ABNORMAL ELECTROCARDIOGRAMS RESEMBLING MYOCARDIAL INFARCTION IN A CASE OF RETICULUM CELL SARCOMA

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A rare and instructive case of cardiac involvement by reticulum cell sarcoma in a 72-year-old woman was presented. In this case acute myocardial infarction was suspected on an electrocardiogram but was proved absent, and only scattered tumor infiltration was demonstrated at autopsy.

CARDIAC involvement by malignant neoplasms has been considered to be relatively uncommon.¹⁻³ Electrocardiographic changes due to myocardial infiltration with tumor vary in many different ways,¹⁻⁴ but, in general, the electrocardiogram has not been particularly helpful in the diagnosis of cardiac tumor.⁴

The present report shows a patient with reticulum cell sarcoma demonstrated typical characteristics of myocardial infarction with chest pain and electrocardiographic changes with abnormal Q waves and ST-segment elevation but elevation of cardiac enzymes was absent and was proved to have myocardial infiltration by malignant lymphoma at autopsy.

CASE REPORT

A 72-year-old woman was admitted to our hospital due to severe chest pain and dyspnea on April 9, 1977. She had been suffered from recurrent growing tumors in multiple regions of the

skin such as the neck, axillae, abdomen and the back since 1975. The tumor was diagnosed as reticulum cell sarcoma by the lymphnode biopsy. Chemotherapy with methotrexate and ⁶⁰Co irradiation had been performed without satisfactory effects. Chest X-ray one month prior to admission revealed abnormal shadows in the right lower lung field (Fig. 1). On April 9, 1977 she woke up early morning with severe anterior chest pain, and was admitted to our hospital in emergency. She was thin and small, and with cold extremities. Pulse rate was 122/min and irregular. Blood pressure was 80/60 mmHg. Systolic murmur of Grade 2/6 were audible at the apical area. Sibilant sounds were present in the right lower lung field. There were several nodes palpable subcutaneously with a size of finger-tip in the abdomen, axillae and the neck.

An electrocardiogram on admission showed atrial fibrillation, ST-segment elevation in leads II, III, aVF and V₄₋₆ and abnormal Q wave in leads V₁₋₃ suggestive of anterior and inferior myocardial infarction (Fig. 2). There was no elevation in serum enzymes except lactic dehydrogenase (Table I). Neither leucocytosis nor increased blood sedimentation rate was present. Serum creatinine phosphokinase was 29 mU/ml on admission and did not rise any more after

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Fig.1. The chest X-ray showed cardiomegaly and an abnormal round shadow in the right lower lung field.

admission. Cardiac output measured by the thermodilution method was markedly decreased to 1.03 L/min/m² (Table I).

Fig.2. The electrocardiogram on admission showed atrial fibrillation, ST-segment elevation in leads II, III, aVF and V₄₋₆ and abnormal Q wave in leads V₁₋₃ suggestive of acute anterior and inferior myocardial infarction.

TABLE I LABORATORY DATA

	9/IV	10/IV	11/IV	13/IV	16/IV
CPK	29	25	27	21	21
GOT	37	25	27	27	35
LDH	525	495	560	560	600
PA	16/8	17/8	14/9	—	—
CO	1.24	2.14	2.43	2.93	—
ΣST	140	82	19	—	—

Shortly after admission, her cardiac rhythm returned to sinus rhythm, but atrioventricular block progressed to complete block. In spite of temporal pacing, she died of pump failure on the 9th hospital day.

Electrocardiograms (Fig. 3) demonstrated sequential changes with returning of ST-segment to the baseline and reappearance of small r waves in precordial leads.

