

# Analysis of the Thyroid Carcinoma Incidence in Tianjin Over a Recent Twenty-Year Period

Biyun Qian  
Kexin Chen  
Min He  
Shufen Dong  
Haixin Li  
Fengju Song

Department of Cancer Epidemiology,  
Tianjin Medical University Cancer  
Institute and Hospital, Tianjin 300060,  
China.

**OBJECTIVE** To analyze the incidence rate and trend of thyroid cancer in Tianjin over a recent 20-year period.

**METHODS** A method of descriptive epidemiology was used to study the occurrence of thyroid cancer.

**RESULTS** During 1981~2001, the average incidence rate of thyroid cancer was 1.770 per 100,000 with a male to female incidence ratio of 1:2.74, the occurrence being higher in females than in males. Thyroid cancer incidence increased gradually with time over the 20 years in both males and females, especially the incidence peaked in females of 35~50 years of age.

**CONCLUSION** The rapid increase in the incidence rate of thyroid cancer, especially in females, suggests that further research on the risk factors and preventive efforts related to high-risk women should be conducted.

**KEYWORDS:** thyroid cancer, epidemiology, incidence rate, time trend.

While being relatively rare overall, thyroid cancer is the most prevalent endocrine malignancy which mostly affects young women. However because the incidence and mortality are relatively lower than other cancers, to the best of our knowledge there has been no population-based study in China. This study is a statistical analysis of the incidence and trends of thyroid cancer in Tianjin from 1981 to 2001, and thus provides insight for future research on the cause of the trends and etiology of thyroid cancer.

## MATERIALS AND METHODS

### Data

All of the cases were from the Tianjin Cancer Registry that was established in 1978. This registry is one of the members of the International Agency for Research on Cancer (IARC) of the World Health Organization. Since 1981 the cancer incidence data from Tianjin has been included in the IARC official publication: "Cancer Incidence in Five Continents". In our study, we included all primary thyroid cancer patients (ICD-9 codes 192) from 1981 to 2001 in the Tianjin urban population. Numbers in each age-sex specific population for the 6 urban districts were obtained from the Tianjin Public Security Bureau.

### Descriptive analyses

The statistical analysis was carried out using SAS 8.1 for windows and Epi info2000 software. Age and sex specific incidence rates were calculated and plotted. Age-adjusted incidence rates were calculated

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CJCO <http://www.cjco.cn> E-mail: [cocr@eyou.com](mailto:cocr@eyou.com)

Tel (Fax): 86-22-2352-2919

万方数据

**Table 1. Constituent ratio (CR) of the histological type of thyroid cancer in Tianjin, 1981–2001 (%).**

Histological type	Male		Female		Total	
	Case	CR	Case	CR	Case	CR
Papillary adenocarcinoma	105	57.69	387	67.42	492	65.08
Adenocarcinoma	34	18.68	77	13.41	111	14.68
Follicular	13	7.15	47	8.19	60	7.94
Parafollicular cell	14	7.69	26	4.53	40	5.29
Anaplastic	4	2.20	4	0.70	8	1.06
Others	12	6.59	33	5.75	45	5.95
Total	182	100.00	574	100.00	756	100.00

Comparison of the histological type difference by gender:  $\chi^2=10.53$ ,  $P=0.06$ .

using the world standard population. The incidence rate was compared from 1981 to 2001 using the  $\chi^2$  trends test and the  $\chi^2$  test was used to compare the average incidence rate. The age at diagnosis was compared employing the  $t$ -test.

## RESULTS

### Histological type

Data from the cancer incidence reporting cards during the period of 1981–2001 showed that 756 cases had thyroid pathological results, accounting for about 57.4% of all thyroid cases. Papillary adenocarcinoma was the most common type. There was no significant difference in the histological type between males and females (Table 1).

### Age and sex constitution at diagnosis

A total of 1,318 cases of thyroid cancer were identified in Tianjin between 1981 and 2001 with 352 cases occurring in males and 966 cases in females. The male: female incidence ratio was 1:2.74. The incidence was the highest in the 60–65 age groups for males and in the 35–50 age groups for females. The median age at diagnosis was 50 years, being 55 and 49 years for males and females respectively. The age of onset occurred earlier in females than in males ( $t=3.01$ ,  $P=0.0026$ ).

