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CASE REPORT

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Cardiac metastases

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Abstract We report a case of esophageal cancer with symptomatic metastases to the heart; the patient was treated with short-course radiotherapy with good symptomatic relief. We reviewed the current literature regarding the epidemiology, clinical presentation, diagnostic tools, treatment modalities, and the prognosis of cardiac metastases. In this report we summarize the most recent autopsy studies (published between 1975 and 2007), in which we found an autopsy incidence of cardiac metastases of 2.3% among the general population, while the incidence among autopsies of cancer patients was 7.1%. Therefore, we share the opinion with others that there has been an increase in the incidence of cardiac metastases among cancer patients diagnosed after 1970, in comparison with the reported incidences in older series before 1970 (7.1% vs 3.8%; Kruskal-Wallis rank test; $P = 0.039$). Special attention was given to the role of radiotherapy in the management of cardiac metastases.

Key words Cardiac metastases · Radiotherapy · Esophageal carcinoma

Case report

A 60-year old man presented in January 2006 with carcinoma of the esophagus (T3N1Mx). A computed tomography (CT) scan of the chest at the time of this diagnosis was unremarkable regarding the heart (Fig. 1), but the esophageal cancer was well documented. He was initially treated with induction chemotherapy, with a poor response. Radiotherapy was initiated in order to reduce dysphagia. After 10.8-Gy radiotherapy was stopped because of increasing dyspnea arising from the narrowed left major bronchus (produced by local progression of the tumor), the placement of a bronchial stent was necessitated. At the same time, a second stent was placed in the esophagus to relieve the dysphagia. Palliative radiotherapy was given in five daily fractions of 4 Gy, with marked alleviation of the dysphagia.

In December 2006 he developed atypical chest pain. CT of the chest at that time showed regression of the esophageal tumor; but, surprisingly, cardiac metastasis was seen (Fig. 2). On echocardiography left ventricular function appeared normal. A dense hyperechogenic mass was seen in the myocardium, with a small amount of pericardial effusion. Palliative radiotherapy was delivered with anterior-posterior opposing fields. Radiation portals encompassed the CM with a margin of 1.5 cm to make sure that, with cardiac motion, the target volume remained in the portal. In order to shorten the treatment period, we prescribed a total dose of 20 Gy, in daily fractions of 4 Gy. Three weeks after the initiation of the palliative radiotherapy his symptoms were alleviated. Unfortunately we could not confirm this subjective relief with chest CT, because the patient died of aspiration pneumonia 10 weeks after the initiation of the palliative radiotherapy. No autopsy was performed.

Discussion and review of the literature

Epidemiology

Although cardiac metastases (CM) are much more common than primary cardiac tumors, the diagnosis of CM antemortem is seldom made, because more than 90% are clinically silent. About 75% of primary cardiac tumors are benign and 25% are malignant (4% primary malignancy and 96% CM). According to the literature, CM have been found in 1.5%–20% of autopsies of cancer patients and in 0.2%–6.5% of subjects in unselected autopsy series.[1–11] Most

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experiences about the incidence of CM were derived from postmortem examinations. We summarized the most recent autopsy studies (published between 1975 and 2007), and found an autopsy incidence of CM of 2.3% among the general population, while the incidence among autopsies of cancer patients was 7.1% (Table 1). When we compared these results to older series published between 1917 and 1951[12] (Table 2), we tended to agree with the conclusions of Karwinski and Svendsen[6] and Lockwood and Broghamer,[7] who suggested an increasing incidence of CM after 1970. Therefore, we performed a statistical comparison, using the Kruskal-Wallis rank test, and found a statistically significant

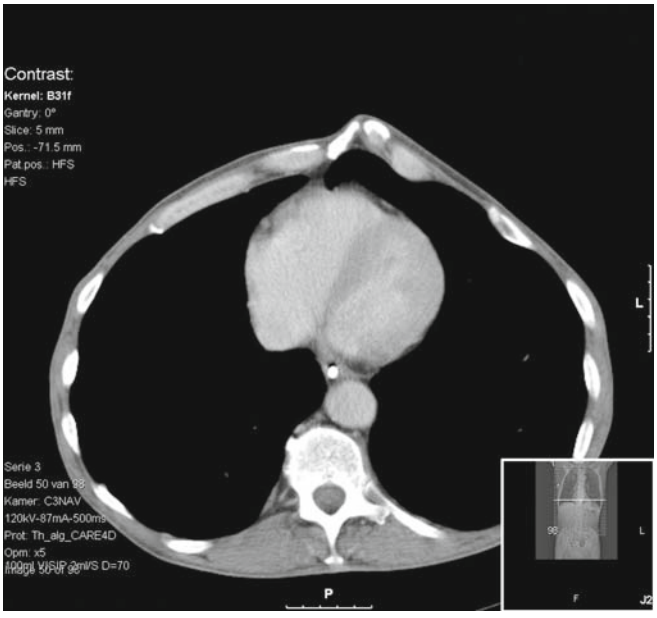

Fig. 1. Chest computed tomography (CT) scan: performed 4 months after the diagnosis of esophageal carcinoma, to evaluate the response of the esophageal mass to radiation therapy. At that time, the CT scan of the heart was unremarkable

