Kardiologia Polska 2012; 70, 12: 1243–1249 ISSN 0022–9032

ARTYKUŁ ORYGINALNY / *ORIGINAL ARTICLE*

The usefulness of scintigraphy with ^{99m}Tc-Anti-Granulocyte antibody for diagnosis and follow-up in children with myocarditis

Lidia Ziółkowska[1], Wanda Kawalec[1], Maria Biernatowicz[2], Elżbieta Świątek-Rawa[2], Anna Kamińska[2], Anna Turska-Kmieć[1]

[1]Department of Paediatric Cardiology, The Children's Memorial Health Institute, Warsaw, Poland
[2]Department of Nuclear Medicine, The Children's Memorial Health Institute, Warsaw, Poland

Abstract

Background and aim: The aim of this study was to investigate whether scintigraphy with ^{99m}Tc-Anti-Granulocyte antibody is useful for diagnosis and follow-up in children with myocarditis, and to determine its correlation with endomyocardial biopsy (EMB) and clinical features.

Methods: A total of 11 children, mean age 13 years and presenting with symptoms of myocarditis, were evaluated at the time of initial presentation and 6, 12 and 24 months after the first study. In all patients, myocardial scintigraphy was performed with estimation of antigranulocyte antibody uptake. EMB was done in 10 patients at the time of initial presentation and in 8 patients after 6 months.

Results: In 10 (91%) patients, positive antigranulocyte uptake was observed, with EMB confirming myocarditis in 8 children. In scintigraphy after 6 months, positive uptake was found in 9 (82%) patients, with EMB performed in 8 patients showing persistent myocarditis; after 12 months, scintigraphy indicated positive uptake in 7 (64%), and after 24 months only in 4 (36%) patients.

Conclusions: 1. In 80% of patients with positive scintigraphy results, biopsy-proven myocarditis was observed. 2. The positive antigranulocyte uptake correlated with clinical features at diagnosis and in follow-up. 3. The control scintigraphy performed in follow-up after 6, 12, and 24 months allowed the evaluation of resolved or persistent myocarditis. 4. Myocardial scintigraphy results indicate that the inflammatory process in the myocardium decreases significantly after 12 months from the onset of the disease. 5. Scintigraphy with ^{99m}Tc-Anti-Granulocyte antibody seems to be a useful diagnostic method in myocarditis, but further studies are needed to establish its sensitivity and specificity.

Key words: myocarditis, endomyocardial biopsy, myocardial scintigraphy, ^{99m}Tc-Anti-Granulocyte antibody

Kardiol Pol 2012; 70, 12: 1243–1249

INTRODUCTION

Myocarditis (MYO) is characterised by the presence of inflammatory infiltrates in the myocardium, composed mainly of T lymphocytes, and necrosis or cardiomyocyte damage atypical for myocardial infarction. To place an ongoing inflammatory process in the myocardium, granulocytes migrate through the body's response to an infectious agent. Clinical diagnosis of MYO is difficult due to variable presentation ranging from asymptomatic cases to acute heart failure and sudden cardiac death. Endomyocardial biopsy (EMB) with immunohistochemical evaluation is a reliable but invasive procedure [1]. Therefore, a non-invasive diagnostic method is highly desirable, especially in a paediatric population. Literature on the issue shows that myocardial scintigraphy using technetium 99-labelled monoclonal antigranulocyte antibody (^{99m}TcAGA) is a very valuable non-invasi-

Address for correspondence:
Lidia Ziółkowska, MD, PhD, Department of Paediatric Cardiology, The Children's Memorial Health Institute, Al. Dzieci Polskich 20, 04–730 Warszawa, Poland, tel: + 48 22 8157370, fax: + 48 22 8157365, e-mail: l.ziolkowska@czd.pl
Received: 07.01.2012 **Accepted:** 13.09.2012

ve diagnostic method for focal and diffuse inflammatory changes in the myocardium in adult patients with suspected MYO and inflammatory cardiomyopathy [2, 3]. The usefulness of scintigraphy with ^{99m}TcAGA for diagnosis of MYO in the paediatric age group has not to date been evaluated. The aim of this study was to investigate whether scintigraphy with ^{99m}TcAGA is useful for diagnosis and follow-up in children with MYO and to determine its correlation with EMB and other clinical features.

