Original Article

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Trends in the Prevalence of Cancer in Cardiovascular Diseases: A Single Center Retrospective Study, 2011-2018

JIAHUI SUN*, KOUTATSU SHIMOZONO*, HISASHI ADACHI**, SHOICHIRO NOHARA*, TATSUHIRO SHIBATA*, YOICHI SUGIYAMA* AND YOSHIHIRO FUKUMOTO*

** Division of Cardiovascular Medicine, Department of Internal Medicine,*
*** Department of Community Medicine, Kurume University School of Medicine, Kurume 830-0011, Japan*

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Summary: ***Background*:** Recent progress of cancer therapy has increased the number of cancer survivors, in whom cardiovascular diseases (CVDs) have become a big concern. This study aimed to clarify the prevalence of various types of CVDs in cancer patients, using the database of the Cardiovascular Medicine in Kurume University Hospital.

***Methods and Results*:** This retrospective cohort study enrolled 11,093 hospitalized patients in Cardiovascular Medicine, Kurume University Hospital from April 2011 to March 2019. Among 11,093 enrolled patients, there were 992 CVDs patients with cancer (8.94%). The five most prevalent forms of cancer were colon cancer, prostate cancer, hepatocellular carcinoma, lung cancer, and gastric cancer. Although there was no statistical significance, the comorbidity of breast cancer gradually increased during the study period (2011-2018). In all CVDs, prostate cancer, lung cancer, and uterine cancer tended to increase as comorbidities, while hepatocellular carcinoma and tongue cancer tended to decrease during the observational period. The absolute number of patients with cancer increased in all CVDs, including coronary artery diseases, heart failure, arrhythmia, and pulmonary hypertension.

***Conclusions*:** The present study demonstrates that the prevalence of cancer in hospitalized CVDs patients was around 10%, and is showing a tendency to increase. Thus, cancer may have substantial impacts on CVDs treatment.

Keywords onco-cardiology, cardiovascular diseases, cancer, coronary artery diseases, valvular heart diseases

INTRODUCTION

Cancer is the leading cause of death in Japan, followed by cardiovascular diseases (CVDs) [1]. Recent prognosis of cancers has been significantly improved due to advancements in early detection, surgery, and anticancer drug treatment, leading to an increase in the number of cancer survivors [2,3]. Actually, childhood cancer patients are reported to have a higher risk for CVDs compared to the same generation, even when they were young [4,5]. Further, in breast cancer, deaths from CVDs became the cumulative primary cause of death 9 to 10 years after the breast cancer diagnosis, which means that the prognostic factors in the chronic stage of breast cancer patients were CVDs, rather than cancer [6,7]. Additionally, cardiotoxicity has become apparent many years after cancer treatment, including vascular complications and cardiac structural problems [8]. These clinical situations require the attention of the clinical and research field of onco-cardiology.

Both cancer and CVDs are related to high-risk

Corresponding Author: Yoshihiro Fukumoto, M.D., Ph.D., Professor and Chairman, Division of Cardiovascular Medicine, Department of Internal Medicine, Kurume University School of Medicine, 67 Asahi-machi, Kurume, Fukuoka 830-0011, Japan. Tel: +81-942-31-7562 Fax: +81-942-33-6509
E-mail: fukumoto_yoshihiro@med.kurume-u.ac.jp

Abbreviations: CADs, coronary artery diseases; CVDs, cardiovascular diseases; SD, standard deviation; PAD, peripheral artery disease; PH, pulmonary hypertension; PTTM, pulmonary tumor thrombotic microangiopathy; VHD, valvular heart diseases; VTE, venous thromboembolism.

lifestyle factors, such as smoking, obesity, and unhealthy food intake, whereas a healthy lifestyle is associated with a longer life expectancy free of chronic diseases, including cancer and CVDs [9]. Thus, unhealthy lifestyle should have some relation to outcome in cancer and CVDs; however, detailed data on disease type in both cancer and CVDs remains scant.

Therefore, the purpose of the present study was to clarify the prevalence of CVDs in patients with cancer, focusing on the types of CVDs and cancer, using the database of the Cardiovascular Medicine in Kurume University Hospital.

MATERIALS AND METHODS

Study Design

This was a retrospective cohort study using the database of Cardiovascular Medicine, Kurume University Hospital. We enrolled 11,093 patients who were admitted to Cardiovascular Medicine, Kurume University Hospital from April 2011 to March 2019. In the present study, we expressed each year as "from April of the year to March of the next year", for example, "April 2011-March 2012" was expressed as "2011".

The present study was approved by the institutional review board at Kurume University. The requirement for informed consent was waived because all the data were anonymized.

Data Collection

The database consists of baseline demographic data, including age, sex, and main clinical diagnoses. All cardiovascular diseases were diagnosed by expert cardiologists. Heart failure is a complex clinical syndrome resulting from structural and functional cardiac abnormalities. In the present study, heart failure was considered the main clinical diagnosis when patients suffered from heart failure symptoms caused by any cardiac disorder. Coronary artery diseases included chronic stable angina, asymptomatic myocardial ischemia, acute coronary syndrome, prior myocardial infarction, prior coronary revascularization, coronary spastic angina, and nonobstructive coronary atherosclerosis. Arrhythmia was considered the main clinical diagnosis in patients hospitalized due to atrial and/or ventricular arrhythmia, including atrial fibrillation and ventricular tachycardia. Pulmonary hypertension was diagnosed in patients with an increase in mean pulmonary arterial pressure of 25 mmHg or greater at rest due to pulmonary arterial diseases and chronic thromboembolic diseases, which were also diagnosed as pulmonary arterial hypertension and chronic thromboembolic pulmonary hypertension. Valvular heart diseases was the main clinical diagnosis in patients hospitalized due to aortic, mitral, tricuspid, and pulmonary valve abnormalities, including aortic stenosis, aortic regurgitation, and mitral regurgitation. Peripheral artery diseases included acute or chronic obstruction of the arteries supplying the lower or upper extremities, along with atherosclerosis obliterans and Buerger's disease. Venous thromboembolism included pulmonary thromboembolism and deep vein thrombosis. Cancers were reported by enrolled patients or obtained from medical records.

