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ARTYKUŁ ORYGINALNY / *ORIGINAL ARTICLE*

The usefulness of cardiovascular magnetic resonance imaging in children with myocardial diseases

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Abstract

Background: Cardiovascular magnetic resonance (CMR) imaging is a clinically proven and reliable diagnostic method for the assessment of morphology, function, and characteristics of myocardial tissue in patients with myocardial diseases. The use of gadolinium contrast agents has created new diagnostic possibilities for tissue characterisation in patients with suspected or known cardiomyopathy, myocarditis, and cardiac tumours.

Aim: To evaluate the usefulness of CMR in the diagnostic process in children with myocardial diseases and to compare the results of CMR and other non-invasive cardiovascular methods, including echocardiography.

Methods: The study included 112 children, with an average age of 12 ± 4.64 years, with various forms of myocardial disease: 63 children with hypertrophic cardiomyopathy (HCM), 9 with suspected myocarditis, 5 with history of myocarditis, 4 with dilated cardiomyopathy (DCM), 9 with suspected arrhythmogenic right ventricular cardiomyopathy (ARVC), 6 with left ventricular non-compaction cardiomyopathy (LVNC), 9 with suspected restrictive cardiomyopathy (RCM) to be differentiated with constrictive pericarditis (CP), and 7 with cardiac tumours.

Results: CMR confirmed the echocardiographic diagnosis of HCM in 92% of children and ruled it out in 8%, and in three children apical hypertrophy was found. CMR revealed the presence of myocardial fibrosis in 60% of patients with HCM. In 33% of children with clinically suspected myocarditis CMR confirmed this diagnosis, while in 44% of them DCM was recognised. Of the five children with a history of myocarditis, in one patient CMR performed 13 years after myocarditis revealed features of post-inflammatory DCM. In 75% of patients with the echocardiographic diagnosis of post-inflammatory DCM the result of CMR was consistent. CMR ruled out the presence of ARVC in 89% of children. Echocardiographic and CMR diagnosis of LVNC was consistent in 67% of children. CMR confirmed the clinical diagnosis of RCM in 63% of patients, and in one patient CP was recognised. CMR confirmed the presence of cardiac tumour in 57% of children and excluded it in 43% of patients.

Conclusions: CMR is increasingly recognised as an important tool in the investigation of myocardial disease and should be part of routine clinical work-up. CMR provides an additional diagnostic technique to assess the presence or exclusion of an active myocarditis. In children with clinical and echocardiographic suspicion of LVNC, ARVC, RCM, CP, and cardiac tumours CMR can conclusively confirm the presence of the disease.

Key words: cardiovascular magnetic resonance, myocarditis, hypertrophic cardiomyopathy, dilated cardiomyopathy, children

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INTRODUCTION

Cardiovascular magnetic resonance (CMR), a non-invasive diagnostic method of heart imaging, can be regarded as a routine technique in clinical practice. CMR imaging is a clinically proven, consistent, and reliable diagnostic method for the assessment of the morphology, function, and characteristics of

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the myocardial tissue as well as for the evaluation of changes in the myocardium resulting from myocardial pathologies such as myocarditis and ischaemic and non-ischaemic cardiomyopathies. The use of gadolinium contrast agents for the visualisation of late gadolinium enhancement (LGE) has created a new diagnostic possibility for tissue characterisation in patients with suspected or known cardiomyopathy, myocarditis, and cardiac tumours. The extent and pattern of LGE varies according to the underlying pathological process and therefore contributes to correct diagnosis in myocarditis and non-ischaemic cardiomyopathies [1]. Since the beginning of the 1990s published studies have indicated the significant usefulness of CMR in the diagnosis of myocarditis in children [2] and in adults [3, 4]. CMR-LGE has created new diagnostic and differential opportunities in patients with dilated cardiomyopathy (DCM) and myocarditis, helping to characterise the myocardial tissue (in terms of oedema, hyperaemia, fibrosis) [4–7] and to differentiate patients with post-inflammatory (DCMi) or idiopathic DCM [8–10]. CMR is extremely useful in the diagnosis of arrhythmogenic right ventricular cardiomyopathy (ARVC). Diagnosis relies largely on the ARVC Task Force criteria, recently revised to include quantitative parameters for imaging studies [11]. CMR is a useful noninvasive diagnostic tool in children with restrictive cardiomyopathy (RCM) or constrictive pericarditis (CP) because it clearly demonstrates the thickness of the pericardium and may provide additional information to aid in the diagnosis of some of the infiltrative conditions that cause restrictive heart disease [12]. Although echocardiography is considered as the reference point for the diagnosis of left ventricular non-compaction cardiomyopathy (LVNC), CMR criteria have also been proposed [13]. Moreover, CMR imaging offers outstanding soft-tissue characterisation in cardiac tumours in children as an addendum or verification of echocardiographic diagnosis [14]. In children with hypertrophic cardiomyopathy (HCM), CMR offers the potential for accurate measurement of peak wall thickness, and detection of localised hypertrophy and areas of focal interstitial expansion due to myocardial fibrosis [15, 16].

