(1 : 5.64) 이것 역시 한국인에서의 성별빈도와 매우 유사하였다(1 : 5.22).
- 3) 연령분포는 10세에서 91세까지로서 87.03%가 20세에서 59세 사이에 있었다.
- 4) 유두상암이 가장 흔하였고(78.24%), 다음이 여포상암(14.44%) 그 다음이 미분화암(22.30%)이었다.
- 5) 갑상선주사 소견상 대부분의 암은 solitary cold nodule 을 보였다(82.96% : 258/311).

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Materials and Methods

478 cases of thyroid cancer in this study were selected from three hospitals in Pusan: Pusan National Univ. Hospital, Gosin Medical Center and Inje Univ. Pusan Paik Hospital from January, 1983 to December, 1987. There were 629 pathologically confirmed thyroid cancers in these hospitals, but of these, chart review was possible in 478 cases.

Recurred thyroid cancer cases were excluded from this study, and 311 cases of ^{99m}Tc-pertechnetate thyroid scan findings were analyzed according to cold and hot nodules. Warm nodules were included within cold ones.

Results

The number of malignant tumor patients in these three hospitals was 24,749 for 5 years, and pathologically confirmed thyroid cancer cases were 629, so thyroid cancer accounted for 2.54% of all cancers (Table 1, 2).

Male to female ratio was 1:5.64(72 : 406), age distribution was 10-91 and 87.03% (416/478) of cancers occurred between 20 and 59 years of age. Very similar rate (87.93% : 357/406) was found in the same age group of female (Table 3).

Histopathological classification of thyroid cancers in both sexes and in female is shown in Table 4

Table 1. Number of Malignant Tumor Patients in Three Univ. Hospitals

Hosp. Year	P.N.U.	Gosin	Inje	Total
1983	1110	1939	638	3684
1984	1113	2026	869	4008
1985	953	1841	1193	3987
1986	968	2606	1467	5041
1987	1235	5094	1700	8029
Total	5379	13503	5867	24749

and Table 5, respectively. Papillary cancer was most common and accounted for 78.24% and 78.5%, respectively, and the next was follicular type (14.44%, 15.27%). The others were in descending order: undifferentiated (2.30%, 2.21%), mixed with papillary and follicular (1.67%, 1.72%), medullary (1.46%, 0.74%), Hürthle cell (1.05%, 0.74%), clear cell (0.42%, 0.25%), mixed with undifferentiated and follicular (0.21%, 0.25%), and squamous cell carcinomas (0.21%, 0.25%) (Table 4, 5).

90.68% (282/311) of thyroid cancer revealed cold nodules (solitary and multiple) on ^{99m}Tc-pertechnetate thyroid scanning, but of them, vast majority was solitary cold nodule (82.96%:258/311) (Table 6).

Table 2. Number of Pathologically Confirmed Thyroid Cancer

Hosp. Year	P.N.U.	Gosin	Inje	Total
1983	94	31	7	132
1984	102	34	14	150
1985	81	28	7	116
1986	67	27	10	104
1987	67	50	10	127
Total	411 (301)	170 (140)	48 (37)	**629 (478)

* () : Number of the cases with possible chart review.

** 629 / 24749 X 100 = 2.54 (%)

Table 3. Age and Sex Distribution

Sex Age	Male	Female	Total
0 - 9		1	1
10 - 19	3	9	12
20 - 29	15	77	92
30 - 39	11 59	90 357	101 416
40 - 49	19 (81.94%)	95 (87.93%)	114 (87.03%)
50 - 59	14	95	109
60 -	10	39	49
Total (%)	72 (15.06%) 1 :	406 (84.94%) 5.64	478

Table 4. Histopathological Classification of Thyroid Cancer in Both Sexes

Pathology Age	Papil.	Foll.	Undiff.	P. + F.	Medul.	Hurth.	Clear	U. + F.	Squa.	Total
0 - 9		1								1
10 - 19	12									12
20 - 29	72	15		3	2					92
30 - 39	77	20		2	1	1				101
40 - 49	93	13	2	3	2	1				114
50 - 59	85	15	4			3		1	1	109
60 -	35	5	5		2		2			49
Total (%)	374 (78.24)	69 (14.44)	11 (2.30)	8 (1.67)	7 (1.46)	5 (1.05)	2 (0.42)	1 (0.21)	1 (0.21)	478 (100)

