Congestive heart failure secondary to right ventricular metastasis of colon cancer. A case report and review of the literature

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Key words:
Colon cancer; Echocardiography; Heart failure; Heart metastasis.

Although metastatic tumors of the heart occur more frequently than primary ones, infiltration of the right heart by a metastatic colon cancer has rarely been reported. We report the case of a woman previously operated on for colon cancer, presenting with symptoms of congestive heart failure due to metastatic invasion of the right ventricular cavity. Both transthoracic and transesophageal echocardiography were useful in detecting the mass, but not in defining its nature. The patient underwent a palliative surgical resection of the neoplastic mass but died soon after the intervention.

(Ital Heart J 2005; 6 (9): 778-781)

Received January 18, 2005; revision received April 4, 2005; accepted April 7, 2005.

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Introduction

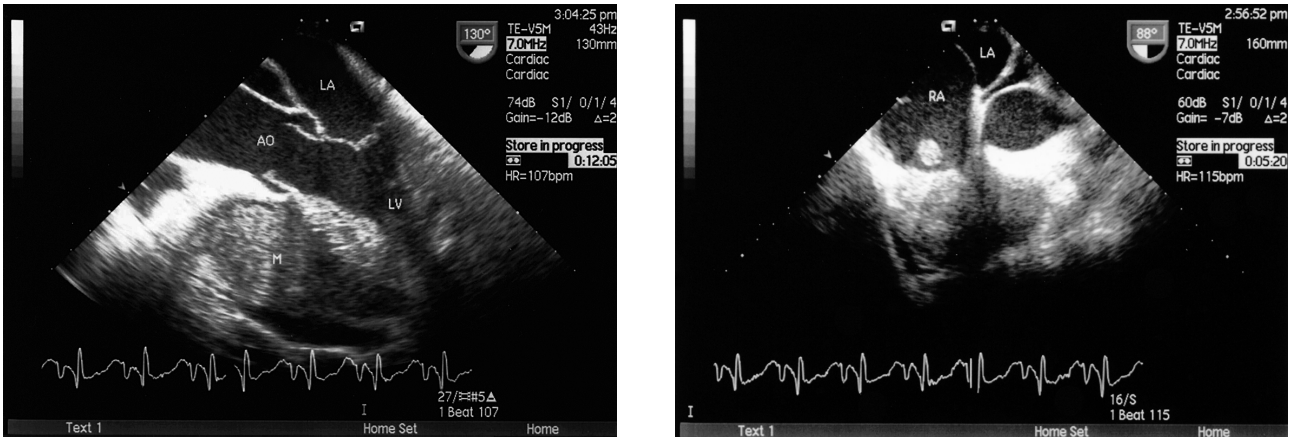
Metastatic malignancies involving the heart occur more frequently than primary ones. Cardiac metastases arise from virtually any malignant neoplasm; however, tumors that more often metastasize to the heart are carcinoma of the lung and breast, mesothelioma, melanoma and lymphomas, while secondary colorectal tumors are rare[1,2]. Unfortunately, a complete surgical extirpation of a cardiac metastasis can be rarely obtained and the only available therapeutic option is often restricted to a palliative treatment like drainage of pericardial effusions.

We report the case of a woman previously operated on of colon cancer, presenting with symptoms of congestive heart failure due to the presence of a mass completely invading the right ventricular cavity. In this case also, surgical intervention was unsuccessful and the patient died in the postoperative phase.

Case report

A 69-year-old woman was admitted to the Cardiology Unit of the S. Orsola Hospital for progressively worsening dyspnea. Three years before she had been operated on of colon resection for a T3,N1,M0 adenocarcinoma followed by both chemotherapy and radiotherapy. After a 2-year period of well-being, she had undergone atypical wedge resection for metastatic involvement of the right and left lung. Some days before admission to the hospital she developed bilateral ankle edema and oliguria and was sent to cardiological evaluation. The clinical examination was consistent with the diagnosis of congestive heart failure while the electrocardiogram showed non-specific ST-T changes. At transthoracic echocardiography a homogeneous echogenic mass filling almost completely the right ventricular cavity was observed, with preserved blood flow only in proximity of the interventricular septum. The mass joined the pulmonary valve without crossing it. A small pericardial effusion was also present.

