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**Case Report**

# Solitary Cardiac Metastasis from Colorectal Cancer: A Case Report

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**Keywords**
Colorectal cancer · Cardiac metastasis · Resection

**Abstract**
A 73-year-old woman with silent cardiac metastasis underwent high anterior resection for rectal cancer 3 years ago. Follow-up computed tomography showed a tumor in the right atrium. Partial vascular resection of the superior vena cava and right atrium was performed. Early postoperative recurrence occurred, and chemotherapy was unsuccessful. The patient died 7 months after surgery.



## Introduction

Colorectal cancer (CRC) is the third most commonly occurring cancer worldwide. Over 1.8 million new cases occurred worldwide in 2020 [1]. CRC metastasizes to the lymph nodes, liver, or lungs as a usual distant metastasis. Based on autopsy studies, cardiac metastasis is seen in 2.0–18.3% of all cases [2, 3], but most cases are detected following postmortem studies. In actual clinical practice, cardiac metastasis from CRC is extremely rare, with a few cases reported in the literature. Here, we present a rare case of cardiac metastasis from CRC with no symptoms who underwent cardiac surgery.

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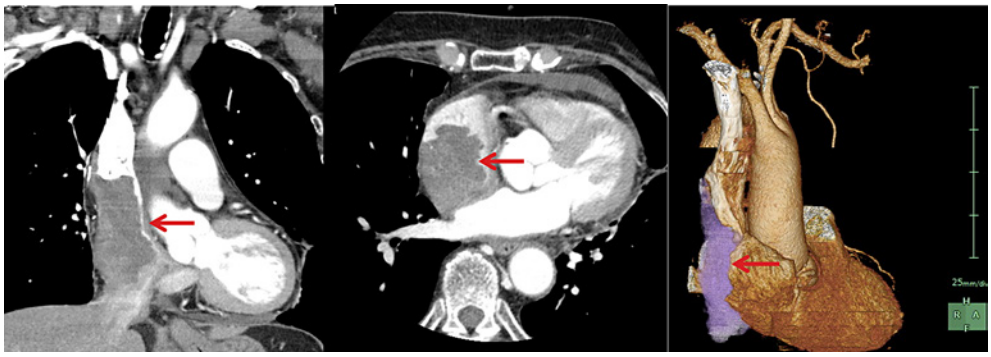

**Fig. 1.** CT scan revealed that the low-density mass was located in the right atrium, narrowing the superior vena cava.

## Case Report/Case Presentation

We present the case of a 73-year-old woman who underwent high anterior resection of a moderately differentiated adenocarcinoma of the rectum (pT4b [small bowel] N2b M1c [P1]) 3 years ago. The patient had no smoking exposure, cancer history, and comorbidities. The patient was administered 12 cycles of adjuvant modified FOLFOX6 (mFOLFOX6) (leucovorin, fluorouracil, and oxaliplatin) chemotherapy. She was closely observed for 3 years, and no evidence of recurrence was noted.

A follow-up contrast-enhanced multidetector computed tomography scan 3 years after surgery showed a mass in the right atrium (shown in Fig. 1). There was no evidence of recurrence without the cardiac tumor. She had no subjective symptoms. Laboratory tests revealed an elevated carcinoembryonic antigen level of 6.4 ng/mL. Myocardial aspiration biopsy with right heart catheterization showed atypical columnar epithelial cells with an irregular karyotype, which was diagnosed as metastatic adenocarcinoma.

These findings indicated that the tumor in the right atrium was metastatic cancer originating from rectal cancer. There was concern about obstruction due to the tumor. Therefore, we decided to perform surgical tumor resection. The patient underwent a median sternotomy, and the tumor in the right atrium was resected. The atrial wall defect was reconstructed using bovine pericardium.

The atrial mass showed a nodular necrotic appearance measuring 55 mm × 35 mm × 30 mm. Histological examination revealed adenocarcinoma, identical to the primary lesion (shown in Fig. 2). The metastatic tumor tissue genotype (*RAS* mutant/*BRAF* wild/*microsatellite instability-stable*) was examined.

The postoperative course was uneventful, and the patient was discharged from our hospital 14 days postoperatively. A follow-up positron emission tomography-CT scan 2 months after surgery showed cardiac and right adrenal recurrence. The patient was treated with mFOLFOX6 and FOLFIRI (leucovorin, fluorouracil, and irinotecan) chemotherapy, but the treatment was ineffective, and the patient died of superior vena cava syndrome and heart failure 7 months after surgery.