The aim of study was to evaluate the usefulness of CMR imaging in the diagnostic process in children with myocardial diseases and to compare the results of CMR and other non-invasive cardiovascular methods, including echocardiography.

METHODS

Study patients

The study included 112 children consecutively hospitalised in the Department of Paediatric Cardiology in the period from March 2008 to April 2014, with an average age of 12 ± 4.64 years (from 10 months to 18 years), diagnosed with HCM (n = 63), suspected myocarditis (n = 9) or history of myocarditis (n = 5), DCM (n = 4), suspected ARVC (n = 9), LVNC (n = 6), suspected RCM to be differentiated with the CP (n = 9) and with cardiac tumours (n = 7). In all 112 children with various forms of heart muscle disease, comprehensive cardiac tests and CMR imaging were performed in the period from January 2010 to April 2014. Table 1 details the baseline characteristics of the study population.

Data collection

Patient demographics, clinical symptoms (dyspnoea on exertion, syncope, chest pain, arrhythmias, heart failure), family history of cardiomyopathies and sudden cardiac death as well as the results of transthoracic echocardiography, CMR imaging, 12-lead electrocardiogram (ECG), and 24-h Holter ECG were collected. In patients with suspected myocarditis, myocardial scintigraphy was performed using technetium-99m labelled anti-granulocyte antibodies to assess the presence or absence of inflammatory infiltrates in the myocardium. Two-dimensional, conventional pulsed Doppler, tissue Doppler imaging (TDI), and M-mode echocardiography were performed at rest using standard methods [17–19]. Echocardiographic measurements included septal wall thickness and left ventricular (LV) posterior wall thickness (mm, z-score), left atrial (LA) size (mm, z-score), LA volume indexed to the body surface area (BSA), and the presence of LV outflow tract obstruction (LVOTO). HCM was diagnosed when echocardiographic evidence of concentric, asymmetric, or apical hypertrophy defined as a diastolic septal thickness or LV diastolic wall thickness z-score > 2 were present. CMR was performed on a 1.5 T scanner (Sonata, Siemens, Erlangen, Germany). Cine images with steady-state free-precession (trueFISP; slice thickness 8 mm) were acquired in three long-axis planes and contiguous short-axis slices (trueFISP; slice thickness 8 mm, 2 mm gap) from the atrioventricular ring to the apex. An intravenous bolus of 0.1 mmol/kg of gadobutrol (Gadovist, Schering, Berlin, Germany) or gadodiamid (Omniscan, GE Healtcare, United Kingdom in patients below 2 years of age) was then given, and late gadolinium images were acquired in the same planes after 10 min, with breath-hold segmented inversion-recovery sequence (inversion time 280–400 ms). Both global LV function and segmental wall thickening were analysed using commercially available software by manual tracing of endocardial and epicardial contours (Argus, Siemens Medical Solutions, Germany). The following parameters (indexed to BSA) were calculated: LV end-diastolic volume index (mL/m^2), LV end-systolic volume index (mL/m^2), LV ejection fraction (%), and LV mass index (g/m^2). End-diastolic septal and LV posterior wall thickness were measured in short axis (mm). LA dimension was measured in three-chamber view in end-systole and its enlargement was defined as z-score > 2. The presence of LV LGE was estimated using a visual evaluation.

Ethical standards

All our studies, covering a cardiological examination and CMR study, have been approved by the Ethics Committee and have been performed in accordance with ethical standards. All persons gave their informed consent prior to their inclusion in the study.