At transesophageal echocardiography it was observed that the mass not only filled almost completely the right ventricle (Fig. 1A), but also reached the right atrium across the tricuspid valve (Fig. 1B). As first hypothesis we considered that of a cancer-related thrombotic nature of the mass and an attempt of pharmacological thrombolysis with tissue-type plasminogen activator was deemed appropriate but was unsuccessful, so that the possibility of a metastatic origin of the mass was taken into consideration. The patient was therefore referred to the University Division of Cardiac Surgery. After conventional median sternotomy, the ascending aorta and both venae cavae were cannulated and cardiopul-



A B

Figure 1. *Transesophageal imaging of right ventricular invasion by the tumoral mass (M)* (A) *and protrusion of the mass into the right atrium* (RA) (B). *AO = aorta; LA = left atrium; LV = left ventricle.*

monary bypass instituted. The free wall of the right ventricle was thick and woody, infiltrated and calcified on its margin. After opening of the right atrium, the metastatic mass was seen protruding into the right atrial cavity: neoplastic involvement of the tricuspid annulus and both the anterior and posterior leaflets were also detected (Fig. 2), leaving only a virtual orifice close to the interventricular septum. The pulmonary valve was not affected by the cardiac metastasis. Despite a careful resection, the deep infiltration of the tricuspid annulus did not allow replacement of the native valve by means of a prosthesis. A considerable hemodynamic instability along with respiratory failure occurred, thus hampering the weaning from cardiopulmonary bypass and requiring the placement of an extracorporeal membrane oxygenation device. The patient did not recover from the mechanical support and died for multiorgan failure.

The histology on the autoptic samples colored with hematoxylin-eosin showed muscular tissue infiltrated by carcinomatous neoplasia with epithelial cells organized in mostly atypical gland structures (Fig. 3). Histochemical analysis with PAS showed intracellular presence of mucus (Fig. 4). Immunochemistry with PAN keratin and cytokeratin 20 confirmed the epithelial origin of the neoplastic cells (Fig. 5). The morphologic, histochemical and immunohistochemical diagnosis was therefore that of heart metastasis from moderately differentiated mucinous adenocarcinoma of colonic origin.

Discussion

Cardiac involvement by primary and secondary tumors is one of the least investigated issues in oncology, although being a true clinical problem. Old data quoted by Abraham and derived from unselected autopsies were consistent with an incidence of 0.0017% for primary tumors and of 0.24 to 6.45% for cardiac metastases, while Abraham[1] himself in 1990 found an inci-

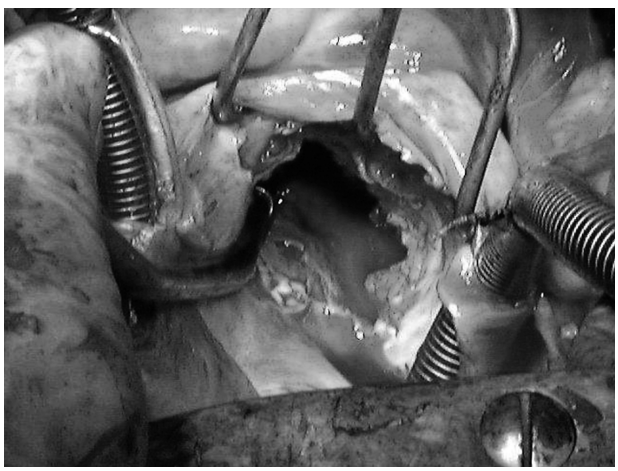


Figure 2. *Intraoperative view of the tricuspid annulus following excision of the valvular leaflets.*