Statistical analyses

Data were presented as mean±standard deviation (SD). Chi-square test and Mantel-Haenszel method were used for evaluation of categorical parameters. P-values <0.05 were considered statistically significant. All statistical analyses were performed using SPSS version 23.0 (IBM Inc., Chicago, IL, USA).

RESULTS

Time trends of different types of cardiovascular diseases with and without cancer

Among 11,093 enrolled patients in the present study, 992 CVDs patients had cancer (8.94%) (Table 1). The most prevalent was colon cancer, followed in order by prostate cancer, hepatocellular carcinoma, lung cancer, and gastric cancer (Table 1). Although the absolute number of CVDs patients with cancer increased during the observational period (2011-2018), the prevalence of cancer in all CVDs varied between 7 to 11% (Table 2), with the prevalence of cancer lowest in 2012 and highest in 2017. The prevalence of cancer in coronary artery diseases showed a similar trend as all CVDs (Table 2, Figure 1). Further, significant increases or decreases in cancer prevalence were also observed in heart failure, arrhythmia, and pulmonary hypertension (Table 2, Figure 1). Other CVDs, such as valvular heart disease and venous thromboembolism, did not show any significant fluctuation (Table 2).

Sex difference in time trends of different types of cardiovascular diseases with cancer

As shown in Table 2 and Figure 2, significant variations were observed in all CVDs, heart failure, valvular heart diseases, and pulmonary hypertension, but not in coronary artery diseases and arrhythmia. Due to the very small number of patients, we did not perform statistical analyses in peripheral artery disease and ve-

nous thromboembolism (Table 2).

Time trends of different types of cancer and cardiovascular diseases

As shown in Table 3, the five most prevalent forms of cancer were consistently colon cancer, prostate cancer, hepatocellular carcinoma, lung cancer, and gastric cancer. However, the comorbidity of breast cancer and CVDs gradually increased during the study period (2011-2018) (Table 3). Prostate cancer, lung cancer, and uterine cancer tended to increase as comorbidities in all CVDs, while hepatocellular carcinoma and tongue cancer tended to decrease during the observational period (Table 4, Figure 3).

DISCUSSION

The novel findings of the present study are that (a) the prevalence of cancer in hospitalized CVDs patients varied between 7 to 11%, suggesting a gradual increase of cancer comorbidity, (b) significant increases in comorbidity were observed in all CVDs and coronary artery diseases, (c) the five most prevalent forms of cancer were colon cancer, prostate cancer, hepatocellular carcinoma, lung cancer, and gastric cancer, (d) a tendency for increased comorbidity with breast cancer was observed, and significant decreases were seen in hepatocellular carcinoma and tongue cancer. To the best of our knowledge, this is the first study that provides detailed evidence regarding various types of CVDs and cancer.

Prevalence and trends in cancer in patients hospitalized for cardiovascular diseases

In colon cancer, the use of anti-thrombotic agents can easily cause bleeding. This may sometimes lead to the discovery of colon cancer in CVDs patients treated by anti-thrombotic agents. According to the Cancer Registry and Statistics from Cancer Information Service, National Cancer Center, Japan (Ministry of Health, Labour and Welfare, National Cancer Registry), the largest 4 populations of cancer were colon cancer, including rectal cancer, breast cancer, gastric cancer, and lung cancer, followed by liver cancer and pancreatic cancer [10], which order was slightly different from our onco-cardiology database. This may be caused by the difference between the prevalence of cancer alone and combined cancer and CVDs, or by regionality. Further, we reported in the present study that hepatocellular carcinoma tended to be decreased, while prostate, lung, and uterine cancers tended to be increased. This may be in response to the gradual decrease of liver cancer and the gradual increase of prostate, lung, and uterine cancers during 2011-2017, as reported by the Cancer Registry and Statistics from Cancer Information Service, National Cancer Center, Japan (Ministry of Health, Labour and Welfare, National Cancer Registry) [10]. Taken together, we observed a gradual and significant increase of comorbidity of cancer in hospitalized CVDs patients, which indicated the increase of CVDs in cancer survivors; however, the importance of onco-cardiology in the cardiovascular clinical fields is little understood.

Common pathway of life-style diseases for cardiovascular diseases and cancer

It is well known that daily lifestyle, including physical activity, and lifestyle diseases are correlated with various CVDs, including heart failure [11,12]. Also, colon cancer, prostate cancer, hepatocellular carcinoma, lung cancer, gastric cancer, and breast cancer are related with lifestyle, including food habits and smoking, and lifestyle diseases [13-20]. Thus, many types of CVDs and cancer originate from similar lifestyle and lifestyle disorders, indicating that cancer survivors may experience CVDs and that CVDs survivors may experience cancer. As primary and secondary prevention, lifestyle intervention is very important.

Pulmonary vascular diseases and cancer

Pulmonary thromboembolism is often observed in cancer patients. In the real-world data of the COMMAND VTE Registry, one third of venous thromboembolism were related with cancer [21]. In spite of major bleeding risks in cancer patients, anticoagulation therapy is performed as long as possible [22]. Probably due to thromboprophylaxis, our database did not show a significant increase of venous thromboembolism in cancer patients.

Pulmonary tumor thrombotic microangiopathy (PTTM) is a specific type of tumor embolism in the small and medium pulmonary arteries, leading to rapid progressive pulmonary hypertension [23]. PTTM should be histopathologically diagnosed, and our data base included only a few patients suspected as PTTM. Therefore, we were not able to examine this issue in the present study.

Limitations

Several limitations should be acknowledged in the present study. First, the present study is an observational retrospective cohort study from a single center. Thus, the present findings regarding the impact of cancer in different types of cardiovascular diseases remain to be confirmed in a multi-center large clinical

study. Second, we were not able to divide cancer patients into active cancer and history of cancer, due to the limited function of our database in the current situation. Third, we have no data regarding the association between heart failure and anti-cancer drugs in the current study. However, we are clarifying this issue in another study, using other big data. Fourth, the enrolled patients in the present study were hospitalized in the University Hospital, and further, the patients in intensive care unit or cardiac care unit were not enrolled, which could have introduced some bias. Taken together, further investigations should be necessary in larger cohort studies, using big data.