Table 5. Histopathological Classification of Thyroid Cancer in Female

Pathology Age	Papil.	Foll.	Undiff.	P. + F.	Medul.	Hurth.	Clear	U. + F.	Squa.	Total
0 - 9		1								1
10 - 19	9									9
20 - 29	61	13		2	1					77
30 - 39	70	18		2						90
40 - 49	80	10	1	3		1				95
50 - 59	72	15	4			2		1	1	95
60 -	27	5	4		2		1			39
Total (%)	319 (78.57)	62 (15.27)	9 (2.21)	7 (1.72)	3 (0.74)	3 (0.74)	1 (0.25)	1 (0.25)	1 (0.25)	406 (100)

Right lobe was involved more frequently than left, but there was no significant difference in frequency between both lobes (Table 6).

Discussion

According to the date from 1973-1977 SEER ("Surveillance, Epidemiology, and End Results") program of the National Cancer Institute in U.S.A., thyroid cancer accounted for 1.2% of all cancers, and the incidence in women (5.5 : 100,000) is more than double that of men (2.4 : 100,000), with the majority of cases occurring between 25 and 65 years of age^{1-4).}

In 1988, "Five Years' Report for Cancer Registry Programme in Republic of Korea" was reported by Ministry of Health and Social Affairs, and according

to it, thyroid cancer was 2.5% of all cancers (3,102/123,044) from July, 1982 to June, 1987. Male to female ratio was 1 : 5.22 and 73.3% of thyroid cancer occurred between 25 and 64 years of age in both sexes and 73.8% in the same age group of female. Thyroid cancer was 4th in order of frequency of malignant tumor in female (stomach:27.8%, liver and intrahepatic bile duct : 17.8%, breast : 9.1%, thyroid : 4.6%)^{5).}

The number of malignant tumor in our study was 24,749 and pathologically confirmed thyroid cancer was 629 cases, therefore thyroid cancer occupied 2.54% of all cancers. Male to female ratio was 1 : 5.64 (72 : 406), with 87.03% of cases occurring between 20 and 59 years of age in both sexes and 87.93% in female. In my previous report in 1987^{6).} male to

Table 6. ^{99m}Tc -Pertechnetate Scan Findings of Thyroid Cancer

Site Scan Finding	Rt.	Lt.	Both	Isthmic	Total
Normal					5
Cold Nodule					
* Solitary	142	102		14	*258
Multiple	5	5	28		24
Hot Nodule					
Solitary	1				1
Multiple					
Diffuse Enlargement					
→ Activity		2			
↑ Activity			4		
↓ Activity	1	1	1		9
Total	149	110	33	14	311