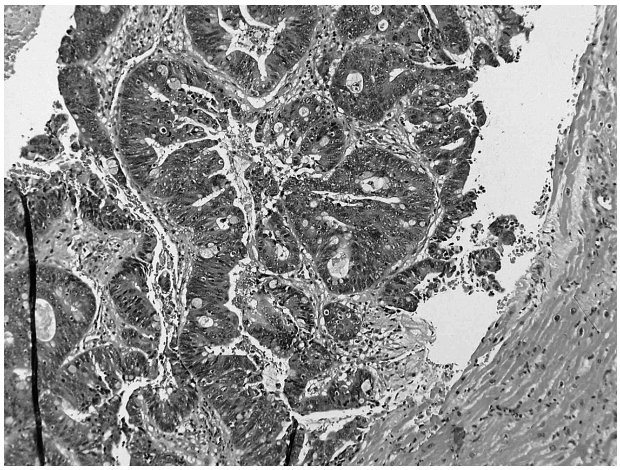


Figure 3. *Hematoxylin-eosin (×10).*

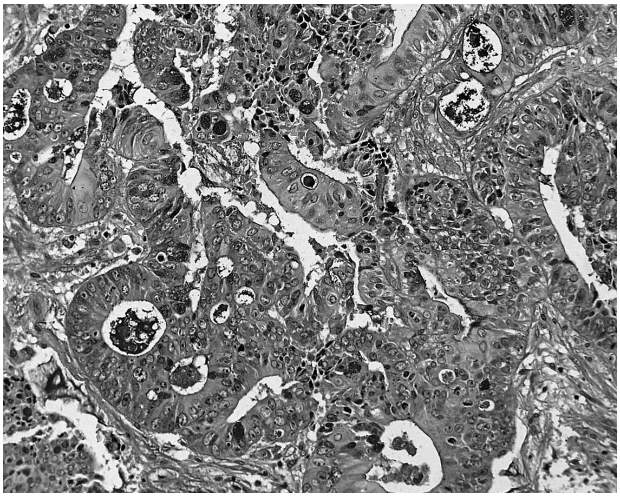


Figure 4. *Staining with PAS (×20).*

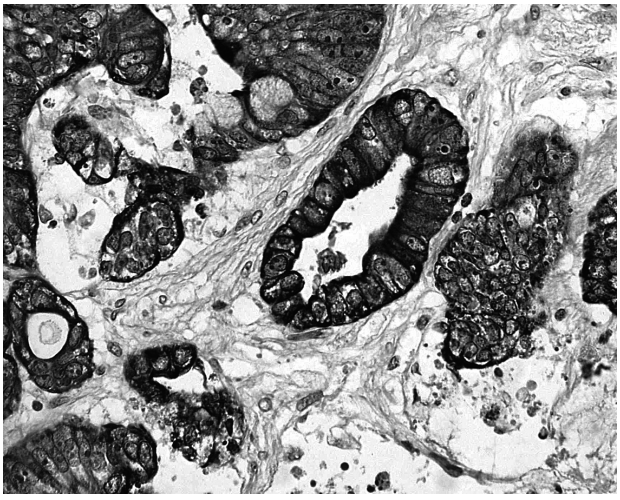


Figure 5. *Anti-cytokeratin-PAN (×40).*

dence of 95 cases of cardiac involvement in 806 autopsies with some kind of malignancy (11.8%), from an overall number of 3314 consecutive autopsies performed over a 14-year period. Later, in their review of 12 485 consecutive unselected autopsies performed over a 20-year period in Hong Kong, Lam et al.[3] reported an incidence of 0.056% for primary and of 1.23% for secondary heart tumors, respectively. On the other hand Klatt and Heitz[4] had found cardiac metastases in 10.7% of 1029 autopsies in which a malignant neoplasm had been diagnosed, while previous studies had reported a rate of involvement of 1.6 to 20% in similar settings. Similarly, the Italian study of Silvestri et al.[2] on 1928 cancer patients showed an incidence of 8.4% of cardiac metastases with a significant decrease in frequency in elderly patients.

Metastatic cancer to the heart assumes greater importance nowadays as the incidence of cancer rises and survival of neoplastic patients is prolonged due to earlier diagnosis and advances in radiotherapy and chemotherapy, so that the incidence of secondary tumors to the heart will be progressively increasing. The probability of heart metastases must therefore be deemed higher than in the past and more often suspected after considering the nature of the primary tumor: in the study of Silvestri et al.[2] mesothelioma, melanoma and lung cancer, as origin of cardiac metastases, had the highest frequency in males (100, 50 and 31% respectively), while in females the sequence in decreasing order was that of melanoma (45%), lung tumors (26%) and renal neoplasms (20%). Data from Lam et al.[3] also report lung carcinoma as the overall most frequent source of heart lesions, followed by esophageal carcinoma and lymphoma.