CONCLUSION

The present study demonstrates that the prevalence of cancer in hospitalized CVDs patients was around 10%, and is showing a tendency to increase over time. Our results suggested that cancer may have substantial impacts on CVD treatment.

CONFLICT OF INTEREST: The authors declare no conflict of interest.

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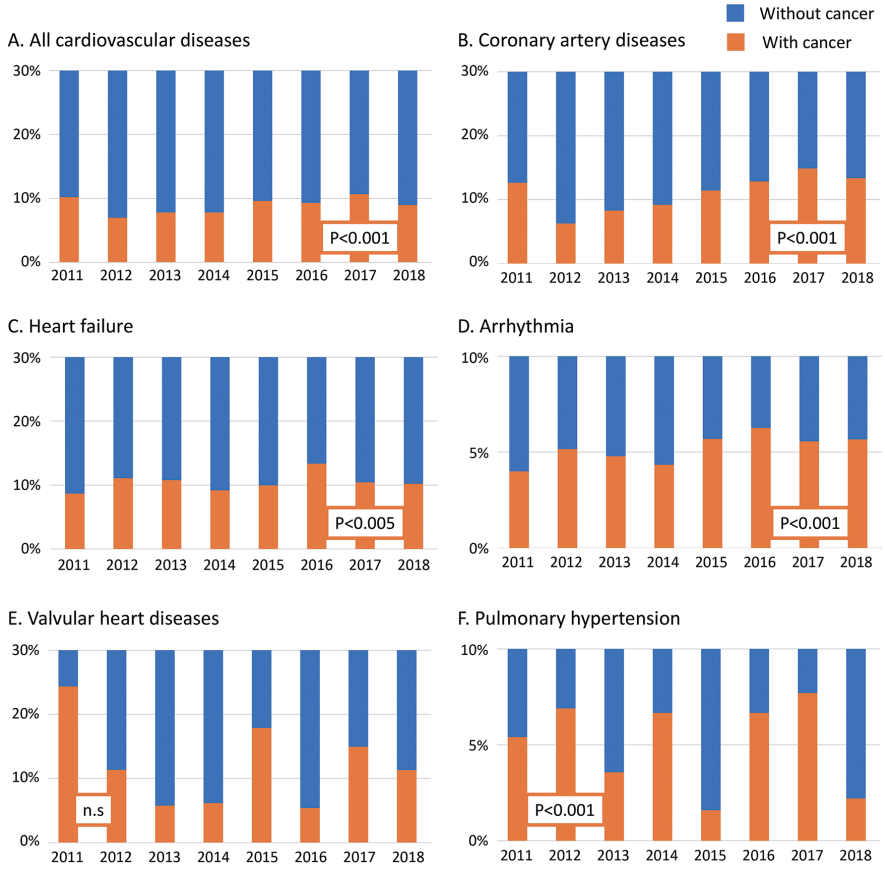

Fig. 1. Time trends of different types of cardiovascular diseases with and without cancer
A: The prevalence of cancer in all cardiovascular diseases varied between 7 to 11% during the observational period of 2011-2018, during which the prevalence of cancer was lowest in 2012 and highest in 2017. B: The prevalence of cancer in coronary artery diseases shows significant changes, similar to the trend in cardiovascular diseases as a whole. C-F: Significant increases in comorbidity are also observed in heart failure (C), arrhythmia (D), and pulmonary hypertension (F); however, there are no significant differences in valvular heart diseases (E).

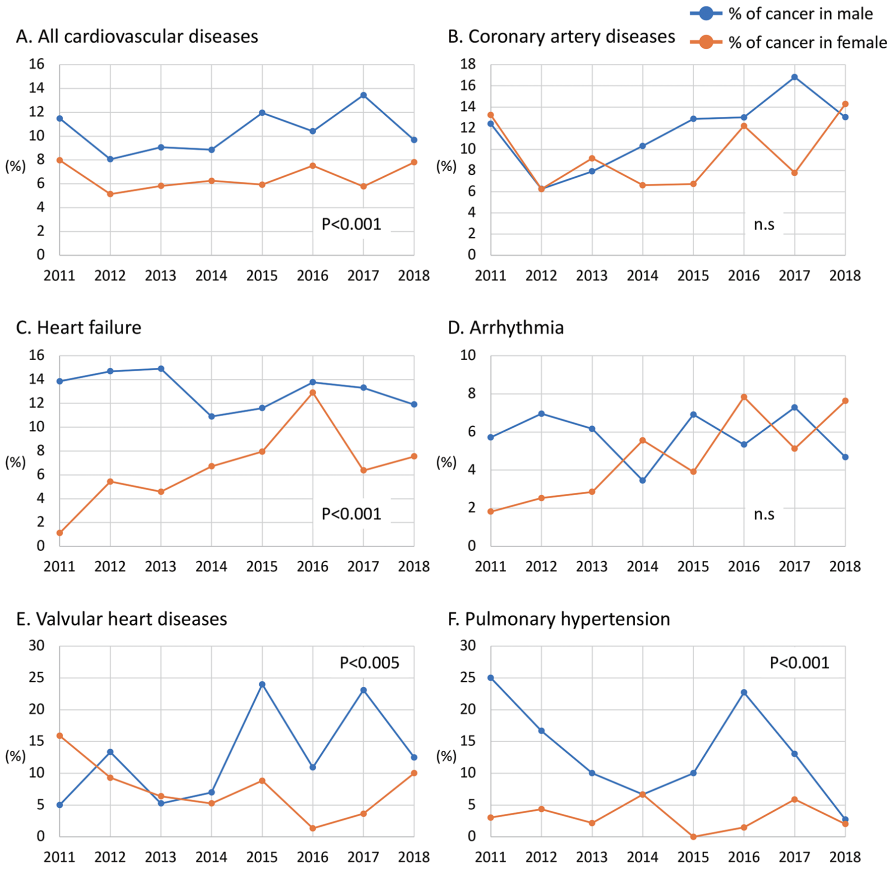

Fig. 2. Sex difference in time trends of different types of cardiovascular diseases with cancer
Significant sex differences were observed in all cardiovascular diseases (A), heart failure (C), valvular heart diseases (E), and pulmonary hypertension (F), but not in coronary artery diseases (B) and arrhythmia (D).