Table 1. Patient characteristics

Clinical parameters	Total study group (n = 112)
Patients with HCM	**N = 63**
Age (range) [years]	12.2 ± 4.5 (1.4–18)
BSA [m^2]	1.42 ± 0.43
Male	42 (67%)
Chest pain	19 (30%)
Syncope	6 (10%)
NYHA class I/II/III	20 (32%)/36 (57%)/7 (11%)
Patients with suspected myocarditis	**N = 9**
Age (range) [years]	13.4 ± 5 (0.10–16.9)
BSA [m^2]	1.61 ± 0.46
Male	9 (100%)
Chest pain	3 (33%)
NYHA class II/III/IV	7 (78%)/1 (11%)/1 (11%)
Patients with a history of myocarditis	**N = 5**
Age (range) [years]	15.2 ± 2.9 (10.7–17.5)
BSA [m^2]	1.64 ± 0.37
Male	5 (100%)
Fatigability	2 (40%)
NYHA class I/II	3 (60%)/2 (40%)
Patients with post-inflammatory DCM	**N = 4**
Age (range) [years]	15.6 ± 2.2 (13.5–17.8)
BSA [m^2]	1.56 ± 0.2
Male	3 (75%)
Fatigability	2 (50%)
NYHA class I/II	1 (25%)/3 (75%)
Patients with suspected ARVC	**N = 9**
Age (range) [years]	11.4 ± 4.1 (4.6–15.5)
BSA [m^2]	1.39 ± 0.41
Male	8 (89%)
Fatigability	2 (22%)
Palpitations	2 (22%)
NYHA class I/II/III	4 (44%)/4 (44%)/1 (12%)
Patients with LVNC	**N = 6**
Age (range) [years]	14.2 ± 3 (8.8–17.1)
BSA [m^2]	1.69 ± 0.49
Male	4 (67%)
Fatigability	3 (50%)
Palpitations	2 (33%)
NYHA class I/II	2 (33%)/4 (67%)
Patients with suspicion of RCM	**N = 9**
Age (range) [years]	8.9 ± 5.2 (0.10–15.5)
BSA [m^2]	1.08 ± 0.51
Male	6 (67%)
Fatigability	5 (56%)
Palpitations	2 (22%)
Syncope	2 (22%)
NYHA class II/III	7 (78%)/2 (22%)
Patients with suspicion of cardiac tumours	**N = 7**
Age (range) [years]	9 ± 5.5 (3.1–17.5)
BSA [m^2]	1.1 ± 0.43
Male	3 (43%)
Fatigability	1 (14%)
Palpitations	4 (57%)
NYHA class I/II	6 (86%)/1 (14%)

BSA — body surface area; NYHA — New York Heart Association functional class; HCM — hypertrophic cardiomyopathy; DCM — dilated cardiomyopathy; ARVC — arrhythmogenic right ventricular cardiomyopathy; LVNC — left ventricular non-compaction cardiomyopathy; RCM — restrictive cardiomyopathy

RESULTS

Comparison of clinical and echocardiographic diagnosis with the result of CMR in children with HCM

In 63 patients echocardiography revealed LV hypertrophy, including suspected apical form in two children. The interventricular septal (IVS) thickness in diastole ranged from 7.8 mm to 43.5 mm, mean 17.6 mm (z-score: 2.2 to 29.6, mean 10.1); the LV posterior wall thickness ranged from 4.3 mm to 28.1 mm, on average 9.3 mm (z-score: –1.4 to 13.5, mean 1.8). In 15 (24%) children LVOTO with systolic pressure gradient ≥ 30 mmHg at rest was observed. CMR confirmed HCM in 58 (92%) patients; in five (8%) children the presence of myocardial hypertrophy was excluded. In three children apical HCM was found, including two patients with earlier echocardiographic suspicion of apical HCM and one diagnosis based on CMR. The IVS thickness in diastole ranged from 6 mm to 45 mm, on average 20 mm (z-score: 0.6 to 33.3, mean 13.4); the LV posterior wall thickness ranged from 3.6 mm to 19 mm, on average 8.8 mm (z-score from –2.1 to 18.8, mean 1.7). In 20 (32%) patients LVOTO was observed. CMR-LGE revealed the presence of myocardial fibrosis in 38 (60%) children with HCM. Echocardiography, when compared to CMR used as a reference standard, showed underestimation of IVS thickness (in echo 17.6 mm vs. 20.3 mm in CMR; z-score in echo 10.1 vs. 13.4 in CMR) and LA area (in echo of 12.4 cm^2/m^2 vs. 15.7 cm^2/m^2 in CMR) as well as underestimation of LV mass (in echo 149.3 g/m^2 vs. 97.9 g/m^2; z-score in echo 5.9 vs. 2.8 in CMR) (Fig. 1A–C).

