RESEARCH COMMUNICATION

Decrease in the Esophageal Cancer Incidence Rate in Mountainous but Not Level Parts of Cixian County, China, Over 29 Years

Yu-Tong He[a], Jun Hou[a], Zhi-Feng Chen[a], Cui-yun Qiao[b],Guo-Hui Song[b], Fan-Shu Meng[b], Hong-Xin Jin[b], Chao Chen[b]

Abstract

Background: Cixian county has one of the highest incidence rates of esophageal cancer (EC) in China, as well as the world. In 1974, the Cixian population-based cancer registry system was established, so that there is now information on esophageal cancer cases over almost 30 years. Methods: Data from Cixian Cancer Registry were checked and analyzed using SPSS 11.5. Results: From 1974 to 2002, a total of 18,471 new esophageal cancer cases were registered in Cixian, 11,068 in males and 7,403 in females. The age standardized incidence rate (ASR) for males was 208.77 per 100,000, while for females it was 120.47 per 100,000. There was a clear trend for decrease overall in the incidence rate of esophageal cancer over the 29 years (X^2=19.94, P<0.001). As to the geographic distribution, the incidence rate in mountainous and hilly areas showed a significant decline (X^2 = 195.00 and X^2 = 46.08, respectivbely, both P<0.001). Data for esophageal cancer incidence in level land areas in contrast were relatively steadily, with increase in recent years. Conclusion: Esophageal cancer has decreased in Cixian county during the last 29 years, but this is due to change in mountainous and hilly areas. Compared to other regions in the world, Cixian county still has a very high incidence of ECs.

Key Words: Esophageal cancer - incidence data - tumour registration

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Introduction

Cancer in China is increasing rapidly because of population growth, aging and huge changes in the socioeconomic situation, diet, lifestyle and enviormental factors. Now cancer is becoming the first killer in urban areas, and the second killer in the countryside. Cixian County has one of the highest esophageal cancer (EC) incidence rates in China, as well as in the world (Put et al., 2001; Ad et al., 2000; Vega and Jamal, 2000; Martin, 2002; Corley and Buffler, 2001; Aksel et al., 2001; Kocher et al., 2001). As cancer becomes increasingly important as a public health problem and a huge burden in Cixian, the need to evaluate trends in incidence rates becomes of higher priority.

In 1972, a retrospective survey of esophageal cancer mortality of the Taihang Mountain area was organized by the Chinese Ministry of Public health. The results demonstrated Hebei province to be a very high incidence region for esophageal cancer. Cixian, Shexian and Linxin harbored the highest mortality rates. At the start of the 1970s, a field study of EC prevention and treatment was set up in Cixian. At the same time the population-based cancer registry system, so called the three-level prevention web, was established. In 1995, the Chinese cancer incidence, mortality and risk factor surveillance program was set up to improve the quality of registration as one of the National Ninth- Five-Year Scientific Championship Projects of China. In 1996, the Cixian cancer registry became a member of the International Association of cancer Registries (IACR) and in 2000, the EC incidence data from 1993 to 1997 were accepted and published in Cancer Incidence in Five Continents Vol.VIII. In 2002, the Chinese Cancer Registry Center was set up, and Cixian Cancer Registry was named an example division.

Materials and Methods

Materials

Cixian is located at latitude 36º30ºNorth and longitude 114º40ºEast. It is situated on the east side of the Taihang

[a]*Hebei Cancer Institute, and The Fourth Affiliated Hospital of Hebei Medical University,* [b]*Cixian Cancer Institute,* *Supported by The National Ninth-Five-Year Scientific Championship Project No.96-906-01-01* *Correspondence to: Dr.Yu-Tong He, Hebei Cancer Institute, Jiankanglu 5, Shijiazhuang 050011, Hebei Province China. hytong69@yahoo.com Telephone: +86-311-6033511 Fax:+86-311-6077634*

Mountain, along the Zhanghe River and it lies in the south of the Handan City. Across the Zhanghe River to the south is Anyang City of Henan Province. Cixian county occupies an area of about 1014 square kilometers, composed of 19 districts, and its population is 625,147, consisting of 316,876 males and 308,271 females at the 2000 census.There is remarkable geographical, with mountainous, hilly, and level land each constituting about one-third of the total area. The climate is influenced mainly by the warm mainland seasonal winds. The average temperature is 13.2˚C and the rainfall range is 600~700 millimeters. 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.