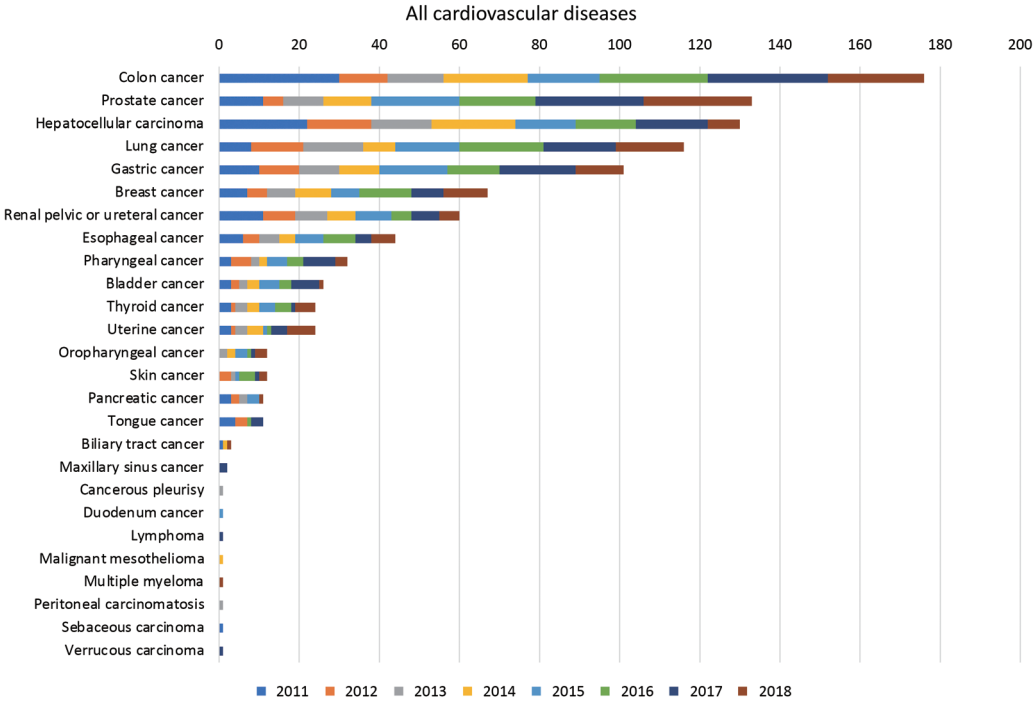

Fig. 3. Time trends of different types of cancer and cardiovascular diseases
The five most prevalent forms of cancer are consistently colon cancer, prostate cancer, hepatocellular carcinoma, lung cancer, and gastric cancer. The comorbidity of breast cancer gradually increased during the period 2011-2018. All CVDs, prostate cancer, lung cancer, and uterine cancer tend to increase as comorbidities, while hepatocellular carcinoma and tongue cancer tend to decrease during the observational period (2011 to 2018).

TABLE 1.
Clinical characteristics

Year	2011-2018
Age (years old)	66.8±14.3
Total number of patients	11093
Male	6855
Female	4238
All cardiovascular diseases	11093
Coronary artery diseases	3700
Heart failure	2465
Arrhythmia	2303
Valvular heart diseases	693
Pulmonary hypertension	577
Peripheral artery disease	183
Venous thromboembolism	63
Other cardiovascular diseases	1109
All cancer	992
Colon cancer	176
Prostate cancer	133
Hepatocellular carcinoma	130
Lung cancer	116
Gastric cancer	101
Breast cancer	67
Renal pelvic or ureteral cancer (bladder cancer, excluded)	60
Esophageal cancer	44
Pharyngeal cancer	32
Bladder cancer	26
Thyroid cancer	24
Uterine cancer	24
Oropharyngeal cancer	12
Skin cancer	12
Pancreatic cancer	11
Tongue cancer	11
Biliary tract cancer	3
Maxillary sinus cancer	2
Cancerous pleurisy	1
Duodenum cancer	1
Lymphoma	1
Malignant mesothelioma	1
Multiple myeloma	1
Peritoneal carcinomatosis	1
Sebaceous carcinoma	1
Verrucous carcinoma	1

TABLE 2.
Time course of cardiovascular diseases with cancer

Year	2011	2012	2013	2014	2015	2016	2017	2018	P-value
All cardiovascular diseases (CVDs)									
Age	67.2±13.9	66.0±13.9	66.3±14.4	67.1±14.2	67.5±14.2	66.7±14.4	67.3±14.5	66.3±14.9	
Sex (male/female)	784/451	807/487	795/498	813/576	853/540	913/585	960/537	930/564	
No. of CVDs patients	1235	1294	1293	1389	1393	1498	1497	1494	
Cancer									
No	1109	1204	1192	1281	1259	1359	1337	1360	P<0.001
Yes	126	90	101	108	134	139	160	134	
Prevalence of cancer	10.20%	6.96%	7.81%	7.78%	9.62%	9.28%	10.69%	8.97%	
Male, n (% of cancer in male)	90 (11.48%)	65 (8.05%)	72 (9.06%)	72 (8.86%)	102 (11.96%)	95 (10.41%)	129 (13.44%)	90 (9.68%)	P<0.001
Female, n (% of cancer in female)	36 (7.98%)	25 (5.13%)	29 (5.82%)	36 (6.25%)	32 (5.93%)	44 (7.52%)	31 (5.77%)	44 (7.80%)	
Coronary artery diseases (CADs)									
Age	69.8±10.4	69.0±10.2	68.5±9.8	69.4±10.9	70.3±10.4	69.8±9.9	69.5±11.2	68.1±12.6	
Sex (male/female)	459/151	399/144	328/131	310/136	334/104	315/90	327/90	284/98	
No. of CADs patients	610	543	459	446	438	405	417	382	
Cancer									
No	533	509	421	405	388	353	355	331	P<0.001
Yes	77	34	38	41	50	52	62	51	
Prevalence of cancer	12.62%	6.26%	8.28%	9.19%	11.42%	12.84%	14.87%	13.35%	
Male, n (% of cancer in male)	57 (12.42%)	25 (6.27%)	26 (7.93%)	32 (10.32%)	43 (12.87%)	41 (13.02%)	55 (16.82%)	37 (13.03%)	n.s
Female, n (% of cancer in female)	20 (13.25%)	9 (6.25%)	12 (9.16%)	9 (6.62%)	7 (6.73%)	11 (12.22%)	7 (7.78%)	14 (14.29%)	
Heart failure									
Age	69.7±14.0	67.9±13.6	69.2±14.4	70.5±13.8	71.7±13.2	70.4±13.7	71.2±14.0	70.6±14.0	
Sex (male/female)	130/90	143/92	161/109	211/149	181/151	138/124	218/157	252/159	
No. of heart failure patients	220	235	270	360	332	262	375	411	
Cancer									
No	201	209	241	327	299	227	336	369	P<0.005
Yes	19	26	29	33	33	35	39	42	
Prevalence of cancer	8.64%	11.06%	10.74%	9.17%	9.94%	13.36%	10.40%	10.22%	
Male, n (% of cancer in male)	18 (13.85%)	21 (14.69%)	24 (14.91%)	23 (10.90%)	21 (11.60%)	19 (13.77%)	29 (13.30%)	30 (11.90%)	P<0.001
Female, n (% of cancer in female)	1 (1.11%)	5 (5.43%)	5 (4.59%)	10 (6.71%)	12 (7.95%)	16 (12.90%)	10 (6.37%)	12 (7.55%)	
Arrhythmia									
Age	60.4±18.2	61.5±17.6	63.2±15.9	62.8±15.1	62.3±15.9	62.6±15.7	62.0±15.5	62.1±14.8	
Sex (male/female)	70/55	115/79	146/105	145/108	188/128	281/166	247/117	235/118	
No. of arrhythmia patients	125	194	251	253	316	447	364	353	
Cancer									
No	120	184	239	242	298	419	340	333	P<0.001
Yes	5	10	12	11	18	28	20	20	