## Discussion/Conclusion

Cardiac metastasis of noncardiac malignant tumors occurs in about 10% of cases based on autopsy studies [4–6]. Of these, only 10% are clinically symptomatic. In addition, even if there are symptoms, the symptoms may be similar to those of other differential diagnoses [7].

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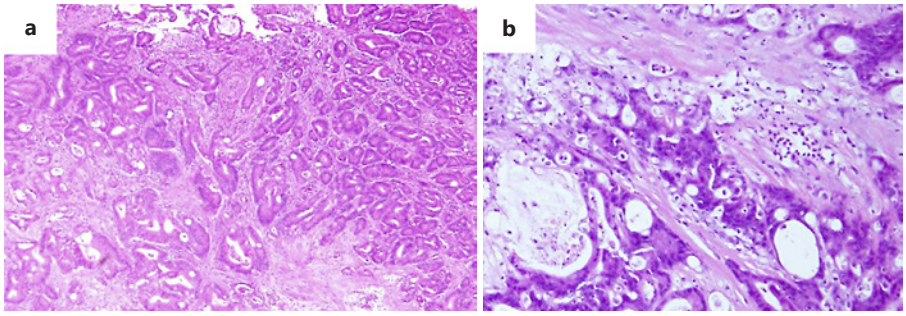


**Fig. 2.** Pathological findings. **a** An infiltrating moderately differentiated primary rectal adenocarcinoma. **b** The cardiac tumors are composed of tubular adenocarcinoma with partial mucus production. The features are consistent with metastatic rectal adenocarcinoma.

Therefore, only 1% of the total malignancies have clinically symptomatic cardiac involvement [8]. The most common primary lesions are lung and breast malignancies, lymphoma, leukemia, and malignant melanoma [9]. Cardiac metastasis from CRC is very rare, accounting for 1.2% in the large autopsy series [3]. Furthermore, since metastases to the heart usually occur due to multiple organ metastases, solitary cardiac metastasis such as in this case is extremely rare. In the literature, there are only 14 case reports of surgery for cardiac metastases from CRC (including our case) (Table 1) [10–22].

The cardiac metastasis mechanism is thought to be as follows: (a) direct extension: Klatt and Heitz [23] suggested that as the lungs are close to the heart, metastases can reach the heart directly; (b) hematogenous spread: Patel et al. [24] reported the ability of tumor embolization to invade the heart through the portal circulation via the vena cava and liver without seeding into it; and (c) lymphatic spread: Mukai et al. [2] suggested that intralymphatic retrograde metastasis due to mediastinal lymph node metastasis was the major pathway in gastrointestinal cancer.

Cardiac metastasis locations include the pericardium, myocardium, and endocardium, with the pericardium being the most common site. About two-thirds of heart metastases are associated with the pericardium (69.4%), one-third with the epicardium (34.2%) or myocardium (31.8%), and only 5% with the endocardium [3]. Contrarily, in CRC, metastasis in the endocardium is high. In principle, surgical resection is considered when metastatic lesions are localized in cases of CRC, but in cases of cardiac metastasis, there are some problems in considering surgery.

First, cardiac surgery has high complications and mortality rates. According to our review, out of the 14 reported cases, 5 cases died early after surgery without being discharged. Therefore, the indications for cardiac surgery should be carefully considered. However, several reports described the usefulness of surgery based on significant improvement in survival times [17, 25]. Recently, the number of hospital deaths has decreased, as shown in Table 1. This is thought to be due to improved management after heart surgery. Therefore, if curative resection is possible, it is considered appropriate to select surgery after careful consideration of the surgery risks.

Second, cardiac metastasis has a high postoperative recurrence rate. In our case, recurrence was observed early after surgery. As mentioned previously, cardiac metastases are often asymptomatic, and in some cases, chemotherapy is administered as systemic treatment with a good course [26, 27]. Recently, there have been many systemic chemotherapy regimens with high response rates, which may effectively prevent postoperative recurrences. However, in our case, the risk of heart failure and embolism due to the tumor was high; thus, surgery