The aim of Cixian population-based cancer registry is to collect and analyze data on all new cases of cancer. Initially, it was mainly concerned with collecting data on the incidence and mortality rates of EC in Cixian county. However, from 1988, it began to also collect information on the histopathology of the cancers reported.

Methods

The register was conducted using the three-level prevention web. Each clinic doctor in every township (prevention web I) is required to report each new case of cancer occurring in the township with a standard card, then the cards are sent to the clinic of the rural administration unit (prevention web II). There they are sorted before being sent to the Cixian Cancer Registry (prevention web III) once a month. These cards are then checked, analyzed, coded and stored there. At the end of each year, a comprehensive sample survey is conducted, to check in detail the quality of the registration.

The carcinomas were coded according to International Classification of Disease (ICD-10) and all the data were checked and analyzed by SPSS11.5 software. Age-standardized rates (ASR) were standardized to the world population using the direct method and statistical analyses was carried out using the U-test, with a probability value of less than 0.05 considered statistically significant.

Table 1. Cixian EC Incidence Rates from 1974 to 2002

Year	Male					Female				
	Population	Case	Incidence Rate	ASR (C)	ASR (W)	Population	Case	Incidence Rate	ASR (C)	ASR (W)
1974	221842	450	202.85	178.69	281.81	217799	279	128.10	96.56	157.96
1975	224063	392	174.95	158.79	244.74	220937	279	126.28	96.45	162.80
1976	226098	407	180.01	158.6	247.68	222526	236	106.06	81.28	131.44
1977	227998	335	146.93	129.92	195.17	224094	193	86.12	67.35	103.31
1978	227677	320	140.55	126.05	186.94	228524	191	83.58	63.65	104.51
1979	231485	302	130.46	127.53	197.31	229242	190	82.88	71.44	108.11
1980	235881	323	136.93	132.59	199.38	232902	221	94.89	80.59	124.86
1981	242181	301	124.29	121.75	193.06	239136	191	79.87	69.24	101.76
1982	242211	334	137.90	133.79	210.05	244007	194	79.51	67.22	106.98
1983	251237	348	138.51	136.34	220.67	249751	228	91.29	77.39	122.07
1984	254822	367	144.02	143.52	239.86	253044	192	75.88	64.48	101.77
1985	258260	324	125.45	126.43	215.12	256157	214	83.54	71.56	112.55
1986	261858	374	142.83	142.26	249.78	259363	205	79.04	64.18	100.89
1987	265498	331	124.67	124.15	202.98	261498	230	87.95	74.82	114.62
1988	262726	404	153.77	155.68	250.76	260173	267	102.62	106.79	153.86
1989	272643	401	147.08	148.61	237.16	264539	251	94.88	94.23	131.13
1990	289391	443	153.08	154.26	248.10	285840	307	107.40	110.13	151.55
1991	294993	446	151.19	154.63	260.53	285437	289	101.25	103.63	139.36
1992	299306	430	143.67	146.4	240.72	287546	287	99.81	102.34	139.60
1993	299498	457	152.59	133.57	209.20	296060	313	105.72	80.38	123.02
1994	303761	408	134.32	119.69	183.23	295104	291	98.61	76.45	114.85
1995	302782	392	129.47	112.98	176.93	294867	333	112.93	87.87	133.34
1996	302537	416	137.50	122.57	186.58	298595	340	113.87	85.51	134.74
1997	306383	374	122.07	108.52	171.91	298596	259	86.74	66.53	101.02
1998	312566	405	129.57	110.17	172.44	298694	310	103.79	77.69	119.98
1999	316262	370	116.99	99.49	152.80	300200	284	94.60	70.11	107.66
2000	316876	379	119.61	101.18	159.14	308271	281	91.15	66.66	105.10
2001	322513	390	120.93	99.26	160.73	313500	262	83.57	59.43	93.94
2002	325048	445	136.90	110.56	169.48	312199	286	91.61	64.38	98.60
Total of 1970's	1359163	2206	162.31	145.71	224.16	1343122	1368	101.85	102.17	127.03
Total of 1980's	2547317	3507	137.67	136.68	220.80	2520570	2193	87.00	80.05	116.05
Total of 1990's	3027479	4141	136.78	123.73	193.54	2940939	3013	102.45	80.37	123.59
Total of 2000's	964437	1214	125.88	103.91	163.34	933970	829	88.76	63.55	99.24
Total	7898396	11068	140.13	131	208.77	7738601	7403	95.66	78.15	120.47