Prevalence of cancer	4.00%	5.15%	4.78%	4.35%	5.70%	6.26%	5.49%	5.67%	
Male, n (% of cancer in male)	4 (5.71%)	8 (6.96%)	9 (6.16%)	5 (3.45%)	13 (6.91%)	15 (5.34%)	18 (7.29%)	11 (4.68%)	n.s
Female, n (% of cancer in female)	1 (1.82%)	2 (2.53%)	3 (2.86%)	6 (5.56%)	5 (3.91%)	13 (7.83%)	6 (5.13%)	9 (7.63%)	
Valvular heart diseases (VHD)									
Age	68.9±11.3	67.1±11.8	70.2±15.0	72.4±11.9	71.6±11.3	72.8±11.0	75.6±11.0	75.7±9.9	
Sex (male/female)	40/44	44/44	57/47	43/38	50/34	55/75	52/55	32/30	
No. of VHD patients	37	88	104	81	84	130	107	62	
Cancer									
No	28	78	98	76	69	123	91	55	n.s
Yes	9	10	6	5	15	7	16	7	
Prevalence of cancer	24.32%	11.36%	5.77%	6.17%	17.86%	5.38%	14.95%	11.29%	
Male, n (% of cancer in male)	2(5.00%)	6(13.33%)	3(5.26%)	3(6.98%)	12(24.00%)	6(10.91%)	12(23.08%)	4(12.50%)	P<0.05
Female, n (% of cancer in female)	7(15.91%)	4(9.30%)	3(6.38%)	2(5.26%)	3(8.82%)	1(1.33%)	2(3.64%)	3(10.00%)	
Pulmonary hypertension (PH)									
Age	52.4±17.6	51.3±17.9	54.4±17.4	60.1±16.9	62.0±16.3	61.3±18.1	62.8±14.7	60.9±16.4	
Sex (male/female)	4/33	6/23	10/46	15/60	10/53	22/68	23/68	37/99	
No. of PH patients	37	29	56	75	63	90	91	136	
Cancer									
No	35	27	54	70	62	84	84	133	P<0.001
Yes	2	2	2	5	1	6	7	3	
Prevalence of cancer	5.41%	6.90%	3.57%	6.67%	1.59%	6.67%	7.69%	2.21%	
Male, n (% of cancer in male)	1 (25.00%)	1 (16.67%)	1 (10.00%)	1 (6.67%)	1 (10.00%)	5 (22.73%)	3 (13.04%)	1 (2.70%)	P<0.001
Female, n (% of cancer in female)	1 (3.03%)	1 (4.35%)	1 (2.17%)	4 (6.67%)	0 (0.00%)	1 (1.47%)	4 (5.88%)	2 (2.02%)	
Peripheral artery disease (PAD)									
Age	60.5±20.4	63.8±15.9	64.4±16.8	60.5±15.1	67.3±10.4	71.1±12.3	64.2±15.4	57.3±17.8	
Sex (male/female)	9/4	15/4	14/3	33/8	9/5	26/9	13/9	13/9	
No. of PAD patients	13	19	17	41	14	35	22	22	
Cancer									
No	12	17	15	40	12	32	19	22	n.s
Yes	1	2	2	1	2	3	3	0	
Prevalence of cancer	7.69%	10.53%	11.76%	2.44%	14.29%	8.57%	13.64%	0.00%	
Male, n (% of cancer in male)	1(11.11%)	2(13.33%)	2(14.29%)	1(3.03%)	2(22.22%)	3(11.54%)	3(23.08%)	0	
Female, n (% of cancer in female)	0	0	0	0	0	0	0	0	
Venous thromboembolism (VTE)									
Age	62.3±18.2	64.7±12.7	57.6±16.8	66.0±15.8	61.3±20.9	61.8±17.1	57.4±20.4	62.0±15.0	
Sex (male/female)	9/4	1/6	2/3	1/9	1/3	2/9	4/3	1/5	
No. of VTE patients	13	7	5	10	4	11	7	6	
Cancer									
No	11	7	3	9	3	11	6	6	n.s
Yes	2	0	2	1	1	0	1	0	

Prevalence of cancer	15.38%	0.00%	40.00%	10.00%	25.00%	0.00%	14.29%	0.00%
Male, n (% of cancer in male)	1(50%)	0	0	0	1(100%)	0	1(25.0%)	0
Female, n (% of cancer in female)	1(9.09%)	0	2(66.67%)	1(11.11%)	0	0	0	0