### Incidence and time trend

The total average incidence rate of thyroid carcinomas was 1.770 per 100,000 in the Tianjin urban area during the 1981–2001 period. The incidence rate increased from 0.869 per 100,000 in 1981 to 2.543 per 100,000 in 2001, an increase of 193% during the entire period.

The incidence rate showed a statistically significant elevation trend over this period (Table 2). The rank of thyroid cancer incidence also climbed from 22 in 1981 to 17 in 2001.

**Table 2. Thyroid cancer incidence rate in Tianjin during recent 21 years(1/100,000).**

Year	Caese	Crude rates	World standard rates
1981	30	0.869	0.804
1982	47	1.503	1.317
1983	46	1.444	1.506
1984	39	1.201	1.079
1985	54	1.617	1.354
1986	48	1.413	1.310
1987	57	1.653	1.447
1988	49	1.400	1.190
1989	68	1.914	1.496
1990	71	1.971	1.681
1991	69	1.904	1.627
1992	56	1.537	1.279
1993	64	1.745	1.415
1994	58	1.576	1.186
1995	75	2.034	1.514
1996	59	1.598	1.185
1997	80	2.167	1.644
1998	86	2.314	1.734
1999	74	1.988	1.468
2000	93	2.485	1.825
2001	95	2.543	1.799
Total	1318	1.770	1.422

Comparison of the thyroid cancer incidence rate every year from 1981 to 2001 using the  $\chi^2$  trend test method,  $\chi^2=48.794$ ,  $P=0.000$ . This difference has statistical significance.

### Age and sex-specific incidence trend

During the 1981~2001 periods, the average thyroid cancer incidence rate was 0.938 per 100,000 for males, and showed an increase of 99.12% over those years. The average incidence rate was 2.615 per 100,000 for females, and from 1981~2001 it increased from 1.296 to 4.187 per 100,000, an elevation of 223%. Females had consistently higher incidence rates compared to males across all age groups during this period ( $\chi^2=294.429$ ,  $P=0.000$ ). Moreover the magnitude of incidence increase was greater in females (Fig.1). The mean male:female incidence ratio was 1:2.74 in 1981 and 1:4.59 in 2001.

The patterns of age-specific incidence differ significantly by gender. Incidence rates in females climbed steeply after 25 years of age and through the reproductive years, gradually leveling off at about age 45, but then rose quickly again from age 60, increasing slightly after 65. Male incidence rates simply increased gradually with increasing age (Fig.2).

## DISCUSSION

### Incidence trend

Thyroid cancer is one of the most common malignant tumors in women of childbearing age, although overall it is a rare malignancy. In many parts of China, it often ranks first in entire head and neck cancers.<sup>[1]</sup> Data from Surveillance, Epidemiology, and End Results (SEER) reports from the National Cancer Institute showed that the thyroid cancer incidence rate in the U.S. increased

from 6.4/100,000 in 1975 to 11.7/100,000 in 2001 for females, and from 3.1/100,000 to 4.2/100,000 for males.<sup>[2]</sup> Thyroid cancer showed one of the biggest increases in malignant tumors during the period of 1978~2001 in France.<sup>[3]</sup> In a 1990 report from Norway, the annual incidence rate of thyroid cancer in females increased over the 1970~1985 period.<sup>[4]</sup> The statistical results among the most recent 20 years in Tianjin also indicated the same trend. It has been suggested that the gradual improvement of medical diagnosis might be responsible for this increasing trend. It is interesting that the thyroid incidence rate is higher in developed countries compared to developing countries and districts in the IARC reports.<sup>[5]</sup> Our study is consistent with previous research.

### Sex and age distribution

The report of cancer incidence in 5 continents from the IARC showed that the thyroid cancer incidence rate has increased with age in the entire world and was higher in females than males. The male: female incidence ratio was about 1:3 and has reached a peak at 45 years or so in females.<sup>[5]</sup> It is reported from New Mexico that thyroid cancer occurs 2 to 3 times more frequently in females than in males. The patterns of age-specific incidence also differ significantly by gender. Incidence rates in females climb steeply after puberty and through the reproductive years, gradually leveling off at about age 40 and then declining slightly after age 75. Male incidence rates simply increase gradually with increasing age, leading to an almost

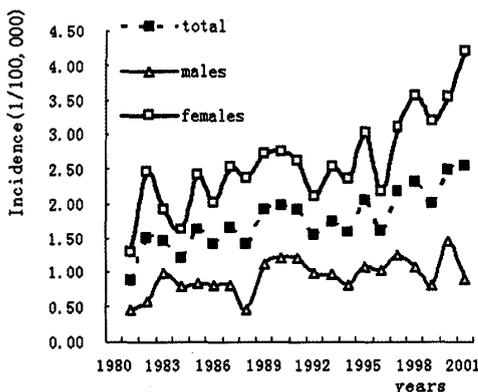


Fig.1. Thyroid cancer incidence time trend by sex during 1981~2001 in Tianjin.

