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• ESOPHAGEAL CANCER •

An analysis of esophageal cancer incidence in Cixian county from 1974 to 1996

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Abstract

AIM: To describe the incidence of esophageal cancer (EC) in Cixian, a county of Hebei province during 1974-1996. We analyzed the sex and age characteristics as well as the geographic distribution of EC, in order to determine the impact so that methods of preventing and controlling EC in Cixian can be put in place.

METHODS: Since the early 1970s, the cancer registry system has been established, which collects the cancer incidence in Cixian county. The malignant tumors were coded according to International Classification of Disease IX (ICD-9). All the data were checked and analyzed using EPIINFO.

RESULTS: The trend of the incidence rate of EC from 1974 to 1996 had declined, (229.9/100 000 *vs* 178.5/100 000, Odds ratio=1.47, 95 % CI:1.32~1.63, χ^2=52.89. trend χ^2=26.54, P<0.001). The incidence rate of males declined significantly (281.81/100 000 *vs* 157.96/100 000, Odds ratio=1.61, 95 % CI: 1.41~1.84, χ^2=47.85. Trend χ^2=44.86, P<0.001), whereas, the females remained steady (157.96/100 000 *vs* 133.41/100 000, odds ratio=1.28, 95 % CI:1.17~1.49, χ^2=9.26. trend χ^2=2.69, P>0.05). Male average annual incidence rate was 142.80/100 000 and the female's was 95.18/100 000. The sex ratio (males to females) was 1.50:1. The incidence rate was increasing along with the age. As to the geographic distribution, the incidence rate in mountainous areas and hilly areas showed a significantly declining trend (mountainous areas, trend χ^2=149.93, P<0.001; hilly areas, trend χ^2=42.70, P<0.001). The incidence rate of EC in plain areas had increased (trend χ^2=22.39, P<0.001).

CONCLUSION: The incidence rate of EC in Cixian county shows a trend and has declined after two decades, especially in mountainous area. But compared to other regions in the world, Cixian county still had a high incidence rate of EC.

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INTRODUCTION

Cixian county is one of the highest incidence rates of esophageal cancer (EC) in China, as well as in the world[1-7]. At the start of the 1970s, a field study of EC prevention and treatment was set up[8]. At the same time the population-based cancer registry system, so called the three-level prevention web, was established. Each clinic doctor in every township was required to report each new case of cancer occurring in the township using a standard card, then the cards were sent to the clinic of the rural administration unit. The unit sorted the cards and sent them to the Cixian Cancer Registry. To this day the Cixian Cancer Registry continues to collect incidence data. This present report came from "A study of incidence, mortality and surveillant method of risk factors of common carcinoma" carried out in the Cixian county of Hebei province, which is adjacent to the Linxian county of Henan province. This study was one of The National Ninth-Five-Year Scientific Championship Project.

MATERIALS AND METHODS

Materials

Cixian is located at latitude 36° 30' North and longitude 114° 40' East. It is situated on the east side of the Taihang Mountain, along the Zhanghe River and it lies in the south of the Handan City. Across the Zhanghe River to the south is the Anyang City of Henan Province. Cixian county occupies an area about 951 square kilometers, composed of 35 districts, and its population is 574 828, consisting of 289 391 males and 285 437 females. There is a remarkable variation in the earth stratum of the county, with mountainous, hilly, and level land each constituting about one-third of its total area. The climate is influenced mainly by the warm mainland seasonal winds. The temperature range is bewteen 18-25 ℃ and the rainfall range is bewteen 600-700 millimeters. The major soil there is brown and light colored weed earth. Farm products include wheat, corn, millet, rice, red potato and beans. Iron and coal are the main minerals, and coal is the main local fuel of the county.

Cixian Cancer Registry is a population-based registry that was established in 1974. Its aim is to collect and analyze data on every new case of cancer occurring in Cixian county. Initially, it was mainly concerned with collecting data on the incidence and mortality rates of EC in Cixian. However, from 1988, it began to also collect information on the histopathology of the cancers reported.