Comparison of clinical and echocardiographic diagnosis with the result of CMR in children with suspected myocarditis

In nine patients the clinical suspicion of myocarditis was raised; in four of them echocardiography had demonstrated

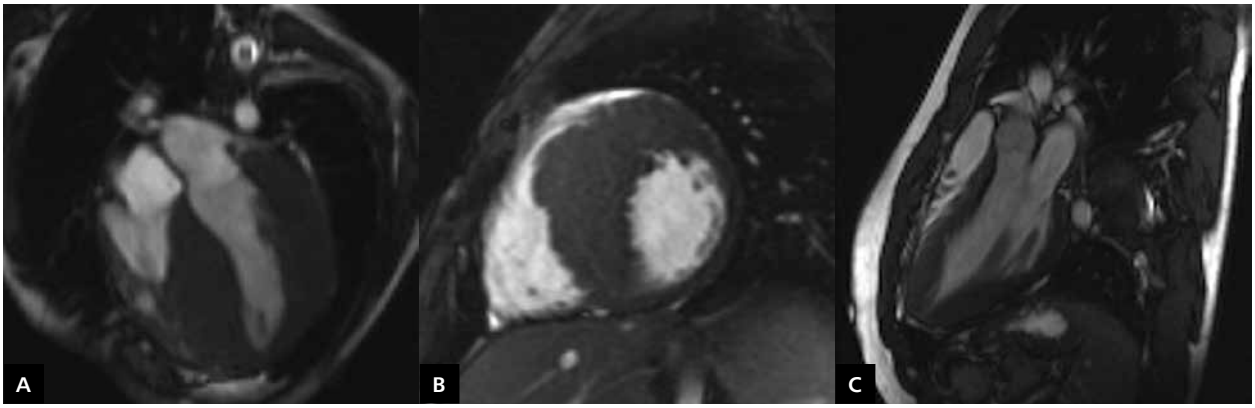

Figure 1. Cardiac magnetic resonance images in patients with hypertrophic cardiomyopathy; **A**. Four-chamber view, cine SSFP sequence. Massive hypertrophy of the interventricular septum and left ventricular lateral wall is seen; **B**. Short-axis view, cine SSFP sequence. Massive interventricular septum hypertrophy is seen; **C**. Three-chamber view in a patient with apical hypertrophic cardiomyopathy, cine SSFP sequence

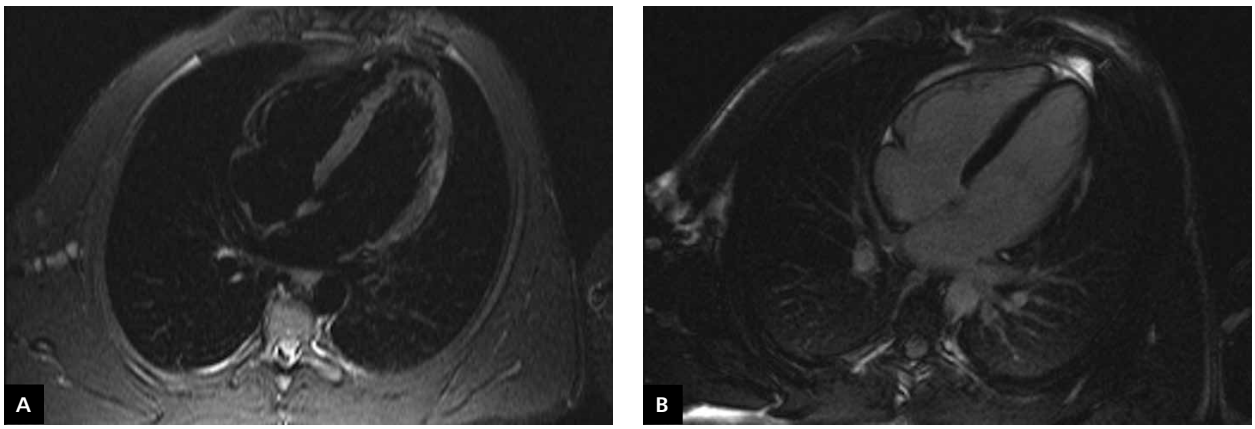

Figure 2. Cardiac magnetic resonance images in a patient with acute myocarditis; **A**. Four-chamber view. T2-weighted TIRM images. Myocardial oedema in the left ventricular lateral wall is seen (hyperintense areas); **B**. Four-chamber view. Late gadolinium enhancement images in the same patient. Areas of late gadolinium enhancement (areas of myocardial necrosis/fibrosis) corresponding to areas of myocardial oedema seen in Figure 2A

