Cardiac Tumor Biopsy Under the Guidance of Intracardiac Echocardiography

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Transthoracic echocardiography or transesophageal echocardiography is sometimes useful in intracardiac tumor biopsy. Intracardiac echocardiography was used as an alternative to either of these for performing a biopsy of a right cardiac tumor in a 79-year-old woman. The procedure was well tolerated and no complications occurred. Histopathological findings and immunohistochemical staining were compatible with the diagnosis of neurogenic sarcoma. (Jpn Circ J 2000; 64: 638–640)

Key Words: Cardiac tumor; Intracardiac echocardiography; Myocardial biopsy

The recent development of echocardiography has facilitated the detection of cardiac tumors. However, a biopsy is still necessary for making the final diagnosis and establishing the therapeutic strategy. In the case of primary cardiac tumors, surgery is the first-choice therapy, but for secondary malignant tumors, and even in the case of primary cardiac tumors with metastasis, chemotherapy and/or radiotherapy are the first-choice therapies. When tumor biopsy is performed, confirmation of the position of the tumor is very important and usually transesophageal echocardiography (TEE) is used to monitor the procedure. However, this method sometimes requires general anesthesia. In the present case, we used intracardiac echocardiography (ICE) to guide the bioprobe to the tumor and we describe here the usefulness of this technique.

Case Report

The patient, a 79-year-old woman, presented with the complaint of exertional dyspnea and systemic edema and was admitted to hospital for evaluation of these symptoms. Physical examination confirmed the systemic edema and revealed dilation of the jugular veins. Her pulse rate was 110 beats/min and her blood pressure was 132/80 mmHg. No rales were detected on lung auscultation. Cardiac auscultation revealed normal S1 and S2 with no murmur, rub or gallop. The chest roentgenogram showed an enlarged cardiac silhouette, but no lung congestion or pleural effusion. The electrocardiogram demonstrated normal sinus rhythm with negative T waves in leads V1 through V3. A transthoracic echocardiogram (TTE) demonstrated massive pericardial effusion, but did not clearly demonstrate the presence of any tumor (Fig 1). Clinical symptoms improved after sanguineous fluid was removed from the pericardial space. Gram staining and culture of the fluid revealed neither bacteria nor mycobacteria and malignant cells were not found. Further examination using magnetic resonance imaging was performed 3 weeks later and a 7.5x7.0 cm mass was disclosed at the medial side of the right atrium, extending to the right ventricle (Fig 2). Masses with the same intensity were detected in the liver (Fig 2) and the thoracic vertebra. Considering the pericardial effusion, the cardiac mass was suspected to be a malignant tumor.

Although the patient suffered from severe pharyngeal reflex, TEE clearly delineated the tumor 3 weeks after admission. The right atrium was enlarged and the tricuspid valve was slightly compressed by the tumor (Fig 3), but without tricuspid regurgitation. At this time TTE also detected the tumor (Fig 4), but did not delineate it as clearly as TEE (Fig 3). Selective coronary angiography showed an extensive neovascular network supplied by the right coronary artery (Fig 5A), and the proximal-mid portion of the right coronary artery did not move during cardiac cycles because it was compressed by the tumor.

Percutaneous biopsy was performed with the patient in the supine position. A catheter bioprobe was advanced through a 9F sheath in the right femoral vein up to the right atrium. An ICE system consisting of a 10F, 10 MHz imaging catheter (Boston Scientific, Boston, MA, USA) and a CVIS imaging console (Clear View, Boston Scientific) gave excellent anatomic identification of the tumor and guidance of the bioprobe, which was advanced through a 10F sheath in the left femoral vein up to the right atrium. ICE demonstrated the tumor protruding toward the cavity of the right atrium (Fig 6). It was less echogenic than the atrial wall and was inhomogeneous. Under both ICE and fluoroscopic guidance, the bioprobe was directed toward the tumor and some surface specimens were obtained (Figs 5B, 6). The procedure was well tolerated under only local anesthesia and no complications related to the procedure occurred.

The histopathological (Fig 7) and immunohistochemical findings of the biopsy specimens were compatible with a diagnosis of neurogenic sarcoma.
Fig 1. Transthoracic echocardiography on admission showing massive pericardial effusion (PE), but no tumor.

Fig 2. Magnetic resonance imaging 3 weeks after admission disclosing a 7.5x7.0cm mass in the right atrium, extending to the right ventricle. A similar intensity mass can be seen in the liver.

Fig 3. Transesophageal echocardiography 3 weeks after admission delineates the tumor, showing the tricuspid valve compression.

Fig 4. Transthoracic echocardiography 3 weeks after admission detects the tumor, but does not delineate it as clearly as TEE. PE, pericardial effusion.

Fig 5. (A) Selective left-anterior, oblique coronary angiography showing an extensive neovascular network (arrows) supplied by the right coronary artery. (B) Fluoroscopy showing the biopotence directed toward the tumor.

Fig 6. Intracardiac echocardiography showing the biopotence in contact with the tumor, which is less echogenic than the right-atrial wall and is inhomogeneous (arrows). CT, crista terminalis.
Discussion

Primary malignant cardiac tumors are infrequent, whereas metastatic cardiac tumors are quite common with autopsy series involving subjects with malignancy revealing cardiac involvement in 12–20% of the cases. However, antemortem recognition of metastatic cardiac disease is sometimes difficult, but should be taken into consideration if a patient has pericardial effusion. Echocardiography, computed tomography or magnetic resonance imaging techniques must be employed to detect cardiac tumors. If these detect a cardiac mass, then biopsy is the preferred method for final diagnosis.

Traditionally, biopsy specimens of cardiac tumors are obtained at thoracotomy, but recently an alternative method, transvenous biopsy, has become more popular. Performing intracardiac biopsy under only fluoroscopic guidance limits the sites in the cardiac cavity from which samples can be obtained and can be hazardous. For transvenous intracardiac biopsy, echocardiography is useful not only to confirm the position of the tumor but also to guide the bioprobe. Thus, potentially serious complications are decreased. Trans-thoracic echocardiography is usually an excellent modality to delineate cardiac tumors, but in the present case, TTE on admission did not clearly detect the cardiac tumor, which was, however, detected by both TEE and TTE performed 3 weeks later. One possible reason is that the tumor on admission was too small to be detected by TTE, and another is that it is sometimes difficult to get a clear image of the medial side of the heart when using TTE. In the present case, TEE provided a clearer image of the cardiac tumor, but it can potentially cause patient discomfort and also require additional general anesthesia, and it has the drawback of exposing medical staff to X-rays while monitoring the cardiac tumor biopsy procedure. Another drawback of TEE is that the patient is at some risk of aspiration of saliva in the supine position.

In the present case, we used ICE in which, compared with TEE and TTE, the operator can handle the probe alone and so there is no exposure of personnel to X-rays. Although ICE enabled clear identification of the tumor’s position during the biopsy, it was somewhat difficult decipher the 3-dimensional image, which could make it less useful than TEE and TTE, especially in the case of smaller tumors. However, we consider that ICE is preferable to TEE and TTE in guiding the biopsy of a large cardiac tumor because it provides a clearer image than either of the 2 other techniques and because it can be performed by one operator. In addition, ICE does not cause patient discomfort nor does it require general anesthesia.

To the best of our knowledge, there is only one other report describing intra-cardiac biopsy under ICE, but we conclude that ICE-guided transvenous biopsy is a very useful method for diagnosing large cardiac masses and should be used more frequently.

References