Methods

The register was conducted by the three-level prevention web. Each clinic doctor in every township (prevention web I) was required to report each new case of cancer occurring in the township by a standard card, then the cards were send to the clinic of the rural administration unit (prevention web II). They were sorted and sent to the Cixian Cancer Registry (prevention web III) once a month, these cards were checked, analyzed, coded and stored there. At the end of each year, a sample survey was conducted, to check the quality of the registration.

The carcinoma were coded according to International Classification of Disease IX (ICD-9)[9]. All the data was checked and analyzed by EPIINFO software. Age-standardized

rates (ASR) were standardized to the world population using the direct method and the statistical analysis was carried out by using χ^2 and U-test, a probability value of less than 0.05 was considered statistically significant.

RESULTS

Incidence of esophageal cancer

Bewteen the years 1974 and 1996 there were 14 207 cases of EC in the county. The annual average incidence rate was 119.43/100 000, the ASR was 167.22/100 000. In 1974, the incidence rate of EC was 165.81/100 000. It declined to 113.49/100 000 in 1996, representing a decline of 31.5 percent. From Table 1 and Figure 1, we can see that the incidence rate of EC in Cixian had a trend of gradual decline. The trend test revealed that χ^2=26.54, P<0.001. The incidence rate among males declined significantly (χ^2=44.86, P<0.001), whereas, the females remained steady (χ^2=2.69, P>0.05). In total, the incidence rate between 1970s and 1990s showed significant differences (U test: P<0.01). While the difference between 1980s and 1990s was not significant.

The sex and age distribution

During the period there were 8 559 males and 5 648 females with EC. The incidence rate among males was 142.80/100 000, while females was 95.18/100 000. The sex ratio was 1.50:1. The sex ratios (males to females) in 1970s, 1980s and 1990s respectively was 1.57:1, 1.56:1 and 1.35:1.

The minimum age group of incidence was 1-year group over 23 years. The incidence rate of EC increased with age after 30 years old. It reached the highest at 80 years old group. In 1970s, the minimum age group was 25 years old group. The incidence rate had significantly increased after 35 years of age, and reached the highest level at 70 years old, then declined in 75-year old group. In 1980s, the minimum incidence group was one-year group. The incidence rate increased with age after that 25-year old group. The male incidence rate reached the highest at 80-year-old group. In females at the 60-year-old group it declined a little and reached the highest at 80-year-old group. In 1990s the minimum incidence group was 10-year-old group. The incidence rate increased with age after 25-year-old group and reached the highest at 80-year-old group. The male incidence rate reached the highest at 80 years old group, while the female declined little at 60-year-old group and reached the highest at 80-year-old group.

Geographic Distribution

In the mountainous area there were 2 106 EC cases from 1974 to 1996. The annual average incidence rate was 112.14/100 000. The incidence rate of EC in 1974 was 213.60/100 000, which declined to 82.55/100 000 in 1996. Decreased by 131.05/100 000, and the decline rate was 61.35 percent. From Table 2 and Figure 3 we could find that the incidence rate of EC in mountainous