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**Table 1.** Reported antemortem cases of cardiac metastasis of colorectal cancer that underwent surgical resection

| Author, year | Age/sex | Tumor location | Histological type | Stage | Diagnostic modality | Cardiac site | Tumor size, mm | Interval, month | Symptom | Curative resection | Postoperative chemotherapy | Outcomes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Henuzet (1982) [10] | 60/M | Rectum | Tub2 | NA | TTE | RV and PV | 20 | NA | Anorexia and dyspnea | Yes | No | Dead/in-hospital death |
| Nishida (1991) [11] | 69/M | Colon | Tub2 | NA | TTE and MRI | RA | 100 | 7.9 | Dyspnea and chest pain | Yes | No | Dead/in-hospital death |
| Parravicini (1993) [12] | 47/M | Rectum | NA | NA | Surgery | RV | 100 | 24 | SVC syndrome | Yes | Fluorouracil and levamisole | Dead/8 months |
| Koizumi (2003) [13] | 65/M | Colon | Tub1 | III | TTE | RA | 60 | 19 | SVC syndrome | No | No | Dead/11 months |
| Lui (2004) [14] | 71/F | Rectum | Tub | II | TTE, CT, and MRI | RV and RVOT | 50 | 108 | Dyspnea | No | No | Dead/in-hospital death |
| Oneglia (2005) [15] | 70/F | Colon | Tub2 | III | TTE and TEE | RV and TV | NA | 24 | Dyspnea | Yes | No | Dead/in-hospital death |
| Choi (2009) [16] | 70/M | Colon | Tub2 | IV | TTE | RA | 55 | 0 | Dyspnea and bloody stools | Yes | No | Dead/in-hospital death |
| Butler (2012) [17] | 77/F | Rectum | Tub1 | III | CT | RA | NA | 204 | None | Yes | FOLFOX and bevacizumab | Alive/2 years with recurrence |
| Kasama (2014) [19] | 72/M | Colon | Tub1 | III | CT | RA | NA | 180 | Dyspnea | No | No | Dead/3 months |
| Reisenauer (2015) [20] | 67/M | Rectum | NA | III | CT | LA | 76 | 12 | NA | Yes | Yes/NA | Alive/6 weeks |
| Bianchi (2016) [18] | 77/F | Colon | Tub |  | TTE and PET-CT | RA | 41 | 24 | Dyspnea | Yes | FOLFIRI and bevacizumab | Dead/3 months (PE) |
| Namireddy (2017) [21] | 51/M | Rectum | Por | III | CT, MRI, and PET-CT | RA | 35 | 12 | Dyspnea and syncope | No | Yes/NA | Dead/3 months |
| Elbatarny (2019) [22] | 59/M | Colon | NA | NA | TTE and MRI | RV | NA | 204 | Chest pressure, fatigue, and nausea | No | No | NA |
| Our case | 73/F | Rectum | Tub2 | IV | CT and PET-CT | RA | 40 | 36 | None | Yes | FOLFOX and FOLFIRI | Dead/7 months |

NA, not applicable; Tub, tubular adenocarcinoma; Tub2, moderately differentiated tubular adenocarcinoma; Tub1, well-differentiated tubular adenocarcinoma; Por, poorly differentiated adenocarcinoma; TTE, transthoracic echocardiography; MRI, magnetic resonance imaging; CT, computed tomography; TEE, transesophageal echocardiography; PET, positron emission tomography; RV, right ventricular; PV, pulmonary valve; RA, right atrium; RVOT, right ventricular outflow tract; TV, tricuspid valve; SVC, superior vena cava; FOLFOX, leucovorin, fluorouracil, and oxaliplatin; FOLFIRI, leucovorin, fluorouracil, and irinotecan; PE, pulmonary embolism.

was performed immediately. In this way, patients with cardiac metastases are often in urgent condition and may not be able to afford preoperative chemotherapy.

In conclusion, we presented an extremely rare case of isolated cardiac metastasis from CRC. In our case, the patient had a risk of obstruction of the vena cava due to the tumor, so we had to perform surgery first. There are no standardized guidelines for treating patients with cardiac metastases from CRC. Thus, it is necessary to collect more cases and establish a more effective treatment approach.

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## Statement of Ethics

This study was exempted from ethical approval by the Ethics Committee of the Hiratsuka Kyosai Hospital. Written informed consent for publication of this case and clinical dates was obtained from the patient. Written informed consent was obtained from the patient's next of kin for publication of the details of their medical case and any accompanying images.

## Conflict of Interest Statement

The authors have no conflict of interests to declare.

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## Author Contributions

Koji Numata made a major contribution to writing the manuscript. Nozomi Urata, Yuta Nakayama, Ayano Tanaka, Mihwa Ju, Hirotaka Nakayama, Kazuki Yamanaka, Shinsuke Hatori, Osamu Matsubara, Yasushi Rino, and Kazuyuki Tani read and approved the final manuscript.

## Data Availability Statement

All data generated or analyzed during this report are included in this article. Further inquiries can be directed to the corresponding author.

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