Results

1. Incidence of Esophageal Cancer

Between the years 1974 and 2002 there were 18,471 cases of EC in the county, 11068 in males and 7403 in females (see Table 1 and Figure 1). The age standardized incidence rate (ASR) for males was 208.77 per 100,000, while for females it was 120.47 per 100,000. From the 1970's to the beginning of the 21st century, the incidence rates demonstrated a trend for decrease. In 1974, the ASR for males was 281.81/100,000, declining to 169.48/100,000 in 2002, representing a decline of 39.9 percent. For females, the ASR was 157.96/100,000 in 1974 and 98.6/100,000 in 2002, showing a decline of 37.6 percent. The trend test revealed X^2=19.94, P<0.001. The incidence rate among males declined significantly (X^2=62.12, P<0.001), whereas, in females it was more steady (X^2=0.027, P>0.05).

2. Geographic Distribution

In the mountainous area there were 2,511 EC cases from 1974 to 2002. The annual average incidence rate was 104.57/100,000. The incidence rate of EC in 1974 was 213.62/100,000, which declined to 61.45/100,000 in 2002. Decreased by 152.17/100,000, and the decline rate was 71.23 percent. From Table 2 and Figure 2 we could find that the incidence rate of EC in mountainous area had significantly decreased. The result of trend test was X^2=195.00, P<0.001. The incidence rates of EC in 1970's, 1980's, 1990's and 2000's were 155.33/100,000, 114.38/100,000,78.36/100,000 and 70.44/100,000, respectively. The U test result between them had significant difference.

In the hilly area there were 5,934 EC cases. The annual average rate was 114.17/100,000. From 1974 to 2002, the incidence rate changed from 165.72/100,000 to 119.98/100,000. Decreasing in number was 45.74/100,000. And declining rate was 27.60 percent. The result of trend test was X^2=46.08, P<0.001. From Table 2 and Figure 2, we could see that from 1970's to 1980's the incidence rate of EC declined significantly, from 141.95/100,000 to 106.97/100,000 (U test: P<0.01). The U test result between 1980's

Table 2. The Geographic Distribution of Esophageal Cancer in Cixian from 1974 to 2002 (1/100,000)