Table 1 Cixian EC incidence rate state from 1974 to 1996

Year	Male				Female			
	Population	Case	Incidence rate	ASR	Population	Case	Incidence rate	ASR
74	221842	450	202.85	281.81	217799	279	128.10	157.96
75	224063	392	174.95	244.74	220937	279	126.28	162.8
76	226098	407	180.01	247.68	222526	236	106.06	131.44
77	227998	335	146.93	195.17	224094	193	86.12	103.31
78	227677	320	140.55	186.94	228524	191	83.58	104.51
79	231485	302	130.46	197.31	229242	190	82.88	108.11
80	235881	323	136.93	199.38	232902	221	94.89	124.86
81	242181	301	124.29	193.06	239136	191	79.87	101.76
82	242211	334	137.90	210.05	244007	194	79.51	106.98
83	251237	348	138.51	220.67	249751	229	91.69	122.07
84	253097	367	145.00	240.89	251332	192	76.39	103.22
85	256616	324	126.26	217.06	254526	214	84.08	113.06
86	260149	374	143.76	250.52	257671	205	79.56	100.92
87	265498	331	124.67	202.98	261498	231	88.34	114.62
88	262726	404	153.80	250.76	264539	287	108.49	153.86
89	272643	401	147.10	237.16	285840	258	90.26	131.13
90	289391	443	153.10	248.1	285437	322	112.81	151.55
91	294993	446	151.20	260.53	287546	305	106.07	139.36
92	299306	430	143.70	240.72	291905	302	103.46	139.6
93	299498	408	136.20	216.73	296060	283	95.59	126.12
94	303761	379	124.80	197.96	295104	260	88.10	114.01
95	302782	359	118.60	192.95	294867	289	98.01	125.92
96	302538	381	125.90	203.65	298596	297	99.47	133.41
Total of 70's	1595044	2529	158.55	–	1576024	1589	100.82	–
Total of 80's	2595749	3627	139.73	–	2593737	2323	89.56	–
Total of 90's	1802878	2403	133.29	–	1764078	1736	98.41	–
Total	5993671	8559	142.80	–	5933839	5648	95.18	–

Table 2 The geographic distribution of esophageal cancer in Cixian from 1974 to 1996 (1 / 100 000)

Year	Mountainous area			Hilly area			Level land area		
	Population	Cases	Incidence rate	Population	Cases	Incidence rate	Population	Cases	Incidence rate
74	77240	165	213.60	145428	241	165.71	216973	323	148.81
75	77581	151	194.63	147830	232	156.93	219589	288	131.15
76	77981	132	169.27	148692	221	148.62	221951	290	130.65
77	78231	116	148.27	149995	192	128.00	223866	220	98.27
78	78257	85	108.60	151456	220	145.25	226488	226	99.78
79	78112	80	102.41	152682	173	113.11	229933	239	103.94
80	78331	92	117.45	155341	210	135.18	235111	242	102.93
81	78555	79	100.56	160010	157	98.12	242752	256	105.45
82	79271	92	116.05	162756	161	98.92	244191	275	112.62
83	80023	100	124.96	166662	186	111.60	254303	290	114.04
84	80294	95	118.32	168296	144	85.56	259276	320	123.42
85	80877	80	98.92	170916	173	101.22	262624	285	108.52
86	82214	101	122.85	172888	179	103.54	266119	296	111.23
87	82291	78	94.79	175132	173	98.78	269573	310	115.00
88	81953	114	139.10	177724	215	120.97	263222	340	129.17
89	82289	91	110.58	179502	206	114.76	275391	355	128.91
90	84228	62	73.61	190411	239	125.52	298185	449	150.58
91	85459	48	56.17	192370	262	136.20	302601	425	140.45
92	85498	59	69.01	194281	250	126.68	307073	405	131.90
93	86484	68	78.63	195963	225	114.88	308956	386	124.94
94	87881	68	77.38	198956	188	94.49	312984	374	119.50
95	87661	78	88.98	198715	195	98.13	311510	413	132.58
96	87221	72	82.55	198276	191	96.33	311009	409	131.51
Total of 70's	545733	821	150.44	1051424	1489	141.62	1573911	1828	116.14
Total of 80's	811995	892	109.85	1724297	1833	106.30	2635636	3176	120.50
Total of 90's	520204	393	75.55	1178561	1311	111.24	1854133	2412	130.09
Total	1877932	2106	112.14	3954282	4633	117.16	6063680	7416	122.30

area had significantly decreased. The result of trend test was χ^2=149.93, P<0.001. The incidence rates of EC in 1970s, 1980s, and 1990s were 150.44/100 000, 109.85/100 000 and 75.55/100 000, respectively. The U test result between 1970s and 1990s, between 1980s and 1990s was P<0.01. Both of them had significant difference.