normal LV size and function, whereas in five children LV dilatation and reduced contractility was present. CMR confirmed the presence of myocarditis in three (33%) patients, showing the typical features for active myocarditis with oedema and myocardial fibrosis by LGE. In the remaining six children the presence of inflammation was excluded, but in four (44%) of them the features of DCM were found. In one (11%) patient unclassified myocardial pathology with LV hypokinesis and in one (11%) patient a completely normal myocardium was found (Fig. 2A, B).

Comparison of clinical and echocardiographic diagnosis with the result of CMR in children with a history of myocarditis

In five patients CMR was performed in the period from six months to 13 years (mean 6.5 ± 6.06 years) after myocarditis. In all five patients echocardiography demonstrated normal LV size and function. In CMR study post-inflammatory scars with the foci of fibrosis were found in two (40%) patients, without features of DCM. In a total of four (80%) children DCM as a late consequence of the inflammatory process in the myocardium was excluded, and one (20%) patient developed post-inflammatory DCM in the follow-up period of 13 years after myocarditis.

Comparison of clinical and echocardiographic diagnosis with the result of CMR in children with DCMi

In four patients after previous myocarditis (from 4 to 17 years earlier, mean 9.5 ± 5.5 years) echocardiography showed the features of DCMi. In three (75%) children CMR study confirmed the presence of post-inflammatory DCM,

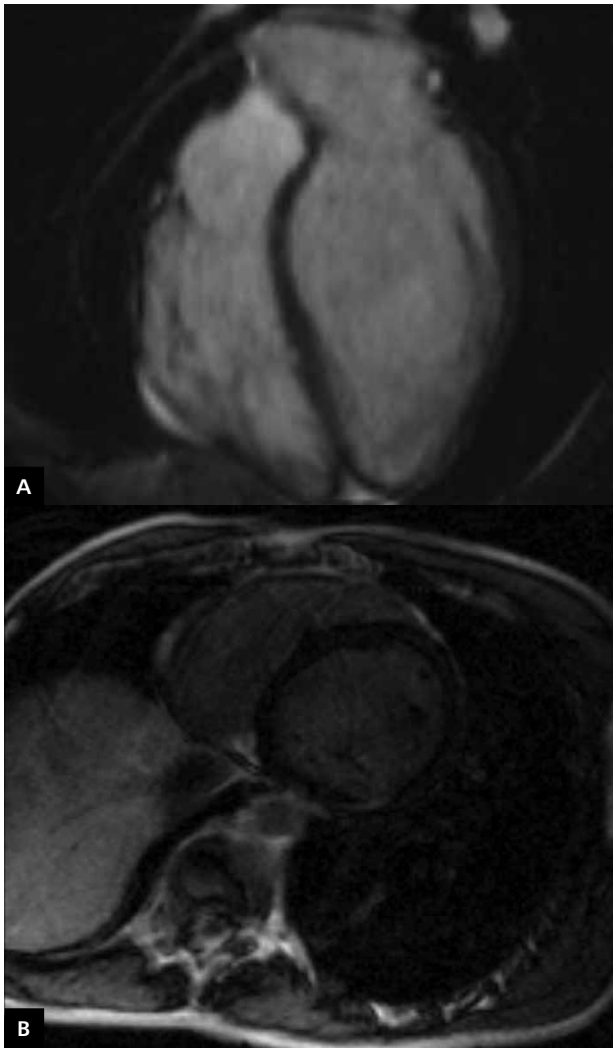

Figure 3. Cardiac magnetic resonance images in a patient with post-inflammatory dilated cardiomyopathy; **A**. Four-chamber view, cine SSFP sequence. Enlarged left ventricle; **B**. Short--axis view, cine SSFP sequence. The image of late gadolinium enhancement (visible sub-epicardial fibrosis in the inferior wall suggestive of post-inflammatory aetiology)

whereas in one (25%) patient there were no features of DCM (Fig. 3A, B).