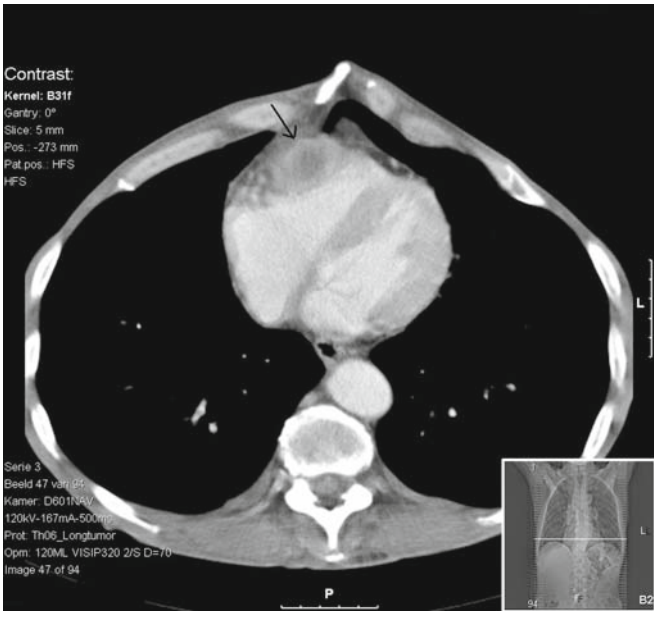

Fig. 2. Chest CT scan: performed to evaluate the patient's complaint of atypical chest pain, demonstrating a cardiac mass of 3 × 2.5 cm (*arrow*)

Table 1. Reported incidence of CM in autopsy studies of cancer patients and general populations (published 1975–2007)

Author	Year of publication	Autopsies; *n*	Malignancies; *n* (%)	CM in cancer patients; *n* (%)	CM in general populations (%)
Bussani et al.[5]	2007	18751	7289 (38.9)	662 (9.1)	3.5
Rafajlovski et al.[9]	2005	11403	2928 (25.7)	79 (2.7)	0.7
Abraham et al.[2]	1999	3314	806 (24.3)	95 (11.8)	2.9
Silvestri et al.[10]	1997	4769	1928 (40.4)	162 (8.4)	3.4
Mac Gee[8]	1991	2455	1311 (53.4)	57 (4.4)	2.4
Karwinski and Svendsen[6]	1989	8571	2833 (33.0)	130 (4.6)	1.5
Xiong and Smith[11]	1986	2050	484 (23.6)	68 (14.0)	3.3
Ambrosio[3]	1980	2222	590 (26.5)	38 (6.4)	1.7
Abioye and Maolomo[1]	1975	6064	752 (12.4)	64 (8.5)	1.1
Total		59599	18921 (31.7)	1355 (7.1)	2.3

Table 2. Reported incidence of CM in autopsy studies of cancer patients (published 1917–1951)[12]

Author	Year of publication	Autopsies of cancer patients	Number of cardiac metastases	Incidence (%)
Scott and Garvin	1939	1082	101	9.3
Burke	1934	327	14	4.3
Pollia and Gogol	1936	1450	29	2.0
Pirchard	1951	4375	146	3.3
Ritchie	1941	857	16	1.9
Symmers	1917	298	5	1.7
Willis	1933	323	20	6.2
Total		8712	331	3.8

increase in the incidence of CM after 1970 compared to that in older series before 1970 (7.1% vs 3.8%; $P = 0.039$).

With the advent of modern diagnostic tools, better chemotherapeutic regimens, and better radiation techniques, and with the implementation of better perioperative care, patients with cancer have a somewhat improved survival. With increased longevity, a trend of increased incidence of CM has been shown in different studies.[5–7] Because of the above-mentioned factors, together with the widespread use of modern imaging techniques, an increase in the frequency of the antemortem diagnosis of CM is to be expected in the near future.

Although any malignant tumor can metastasize to the heart, the most common tumors with CM potential are carcinomas of the lung, pleura, breast, esophagus, and kidney, and malignant lymphoma, leukemia, sarcoma, and malignant melanoma.[5] In reviewing 32 articles on the epidemiology of CM, we found that the combination of bronchogenic carcinoma, hematological malignancies, and breast cancer accounted for about two-thirds of all tumors with a significant tendency for CM. Data on metastatic involvement of the heart in childhood are scanty. Data from the available literature indicate that more than 90% of CM in childhood originate from lymphoma, leukemia, Wilms' tumor, neuroblastoma, hepatoblastoma, and sarcomas.[13]