* $258 / 311 \times 100 = 82.96\%$

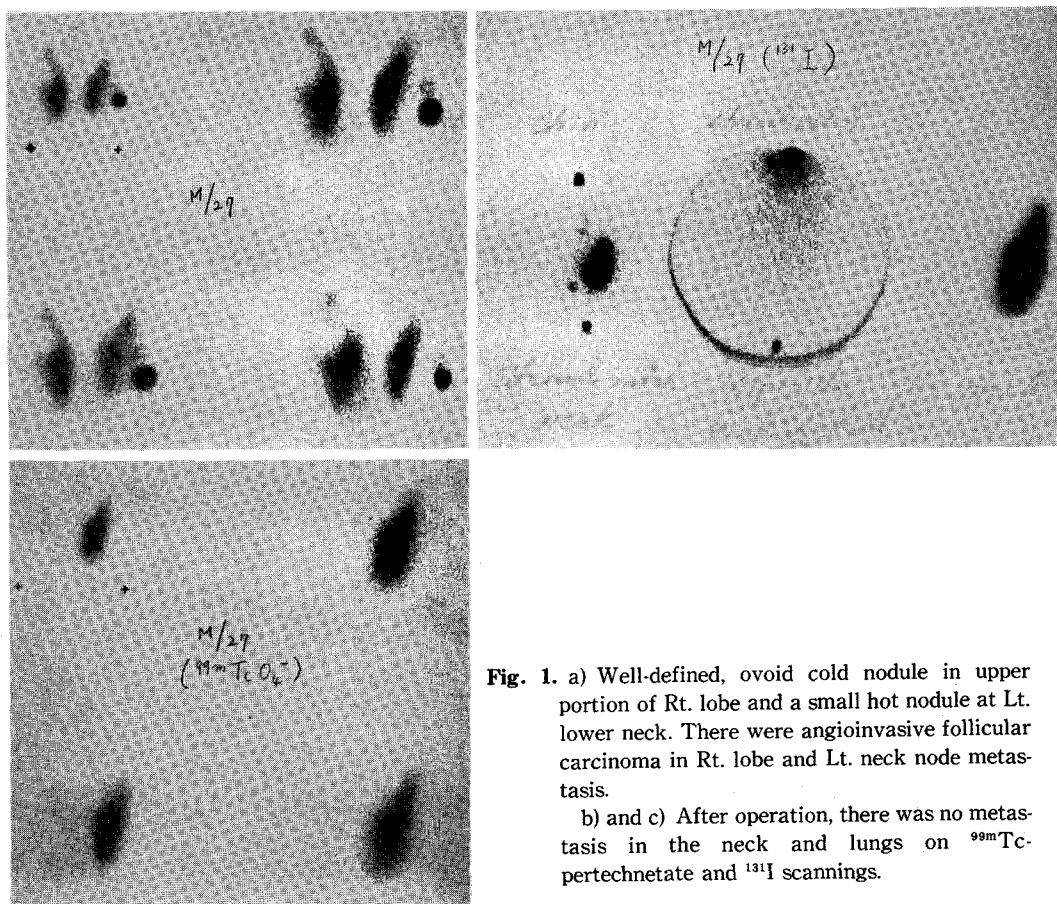


Fig. 1. a) Well-defined, ovoid cold nodule in upper portion of Rt. lobe and a small hot nodule at Lt. lower neck. There were angioinvasive follicular carcinoma in Rt. lobe and Lt. neck node metastasis.
b) and c) After operation, there was no metastasis in the neck and lungs on ^{99m}Tc -pertechnetate and ^{131}I scannings.

female ratio of thyroid cancer was 1 : 4 and 56.41% (44/78) was over 40 years of age, and in Liechty's

report in 1965⁷⁾, male to female ratio was 1:8 and age distribution was 16-76(42.3y). So, the percentage and

sex ratio of thyroid cancer in Korea and in Pusan area were similar (Table 1,2,3).

Histopathologic type of thyroid cancer in this study was in descending order: papillary (78.24%), follicular (14.44%), undifferentiated (2.30%), mixed with papillary and follicular (1.67%), medullary (1.46%), Hürthle cell (1.05%), clear cell (0.42%), mixed with undifferentiated and follicular (0.21%), and squamous cell (0.21%) in both sexes. In female, the order of frequency is very similar (Table 4,5) (Fig. 1, 2).

In my previous report in 1987⁶⁾, the order of frequency of histopathologic type was in descending order: papillary (73.08%), follicular (20.51%), mixed papillary and follicular, undifferentiated, and medullary (1.28%), respectively, and metastasis 1.28%. And in Liechty's in 1965⁷⁾: papillary (65%), follicular (18%), mixed with papillary and follicular (12%), and undifferentiated (6%).

As shown in these reports, papillary cancer is the most common thyroid malignancy and the frequency is similar among the reports^{3,8)}(Fig. 3).

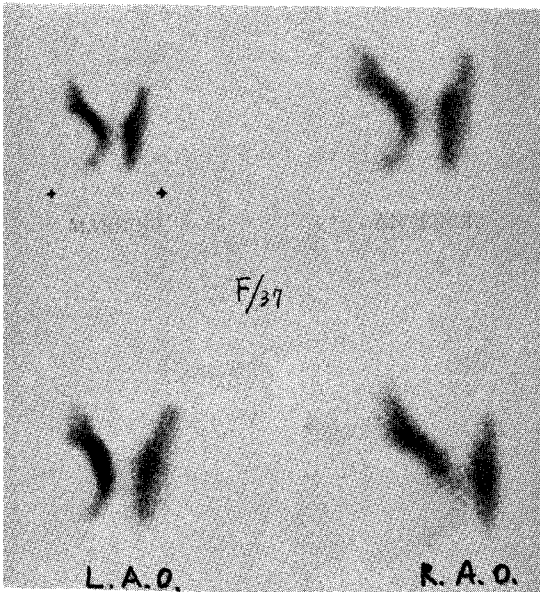


Fig. 2. Sharply demarcated, expanding, oval nodule in Lt. lobe was compressed by extrinsic mass. Rt. lobe was encapsulated follicular carcinoma.

