Metastatic Cardiac Papillary Carcinoma Originating From the Thyroid in Both Ventricles With a Mobile Right Ventricular Pedunculated Tumor

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A 62-year-old man with a history of surgical therapy for papillary thyroid carcinoma was admitted because of chest pain, dyspnea on effort, pretibial edema, and slight fever. An electrocardiogram showed ST segment elevation in the precordial leads and low voltage in the limb leads. A large solid mass was demonstrated in both ventricles, with pericardial effusion, by echocardiography, thoracic computed tomography scan, transesophageal echocardiography, and angiography. A punch biopsy of the tumor revealed metastatic papillary carcinoma. During radiation therapy, the patient suddenly died of ventricular fibrillation. At autopsy, the tumor occupied almost the entire right ventricular cavity, expanding toward the main trunk of the pulmonary artery with a mobile peduncle and it had infiltrated the left ventricular wall through the interventricular septum. Microscopic examination confirmed metastatic papillary thyroid carcinoma. Only 2 other cases of cardiac metastases of papillary thyroid carcinoma have been reported and this case is the first report of metastases in both ventricles with a mobile right ventricular pedunculated tumor. (*Jpn Circ J* 2000; 64: 890–892)

Key Words: Metastatic cardiac tumor; Papillary thyroid carcinoma; Sudden death; Ventricular infiltration

A 62-year-old man had been well until 6 months prior to admission, when he visited an outpatient clinic of another hospital complaining of hoarseness and goiter. The diagnosis was papillary thyroid cancer and the patient underwent total thyroidectomy with right modified radical neck dissection and left lateral neck dissection. At that time, no abnormal mass was recognized in the heart, although an echocardiogram showed a slight dilatation of the left ventricular cavity and an ECG revealed T wave inversion in all precordial leads. After discharge the patient was prescribed supplementary thyroxine.

The patient was admitted to Kansai Electric Power Hospital in April 1999 because of chest pain, pretibial edema, and dyspnea on effort. On admission, his temperature was 36.9°C, pulse rate was 102 beats/min, and respiration was 20 /min. Blood pressure was 160/97 mmHg. There were a few rales in both the lower lung fields and a grade 3/6 systolic murmurs with S₃ gallop rhythm were audible in the 4th intercostal space of the left sternal border and the apical area. No friction rub was audible. Pretibial and facial edema was noted and the neck veins were dilated. Neither hepatomegaly nor splenomegaly was noted. There was no elevation in creatine kinase, creatine kinase MB, lactate dehydrogenase or troponin. A thoracic radiograph showed cardiomegaly (cardiothoracic ratio, 68%) with bilateral pleural effusion. An ECG showed low voltage in all leads and concave ST segment elevation in leads I, II, aVL, and V₂₋₆ (Fig 1). A 2-dimensional echocardiogram revealed a giant, hyperechoic

mass occupying the right ventricular cavity and the apical half of the left ventricular cavity, with pericardial effusion. Both moderate tricuspid regurgitation and mild mitral regurgitation were detected by a Doppler echocardiogram. A computed tomography scan of the chest showed a heterogeneous mass distributed in both ventricles and which also expanded to the main trunk of the pulmonary artery via a mobile peduncle. Similar findings were confirmed by transesophageal echocardiography (Fig 2). A 67-Gallium (⁶⁷Ga) scintigram showed an accumulation of ⁶⁷Ga in the heart, but no accumulation of 201-Thallium (²⁰¹Tl) was seen in a ²⁰¹Tl scintigram. The serum levels of thyroglobulin, free T₃, free T₄, and thyroid stimulating hormone (TSH) were all within normal limits. Cardiac catheterization revealed the following findings: pulmonary capillary wedge pressure 14, pulmonary artery 25/9, right ventricle 22/2, right atrium 3, aorta 127/67,

Fig 1. ECG showing low voltage in all leads and concave ST segment elevation in leads I, II, aVL, and V₂₋₆.

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Fig 2. (Upper) Transesophageal echocardiography revealed a giant hyperechoic mass in the right ventricular cavity expanding to the main trunk of the pulmonary artery through the right ventricular outflow tract (arrows). (Lower) Right atrial angiography shows a large mass defect in the right ventricular cavity and a swinging mass in the main trunk of the pulmonary artery (arrows). LA, left atrium; PA, pulmonary artery; RV, right ventricle.

left ventricle 140/16 mmHg, cardiac output 4.51 L/min, cardiac index 2.95. Coronary arteriography showed no abnormal findings. Left ventriculography revealed left ventricular deformity because of the compression by the right ventricular mass, and right atrial angiography also showed the large mass defect in the right ventricular cavity expanding toward the main trunk of the pulmonary artery with a mobile peduncle (Fig 2). A punch biopsy of the tumor in the right ventricular apical myocardium was performed by a sub-xiphoid approach and histology revealed metastatic poorly differentiated papillary thyroid carcinoma. During the first week of admission the patient was medicated with diuretics and the symptoms improved. The infiltration of the malignant tumor was so extensive that surgical therapy was not indicated, and radiation therapy was started. On the 27th hospital day, 6 days after receiving radiation therapy of 2 Gy per day, the patient suddenly died of ventricular fibrillation without any significant or warning arrhythmias.