METHODS

Study group

From 2005 to 2010, 11 children, 8 boys and 3 girls, aged 6.6–17 years, mean 13 ± 3.8 years, presenting with symptoms of MYO, were evaluated at the time of initial presentation and 6, 12 and 24 months after the first study. Patient demographics and clinical symptoms, as well as the results of echocardiography, 12-lead electrocardiography (12-lead ECG), 24-hour Holter electrocardiography (24-h Holter ECG), radionuclide angiocardiography, EMB, and myocardial scintigraphy were analysed.

In all children detailed data was collected, with a particular focus on recent 'flu-like' infections and the occurrence of clinical symptoms such as weakness, fatigue and chest pain. In all children New York Heart Association (NYHA) functional class and symptoms of heart failure were estimated. A control group consisted of 10 children without cardiovascular disease who underwent scintigraphy with ^{99m}TcAGA due to a suspicion of enterocolitis (heart-to-lung ratio [HLR] was 1.06–1.50). In echocardiographic examination, left ventricular (LV) dimension and function were assessed. LV end-diastolic dimension (LVEDD) was measured, and it was calculated as a percentage of the average standards in relation to body surface area (BSA). Additionally, the value of the LV fractional shortening (%SF) and ejection fraction (EF) were assessed. In 12-lead ECG cardiac repolarisation abnormalities (presence of T wave flattening or inversion) and in 24-h Holter ECG the occurrence of ventricular arrhythmias were evaluated. In radionuclide angiocardiography, the EFs of the left (LVEF) and right ventricle were assessed.

Myocardial scintigraphy

In all patients, myocardial scintigraphy with ^{99m}TcAGA (CIS bio Scintimun Granulocyte) was performed; with a dose of 12 MBq/kg body mass given intravenously, the effective dose of radiation was 1.04^{-2}mSv/MBq. Scintigraphic images were recorded 4 hours after tracer administration, in the anterior and posterior projection. The images covered the entire chest region. The study was performed with a Siemens gamma camera, using a high resolution collimator, matrix 128 × 128. Images were recorded at 1 million counts (about 4 min). Analysis of antigranulocyte scintigraphy was done by visual interpretation by an experienced observer unaware of the clinical data and by estimation of antigranulocyte antibody uptake by calculation of the HLR. For semi-quantitative calculation of the HLR, 3 regions of interest (ROI) of each lung and heart were outlined. HLR was the ratio of the number of counts over the heart to the average of both lungs, and a value above 1.50 was deemed a positive result.

Endomyocardial biopsy

EMB was done in 10 patients (1 patient did not consent to EMB) at the time of initial presentation, and in 8 patients (no consent to EMB in 2 patients, no indication for EMB in 1 patient) after 6 months. Three to 5 specimens from the right side of the interventricular septum were investigated to evaluate the inflammatory infiltration and myocyte necrosis characteristic of MYO. Immunohistological evaluation and typing of lymphocytes T, B, macrophages in myocardial tissue using specific monoclonal antibody directed against surface antigens of human lymphocytes (CD3, CD4, CD8, CD22, CD68) were done. Immunostaining of the endomyocardial bioptates with antigranulocyte antibody was also performed. Additionally, using antibodies against the intercellular adhesion molecule (ICAM-1), the activation of ICAM-1 was analysed. When the immunohistological analysis revealed pathologically increased lymphocytic infiltrates and an increased expression of ICAM-1, the biopsy result was classified as lymphocytic myocarditis. When neither the histological nor the immunohistological analysis revealed myocyte necrosis or lymphocytic infiltrates, the biopsy was classified as no MYO. The scintigraphic scan results were compared to EMB results and to clinical features.

All our studies have been approved by the ethics committee and have been performed in accordance with ethical standards. All participants gave their informed consent prior to their inclusion in the study.

Statistical analysis

The Friedman test and Cochran's Q test were used to compare the distributions of several related variables. While searching for a correlation between various variables, r Spearman correlation coefficient was used. While testing p values, < 0.05 were considered to indicate statistical significance.

RESULTS

The mean time from onset of symptoms of MYO to diagnosis was 2.5 months. In all patients in the period preceding clinical symptoms of MYO, a 'flu-like' infection occurred.

The clinical symptoms and the results of echocardiography, radionuclide angiocardiography and ECG, as well as myocardial scintigraphy and EMB performed at the time of initial presentation of MYO and in follow-up after 6, 12, and 24 months from the onset of disease are presented in Table 1.