AUTOPSY FINDINGS

There was a 8 × 8 cm in size tumor in the head of the pancreas which was considered to be a primary lesion. The microscopic studies showed that tumor cells had scant cytoplasm and vesicular nucleus with occasional pleomorphic changes (Fig. 4). Reticulum staining showed a faint but fine network of reticulum. The malignant cells were metastasized to multiple sites, including both lungs, heart, pericardium, ribs, diaphragm, both adrenal glands, the skin and lymphnodes at the para-aortic, subclavian, paratracheal, both hilar and mesenteric areas. There was pleural and pericardial effusion. The heart weighed 350g and demonstrated an infiltration of the malignant tumor forming multiple bean-size nodules in the right atrium, the anterior wall of the right ventricle and the posterior portion of the septum. Subendocardial and subepicardial infiltration were observed. Tumor invasion was also present in the S-A and A-V nodes and the right and left bundle branches. The normal tissue of the A-V node was essentially replaced by malignant cells. Narrowing of each major coronary artery was less than 50%. The wall thickness of the left ventricle was 14 mm in the upper third of the free wall and mild hypertrophy of the myocardial cells was detected. There was no evidence of massive fibrosis and coagulation necrosis in the left ventricle. Microthrombi in the small and microvessels were not noted in the heart, kidney, and lungs.

Fig.3. Serial electrocardiograms demonstrated sequential changes with returning of ST-segment to the baseline except in lead V_4 and appearance of small r waves in precordial leads.

Fig.4. Malignant cells of reticulum cell sarcoma had infiltrated in the myocardium.

DISCUSSION

Frequency of cardiac metastasis at autopsy

varies from 2% to as high as 21%, and the most frequent tumors which involve the heart are carcinoma of the lung, carcinoma of the breast

and malignant melanoma.¹⁻⁴ The incidence of cardiac infiltration in leukemia and malignant lymphomas is also quite high, varying from 20-40%.¹⁻⁷ The most common type of malignancy was reticulum cell sarcoma with an incidence of 21 to 67% at autopsy.^{2,5,6}

Cardiac metastasis were associated with symptoms and signs suggestive of heart disease in only 8.5% of the patients,⁴ and antemortem diagnosis is less frequently made. Electrocardiographic findings were usually nonspecific but possibly suggestive of morphologic alterations.^{1-4,6} The latter changes will include various arrhythmias or conduction disturbances, and Q-wave, ST-segment or T-wave abnormalities, resulting from injuries to the conduction system, pericardium, myocardium and/or coronary vessels.^{1-4,6-8} However, pathologic Q-waves and pronounced ST-segment elevation were rarely seen. Such an instance was first described by Rosenbaum et al. in 1944.⁹ The patient had carcinoma of the esophagus with massive metastasis to the heart. Harris and associates, in 1965, reported a case of bronchogenic carcinoma with metastatic tumor in the heart.¹⁰ The patient demonstrated progressive and prolonged ST-segment elevation and abnormal Q-waves comparable to the present case. Serial enzymes of sGOT and LDH were within a normal range. In 1977, Akaike described a patient with myocardial infarction due to metastasis of choriocarcinoma of the uterus.¹¹ His case demonstrated serial enzymatic changes of myocardial infarction.

Our present case was characterized by abnormal Q waves and pronounced ST-segment elevation resembling myocardial infarction, but no elevation of serial cardiac enzymes occurred. These electrocardiographic changes are considered to be due to injury current by neoplastic infiltration into the myocardium¹⁰ rather than acute pericarditis. When progressive neoplastic infiltration involves the myocardial cell membrane, transmembrane ionic gradient would alter resulting in a loss of intracellular potassium and an increase in intracellular sodium in the heart. Furthermore, potassium ions would be transferred from necrotizing tissue of tumor to surrounding healthy myocardium, whose depolarization would be disturbed by alternation of transmembrane ionic gradient. When pathologic Q-waves and ST-segment elevation occurred in this patient, transmural changes of the ionic gradient in the anterior wall of the myocardium was suspected to be present. But there was no

tumor invasion in this region, and such ionic changes were considered to be due to indirect influences by the potassium leaving injured cells. After several days, when the effect of potassium efflux had diminished, small r waves would appear and ST-segment would return to the baseline.

Pericarditis might cause ST-segment elevation, but not abnormal Q waves. It has been reported^{12,13} that abnormal Q waves, generally thought to indicate transmural myocardial damage, are frequently found associated with subendocardial damage. It might have been so in this case, but there was no infarction. It is difficult to explain the reappearance of small r waves by myocardial infiltration of malignant cells alone.

Thus, this case was considered to demonstrate a very rare case of tumor cell infiltration suggesting ST-segment elevation due to injury current and abnormal Q waves due to electrical silence of the myocardium, mimicking myocardial infarction.

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