In the hilly area there were 4 633 EC cases. The annual average rate was 117.16/100 000. From 1974 to 1996, the incidence rate changed from 165.71/100 000 to 96.33/100 000. Decreasing in number was 69.38/100 000. And declining rate was 41.86 percent. The result of trend test was χ^2=42.70, P<0.001. From Table 2 and Figure 3, we could see that from 1970s to 1980s the incidence rate of EC declined significantly, from 141.62/100 000 to 106.30/100 000 (U test: P<0.01). While comparing the incidence rate of EC of 1980s with that of the 1990s', it increased from 106.30/100 000 to 111.24/100 000 (U test: P<0.01).

On level land there were 7 416 EC cases over 23 years. The annual average incidence rate was 122.30/100 000. According to Table 2 and Figure 3 we can see that during the past 23 years incidence rate of EC increased steadily. The result of trend test was χ^2=22.39, P<0.001. Comparing 1970s' incidence rate with 1990s', it increased from 116.14/100 000 to 130.09/100 000. The increasing in number was 13.95/100 000 and the increasing rate was 12.01 percent (U test: P<0.01). Comparing the incidence rate of 1980s with the 1990s', which increased from 120.50/100 000 to 130.09/100 000. The increasing in number was 9.59/100 000 and the increasing rate was 7.95 percent (U test: P<0.01). We could see that the incidence rate of EC in level land was increasing steatidly.

There are 35 townships in Cixian County. In the 1970s, Linfeng township had the highest incidence rate of EC, which was 211.90/100 000. While Dudang township had the lowest, which was 66.57/100 000. The highest male incidence rate existed in Linfeng and the mumber was 298.02/100 000. While the highest female incidence rate existed in Guanglu township and the number was 164.49/100 000. The lowest incidence rate of EC of both male and female existed in Dudang, which was 79.71/100 000 and 51.51/100 000, respectively. The highest rate was 3.18 times as much as the lowest. Cixian County had two high risk areas, one was the mountainous area which was centered around Baitu district (132.23/100 000), the other was hilly area which was centered around Lintan district (128.64/100 000). Level land had the lowest incidence rate (116.01/100 000). After 1980s, the highest incidence rate existed in Guanglu township (232.04/100 000) and the lowest existed in Dudang (55.08/100 000). Linfeng had the highest male incidence rate of EC (285.37/100 000). While Cizhou town had the lowest (64.77/100 000). Guanglu had the highest female incidence rate of EC (214.28/100 000), while Dudang had the lowest (38.65/100 000). The highest EC incidence rate was 4.21 times as much as the lowest. There were 20 towmships whose incidence rate were higher than the average of county wide, forming a high-risk hilly area, which was centered around Lintan district. After 1990s, Ducun township had the highest EC incidence rate of 275.80/100 000. While Dudang township

had the lowest whose number was 45.92/100 000. The highest male incidence rate existed in Ducun township which was 341.08/100 000. The highest female incidence rate existed in Guanglu which was 213.26/100 000. While the lowest male incidence rate lay in Wuhe township which number was 36.20/100 000. The lowest female incidence rate lay in Huangsha township which was 26.98/100 000. The highest EC incidence rate was 6.01 times as much as the lowest. There were 19 townships whose incidence rate were higher than the average of county wide, forming a high-risk level land area which was centered around Ducun township.

In the 1970s, the high incidence area existed in mountainious areas which are centered around Baitu district and in hilly area which was centered around Lintan district. After 1990s, the incidence rate of EC in Cixian declined significantly. But the hilly area still had high incidence rate, decilining slowly. While the level land area had increasing trend, forming a high risk area which was centered around Ducun township.

