

## RESEARCH ARTICLE

# Analysis of Death Causes of In-patients with Malignant Tumors in Sichuan Cancer Hospital of China from 2002 to 2012

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## Abstract

**Objectives:** To analyze underlying disease, fatality rate and the major causes of death of in-patients with malignant tumors in Sichuan Cancer Hospital. **Methods:** Clinical data of in-patients from 2002 to 2012 were retrospectively analyzed. **Results:** The top 10 tumors (82.0% of the total) of the malignant tumors of the in-patients were lung, cervical, esophagus, breast, colorectal, nasopharynx, liver and gastric cancers, lymphomas and ovarian cancers. The overall fatality rate was 2.7% during these eleven years, 3.4% and 2.0% for male and females, respectively with statistical significance for the difference ( $\chi^2=164.737, P<0.001$ ). The top 10 death causes were lung cancer, liver cancer, colorectal cancer, esophagus cancer, gastric cancer, lymphoma, breast cancer, pancreatic cancer, ovarian cancer and nasopharynx cancer. In-patients with pancreatic cancer had the highest fatality rate (9.6%). There were different ranks of death causes in different sex groups and age groups. **Conclusion:** Prevention and control work of cancer should be enhanced not only for cancers with high incidence such as lung cancer, esophageal cancer but also for the cancers which have low incidence but high fatality rate, such as pancreatic cancer and gallbladder cancer, which would help to improve the survival rate and quality of life of cancer patients in the future.

**Keywords:** Malignant tumors - in-patients - disease type - causes of death

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## Introduction

The incidence and mortality of malignant tumors have been increasing rapidly in recent years, and cancer has become one of the major causes of death as well as a vital public health problem worldwide. To analyze the disease constitution, the fatality rate and the major causes of death and master the epidemiological characteristic of malignant tumors is of great significance for cancer prevention and control. Our scientific research group analyzed the disease and death information of in-patients with malignant tumor in Sichuan Cancer Hospital from 2002 to 2012, in order to provide scientific basis for the prevention and control of malignant tumors

## Materials and Methods

### Objects of the study

The objects of our study included in-patients in Sichuan Cancer Hospital from January 1, 2002 to December 31, 2012 who met all the following criteria for analysis: (1) in-patients with the first diagnosis of malignant tumor based on ICD - 10 classification principle, (2) The death report cards were written by the doctor in charge and had been reported to national mortality registration system.

### Methods

Annual hospitalization and deaths information of all patients were retrieved based on the Hospital Information System (HIS). Each case was diagnosed pathologically. Death causes were classified according to the International Classification Diseases (ICD-10), and fundamental causes of death were used to be the major diagnosis principle.

### Statistical Analysis

Chi-square test was used to compare the difference of rate among groups. Cochran Armitage trend test was adopted to analyze the trend of mortality over time. The level of significance ( $\alpha$ ) is 0.05. Data was analyzed with SPSS 16.0.

## Results

### The Analysis of the Disease Constitution

During the period from January 1, 2002 to December 31, 2012, the total number of in-patients with malignant tumor in Sichuan Cancer Hospital was 94853. The number of male in-patients was 49577 (52.3%), whereas the female was 45 276 (47.7%). The average age of in-patients was  $54.05\pm 13.73$  years. The number of different age group (<40; 40-60; >60) was 14 741 (15.5%), 48 143 (50.8%)

**Table 1. The Major Disease Types and Constitution of In-patients with Malignant Tumors**

Rank of Diseases	Total		Male		Female	
	Disease	Case(%)	Disease	Case(%)	Disease	Case(%)
1	lung cancer	17222(18.2)	lung cancer	12218(24.6)	cervical cancer	11094(24.5)
2	cervical cancer	11105(11.7)	esophagus cancer	8161(16.5)	breast cancer	8960(19.8)
3	esophagus cancer	9882(10.4)	colorectal cancer	4904(9.9)	lung cancer	5004(11.1)
4	breast cancer	9069(9.6)	liver cancer	4011(8.1)	ovarian cancer	3655(8.1)
5	colorectal cancer	8325(8.8)	nasopharynx cancer	3844(7.8)	colorectal cancer	3421(7.6)
6	nasopharynx cancer	5293(5.6)	gastric cancer	3268(6.6)	esophagus cancer	1721(3.8)
7	liver cancer	4717(5.0)	lymphoma	2441(4.9)	lymphoma	1514(3.3)
8	gastric cancer	4515(4.8)	bladder cancer	792(1.6)	nasopharynx cancer	1449(3.2)
9	lymphoma	3955(4.2)	prostatic cancer	629(1.3)	gastric cancer	1247(2.8)
10	ovarian cancer	3662(3.9)	pancreatic cancer	585(1.2)	liver cancer	749(1.7)