Comparison of clinical and echocardiographic diagnosis with the result of CMR in children with suspected ARVC

The ARVC was suspected in nine patients with complex ventricular arrhythmias with left bundle branch block morphology, including two patients with right ventricle (RV) enlargement and impaired contractility. The CMR criteria suggestive of ARVC were absent in eight (89%) children and present in only one (11%) patient in that group. Moreover, in two patients CMR demonstrated an early form of DCM, which was not visualised by echocardiography (Fig. 4A, 4B).

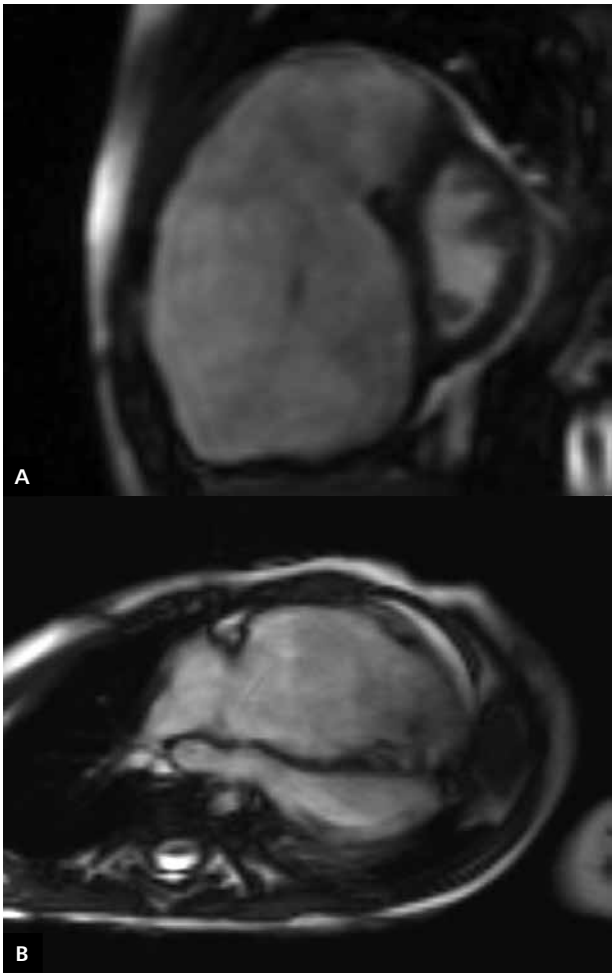

Figure 4. Cardiac magnetic resonance images in a patient with arrhythmogenic right ventricular cardiomyopathy; **A**. Short-axis view in end-systolic phase, cine SSFP sequence. Markedly enlarged right ventricle with the presence of regions of dyskinesis in the right ventricular inferior wall; **B**. Four-chamber view, cine SSFP sequence

Comparison of clinical and echocardiographic diagnosis with the result of CMR in children with LVNC

The presence of cardiomyopathy in the form of LVNC was diagnosed by echocardiography in six patients; in four (67%) of them the diagnosis was confirmed by CMR, whereas the remaining two (33%) patients had increased trabeculation of the left ventricular apex, which did not meet the magnetic resonance diagnostic criteria for LVNC (Fig. 5).

Comparison of clinical and echocardiographic diagnosis with the result of CMR in children with suspicion of RCM

In six patients cardiac echocardiography showed the features of RCM, and in two children suspicion of RCM required differentiation with CP. CMR confirmed the diagnosis of RCM

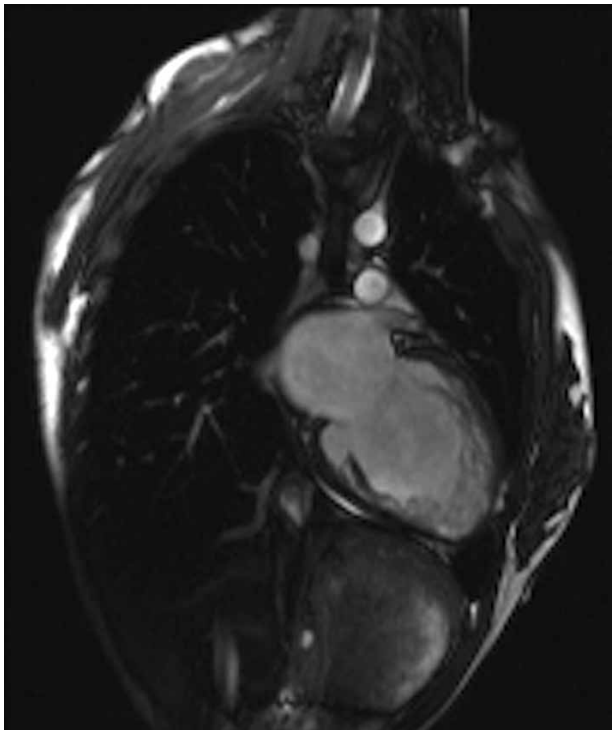

Figure 5. Cardiac magnetic resonance image in a patient with left ventricular non-compaction, cine SSFP sequence. Prominent trabeculations are seen in the left ventricle