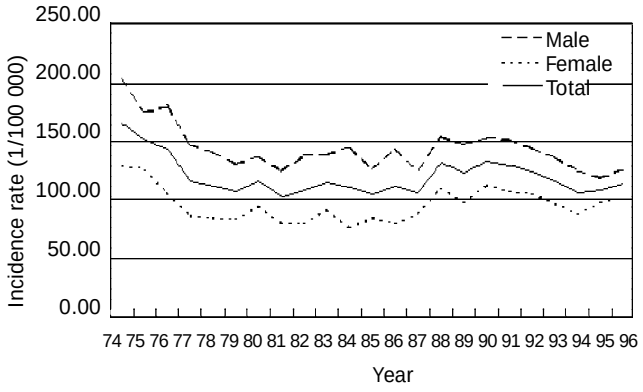

Figure 1 Cixian EC Incidence Rate State from 1974 to 1996.

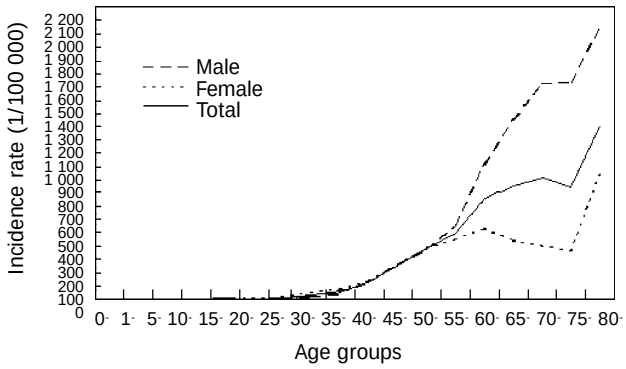

Figure 2 Cixian EC Incidence Rate of Groups from 1983 to 1997.

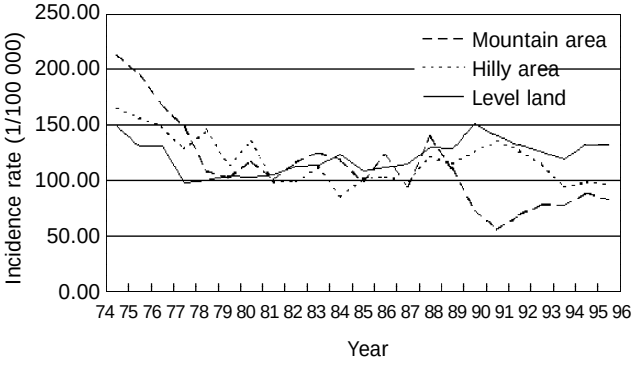

Figure 3 The Geography Distribution of Cixian EC Incidence from 1974 to 1996.

DISCUSSION

Cixian county is one of the highest EC incidence rate areas in China, as well as in the world. Since the early 1970s, cancer registry system has been established where began to collected the cancer incidence in Cixian county[10-21]. Until now Cixian Cancer Registry have piled up the incidence data of more than twenty years. In this study we found the trend of the incidence rate of EC from 1974 to 1996 had declined after two decades. As for the possible causes of EC[22-27], we advocate the inhabitant to take follow prevention: (1) To improve the quality of the drinking water condition; (2) To administer the farm products storage, not to eat the food with mold; (3) Eating more vegetables and fruits, changing the bad life style; (4) Conducting screening survey to find the carcinoma in situ or intramucosal carcinoma especially esophageal epithelium dysplasia (EED). EED is a precancerous lesion which can either develop further into a more severe stage or cancer, stay unchanged, or reverse back to normal again for a period of several years or even a decade[28-34]. It is therefore very promising to detect patients with EED and treat the precancerous lesions before they transform into the irreversible malignant stage. There are several techniques and chemicals or nutrients that have been reported to be effective in blocking precancerous lesions from transforming into cancer[35-38].

The incidence rate among males declined significantly however, females remained steady. As to the geographic distribution, the incidence rate in mountainous area and hilly area showed a declining trend. The incidence rate of EC in level land area had increased. The reasons why these happened needs to be further studied and analysed.

In conclusion, the trend of the EC incidence rate in Cixian county had declined after two decades, especially in mountainous areas. But compared to the other regions in the world Cixian county still had a high incidence rate of EC. By using a register the information can provide the scientific data for cancer prevention and control.

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