**Table 2. Case Fatality Rates of In-patients with Malignant Tumors from 2002 to 2012**

Year	Cases	Deaths(%)	Male		Female	
			Cases	Deaths(%)	Cases	Deaths(%)
2002	1321	167(12.6)	1027	127(12.4)	294	40(13.6)
2003	4100	187(4.6)	2226	119(5.3)	1874	68(3.6)
2004	4450	197(4.4)	2362	124(5.2)	2088	73(3.5)
2005	4816	218(4.5)	2604	126(4.8)	2212	92(4.2)
2006	5230	267(5.1)	2812	183(6.5)	2418	84(3.5)
2007	6295	211(3.4)	3502	139(4.0)	2793	72(2.6)
2008	8320	232(2.8)	4346	143(3.3)	3974	89(2.2)
2009	11213	252(2.2)	5851	173(2.0)	5362	79(1.5)
2010	14248	299(2.1)	7451	186(2.5)	6797	113(1.7)
2011	16380	280(1.7)	8681	174(2.0)	7699	106(1.4)
2012	18480	274(1.5)	8715	178(2.0)	9765	96(1.0)
Total	94853	2584(2.7)	49577	1672(3.4)	45276	912(2.0)

and 31 969 (33.7%), respectively. The top 10 tumors which accounted for 82.0% of all malignant tumors were as follows: lung cancer, cervical cancer, esophagus cancer, breast cancer, colorectal cancer, nasopharynx cancer, liver cancer, gastric cancer, lymphoma and ovarian cancer (Table 1).

*The Analysis of the Fatality Rate*

Altogether 2584 patients who got malignant tumor died between 2002 and 2012 in our hospital, in which 1672 (64.7%) were male and 912 (35.3%) female. The average age of death was 60.22±13.61 years. The death number of different age group(<40; 40-60; >60) was 212 (8.2%), 1 012 (39.2%) and 1 360 (52.6%), respectively. The overall fatality rate of in-patients with malignant tumor during

these eleven years was 2.7%, which was 3.4% and 2.0% in male and female group, respectively. The fatality rate of male group was higher than that of the female group with significant difference ( $\chi^2=164.737, P<0.001$ ) (Table 2). The fatality rate of in-patients with malignant tumor in 2002 and 2012 was 12.6% and 1.5%, respectively with an obviously declining trend ( $\chi^2=697.023, P<0.001$ ). The same trend was observed either in male group and female group ( $\chi^2=391.282, P<0.001, \chi^2 =272.184, P<0.001$ ).

*The Analysis of the Rank of Death Causes*

The death causes analysis of 2 584 in-patients with malignant tumor revealed that the top 10 death causes (ratio 81.3%) were as follows: lung cancer, liver cancer, colorectal cancer, esophagus cancer, gastric cancer, lymphoma, breast cancer, pancreatic cancer, ovarian cancer and nasopharynx cancer. Patients with pancreatic cancer had the highest fatality rate (9.6%), whereas those with nasopharynx cancer had the lowest (1.08%) (Table 3).

*The Analysis of the Rank of Death Causes and Fatality Rate in patients grouped by sex*

Among the top 10 death causes of male, the fatality rate of pancreatic cancer was the highest (9.1%), while that of nasopharynx cancer was the lowest (1.2%). Among the top 10 death causes of female, the rate of pancreatic cancer was also the highest (10.8%), whereas that of breast cancer was the lowest (1.1%). In the top 10 death causes(except prostatic cancer, breast cancer, ovarian cancer and cervical cancer), the fatality rate of male with esophagus cancer was significantly higher than that of female with the same