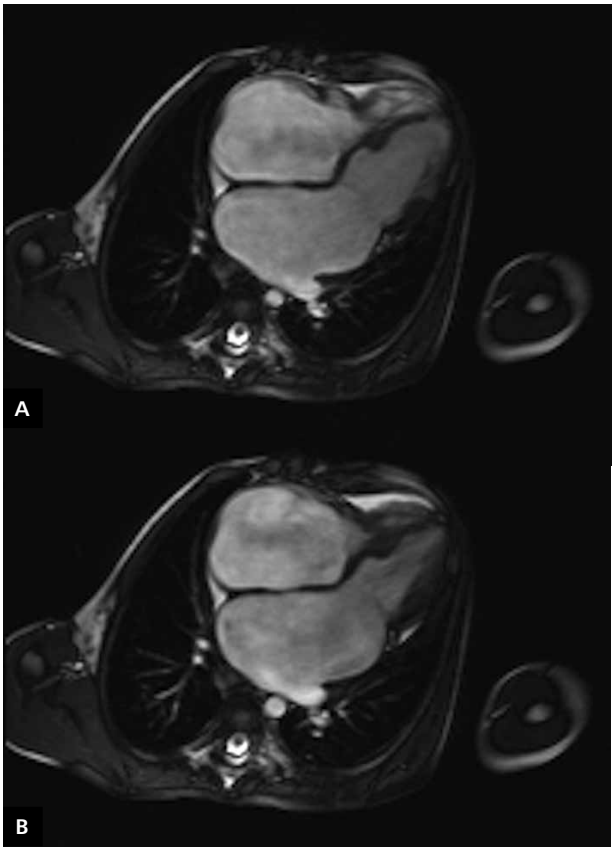

Figure 6. Cardiac magnetic resonance images in a patient with restrictive cardiomyopathy. Severe left and right atrium dilatation is demonstrated, as well as normal left and right ventricular diameters and systolic functions; **A**. Four-chamber view, cine SSFP sequence. End-diastole; **B**. Four-chamber view, cine SSFP sequence. End-systole

in five (63%) patients, whereas this diagnosis was excluded in two (25%) children: one (6%) patient had thickening of the pericardium meeting the criteria for diagnosis of CP; in one (6%) child it was not possible to definitively differentiate RCM from CP, which required further clinical observation (Fig. 6A, B).

Comparison of clinical and echocardiographic diagnosis with the result of CMR in children with cardiac tumours

CMR was performed in seven children with echocardiographic suspicion of cardiac tumour (located in the muscle of IVS in three patients, in the free wall of LV in three children, and in the anterior wall of the RV in one patient). CMR confirmed the presence of cardiac tumour in four (57%) children and ruled out this diagnosis in three (43%) patients. Previously performed echocardiography in these three children revealed the presence of hyperechogenicity, luminescent echo of size 9 mm × 4.4 mm in apical portion of the LV, and numerous small foci of increased echogenicity in the interventricular septum (n = 1), spindle-shaped tumour within the septal at the level of the aortic valve to about 1/3 the length of the IVS (n = 1), and the focus of increased echogenicity of the muscle in the LV apical area (n = 1). The CMR revealed a cardiac tumour in the apex of LV in one child. Furthermore, a possibility of tissue characterised by CMR among these patients led to suspicion of cardiac fibroma in IVS in one child and cardiac fibroma in LV muscle in another child. Moreover, in one patient a lipomatous-like tumour in the muscle of the RV was found. In the absence of features suggestive of a malignant nature of the tumour, or the necessity of resection, after oncology and cardiac surgery, consultation indications for histological examination of tumours were not established. Observed tumours included fibromas, teratoma, and lipomas. Cases in which cardiac tumour or unspecified heart muscle pathology was suspected on echocardiography but ruled-out in CMR included predominantly atypical localisation on the structure of the LV papillary muscles and the presence of muscular bands (Fig. 7A–D).