Dyspnea, cough, palpitations, syncope, and chest pain are the most common presenting symptoms of CM. Sudden death may occur secondary to myocardial rupture, ventricular arrhythmias, or acute myocardial infarction,[4,5] The development of heart failure, rapid cardiomegaly, arrhythmias, or chest pain in a child with history of cancer is very suspicious of CM.[13]

Electrocardiography is nonspecific. More than two-thirds of patients with CM showed some ECG abnormality. Localized and prolonged ST-segment elevation without Q waves appears to be pathognomonic for myocardial tumor invasion.[14] Transesophageal and two-dimensional echocardiography are considered to be ideal tools for the diagnosis of CM. Chest computed tomography (CT) and magnetic resonance imaging (MRI) provide excellent anatomic information about CM. Cytological examination of pericardial fluid is of great value for diagnosis in patients with pericardial effusion. Definite diagnosis requires pathological examination of tumor tissue obtained by transthoracic or open surgical biopsy.

Treatment modalities

CM are usually diagnosed in the setting of generalized carcinomatosis. At this stage, treatment must be with palliative intention, while in rare cases, when the heart is the only site of metastasis, treatment could be with curative intention. In patients with disseminated disease, radiotherapy should be attempted to relieve troublesome symptoms, to produce local control, and to stabilize hemodynamic disturbance. In such patients with limited life expectancy and poor performance status, it is very important to keep the treatment time as short as possible. Short-course radiotherapy may be suitable to achieve these objectives. In chemosensitive tumors, such as leukemias, lymphomas, and germ cell tumors, chemotherapy is recommended. If technically feasible, resection of CM, in highly selected patients, offers the best chance of prolonged survival, although the perioperative mortality rate remains high (40%). Because patients suitable for surgery generally have a better prognosis than inoperable patients, postoperative chemotherapy and/or radiotherapy should be given to reduce the chance of local recurrence.[15]

The role of radiotherapy

The concept of using radiation therapy to treat CM is almost as old as the technique itself. One of the earliest case reports was that by Shelburne and Aronson,[16] published in 1940, followed by another early report, by Blotner and Sosman,[17] in 1944. Nowadays more is known about the tolerance of the heart to radiation therapy. Emami et al.[18] reported information about the [tolerance dose (TD)] 5/5 (the probability of a 5% incidence of radiation-induced heart complications within 5 years from treatment) and the TD 50/5 (the probability of a 50% incidence of complications within 5 years from treatment) for partial and whole-organ tolerance to radiotherapy. Depending on these data, we assume that, in radiosensitive tumors such as lymphomas, CM could be controlled with a radiation dose as low as 20 Gy, while less radiosensitive tumors would require a higher radiation dose to produce the same improvement rates (35–50 Gy). In general, a total dose of 45 Gy, in 25 fractions of 1.8 Gy, would be appropriate in a curative setting; an additional dose of 10–15 Gy may be delivered through small portals, when indicated.[19]

Management of malignant pericardial effusion

Malignant pericardial effusion or tamponade is an acute life-threatening oncological complication requiring emergency pericardiotomy. A median survival of 4 months had been reported in this group of patients.[4,5] Symptomatic malignant pericardial effusion requires repeated pericardiocentesis, possibly with a laparoscopic technique.[20] However, if this procedure fails percutaneous balloon pericardiostomy can be considered. Today, more invasive procedures are only rarely performed in very ill patients.[21] Radiation therapy did prolong life in patients with pericardial effusion as compared with repeated pericardiocentesis alone.[22] Instillation of tetracyclines as sclerosing agents has been a useful palliative procedure.[23] Instillation of radioactive phosphorus has also been shown to be effective, but the technical expenditure is high.[24] Instillation of different chemotherapeutic agents (especially cisplatin) has also been successfully applied to prevent recurrent effusion.[25]

In the treatment of CM in childhood, early operation should be considered only in patients with decompensated hemodynamics, because of the high perioperative mortality. All other patients should initially be treated with chemotherapy and/or radiotherapy.[13]

Prognosis

It seems that whatever the treatment selected, the clinical evolution is usually disappointing, and patients with CM die within a year of the diagnosis, on average. Occasional patients have survived for several years. Overall, a 5-year survival rate of only 7% has been reported. This poor prognosis makes it important to select the appropriate mode of therapy, probably with a rather restrictive approach to the use of heart surgery in this situation.[20,21]

Conclusion

Surgical resection of CM is the treatment of choice in highly selected patients with a long life expectancy and a good performance status. Radiation therapy should be used as palliative therapy for inoperable and/or nonresectable, as well as for chemoresistant CM. We recommend the use of a short-course hypofractionated schedule in patients with a poor predicted survival, as in our patient, as this is more convenient for the patient and more cost effective. After reviewing the most recent literature available, we share the opinion, with other investigators, that there has been an increase in the incidence of CM after 1970 compared with that in older series before 1970 ($P = 0.039$). From the most recent articles collected, we found an average incidence of CM of 2.3% among autopsies of general populations and an average incidence of CM of 7.1% among autopsies of cancer patients.

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