Radionuclide scans have been a mainstay of diagnosis of thyroid cancer for many years. Current techniques usually employ a gamma camera with a pinhole collimator. In the evaluation of solitary nodules, oblique views and localization and palpa-

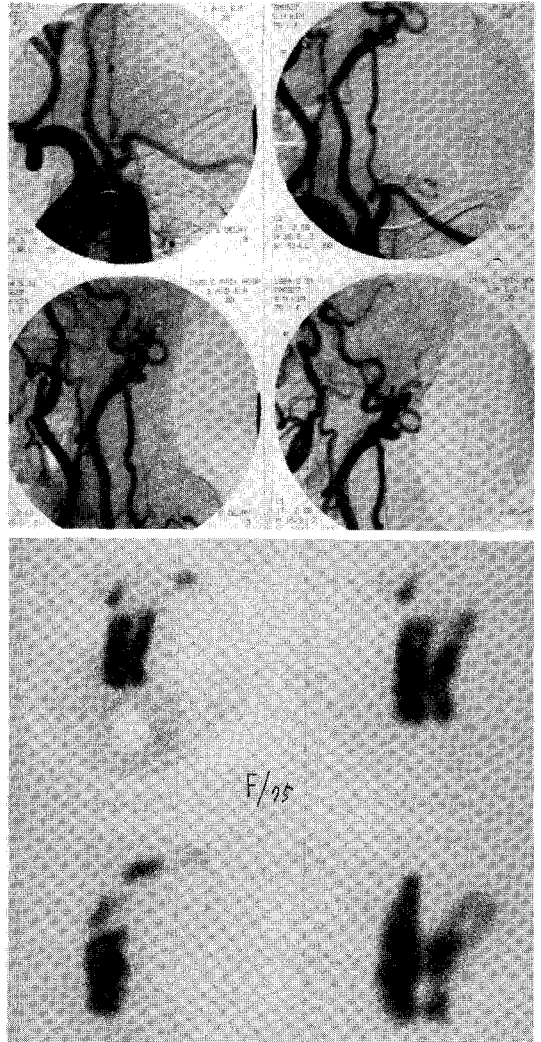


Fig. 3. a) This 75-year-old female has had small mass in Lt. neck for 16 years, and it has been growing rapidly for the recent 5 years. Lt. lobe appeared to be compressed by extrinsic mass. b) Aortic-archgram revealed no abnormal vascularity in the neck. It was small papillary carcinoma in upper pole of Lt. lobe and large, slowly growing nodular goiter with cystic degeneration.

tion with marking nodules are routine techniques. This examination will usually show nodules down to 8 mm in size⁸⁻¹². But thyroid scan is not particularly useful in distinguishing benign from malignant nodules¹³⁻¹⁸(Fig. 4-a).

