

Tc99m-HMPAO white blood cell scintigraphy: added value of SPECT/CT for infection diagnosis in cardiothoracic surgery

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Abstract

We report a case of a woman who came to our attention because of fever and a sternal fistula draining purulent fluid. Four years before, she had undergone cardiothoracic surgery to place a patch because of a myocardial rupture. Under suspicion of a deep mediastinal infection, a Tc99m-HMPAO white blood cell (WBC) scintigraphy was performed. The use of planar imaging and single photon emission computed tomography (SPECT/CT) imaging allowed the identification of a sternal infection, which involved the anterior mediastinum up to pericardium and diaphgram. SPECT/CT led to a precise diagnosis of a thoracic infection, providing the location and extent of the disease. This turned out useful to improve therapeutic strategies.

Introduction

Infection in cardiothoracic surgery is a major problem. Sternal wound infection after cardiac surgery is a relatively uncommon complication occurring in about 1-4% of all patients undergoing median sternotomy.1 However, the relatively high morbidity and mortality associated with these infection pose difficulties to clinical practice, both during diagnosis and treatment.1 Male gender and diabetes mellitus were deemed a risk factor of deep sternal wound infections.² Conventional imaging, like computed tomography (CT) or magnetic resonance imaging (MRI), is useful in order to identify anatomical details of an abscess, but cannot recognize the grade of activity and whether there is involvement of the surrounding structures. The use of hybrid imaging [single photon emission computed tomography (SPECT/CT)] can combine the high specificity and sentitivity of leukocytes scintigraphy with the anatomical details of the CT to identify mediastinal infections and evaluate the efficiency of antibiotic therapy.3 This case report describes the role of hybrid imaging in the complex area of the cardiothoracic surgery.

Case Report

In 2004, a 74-years-old woman suffered a heart attack due to an acute myocardial infarction complicated by a myocardial rupture and a ventricular septal defect. She underwent cardioCorrespondence: Stefano Panareo, Nuclear Medicine Unit, University-Hospital S. Anna, 44100 Ferrara, Italy. E-mail: s.panareo@ospfe.it

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surgical treatment during which a Teflon patch was applied in the apex region of left ventricle. In November 2008, the patient presented with fever and a thoracic fistula discharging purulent fluid close to the median sternotomy scar. Analysis of this fluid demonstrated a mixed infection of Proteus Mirabilis and Staphylococcus Aureus. Subsequently, the patient was admitted to our Nuclear Medicine Unit for a Tc99m-HMPAO WBC scintigraphy under suspicion of a deep infection. Both static planar (anterior and left anterior oblique views, 128×128 matrix, at hours 1, 3 e 24) and thoracic SPECT/CT at hours 24 using a Siemens Symbia T2 (Siemens Medical Solutions, Munich, Germany) were performed to detect the presence and extent of the infection process.



static scintigraphy (20 h after 1.v. injection). Black arrows show the collection of radiolabelled WBCs in thoracic wall and mediastinum; (b) SPECT/CT (axial, sagittal and coronal projections) with radiolabelled WBCs collection in the apex of left ventricular wall and in pericardium (white arrows); (c) SPECT/CT (axial and sagittal projections) with substernal collection of radiolabelled WBCs and fistulous pathway (white arrows).



Tc99m-HMPAO WBC scintigraphy showed a focal uptake of labeled leukocytes in the thoracic wall with a fistula reaching the anterior pericardium region (Figure 1a-c), indicating mediastinal-pericardial infection. A fistulography and a thoracic contrast enhanced multislice CT confirmed the abscess localization in retrosternal region, near pericardium and diaphragm (Figure 2a-b). In December 2008, the patient underwent further sternotomy to remove the fistula and to change the Teflon patch. Later, she followed a specific antibiotic therapy (levofloxacin) for three months.

In May 2009, three months after the end of antibiotic therapy, a Tc99m-HMPAO WBC scintigraphy showed complete disappearance of mediastinal and anterior pericardium uptake (Figure 3a). Currently, the patient remains disease-free as confirmed by the Tc99m-HMPAO WBC scintigraphy on February 2010 with planar and SPECT/CT acquisition (Figure 3b-c).



Figure 2. (a) Fistulography with iodine contrast agent spread; (b) 3D volumetric reconstruction of thoracic contrast enhanced multislice computed tomography with substernal pathological localization (white arrow).



Figure 3. (a) static views of thoracic Tc99m-HMPAO white blood count scintigraphy (20 h after i.v. injection) 3 months after the end of antibiotic therapy with normal findings; (b, c) 11 months planar and SPECT/CT (axial, sagittal and coronal projections) acquisition after the end of antibiotic therapy.



Discussion

In cardiothoracic surgery, post-operative infections are a serious cause of morbidity and mortality and are difficult to diagnose.4 Different techniques have been used to treat this serious complication (for example, autologous vascularized flaps, stand-alone antibiotic therapy or combined with surgery etc).1 Knowledge of the extent and involvement of the surrounding tissues is essential for the surgeon in order to select the appropriate therapy. In this clinical case, Tc99m-HMPAO WBC scintigraphy (planar and SPECT/CT) was very helpful, not only for infection diagnosis, but also in detecting which tissues are involved and determining therapeutic management and its effectiveness. SPECT/CT image fusion can overcome interpretative challenges in characterizing and localizing abnormalities for infectious processes, also in cardiothoracic district.5,6

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