Table 1. Clinical symptoms and results of cardiological tests performed at baseline and in follow-up after 6, 12, and 24 months

Clinical feature	Baseline	After 6 months	After 12 months	After 24 months
Fatigue	8 (73%)	6 (55%)	6 (55%)	4 (36%)
Chest pain	6 (55%)	3 (27%)	1 (9%)	1 (9%)
NYHA class I	3 (27%)	3 (27%)	9 (82%)	10 (91%)
NYHA class II	8 (73%)	8 (73%)	2 (18%)	1 (9%)
LVEDD (% average standards to BSA)	113 ± 21 (94–151)	110 ± 16.5 (89–137)	107.5 ± 13 (90–130)	105 ± 16.6(79–127)
LVSF (%)	33 ± 5.9 (23–38)	34 ± 7.9 (23–48)	34 ± 6.7 (25–45)	36 ± 5.3 (28–44)
LVEF e (%)	59 ± 12 (40–73)	61.5 ± 10 (42–81)	65 ± 12 (48–84)	66 ± 6.6 (54–75)
LVEF r (%)	52 ± 10 (37–67)	56 ± 6.6 (43–65)	58 ± 5.9 (48–67)	58.9 ± 4.3 (52–66)
T wave flattening	6 (55%)	6 (55%)	5 (45%)	4 (36%)
T wave inversion	7 (64%)	2 (18%)	2 (18%)	2 (18%)
Non-sustained ventricular tachycardia	1 (9%)	1 (9%)	1 (9%)	1 (9%)
Myocardial scintigraphy (HLR)	1.90 ± 0.49 (1.3–3.2)	1.87 ± 0.45 (1.3–2.9)	1.74 ± 0.48 (1.2–3.0)	1.65 ± 0.35 (1.4–2.4)
Positive antigranulocyte uptake	10 (91%)	9 (82%)	7 (64%)	4 (36%)
EMB	10/11	8/11	NP	NP
MYO	9 (90%)			
No MYO	1 (10%)			
Persistent MYO		8 (100%)		

NYHA — New York Heart Association; LVEDD — left ventricular end-diastolic diameter; LVSF — left ventricular fractional shortening; LVEF e — left ventricular ejection fraction in echocardiography; LVEF r — left ventricular ejection fraction in radionuclide angiocardiography; BSA — body surface area; HLR — heart-to-lung ratio in myocardial scintigraphy; EMB — endomyocardial biopsy; MYO — myocarditis; NP — not performed

In children with MYO, in the examination of endomyocardial biopsies with immunohistological staining, granulocytes were not found, either in the myocardium or in the vascular endothelium. In children with MYO, in endomyocardial specimens infiltration of lymphocytes, increased expression of ICAM-1 and features of cardiomyocyte injury and myocardial necrosis were present. Of 10 patients with positive antigranulocyte uptake, EMB was performed in 9 (no consent for EMB in 1 patient), and in 8 (80%) patients MYO was diagnosed. In 1 (9%) patient with positive antigranulocyte uptake (HLR 1.66), EMB results showed no features of MYO. In 1 (9%) patient with negative antigranulocyte uptake, EMB results showed evidence of MYO. At the time of initial presentation of MYO, clinical features such as LVEDD, LVEF in echocardiography, and LVEF in radionuclide angiocardiography associated with antigranulocyte uptake and correlation with HLR were present (Figs. 1–3).

Clinical features and their correlation with HLR value were as follows: fatigue (rs –0.26; p = NS), chest pain (rs 0.06; p = NS), NYHA class (rs 0.29; p = NS), T wave flattening (rs 0.03; p = NS), T wave inversion (rs –0.42; p = NS), non-sustained ventricular tachycardia (rs –0.22; p = NS), LVEDD (ECHO) (rs –0.06; p = NS), %SF (rs –0.20; p = NS), LVEF (ECHO) (rs –0.23; p = NS), and LVEF (r) (rs –0.14; p = NS).