Year	Mountainous area			Hilly area			Level land area		
	Population	Cases	Incidence rate	Population	Cases	Incidence rate	Population	Cases	Incidence rate
1974	77240	165	213.62	145428	241	165.72	216973	323	148.87
1975	77581	151	194.64	147830	232	156.94	219589	288	131.15
1976	77981	132	169.27	148692	221	148.63	221951	290	130.66
1977	78231	116	148.28	149995	192	128.00	223866	220	98.27
1978	78257	82	104.78	151456	213	140.63	226488	216	95.37
1979	78112	80	102.42	152682	173	113.31	229933	239	103.94
1980	78331	92	117.45	155341	210	135.19	235111	242	102.93
1981	78555	79	100.57	160010	157	98.12	242752	256	105.46
1982	79271	92	116.06	162756	161	98.92	244191	275	112.62
1983	80023	100	124.96	166662	186	111.60	254303	290	114.04
1984	80294	95	118.32	168296	144	85.56	259276	320	123.42
1985	80877	80	98.92	170916	173	101.22	262624	285	108.52
1986	82214	101	122.85	172888	182	105.27	266119	296	111.23
1987	82291	78	94.79	175132	173	98.78	269573	310	115.00
1988	81953	114	139.10	177724	215	120.97	263222	342	129.93
1989	82289	91	110.59	179502	206	114.76	275391	355	128.91
1990	83951	62	73.85	193768	239	123.34	297512	449	150.92
1991	85459	48	56.17	192370	262	136.20	302601	425	140.45
1992	85498	59	69.01	194281	252	129.71	307073	406	132.22
1993	87091	76	87.27	197340	237	120.10	311127	457	146.89
1994	87741	69	78.64	198639	201	101.19	312485	429	137.29
1995	87626	79	90.16	198636	206	103.71	311387	440	141.30
1996	87897	78	88.74	199814	205	102.60	313421	473	150.92
1997	86818	77	88.69	202178	194	95.96	315983	362	114.56
1998	86520	65	75.13	203133	236	116.18	321607	414	128.73
1999	86621	65	75.04	204876	199	97.13	324965	390	120.01
2000	86906	64	73.64	205676	180	87.52	332565	416	125.09
2001	87839	67	76.28	210617	191	90.69	337557	394	116.72
2002	87877	54	61.45	210875	253	119.98	338495	424	125.26
Total for 1970's	467402	726	155.33	896083	1272	141.95	1338800	1576	117.72
Total for 1980's	806098	922	114.38	1689227	1807	106.97	2870074	3420	119.16
Total for 1990's	865222	678	78.36	1985035	2231	112.39	3118161	4245	136.14
Total for 2000's	262622	185	70.44	627168	624	99.49	1008617	1234	122.35
Total	2401344	2511	104.57	5197513	5934	114.17	8038140	10026	124.73