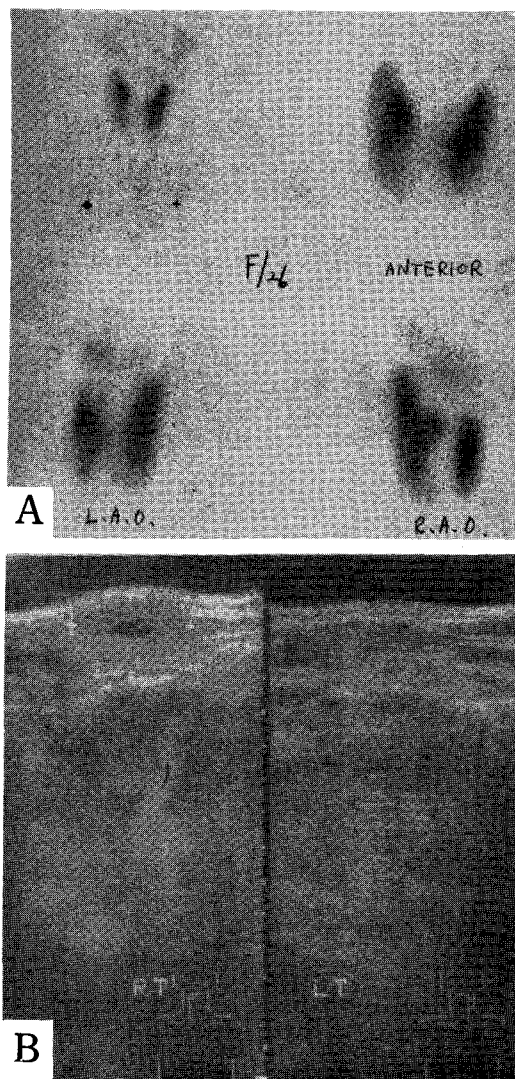


Fig. 4. a) Shallow, smoothly-outlined cold area at inferior-medial portion of Rt. lobe was visualized only on R.A.O. view.
b) On ultrasonogram, it had central cystic portion surrounded by solid lesion. It was confirmed as papillary carcinoma by ultrasono-guided aspiration biopsy.

Presently fine-needle aspiration appears to be the favored modality and it obtains satisfactory material for cytologic examination of thyroid nodules. Many hundreds of specimens have been studied and reported, testifying to the value of this method as a means of choosing patients for surgical treatment of the nodule. An accurate diagnosis can be expected in about 90% of patients^{1,19-22}(Fig. 4-b).

It has been well known that most of clinically palpable thyroid nodules is cold nodule and solitary cold nodule is the most common scan finding of thyroid disease^{15,22-24}. Most cases of well-differentiated thyroid cancer, however, occurs in patients under 40. Solitary cold nodules in young patients, therefore, have a high likelihood of containing cancer^{11,25}.

A history of radiation to the neck increases the likelihood of malignancy, and the probability of malignancy increases in nodules that fail to decrease (or that actually increase in size) after several months of thyroid suppression, and in multinodular glands in males under 40 who do not live in a goitrous area and who have not had a history of thyroiditis^{11,25}.

According to Mazzaferri et al.²⁶, approximately 90% of all radiation induced thyroid cancers are of papillary type. The overall incidence of thyroid cancer in neck-irradiated patients was reported 0.7-7% and the prognosis in irradiated patients appears to be similar to other patients with the same cancer type who have not been irradiated²⁵⁻³⁰.

There was no patient with past history of neck irradiation in our cases.

Solitary nodules that fail to concentrate iodine or pertechnetate are more likely to present malignant tumor than are multiple nodules^{11,16-18}. The incidence of malignancy in solitary cold nodules is different among the reports and ranges from 10 to 25%²³. Dische¹⁸ 15% (3/20), Shimaoka and Sokal¹⁷ 8.0%, Knowlson^{1,31} 4.2% (8/191), Maisey⁹ 3.39% (2/59), Atkins³² 19.8%, Alderson²³ 18.23% (11/60),

Liechty³³⁾ 18%, my previous reports in 1980²⁴⁾ and 1987⁶⁾ 17.25% (44/255), 19.86% (56/282), respectively (Table 7).

We can suggest that the frequency of thyroid cancer in solitary cold nodules is more than 17%.

Alderson²³⁾ suggested that the difference in the frequency of cancer in patients with solitary cold nodules (11/60 : 18.53%) compared with that in patients with multinodular appearing thyroids (3/37 : 3.1%) was clinically important. So, he also suggested that if the perchnetate image demonstrates a multinodular appearing thyroid and there is no past history of thyroid irradiation, the risk of cancer is low.

In patients with cold nodules on scintiscan, Shimaoka and Sokal^{11,17)} found an incidence of 8% malignancy for uninodular glands and 12% in multinodular glands. Warm nodules had an incidence of malignancy of 7% in uninodular glands and

4% in multinodular glands. If warm nodules had been included in cold ones in their study, uninodular glands would have had 16% malignancy with similar rates in both uninodular and multinodular glands as in the reports by Borner¹¹⁾.

Knowlson³¹⁾ found 8 carcinomas (4.2%) in a series of 191 patients with solitary cold nodules but only 3 (1.1%) in those with multinodular goiter.