All 11 patients were followed for 24 months from the time of initial presentation and diagnosis of MYO. During the consecutive four hospitalisations, the number of children with chest pain decreased significantly (p = 0.023), and the NYHA functional class significantly improved (p = = 0.001). Fatigue occurred in fewer patients, but this difference was not statistically significant (p = 0.34). The mean LVEDD in echocardiography decreased during 24 months

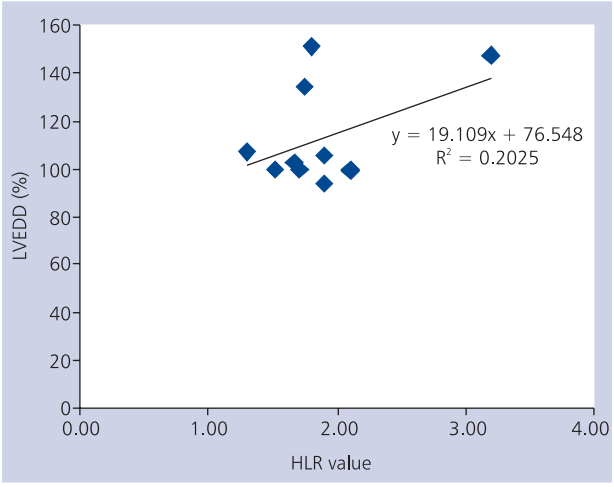

Figure 1. The left ventricular end-diastolic diameter (LVEDD) associated with antigranulocyte uptake and correlation with heart-to-lung ratio (HLR)

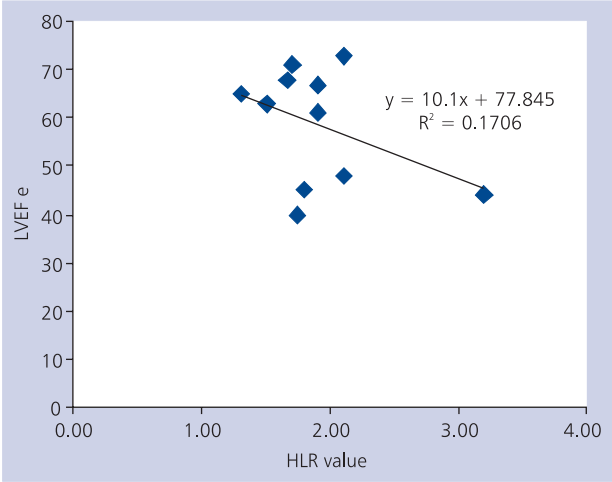

Figure 2. The left ventricular ejection fraction (LVEF) in echocardiography associated with antigranulocyte uptake and correlation with heart-to-lung ratio (HLR)

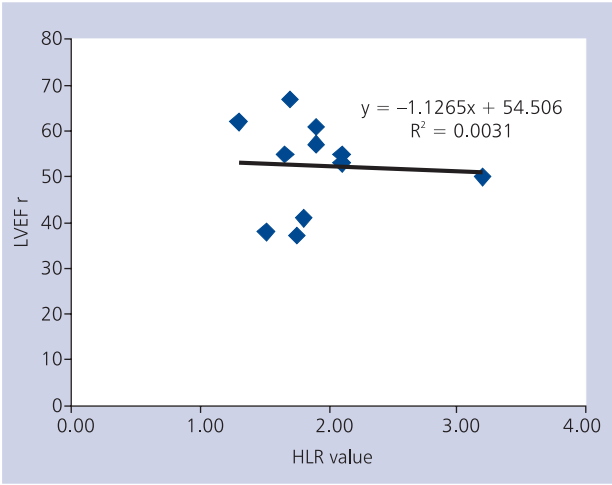

Figure 3. The left ventricular ejection fraction (LVEF) in radionuclide angiocardiography associated with antigranulocyte uptake and correlation with heart-to-lung ratio (HLR)