**Table 3. The Rank of Death Causes of 2584 In-patients with Malignant Tumor**

Rank of Causes of Death	Total			Male			Female		
	Causes of Death	Cases(%)	Fatality Rate (%)	Causes of Death	Cases(%)	Fatality Rate (%)	Causes of Death	Cases(%)	Fatality Rate (%)
1	lung cancer	867(33.6)	5	lung cancer	617(36.9)	5	lung cancer	250(27.4)	5
2	liver cancer	275(10.6)	5.8	liver cancer	232(13.9)	5.8	breast cancer	101(11.1)	1.1
3	colorectal cancer	213(8.2)	2.6	esophagus cancer	170(10.2)	2.1	colorectal cancer	88(9.6)	2.6
4	esophagus cancer	193(7.5)	2	colorectal cancer	125(7.5)	2.5	cervical cancer	64(7.0)	0.6
5	gastric cancer	141(5.5)	3.1	gastric cancer	86(5.1)	2.6	ovarian cancer	60(6.6)	1.6
6	lymphoma	107(4.1)	2.7	lymphoma	64(3.8)	2.6	gastric cancer	55(6.0)	4.4
7	breast cancer	103(4.0)	1.1	pancreatic cancer	53(3.2)	9.1	lymphoma	43(4.7)	2.8
8	pancreatic cancer	84(3.3)	9.6	nasopharynx cancer	45(2.7)	1.2	liver cancer	43(4.7)	5.7
9	ovarian cancer	61(2.4)	1.7	prostatic cancer	35(2.1)	5.6	pancreatic cancer	31(3.4)	10.8
10	nasopharynx cancer	57(2.2)	1.1	gallbladder cancer	25(1.5)	8.8	esophagus cancer	23(2.5)	1.3

**Table 4. The Rank of Death Causes of In-patients in Different Age Groups**

Rank of Causes of Death	<40 Years Old			40-60 Years Old			>60 Years Old		
	Causes of Death	Cases(%)	Fatality Rate (%)	Causes of Death	Cases(%)	Fatality Rate (%)	Causes of Death	Cases(%)	Fatality Rate (%)
1	liver cancer	42(19.8)	4.7	lung cancer	311(30.7)	3.7	lung cancer	525(38.6)	6.6
2	lung cancer	31(14.6)	3.3	liver cancer	126(12.5)	5.1	colorectal cancer	131(9.6)	3.7
3	lymphoma	30(14.2)	2.7	esophagus cancer	79(7.8)	1.7	esophagus cancer	110(8.1)	2.2
4	colorectal cancer	13(6.1)	1.4	colorectal cancer	69(6.8)	1.8	liver cancer	107(7.9)	8
5	gastric cancer	13(6.1)	3.5	gastric cancer	59(5.8)	2.7	gastric cancer	69(5.1)	3.5
6	breast cancer	11(5.2)	0.6	breast cancer	54(5.3)	0.9	pancreatic cancer	52(3.8)	11.8
7	cervical cancer	10(4.7)	0.4	lymphoma	44(4.3)	2.7	breast cancer	38(2.8)	3
8	brain tumor	10(4.7)	2.5	ovarian cancer	37(3.7)	1.6	gallbladder cancer	33(2.4)	12.9
9	nasopharynx cancer	8(3.8)	0.7	cervical cancer	34(3.4)	0.5	lymphoma	33(2.4)	2.8
10	leukaemia	6(2.8)	6.3	pancreatic cancer	29(2.9)	7.4	prostatic cancer	31(2.3)	5.5

disease ( $\chi^2=3.998$ ,  $P=0.046$ ), while the rate of male with gastric cancer was lower than that of female ( $\chi^2=8.803$ ,  $P=0.003$ ). However, no statistical significance was found about the fatality rate between male and female in-patients who got lung cancer, liver cancer, colorectal cancer, lymphoma and pancreatic cancer (Table 3).

#### *The Analysis of the Rank of Death Causes and Fatality Rate in patients grouped by age*

The age analysis of deaths in our study indicated that the overwhelming majority of in-patients with malignant tumor was above 60 years old (52.6%). There were different ranks of death causes in different age groups. Among the top 10 death causes of the <40 age group, the fatality rate of leukaemia was the highest (6.3%), while that of cervical cancer was the lowest (0.5%). Among the top 10 death causes of the 40-60 age group, the rate of pancreatic cancer was also the highest (7.4%), whereas that of cervical cancer was the lowest (0.5%). Besides, among the top 10 death causes of the >60 age group, the fatality rate of gallbladder cancer was the highest (12.9%), while that of esophagus cancer was the lowest (2.2%). In the top 10 death causes, the fatality rate of lung cancer was the highest in the >60 age group comparing with that in other age groups (6.6%,  $\chi^2=79.753$ ,  $P<0.001$ ), as well as that of liver cancer (8.0%,  $\chi^2=15.722$ ,  $P<0.001$ ), colorectal cancer (3.7%,  $\chi^2=33.016$ ,  $P<0.001$ ), and breast cancer (3.0%,  $\chi^2=48.243$ ,  $P<0.001$ ). No significant difference was observed about the fatality rate in patients with gastric cancer or lymphoma among the three age groups (Table 4).