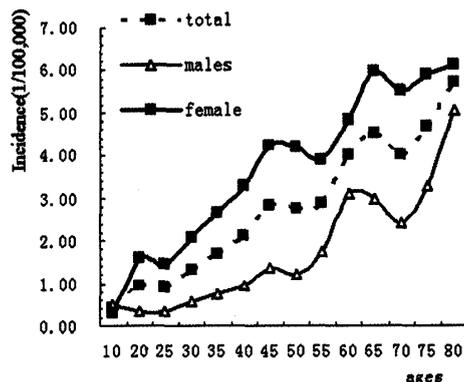


Fig.2. Thyroid cancer age-specific incidence rate during 1981~2001 in Tianjin.

equal sex ratio among the elderly.<sup>[6]</sup>

Gender and age distribution of thyroid cancer was similar for Tianjin and the U.S. However in Tianjin, the incidence rate increased higher in females. Perhaps this finding was related to improved diagnostic ability and obesity and the fluctuation of female hormone levels induced by higher living standards and other correlation diseases such as benign thyroid nodules. Moreover the age-specific incidence curve for females increased sharply from puberty, reaching a plateau after age 40 to 45, after which it peaked in 65 age group, and remained high thereafter.

It is thus clear that thyroid cancer occurred more widely in females in Tianjin compared to males, including the whole fertile parts of life. This may be related to the higher iodine intake resulting from the geographical situation of Tianjin which is along the coast. Further investigations on risk factors are needed to determine the cause of the increase in incidence of thyroid cancer in the female population.

### Regional distribution

According to the 2000 IARC report, the world-wide thyroid cancer incidence rate in males and in females was 1.2/100,000 and 3.0/100,000 respectively. The countries and districts with a higher incidence rate were Polynesia, Ice land, Italy, Israel, Finland, Hong Kong, Canada, USA etc; China belongs to the low-incidence region.<sup>[5]</sup> Our results indicated that the thyroid cancer standard incidence rate according to world population adjusted was 1.422/100,000.

### Prevention strategy

The etiological factors of thyroid cancer, like other cancers, are still obscure. Some researches have shown an enormous elevation of thyroid cancer among the population who lived in the radiated regions after the Chernobyl accident.<sup>[7-10]</sup> It has been suggested that radiation treatment in the head and neck for benign childhood conditions may be responsible for the observed increase of thyroid cancer.<sup>[11]</sup> So exposure to high-dose ionizing radiation could one of the important etiological factors for thyroid cancer, however, such exposures account for a minority of overall cases. Other risk factors include a personal history of benign thyroid nodules, family history of thyroid cancer, obesity and certain reproductive and hormonal factors in women<sup>[12]</sup>. Although some reports have emphasized that sex hormones may influence thyroid carcinogenesis,<sup>[13,14]</sup> these relationships warrant further investigation. Thyroid-stimulating hormone (TSH) receptor may be involved

in the carcinogenic process.<sup>[12,15]</sup> Molecular studies have indicated that some oncogenes and growth factors are involved in thyroid carcinogenesis.<sup>[1,12]</sup> However no clear preventative measures or control methods are known. Therefore the approach to fight thyroid cancer is still based on the principles of early detection, early diagnosis and early treatment. Thyroid benign diseases should be treated quickly. Although the thyroid cancer incidence is not as high as other tumors, its increasing trend in recent years is of great concern.

In summary, data based on the thyroid cancer incidence shows the incidence rate has been growing year by year; especially over the 20 year period studied the incidence trend in females has shown a sharp increase. In addition the incidence ratio of females: males was also shown to be augmented year by year, and in particular, younger women showed increased risk. So not only is there a great need to study risk factors so that preventative measures can be applied, but also there is the need for educating women in the 35-50 age group who are at particular increased risk. Regular self-examinations and checkups should be advocated to increase early diagnosis and the proportion of patients who receive early therapy, so that the quality of life for women in reproductive ages is improved.

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