Continuous variables are presented as mean±standard deviation

TABLE 3.
Patients characteristics of cancer with cardiovascular diseases

Year	2011	2012	2013	2014	2015	2016	2017	2018
All cancer								
Age	72.2±7.7	72.2±8.1	72.3±10.0	72.5±9.6	73.2±8.1	74.2±8.4	74.0±8.6	73.9±9.5
Sex (male/female)	90/36	65/25	72/29	72/36	102/32	95/44	129/31	90/44
No. of all cancer patients	126	90	101	108	134	139	160	134
Colon cancer								
Age	69.9±7.3	71.5±7.3	71.8±8.2	72.9±8.0	73.8±6.1	71.6±6.9	74.7±7.9	75.0±7.5
Sex (male/female)	22/8	8/4	10/4	13/8	16/2	21/6	24/6	13/11
No. of colon cancer patients	30	12	14	21	18	27	30	24
Prostate cancer								
Age	73.9±5.6	78.8±4.3	79.1±4.0	78.6±7.1	74.9±7.2	80.0±6.2	76.9±6.3	76.7±7.2
Sex (male/female)	11/0	5/0	10/0	12/0	22/0	19/0	27/0	27/0
No. of prostate cancer patients	11	5	10	12	22	19	27	27
Hepatocellular carcinoma								
Age	69.0±8.4	68.2±7.0	78±7.6	70.6±7.2	75.1±7.2	76.3±4.1	74.2±10.3	74.1±7.1
Sex (male/female)	17/5	16/0	13/2	17/4	11/4	8/7	13/5	7/1
No. of hepatocellular carcinoma patients	22	16	15	21	15	15	18	8
Lung cancer								
Age	72.8±9.1	72.2±7.3	71.5±8.0	68.1±9.5	72.8±8.9	73.9±8.1	74.2±7.0	71.5±7.9
Sex (male/female)	5/3	8/5	10/5	4/4	10/6	12/9	14/4	11/6
No. of lung cancer patients	8	13	15	8	16	21	18	17
Gastric cancer								
Age	75.3±10.9	77.1±6.5	74.7±8.1	74.8±5.2	73.7±7.9	73.5±6.9	76.6±8.9	77.5±6.8
Sex (male/female)	7/3	6/4	8/2	7/3	12/5	10/3	16/3	11/1
No. of gastric cancer patients	10	10	10	10	17	13	19	12
Breast cancer								
Age	75.6±7.5	68.6±12.2	66.4±7.6	67.8±10.0	72.4±5.1	72.1±9.4	73.3±11.7	71.2±17.9
Sex (male/female)	0/7	0/5	0/7	0/9	0/7	0/13	1/7	0/11
No. of breast cancer patients	7	5	7	9	7	13	8	11
Renal pelvic or uterine cancer (bladder cancer, excluded)								
Age	75.2±3.9	76.6±6.2	72.9±7.0	76.1±9.2	68.3±15.3	76.2±7.5	72.3±7.7	72.2±3.3
Sex (male/female)	10/1	6/2	7/1	6/1	5/4	3/2	6/1	5/0

No. of renal pelvic or uterine cancer patients	11	8	8	7	9	5	7	5
Esophageal cancer								
Age	73.0±5.7	70.0±7.6	70.2±10.6	67.8±12.0	74.9±5.4	74.5±4.9	71.3±1.9	76.2±12.3
Sex (male/female)	5/1	4/0	5/0	3/1	7/0	8/0	4/0	4/2
No. of esophageal cancer patients	6	4	5	4	7	8	4	6
Pharyngeal cancer								
Age	70.3±11.5	74.4±13.1	69.0±19.8	71.5±17.7	64.4±8.9	73.3±12.2	68.5±6.2	76.0±8.0
Sex (male/female)	2/1	4/1	2/0	2/0	5/0	3/1	7/1	3/0
No. of pharyngeal cancer patients	3	5	2	2	5	4	8	3
Bladder cancer								
Age	78.3±5.5	71.5±7.8	67.5±6.4	76.7±10.4	75.4±6.5	75.7±2.3	74.3±10.1	69.0
Sex (male/female)	3/0	2/0	2/0	3/0	5/0	3/0	7/0	1/0
No. of bladder cancer patients	3	2	2	3	5	3	7	1

Continuous variables are presented as mean±standard deviation

TABLE 4.
Time course of different types of cancer in cardiovascular diseases

All cardiovascular diseases	Year	2011	2012	2013	2014	2015	2016	2017	2018
Colon cancer		30	12	14	21	18	27	30	24
Prostate cancer		11	5	10	12	22	19	27	27
Hepatocellular carcinoma		22	16	15	21	15	15	18	8
Lung cancer		8	13	15	8	16	21	18	17
Gastric cancer		10	10	10	10	17	13	19	12
Breast cancer		7	5	7	9	7	13	8	11
Renal pelvic or ureteral cancer (bladder cancer, excluded)		11	8	8	7	9	5	7	5
Esophageal cancer		6	4	5	4	7	8	4	6
Pharyngeal cancer		3	5	2	2	5	4	8	3
Bladder cancer		3	2	2	3	5	3	7	1
Thyroid cancer		3	1	3	3	4	4	1	5
Uterine cancer		3	1	3	4	1	1	4	7
Oropharyngeal cancer		0	0	2	2	3	1	1	3
Skin cancer		0	3	1	0	1	4	1	2
Pancreatic cancer		3	2	2	0	3	0	0	1
Tongue cancer		4	3	0	0	0	1	3	0
Biliary tract cancer		1	0	0	1	0	0	0	1
Maxillary sinus cancer		0	0	0	0	0	0	2	0
Cancerous pleurisy		0	0	1	0	0	0	0	0
Duodenum cancer		0	0	0	0	1	0	0	0
Lymphoma		0	0	0	0	0	0	1	0