of observation, but this difference did not reach statistical significance ($p = 0.26$). In 3 patients, LVEDD was still increased above 95 percentile average standards for BSA; in all these 3 patients, positive antigranulocyte uptake was found (HLR ranged from 1.7 to 2.4). The mean LVSF increased, and in all patients achieved a normal value, although this difference was not statistically significant ($p = 0.33$). The mean LVEF in echocardiographic measurements increased in 10 patients, although this difference was just below statistical significance ($p = 0.055$); only in 1 patient did it remain reduced < 50%. The mean LVEF in radionuclide angiocardiography increased significantly ($p = 0.01$), and only in 1 patient LVEF remained reduced below the normal value. In 12-lead ECG, the presence of T wave inversion occurred significantly less often ($p = 0.01$), but T-wave flattening was still observed in insignificantly fewer children ($p = 0.47$). In the follow-up, the mean value of HLR decreased significantly ($p = 0.045$), although in 4 patients it remained increased (HLR ranged from 1.7 to 2.4). In these patients, scintigraphy was performed also after 1 year, in which the persistence of positive antigranulocyte uptake (HLR 2.3 and 2) in 2 patients, and relief in 2 patients were found. In 2 patients with persistent positive results, scintigraphy was again performed after an additional year (i.e. 48 months after the onset of MYO): the persistence of positive antigranulocyte uptake (HLR 1.8) in 1 patient and the absence of antigranulocyte uptake in the second patient were observed (Table 1).

DISCUSSION

Myocarditis is a very heterogeneous disease, especially in the paediatric age group. Clinical features are often those of congestive heart failure, and MYO has been identified as the commonest cause of new onset cardiac failure in previously well children [4]. Even patients with mild symptoms are at risk of deterioration. Therefore early diagnosis is important in establishing appropriate monitoring and supportive care [5]. The suspicion of MYO is mainly based on clinical symptoms and baseline investigations such as chest X-ray, 12-lead ECG, 24-h Holter ECG and echocardiogram. The gold standard for the diagnosis of MYO remains EMB, but this is, however, an invasive method with significant limitations. Therefore, a non-invasive diagnostic method would be desirable, especially in a paediatric population. Research results showing the usefulness of antimyosin antibody imaging in the diagnosis of MYO in adults have been published [6, 7]. Radiolabelled antibody specific for cardiac myosin administered intravenously has been used to non-invasively define regions of myocardial necrosis. Comparison of the scintigraphic results with histological and clinical standards has indicated a high sensitivity of antimyosin scans for the detection of MYO [8]. The feasibility of using antimyosin scintigraphy in children with clinically suspected MYO has been investigated [9]. Scintigraphy applied to the use of antimyosin monoclonal antibody has been a valuable and sensitive method in evaluating MYO, but is no longer available as ^{111}In-labelled antimyosin is no longer produced because of economic reasons.

The use of radiolabelled leukocyte scintigraphy is currently a routine procedure in most nuclear medicine departments for the investigation of different inflammatory processes involving leukocytic infiltration. Agents which preferentially bind to granulocytes are most suitable for visualising the site of acute inflammation. Several multicentre studies using ^{99m}Tc-labelled antigranulocyte antibody for imaging patients

with bone, joints and soft-tissue infections [10, 11], as well as patients with endocarditis [12], have been able to demonstrate a high degree of sensitivity and specificity. The use of such an antibody against granulocytes was first reported by Locher et al. [13]. There is not much data available so far on the application of this marker in the diagnosis of MYO. The results of a study using ^{99m}TcAGA performed in adults with suspected MYO have shown that this method is sensitive in determining MYO compared to the results of myocardial biopsy [2]. The feasibility and the usefulness of scintigraphy with ^{99m}TcAGA for the diagnosis of MYO in the paediatric age group have not been evaluated.

The aim of our study was to investigate whether scintigraphy with ^{99m}TcAGA is useful not only for diagnosis, but also in follow-up in children with MYO, and to determine its correlation with EMB and clinical features such as symptoms of MYO, 12-lead ECG, 24-h Holter ECG, echocardiogram and radionuclide angiocardiography results. Scintimun granulocyte, which we used in our study, is the monoclonal antigranulocyte antibody which is a mouse immunoglobulin of isotope IgG1 that specifically binds to NCA-95 (non specific cross-reacting antigen of 95 kDa), an epitope expressed at the cell membrane of human granulocytes and granulocyte precursors only. In infection and inflammation, it is postulated that the accumulation of technetium radiolabelled antibody bound to granulocytes provides 'hot spots' upon scintigraphic imaging. It is currently hypothesised that the uptake mechanism of radiolabelled monoclonal antigranulocyte whole antibodies involves two components: (a) migration of antibody-labelled circulating granulocytes to the focus due to their undisturbed chemotactic behaviour; and (b) non-specific, non-antigen-related uptake of free antibody due to an increased capillary permeability at the focus, with subsequent binding to granulocytes.