At autopsy, the heart weighed 770 g. The yellow-gray tumor occupied almost the entire right ventricular cavity (Fig 3) and had infiltrated the left ventricular wall through the anterior portion of the interventricular septum. Both the left kidney and the left adrenal gland had metastases. The histology of the cardiac tumor, and that of the kidney and the adrenal gland, revealed poorly differentiated papillary thyroid carcinoma (Fig 3). The malignant cells had infiltrated the endo-, myo- and epicardium of the right ventricle.

Fig 3. (Upper) Transverse section of the heart. The yellow-gray tumor occupies almost the entire right ventricular cavity and has infiltrated the left ventricular wall through the anterior portion of the septum. RV, right ventricle; IVS, interventricular septum; AW, anterior wall; LV, left ventricle. (Lower) Poorly differentiated papillary thyroid carcinoma (H&E, $\times 100$).

Discussion

Almost all malignant tumors can metastasize to the heart and the incidence of cardiac metastases (pericardium, myocardium, and endocardium) cited in necropsy studies varies from 0.24 to 6.45%.^{1,2} The most common primary malignancies, in decreasing frequency, are lung (31.6%), lymphoma (15.8%), breast (12.8%), leukemia (13.7%), stomach (5.3%), melanoma, liver, and colon (3.2%).³ The myocardium is the most common site (53.9%) followed by the pericardium (28.4%), epicardium/pericardium (13.7%), and endocardium (3.9%).³ Thyroid tumors rarely metastasize to the heart. Gassman et al reported that in 4,124 consecutive autopsies there were no myocardial metastases of thyroid cancers.⁴ Abraham et al reported similar observations from 3,314 consecutive autopsies,⁵ but McAllister and Fenoglio reported 6 (0.18%) myocardial metastases of thyroid cancers in 3,248 autopsies.⁶ To the best of our knowledge only 13 cases of cardiac metastases of thyroid cancers have been reported, and only 2 cases of metastatic papillary thyroid carcinomas.⁶⁻¹²

In the present case, autopsy revealed widespread metastases to all layers of the heart. The signs and symptoms of cardiac metastases are related to the extent and localization of the disease. The pericardial effusion and ST elevation were compatible with the pericardial metastasis. The tumor occupied almost the entire right ventricle and part of the left ventricle, which might have caused the congestive heart failure. The patient died suddenly of ventricular fibril-

lation probably caused by prolapse of the mobile, pedunculated mass into the pulmonary valve orifice, resulting in right ventricular outflow obstruction.

Papillary thyroid carcinoma tends to spread by lymphatic invasion⁹ but in the present case there were no other lung or mediastinal metastases, only left kidney and left adrenal gland tumors, so the hematogeneous route to the heart is most likely. This is a rare case of cardiac metastasis of papillary thyroid carcinoma and we believe to be the first report of such a tumor that occupied almost the entire right ventricular cavity with a mobile peduncle and that had infiltrated the left ventricular wall through the interventricular septum. Metastatic tumors of the heart should be considered when new cardiac symptoms or ECG changes occur.

References

1. Dimmette RM: The anteromortem diagnosis of secondary tumors of the heart; report of 4 cases. *US Armed Forces Medical Journal* 1950; **1**: 750–758
2. DeLoach JF, Haynes JW: Secondary tumors of the heart and pericardium. *Arch Intern Med* 1953; **91**: 224–249
3. Abraham KP, Reddy V, Gattuso P: Neoplasms metastatic to the heart: Review of 3314 consecutive autopsies. *Am J Cardiovasc Pathol* 1990; **3**: 195–198
4. Gassman HS, Meadows R Jr, Baker LA: Metastatic tumors of the heart. *Am J Med* 1955; **19**: 357–365
5. McAllister HA Jr, Fenoglio JJ: Tumors of the cardiovascular system. In: Atlas of tumor pathology. Armed Forces Institute of Pathology, Washington DC, 1978: 1–46, 111–119
6. Chiewvit S, Pusuwan P, Chiewvit P, Pleehachinda R, Attanatho V, Mongkharuk J: Metastatic follicular carcinoma of thyroid to pericardium. *J Med Assoc Thai* 1998; **81**: 799–802
7. Clare-Salzer MJ, Van Herle AJ, Varki NM, Tillisch J: Endocardial metastasis of follicular thyroid carcinoma: A case report and review of the literature. *Eur J Surg Oncol* 1991; **17**: 219–223
8. Hara K, Ohno M, Takenaga M, Tsuneyoshi H, Takeuchi H, Kashida M, et al: Metastatic thyroid cancer to the right ventricle causing obstruction of the right ventricular outflow tract and associated with disseminated intravascular coagulopathy: A case report. *J Cardiol* 1986; **16**: 765–773
9. Kasprzak JD, Religa W, Krzeminska-Pakula M, Marszal-Marciniak M, Zaslonka J, Pawlowski W: Right ventricular outflow tract obstruction by cardiac metastasis as the first manifestation of follicular thyroid carcinoma. *J Am Soc Echocardiogr* 1996; **9**: 733–735
10. Murata S, Kobayashi A, Nakajima H: Surgical resection of cardiac metastasis of thyroid cancer: A case report. *Nippon Kyobu Geka Gakkai Zasshi* 1991; **39**: 219–223 (in Japanese with English abstract)
11. Larsimont D, Renard N, Andry G: Death from myocardial metastasis of thyroid cancers. *Ann Chir* 1998; **52**: 465–468
12. Glaser M, Parry R, Davis K: Papillary carcinoma of the thyroid with cardiac metastasis. *Br J Clin Pract* 1981; **35**: 52–53