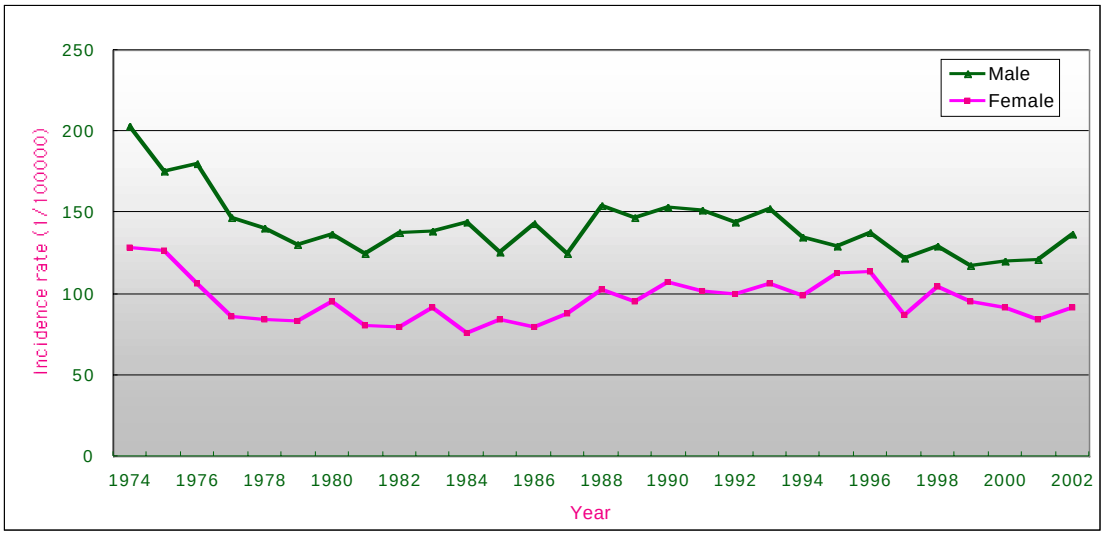

Figure 1. The Esophageal Cancer Incidence Rate in Cixian from 1974 to 2002

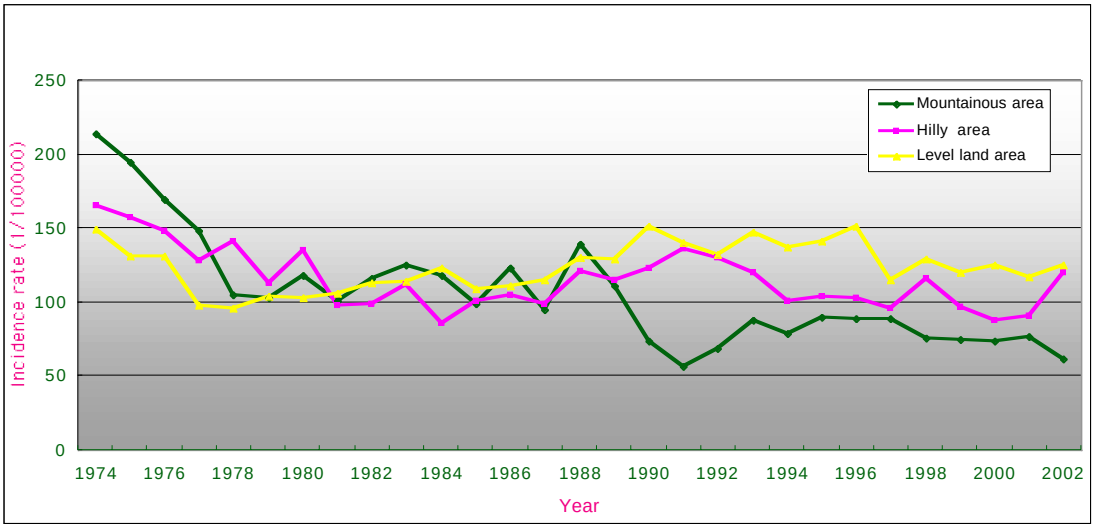

Figure 2. The Geography Distribution of Cixian EC Incidence from 1974 to 2002

and 1990's, between 1990's and 2000's was P>0.05. Both of them had no significant difference.

On level land there were10,026 EC cases over 29 years. The annual average incidence rate was 124.73/100,000. According to Table 2 and Figure 2 we can see that during the past 29 years incidence rate of EC increased steadily. The result of trend test was X^2=47.96, P<0.001.Comparing 1970's incidence rate with 1990s', it increased from 117.72/100,000 to 136.14/100,000. The increasing in number was 18.42/100,000 and the increasing rate was 13.53 percent. Comparing the incidence rate of 1990's with the 2000's, it decreased from 136.14/100,000 to 122.35/100,000. But the U test showed no significant difference between them.

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. Until now, Cixian Cancer Registry has piled up the incidence data of nearly thirty years. In this study we found the trend of the incidence rate of EC from 1974 to 2002 had declined, the possible reasons for these maybe as follows:

For nearly 30 years a great deal of cancer control work has been done by Hebei Cancer Institute together with Chinese Academy of Medical Sciences (Wang et al., 2002; Dong et al., 2002; Lu et al., 2004; Qiao et al., 2001; He et al., 2003; Zhang et al., 2003; Hou, 1989). The national eighth-five-year and ninth-five-year tenth-five-year Scientific Championship Project on study of prevention and treatment of esophageal cancer were carried out in Cixian. About primary prevention: 1 To improve the quality of the drinking water by decreasing the pollution of nitrosamine. 2 To administer the storage of agricultural products and advocate the people to expose grain and drinking water to

the sunshine, not to eat the food with mold. 3 Eating more vegetables and fruits, changing the bad lifestyle. 4 Eating salt strengthen with riboflavinmore. 5 Health education on essential knowledge of cancer prevention and control. Besides, more efforts have been put into screening and early detections 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 (Zuo et al., 2002; Anderson and Jankowski, 2001). It is therefore very promising to detect patients with EED and treat the precancerous lesions before they transform into the irreversible malignant stage.Since the 1970s, we had screened about 37,000 people by the Balloon cytology and 392 early staged esophageal cancer cases, 9,088 severe esophageal epithelium dysplasia cases were screened out.In 2002, esophageal cancer screening was carried out by the use of Iodine dyeing under endoscopy in Cixian, 68 early staged cancer, 261 esophageal epithelium dysplasia were found from 2013 people. There are several techniques and chemicals or nutrients that have been reported to be effective in blocking precancerous lesions from transforming into cancer (Hou et al., 2002; Hou and Yan, 1992).

In conclusion, the trend of the EC incidence rate in Cixian county had declined after three 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, information can provide scientific data for cancer prevention and control.

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