It is well known that in the inflammatory process which takes place in MYO, lymphocytes are involved. The role of granulocytes in MYO and the probable cause of positive results of myocardial scintigraphy with ^{99m}TcAGA which we found in our study are: (1) Granulocytes migrate to sites of inflammation. As follows from the natural history of MYO, the disease is diagnosed late, meaning the initially asymptomatic, acute phase may be missed; (2) Lack of granulocytes, recorded at the time of the study in both the myocardium and vascular endothelium, indicates that the granulocytes which have been stimulated by chemotactic factors came to the site of inflammation and did not recognise the antigen, in contrast to lymphocytes that specifically recognise the antigen in the myocardium, which must be preceded by a presentation of antigen by granulocyte/macrophage. Thus, granulocytes migrate to sites of inflammation but do not become activated and migrate further in the vessels. (3) The chemotaxis should be strictly separated from the activation of granulocytes — so it is with lymphocytes that migrate to sites of inflammation, are at the stage of adhesion, but not yet activated.

In the case of MYO, lymphocytes are activated by the presentation of antigen by granulocytes.

In conclusion, it should be emphasised that MYO in the initial phase can proceed unnoticed. Most clinical studies, including ours, relate to the period after viral infection, after the presentation of antigens by polymorphonuclear cells, where there are only lymphocytes appearing in the form of myocardial infiltration. In our study population, the immunostaining of endomyocardial biopsies with antigranulocyte antibodies was negative for granulocytes, so the most probable explanation of the positive results of the myocardial immunoscintigraphy with ^{99m}TcAGA was a non-specific inflammatory reaction, as described above.

Antigranulocyte scintigraphy and immunohistological analysis of the endomyocardial biopsy at the time of initial presentation and the diagnosis of myocarditis

The present study provides the first report that compares antigranulocyte scintigraphy to immunohistological analysis of EMB in children with clinically suspected MYO. The prevalence of a positive scintigraphy scan is similar to the results of other reported studies [2, 7, 9] and the positive predictive value of antigranulocyte scintigraphy was high. In our study, discrepancies between antigranulocyte scintigraphy and EMB were observed. A positive antigranulocyte scan was also found in 1 (9%) patient who had negative biopsy findings. In this patient, diagnosis of MYO may possibly have been missed because of a sampling error of endomyocardial biopsy, which may be due to the 'patchy' nature of the myocardial inflammation. Immunohistological analysis of EMB also found evidence of MYO in 1 (9%) patient with negative antigranulocyte uptake. It should be pointed out that the presence of lymphocytic infiltrates in the myocardium does not necessarily imply lymphocyte-mediated myocyte necrosis. One could also argue that different time frames exist for the presence of myocardial necrosis (leading to a positive antigranulocyte scan) and myocardial inflammation (leading to the detection of lymphocytic infiltrates in EMB) in the course of MYO, thus explaining the observed differences between the 2 diagnostic methods.

Antigranulocyte scintigraphy and clinical features at the time of initial presentation and the diagnosis of myocarditis

The results of our study indicated positive and negative correlations between the HLR value and the clinical features, but did not show any statistically significant correlation. A limitation of our study was the small number of patients, which could have affected the results of this analysis.

Antigranulocyte scintigraphy and immunohistological analysis of the endomyocardial biopsy after 6 months of follow-up

In follow-up scintigraphy performed after 6 months, the mean value of HLR decreased slightly compared to the previous investigation, which could suggest the persistence of the inflammatory process in the myocardium. EMB results confirmed these suggestions, because in all 8 patients with currently positive scintigraphy scan, features of persistent inflammation in the myocardium were found. We decided not to perform further control EMB in these children because positive antigranulocyte uptake was highly predictive of the presence of MYO, and because of the invasive nature of EMB.

The variability of antigranulocyte scintigraphy results and clinical features in follow-up

In the 24 months of follow-up, the mean value of HLR decreased significantly. It should be noted that a significant reduction of HLR value occurred between the third and fourth hospitalisations, which means after 12 months of follow-up. After 48 months, in scintigraphy performed in 2 patients, in 1 patient resolution of antigranulocyte uptake and in 1 remaining patient persistent positive scan were found. It should be noted that in the patient with negative antigranulocyte scan, the LVEDD in echocardiography completely normalised, but in the patient with persistent positive antigranulocyte uptake, the LV dimension and function were not recovered. In the literature there are many studies which indicate that MYO in some patients leads to dilated cardiomyopathy, which occurred in 1 (9%) of our patients. The results of the present and other studies demonstrate the usefulness of nuclear non-invasive techniques in monitoring the inflammatory process in the myocardium [2, 7, 9]. There is growing evidence to support non-invasive investigations such as chest X-ray, 12-lead ECG, 24-h Holter ECG, echocardiogram, and cardiovascular magnetic resonance imaging by nuclear medicine techniques as adjuncts to the clinical diagnosis.