Neoplasms originating in colon and rectum and causing secondary heart lesions are rather rare: in their study of 1095 primary cardiac tumors in 1029 autopsies of malignancies (two separate malignant neoplasms were found in 66 cases), Klatt and Heitz[4] reported on 72 cases of colon and rectum as primary sites of tumor, with only 2 metastatic cardiac sites from the 64 patients with adenocarcinoma (3.1%), while 8 cases of malignant carcinoid and of neuroendocrine, cloacogenic and squamous cell carcinoma did not originate secondary lesions. A similar value was reported by Abraham et al.[1] in their population of 95 patients with secondary heart lesions, where the percentage of subjects with primary colon cancer was of 3 out of 95, that is 3.2%. In the study of Klatt and Heitz[4], the epicardium was the region most often involved by metastases (75.5%), followed by the myocardium (38.2%) and the endocardium (15.5%), and of the 2 patients with primary colon tumor, one had epicardial and the other myocardial involvement.

Cases of *ante-mortem* diagnosis of heart metastases from colon carcinoma are mainly anecdotal and probably the first reported is that of a patient with tricuspid obstruction and superior vena cava syndrome, caused by a large tumor mass in the right atrium diagnosed by two-dimensional echocardiography and confirmed by autopsy[5]. Teixeira et al.[6] reported a similar case of right atrial obstruction in whom the differential diagnosis between metastasis and thrombotic mass was also discussed but not supported by an autopsy, refused by the patient's relatives. Metastases to the right ventricle from mucinous colon carcinoma are also rare and demand an accurate differential diagnosis[7].

The importance of a transthoracic echographic diagnosis in patients with heart metastases is well recognized[8-10], and we also reported an echocardiographic diagnosis of a secondary lesion discovered 5 months after liver transplantation for cancer[11]. On the other hand, transesophageal echocardiography did not appear to add many elements to the diagnosis in the present case: it was useful in better imaging the mass but did not help diagnose its nature nor did help ascertain the severe degree of tricuspid annular and leaflet infiltration. Indeed echocardiography can provide preliminary diagnostic

information for evaluation of cardiac masses while computed tomography and magnetic resonance imaging (MRI) provide the most complete characterization, for their superior tissue resolution and tumor demarcation[12]. Even though excellent in assessment of the left side of the heart, echocardiography appears limited in the evaluation of the right heart, mediastinum and paracardiac structures, while computed tomography with current multislice technology allows an excellent visualization of the extracardiac anatomy. However, computed tomography requires radiation, is limited in the assessment of valvular function and, if compared to MRI, is less effective at tissue characterization and tumor delineation: therefore, MRI probably plays a more important role also since gadolinium-enhanced MRI is superior to computed tomography for detection of myocardial involvement and usually distinguishes between tumor and intracavitary thrombus, though there may be some overlap with organized thrombi[13]. A case of *ante-mortem* MRI diagnosis of metastatic colon cancer to the right ventricle has been reported by Testempassi et al.[14].

Even though in our patient we considered of being compelled to an urgent intervention for the rapid worsening of the clinical conditions, surgery should perhaps have been avoided if the neoplastic nature of the mass had been more definitely ascertained: definite therapeutic guidelines for these pathologies have not been established until now, the patient's outcome seems unfavorable in any case and surgery is not therapeutic, even if in sporadic cases an aggressive surgery has enabled prolonged survival[15]. We however also considered that among alternative choices, chemotherapy is generally judged inadequate by the oncologists, for potential fragmentation and dissemination of the mass, while radiotherapy seems to be avoided for its radiation-induced effects on the pericardium and myocardial wall. On the other hand, patients not sent to intervention can die of intractable shock[16], while for those operated on there is the risk of metastatic spreading to the lungs and consequent respiratory failure. This was the case of our patient, as for a previous one affected by secondary cardiac melanoma observed by our group[17], and for others already reported by the current literature[5]. On this subject, clamping the pulmonary artery and opening and flushing the right heart circuit before establishing pulmonary blood flow has been suggested as a surgical technique to prevent pulmonary embolization from these very friable tumors[5].

In conclusion, the possibility of secondary cardiac lesions should be taken into consideration in patients already operated on of resection of a primary neoplasia and not affected by preexisting heart disease, presenting with new-onset dyspnea, palpitations or other cardiac symptoms. In the present era of widely available non-invasive diagnostic techniques we suggest early transthoracic and transesophageal echographic studies, at least in those cancer patients with more likely cardiac metastatic potential: prompt echocardiographic investigations in such patients could detect secondary lesions of the heart in the earliest possible phase. So discovering a malignant tumor in this location may assist in planning newer surgical techniques or in the choice of alternative therapeutic options[18], with the further help of accurate and also non-invasive investigations like MRI and/or computed tomography.

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