According to Degroot and Stanbury (1975)³⁴⁾, the suspicion of thyroid cancer in patients with multinodular goiter is very much lower than patients with solitary nodules¹⁰⁾.

Most authors agree that the rate of malignancy is very low in hot nodules: Attie (1960)¹⁶⁾ 12.5%, Dische (1964)¹⁸⁾ 9.9%, Atkins (1975)³²⁾ 2.1%, Ashcraft and Van Herle (1981)³⁵⁾ 3.5%, my previous reports (1980 and 1987)^{24,6)} 12.15%, 17.65%, respectively. Although the rate itself is not different significantly from that in solitary cold nodules, the number of patients of cancer is much more prevalent in solitary cold nodules (Table 6).

The percentage of solitary cold nodules in thyroid cancer is similar among the authors: Liechty⁷⁾ 50%, Hoffman³⁶⁾ 74%, Alderson²³⁾ 78.57%, my previous reports in 1980²⁴⁾ and 1987⁶⁾ 78.57%, 71.79%, respectively, and this study 82.96%(258/311) (Table 8) (Fig. 1,2,3,4).

In our study, hot nodule in thyroid cancer was only one case. It can be concluded that most of thyroid cancer is solitary cold nodule on radionuclide imaging (Table 6).

In general the suspicion of cancer in autonomous nodules is slight, less than 2% (Molnar et al., 1965: Hamburger, 1975)³⁷⁾, although it definitely exists and must not be excluded. But there was no autonomous nodule in thyroid cancer of our study.

Steinburg (1970)³⁸⁾, Turner (1976)³⁹⁾, and O'Connor (1977)⁴⁰⁾ reported one case of follicular carcinoma in discordant nodule respectively, which showed as a perchnetate "hot" nodule, but without ¹³¹I uptake. Discordant nodule is not specific for thyroid cancer

Table 7. Incidence of Cancer in Solitary Cold Nodule by Authors

Author		%
Dische	(1964)	15.0 (3/ 20)
Shimaoka & Sokal	(1964)	8.0
Knowlson	(1971)	4.2 (8/191)
Maisey	(1973)	3.39 (2/ 59)
Atkins	(1975)	19.8
Alderson	(1976)	18.23 (11/ 60)
Liechty	(1977)	18
Kim	(1980)	17.25 (44/255)
Kim	(1987)	19.86 (26/282)

Table 8. % of Solitary Cold Nodule in Cancer

Author		%
Liechty	(1965)	50.0
Hoffman	(1972)	74.0
Alderson	(1976)	78.57 (11/ 14)
Kim	(1980)	78.57 (44/ 55)
Kim	(1987)	71.79 (56/ 78)
*Kim	(1989)	*82.96 (258/311)

but has been reported in primary and secondary neoplasms^{38,39,41-43}, adenomatous goiter⁴¹⁻⁴⁴, follicular adenomas⁴¹⁻⁴⁵, Hürthle cell adenoma⁴⁵, and thyroiditis^{41,45,46}. Wiener, et al (1981)⁴⁷ reported a case of "reversed discordancy" in thyroglossal duct cyst, which was visualized only with ¹²³I and not with pertechnetate and which may be explained by the persistence of organification by the very small amount of normally functioning thyroid tissue. Therefore, any palpable thyroid nodule that appears to be hot with pertechnetate should also be studied using radioiodine. We could not find radioiodine thyroid scannings performed for the purpose of detecting discordant nodule in our study.

Conclusion

- 1) Thyroid cancer accounted for 2.54% of all cancers and this rate was almost the same as that of Korea (2.5%)
- 2) Male to female ratio was (1:5.64) and it was very similar to that of Korea (1:5.22)
- 3) Majority of cases occurred between 20 and 59 years of age (87.03% in both sexes and 87.93% in female.)
- 4) Papillary carcinoma was the most common type (78.24% in both sexes and 78.57% in female), followed by follicular carcinoma (14.44%, 15.27%, respectively), and undifferentiated type (2.30%, 2.21%, respectively).
- 5) Most of thyroid cancer revealed solitary cold nodule on ^{99m}Tc-pertechnetate thyroid scanning (82.96%).

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