## **Discussion**

According to the literatures (National Cancer Institute, 2012; Chinese Health Yearbook Editing Committee, 2010), in the 1990s, the major disease mortality of malignant tumors, cerebrovascular diseases and heart diseases occupied the first three positions sequentially, while in 2002, the mortality of malignant tumors, cerebrovascular diseases and respiratory system diseases turned to be at the top 3. In 2009, the mortality of malignant tumors, heart diseases and cerebrovascular diseases were at the top 3 among Chinese urban residents. Thus, from the end of last century to the future, the malignant tumors, which have become the main causes of death, have affected

and will affect residents for a long time. This study was conducted to analyze the related disease constitution and death causes of hospitalized cancer patients and death cases in Sichuan Cancer Hospital from 2002 to 2012 which showed that the incidence of malignant tumors had been increasing gradually. The number of in-patients with malignant tumor in 2012 (18 480) had already been 14 times as that in 2002 (1321). The result is in accordance with which was reported in related domestic researches (Gao, 2007; Hao et al., 2012). Besides the increasingly serious environmental pollution, more and more work stress, psychological mental state such as anxiety and tension, unreasonable diet structure as well as the change of ecological environment and life style, high early detection rate which benefited from improved medical technology such as B ultrasonic, CT and so on also has close relationship with the gradually increased number of cancer patients. All kinds of endoscopic and advanced imaging equipment have played a significant role in the evaluation of the invasion degree as well as relationship between tumor and adjacent organs, blood vessels and nerve, thus be able to offer more definite diagnosis.

Disease constitution analysis found that lung cancer, cervical cancer and esophageal cancer were the top 3 cancers in our hospital. This finding is closely related to the pathogenesis characteristics of cancer in Sichuan Province and China. The Third Death Sampling Survey conducted by Ministry of Health shows that lung cancer is the leading cause of death among malignant tumors in our country, which has been confirmed by other related domestic literatures (Chen et al., 2009; Zhou et al., 2010; Hao et al., 2012). Meanwhile, Sichuan province has high incidence of malignant tumors, and the incidence and mortality of cancer in Sichuan province are higher than the national average level. The high incidence of esophageal cancer and cervical cancer in Sichuan province is much more obvious. Early detection and treatment project based on population has been implemented in Yanting county (Wang et al., 2012) which has global-representative high incidence of esophageal cancer as well as Northeastern Sichuan areas such as Wangcang county and Cangxi county which have high incidence of cervical cancer (Li et al., 2012). According to the monitoring on death causes of population in Sichuan province from 2002 to 2007 by Liu et al. (2012), the malignant tumors which mortality rate were at the top 3 positions were lung cancer, liver

cancer, esophageal cancer. This result is slightly different from the research findings of our hospital. The relatively better treatment efficacy of cervical cancer than other cancers may make an impact. Sichuan Cancer Hospital is a specialized hospital with most of its patients from Sichuan province and the surrounding areas, thus the obtained cancer spectrum is consistent with the characteristics of cancer in Sichuan area.

Mortality of hospitalized patients is an important indicator to reflect the diagnosis and treatment ability of one hospital. In our hospital, the number of hospitalized cancer patients had increased year by year from 2002 to 2012, but the total cancer fatality rate and gender fatality declined with years thanks to the constantly improved medical technology. The fatality analysis of the top 10 death causes of the malignant tumors revealed that the eighth cancer: pancreatic cancer had the highest fatality rate. Gender distribution showed that pancreatic cancer had the highest fatality rate among the top 10 causes of death regardless of male or female. Age distribution told that among 40-60 years population, pancreatic cancer had the highest mortality, in sixty years and above population group, mortality rate of gallbladder cancer was the highest, followed by that of pancreatic cancer which was as high as 11.8%. It is suggested that the prevention and control work of cancer should be enhanced not only for the cancer with high incidence such as lung cancer, esophageal cancer but also for the cancer which has low incidence but high fatality rate, such as pancreatic cancer and gallbladder cancer, and this would help to improve the survival rate and life quality of cancer patients in the future.

Along with high-speed development of social economy, people's living conditions have been greatly improved and the health state has been enhanced to some extent, but malignant tumors, which haven't got enough control, are still threatening the health of urban and rural residents in our country. At the same time, our several-year health work practice showed that the vast majority of cancers can be prevented or be treated.

The public awareness of major risk factors for cancer can be raised by active health education. The comprehensive prevention and control including serious experience analysis, cause study, health education, environment management, life-style intervention, early-detection and treatment and cancer registration etc. should be strengthened to make them play a significant role in the prevention and control of malignant tumors.

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