CONCLUSIONS

1. In 80% of patients with positive scintigraphy results, biopsy-proven MYO was observed.
2. The positive antigranulocyte uptake correlated with clinical features at diagnosis and in follow-up in children with MYO.
3. The control scintigraphy performed in follow-up after 6, 12, and 24 months allowed the evaluation of resolved or persistent MYO.
4. Myocardial scintigraphy results indicate that the inflammatory process in the myocardium decreases significantly after 12 months from the onset of the disease.
5. Scintigraphy with ^{99m}Tc-Anti-Granulocyte antibody seems to be a useful diagnostic method in children with suspected MYO, but further studies are needed to establish its sensitivity and specificity.

Acknowledgements

The authors gratefully acknowledge the support of Prof. Ewa Bernatowska from the Department of Immunology, Prof. Elżbieta Czarnowska, Dr Wiesława Grajkowska, Prof. Maciej Pronicki, Prof. Grażyna Brzezińska-Rajszys, Dr Jadwiga Daszkowska-York, Dr Agnieszka Boruc from the Department of Pathology, Cardiac Catheterisation Laboratory, Echocardiography Laboratory and Paediatric Cardiology at the Children's Memorial Health Institute. Without their assistance, this paper would not have been possible.

Conflict of interest: *none declared*

References

1. Kuhl U, Noutsias M, Seeberg B et al. Immunohistochemical evidence for a chronic inflammatory process in dilated cardiomyopathy. Heart, 1996; 75: 294–300.
2. Hubalewska A, Dudek D, Dubiel J et al. Screening for acute myocarditis – is scintigraphy with 99mTc-Anti-Granulocyte BW 250/183 an answer? Nuclear Med Rev, 2004; 7: 165–169.
3. Becker W, Meller J. The role of nuclear medicine in infection and inflammation. Lancet Inf Dis, 2001; 1: 326–333.
4. Calabrese F, Rigo E, Milanesi O et al. Molecular diagnosis of myocarditis and dilated cardiomyopathy in children: clinicopathologic features and prognostic implications. Diagn Mol Pathol, 2002; 11: 212–221.
5. May LJ, Patton DJ, Fruitman DS. The evolving approach to paediatric myocarditis: a review of the current literature. Cardiol Young, 2011; 21: 241–251.
6. Dec GW, Palacios I, Yasuda T et al. Antimyosin antibody cardiac imaging: its role in the diagnosis of myocarditis. J Am Coll Cardiol, 1990; 16: 97–104.
7. Kuhl U, Lauer B, Souvatzoglu M et al. Antimyosin scintigraphy and immunohistological analysis of endomyocardial biopsy in patients with clinically suspected myocarditis — evidence of myocardial cell damage and inflammation in the absence of histological signs of myocarditis. J Am Coll Cardiol, 1998; 32: 1371–1376.
8. Narula J, Khaw BH, Dec GW. Diagnostic accuracy of antimyosin scintigraphy in suspected myocarditis. J Nucl Cardiol, 1996; 3: 371.
9. Martin M, Moya-Mur J, Casanova M et al. Role of noninvasive antimyosin imaging in infants and children with clinically suspected myocarditis. J Nucl Med, 2004; 45: 429–438.
10. Goldenberg DM, Goldenberg H, Sharkey RM et al. Clinical studies of cancer radioimmunodetection with carcinoembryonic antigen monoclonal antibody fragments labeled with 99mTc or 123 I. Cancer Res, 1990; 50 (suppl.): 909–921.
11. Goldenberg DM, Ford EH, Lee RE et al. Initial clinical imaging results with a new 99mTc-antibody labeling method. I Nucl Med, 1989; 30: 809.
12. Gratz S, Raddatz D, Hagenah G et al. ^{99m}Tc-labeled antigranulocyte monoclonal antibody FAB fragments versus echocardiography in the diagnosis of subacute infective endocarditis. Int J Cardiol, 2000; 75: 75–84.
13. Locher JT, Seybold K, Andres RY et al. Imaging of inflammatory and infectious lesions after injection of radioiodinated monoclonal antigranulocyte antibodies. Nucl Med Commun, 1986; 7: 659–670.