Malignant mesothelioma		0	0	0	1	0	0	0	0
Multiple myeloma		0	0	0	0	0	0	0	1
Peritoneal carcinomatosis		0	0	1	0	0	0	0	0
Sebaceous carcinoma		1	0	0	0	0	0	0	0
Verrucous carcinoma		0	0	0	0	0	0	1	0
Coronary artery diseases	Year	2011	2012	2013	2014	2015	2016	2017	2018
Colon cancer		20	5	8	8	10	17	13	9
Prostate cancer		9	4	4	8	14	4	11	11
Hepatocellular carcinoma		9	5	3	9	6	5	7	3
Lung cancer		4	5	4	3	6	8	5	7
Gastric cancer		5	3	5	3	5	7	6	2
Breast cancer		3	0	1	1	0	0	2	4
Renal pelvic or ureteral cancer (bladder cancer, excluded)		8	4	5	2	2	4	3	3
Esophageal cancer		4	1	0	0	0	2	3	0
Pharyngeal cancer		3	0	0	1	3	2	1	0
Bladder cancer		3	2	1	2	2	3	1	1
Thyroid cancer		1	0	1	1	1	0	0	3
Uterine cancer		2	0	1	1	0	0	2	5
Oropharyngeal cancer		0	0	1	1	1	0	1	2
Skin cancer		0	0	1	0	0	0	1	1
Pancreatic cancer		2	2	2	0	0	0	0	0
Tongue cancer		3	3	0	0	0	0	3	0
Biliary tract cancer		1	0	0	1	0	0	0	0
Maxillary sinus cancer		0	0	0	0	0	0	2	0
Cancerous pleurisy		0	0	0	0	0	0	0	0
Duodenum cancer		0	0	0	0	0	0	0	0
Lymphoma		0	0	0	0	0	0	0	0
Malignant mesothelioma		0	0	0	0	0	0	0	0
Multiple myeloma		0	0	0	0	0	0	0	0
Peritoneal carcinomatosis		0	0	1	0	0	0	0	0
Sebaceous carcinoma		0	0	0	0	0	0	0	0
Verrucous carcinoma		0	0	0	0	0	0	1	0
Heart failure	Year	2011	2012	2013	2014	2015	2016	2017	2018
Colon cancer		5	4	4	3	3	5	6	8
Prostate cancer		1	1	1	2	4	5	8	9
Hepatocellular carcinoma		5	8	8	10	4	5	3	1
Lung cancer		0	1	3	0	5	4	5	6
Gastric cancer		2	2	4	6	3	3	1	7
Breast cancer		1	2	2	4	5	6	5	4

Renal pelvic or ureteral cancer (bladder cancer, excluded)	2	4	3	2	4	0	3	2
Esophageal cancer	1	1	1	1	0	0	0	4
Pharyngeal cancer	0	1	1	1	2	1	3	0
Bladder cancer	0	0	1	1	0	0	3	0
Thyroid cancer	0	0	1	1	1	2	0	0
Uterine cancer	0	0	0	0	1	1	1	0
Oropharyngeal cancer	0	0	0	1	0	0	0	0
Skin cancer	0	2	0	0	1	3	0	0
Pancreatic cancer	1	0	0	0	0	0	0	0
Tongue cancer	0	0	0	0	0	0	0	0
Biliary tract cancer	0	0	0	0	0	0	0	0
Maxillary sinus cancer	0	0	0	0	0	0	0	0
Cancerous pleurisy	0	0	0	0	0	0	0	0
Duodenum cancer	0	0	0	0	0	0	0	0
Lymphoma	0	0	0	0	0	0	1	0
Malignant mesothelioma	0	0	0	1	0	0	0	0
Multiple myeloma	0	0	0	0	0	0	0	1
Peritoneal carcinomatosis	0	0	0	0	0	0	0	0
Sebaceous carcinoma	1	0	0	0	0	0	0	0
Verrucous carcinoma	0	0	0	0	0	0	0	0

Arrhythmia	Year	2011	2012	2013	2014	2015	2016	2017	2018
Colon cancer		0	1	0	4	1	2	3	5
Prostate cancer		1	0	2	1	2	3	3	4
Hepatocellular carcinoma		0	1	4	1	1	2	2	2
Lung cancer		2	5	2	2	2	6	4	2
Gastric cancer		2	1	0	0	0	3	6	1
Breast cancer		0	0	1	2	2	5	1	2
Renal pelvic or ureteral cancer (bladder cancer, excluded)		0	0	0	1	0	1	1	0
Esophageal cancer		0	1	1	0	6	2	1	0
Pharyngeal cancer		0	1	0	0	0	0	2	1
Bladder cancer		0	0	0	0	1	0	0	0
Thyroid cancer		0	0	1	0	1	2	1	1
Uterine cancer		0	0	1	0	0	0	0	1
Oropharyngeal cancer		0	0	0	0	0	0	0	0
Skin cancer		0	0	0	0	0	1	0	1
Pancreatic cancer		0	0	0	0	2	0	0	0
Tongue cancer		0	0	0	0	0	1	0	0
Biliary tract cancer		0	0	0	0	0	0	0	0

Maxillary sinus cancer		0	0	0	0	0	0	0	0
Cancerous pleurisy		0	0	0	0	0	0	0	0
Duodenum cancer		0	0	0	0	0	0	0	0
Lymphoma		0	0	0	0	0	0	0	0
Malignant mesothelioma		0	0	0	0	0	0	0	0
Multiple myeloma		0	0	0	0	0	0	0	0
Peritoneal carcinomatosis		0	0	0	0	0	0	0	0
Sebaceous carcinoma		0	0	0	0	0	0	0	0
Verrucous carcinoma		0	0	0	0	0	0	0	0
Pulmonary hypertension	Year	2011	2012	2013	2014	2015	2016	2017	2018
Colon cancer		0	0	1	2	0	0	0	0
Prostate cancer		0	0	0	0	0	2	2	0
Hepatocellular carcinoma		2	1	0	1	0	0	4	1
Lung cancer		0	0	1	1	1	0	0	0
Gastric cancer		0	1	0	0	0	0	0	0
Breast cancer		0	0	0	1	0	1	0	0
Renal pelvic or ureteral cancer (bladder cancer, excluded)		0	0	0	0	0	0	0	0
Esophageal cancer		0	0	0	0	0	1	0	1
Pharyngeal cancer		0	0	0	0	0	1	1	1
Bladder cancer		0	0	0	0	0	0	0	0
Thyroid cancer		0	0	0	0	0	0	0	0
Uterine cancer		0	0	0	0	0	0	0	0
Oropharyngeal cancer		0	0	0	0	0	1	0	0
Skin cancer		0	0	0	0	0	0	0	0
Pancreatic cancer		0	0	0	0	0	0	0	0
Tongue cancer		0	0	0	0	0	0	0	0
Biliary tract cancer		0	0	0	0	0	0	0	0
Maxillary sinus cancer		0	0	0	0	0	0	0	0
Cancerous pleurisy		0	0	0	0	0	0	0	0
Duodenum cancer		0	0	0	0	0	0	0	0
Lymphoma		0	0	0	0	0	0	0	0
Malignant mesothelioma		0	0	0	0	0	0	0	0
Multiple myeloma		0	0	0	0	0	0	0	0
Peritoneal carcinomatosis		0	0	0	0	0	0	0	0
Sebaceous carcinoma		0	0	0	0	0	0	0	0
Verrucous carcinoma		0	0	0	0	0	0	0	0
Valvular heart diseases	Year	2011	2012	2013	2014	2015	2016	2017	2018
Colon cancer		4	2	1	1	3	1	5	0
Prostate cancer		0	0	1	0	0	1	2	1