Ocena przydatności scyntygrafii miokardium z użyciem przeciwciał antygranulocytarnych znakowanych technetem (^{99m}Tc-AGA) w rozpoznaniu i monitorowaniu zapalenia mięśnia sercowego u dzieci

Lidia Ziółkowska[1], Wanda Kawalec[1], Maria Biernatowicz[2], Elżbieta Świątek-Rawa[2], Anna Kamińska[2], Anna Turska-Kmieć[1]

[1]Klinika Kardiologii Dziecięcej, Instytut — Pomnik Centrum Zdrowia Dziecka, Warszawa

[2]Zakład Medycyny Nuklearnej, Instytut — Pomnik Centrum Zdrowia Dziecka, Warszawa

Streszczenie

Wstęp: Rozpoznanie zapalenia mięśnia sercowego (ZMS) u dzieci jest trudne ze względu na różny przebieg kliniczny — od przypadków bezobjawowych do ostrej niewydolności serca.

Cel: Celem pracy była ocena przydatności scyntygrafii mięśnia sercowego z użyciem przeciwciał antygranulocytarnych znakowanych technetem (^{99m}Tc-AGA) w rozpoznaniu i monitorowaniu przebiegu ZMS u dzieci oraz określenie korelacji tej metody z wynikami biopsji endomiokardialnej (EMB) i objawami klinicznymi.

Metody: Analizą objęto 11 dzieci (śr. wiek 13 lat), z klinicznym podejrzeniem ZMS, u których badania kardiologiczne i scyntygrafię z oceną wychwytu przeciwciał antygranulocytarnych wykonano w momencie rozpoznania choroby oraz po 6, 12 i 24 miesiącach; EMB wykonano u 10 dzieci w momencie początkowej prezentacji klinicznej ZMS oraz u 8 pacjentów po 6 miesiącach.

Wyniki: U 10 (91%) dzieci stwierdzono dodatni wychwyt przeciwciał antygranulocytarnych, u 8 z nich w EMB potwierdzono ZMS. W scyntygrafii wykonanej po 6 miesiącach dodatni wynik zanotowano u 9 (82%) dzieci, EMB przeprowadzona u 8 pacjentów wykazała u nich przetrwałe ZMS. W kontrolnej scyntygrafii po 12 miesiącach stwierdzono dodatni wynik u 7 (64%), a po 24 miesiącach tylko u 4 (36%) pacjentów.

Wnioski: 1. U 80% pacjentów z dodatnim wynikiem scyntygrafii EMB potwierdziła obecność ZMS. 2. Dodatni wychwyt przeciwciał antygranulocytarnych korelował z objawami klinicznymi w momencie rozpoznania choroby i w okresie obserwacji. 3. Kontrolna scyntygrafia wykonana po 6, 12 i 24 miesiącach umożliwia rozpoznanie przetrwałego procesu zapalnego. 4. Wyniki scyntygrafii wskazują na istotne ustępowanie procesu zapalnego w mięśniu sercowym dopiero po 12 miesiącach od początku choroby. 5. Scyntygrafia z użyciem ^{99m}Tc-AGA wydaje się być przydatną metodą diagnostyczną w ZMS, ale należy przeprowadzić dalsze badania w celu ustalenia jej czułości i specyficzności.

Słowa kluczowe: zapalenie mięśnia sercowego, biopsja endomiokardialna, scyntygrafia mięśnia sercowego, przeciwciała ^{99m}Tc-antygranulocytarne

Kardiol Pol 2012; 70, 12: 1243–1249

Adres do korespondencji:
dr n. med. Lidia Ziółkowska, Klinika Kardiologii Dziecięcej, Instytut — Pomnik Centrum Zdrowia Dziecka, Al. Dzieci Polskich 20, 04–730 Warszawa, tel: +48 22 8157370, faks: +48 22 8157365, e-mail: l.ziolkowska@czd.pl
Praca wpłynęła: 07.01.2012 r. **Zaakceptowana do druku:** 13.09.2012 r.