Hepatocellular carcinoma		2	1	0	0	1	2	1	0
Lung cancer		0	1	0	1	1	1	2	0
Gastric cancer		0	0	0	0	5	0	1	2
Breast cancer		2	3	2	1	0	0	0	0
Renal pelvic or ureteral cancer (bladder cancer, excluded)		0	0	0	0	2	0	0	0
Esophageal cancer		0	0	1	2	0	2	0	1
Pharyngeal cancer		0	2	1	0	0	0	0	1
Bladder cancer		0	0	0	0	0	0	2	0
Thyroid cancer		0	0	0	0	1	0	0	0
Uterine cancer		1	0	0	0	0	0	1	0
Oropharyngeal cancer		0	0	0	0	2	0	0	1
Skin cancer		0	1	0	0	0	0	0	0
Pancreatic cancer		0	0	0	0	0	0	0	1
Tongue cancer		0	0	0	0	0	0	0	0
Biliary tract cancer		0	0	0	0	0	0	0	0
Maxillary sinus cancer		0	0	0	0	0	0	0	0
Cancerous pleurisy		0	0	0	0	0	0	0	0
Duodenum cancer		0	0	0	0	0	0	0	0
Lymphoma		0	0	0	0	0	0	0	0
Malignant mesothelioma		0	0	0	0	0	0	0	0
Multiple myeloma		0	0	0	0	0	0	0	0
Peritoneal carcinomatosis		0	0	0	0	0	0	0	0
Sebaceous carcinoma		0	0	0	0	0	0	0	0
Verrucous carcinoma		0	0	0	0	0	0	0	0
Peripheral artery disease	Year	2011	2012	2013	2014	2015	2016	2017	2018
Colon cancer		0	0	0	0	0	0	1	0
Prostate cancer		0	0	1	0	0	1	0	0
Hepatocellular carcinoma		0	0	0	0	0	0	0	0
Lung cancer		0	0	0	1	0	1	0	0
Gastric cancer		0	1	0	0	1	0	2	0
Breast cancer		0	0	0	0	0	0	0	0
Renal pelvic or ureteral cancer (bladder cancer, excluded)		0	0	0	0	0	0	0	0
Esophageal cancer		1	0	1	0	0	1	0	0
Pharyngeal cancer		0	1	0	0	0	0	0	0
Bladder cancer		0	0	0	0	1	0	0	0
Thyroid cancer		0	0	0	0	0	0	0	0
Uterine cancer		0	0	0	0	0	0	0	0
Oropharyngeal cancer		0	0	0	0	0	0	0	0
Skin cancer		0	0	0	0	0	0	0	0

Pancreatic cancer		0	0	0	0	0	0	0	0
Tongue cancer		0	0	0	0	0	0	0	0
Biliary tract cancer		0	0	0	0	0	0	0	0
Maxillary sinus cancer		0	0	0	0	0	0	0	0
Cancerous pleurisy		0	0	0	0	0	0	0	0
Duodenum cancer		0	0	0	0	0	0	0	0
Lymphoma		0	0	0	0	0	0	0	0
Malignant mesothelioma		0	0	0	0	0	0	0	0
Multiple myeloma		0	0	0	0	0	0	0	0
Peritoneal carcinomatosis		0	0	0	0	0	0	0	0
Sebaceous carcinoma		0	0	0	0	0	0	0	0
Verrucous carcinoma		0	0	0	0	0	0	0	0
Venous thromboembolism	Year	2011	2012	2013	2014	2015	2016	2017	2018
Colon cancer		0	0	0	0	1	0	0	0
Prostate cancer		0	0	0	0	0	0	0	0
Hepatocellular carcinoma		1	0	0	0	0	0	0	0
Lung cancer		0	0	0	0	0	0	0	0
Gastric cancer		0	0	0	1	0	0	1	0
Breast cancer		1	0	0	0	0	0	0	0
Renal pelvic or ureteral cancer (bladder cancer, excluded)		0	0	0	0	0	0	0	0
Esophageal cancer		0	0	0	0	0	0	0	0
Pharyngeal cancer		0	0	0	0	0	0	0	0
Bladder cancer		0	0	0	0	0	0	0	0
Thyroid cancer		0	0	0	0	0	0	0	0
Uterine cancer		0	0	1	0	0	0	0	0
Oropharyngeal cancer		0	0	1	0	0	0	0	0
Skin cancer		0	0	0	0	0	0	0	0
Pancreatic cancer		0	0	0	0	0	0	0	0
Tongue cancer		0	0	0	0	0	0	0	0
Biliary tract cancer		0	0	0	0	0	0	0	0
Maxillary sinus cancer		0	0	0	0	0	0	0	0
Cancerous pleurisy		0	0	0	0	0	0	0	0
Duodenum cancer		0	0	0	0	0	0	0	0
Lymphoma		0	0	0	0	0	0	0	0
Malignant mesothelioma		0	0	0	0	0	0	0	0
Multiple myeloma		0	0	0	0	0	0	0	0
Peritoneal carcinomatosis		0	0	0	0	0	0	0	0
Sebaceous carcinoma		0	0	0	0	0	0	0	0
Verrucous carcinoma		0	0	0	0	0	0	0	0