DISCUSSION

CMR imaging has been applied in the world relatively recently. Its usefulness has been demonstrated predominately in adults and teenagers. This is the first Polish study to demonstrate the usefulness of CMR in a large group of children of different ages, also in infants with various forms of myocardial disease.

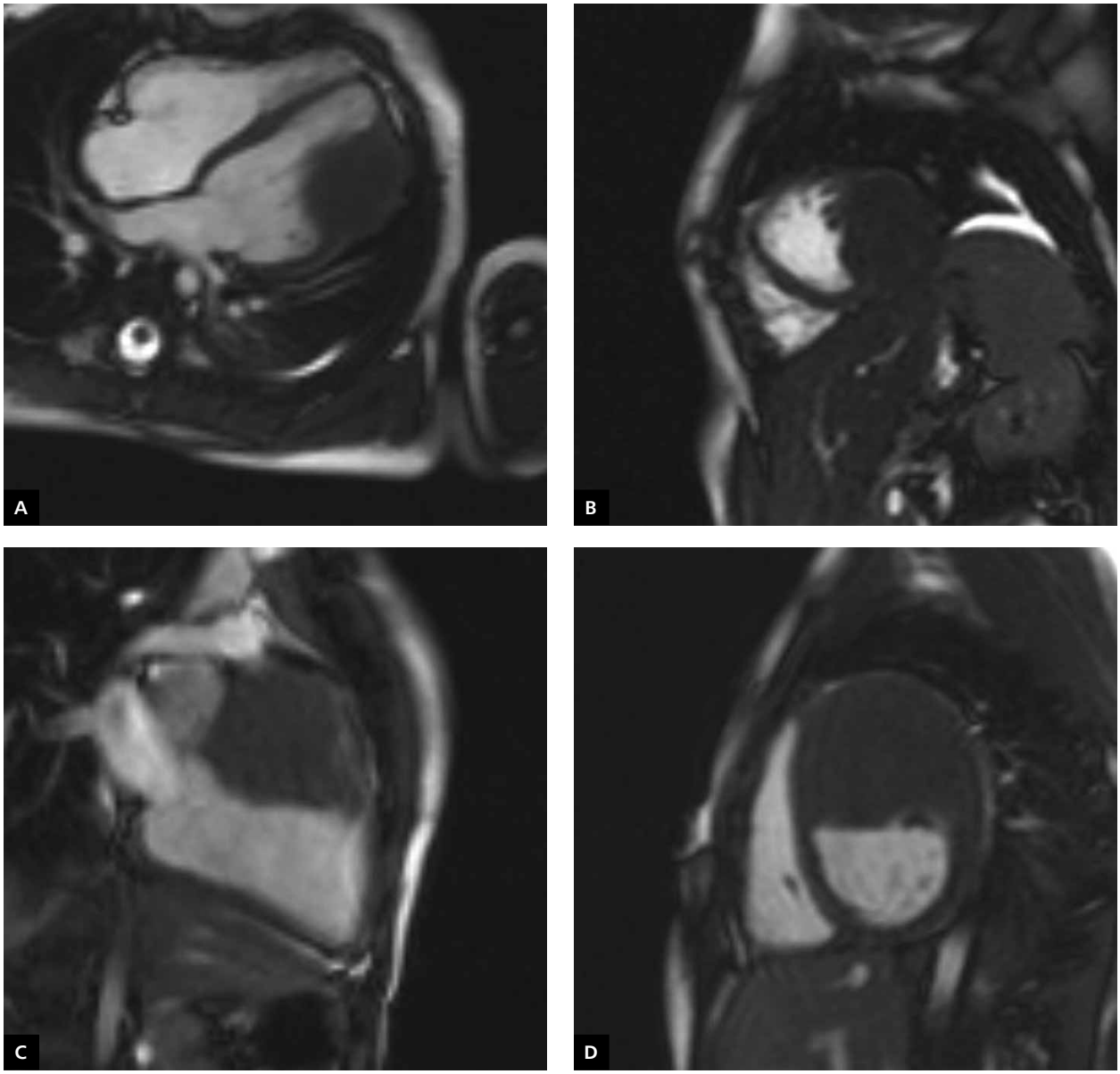

Figure 7. Cardiac magnetic resonance images in patients with cardiac tumours; **A**. Four-chamber view, cine SSFP sequence. Large tumour of the lateral wall is seen; **B**. Short-axis view in the same patient, cine SSFP sequence; **C**. Four-chamber view, cine SSFP sequence. Large tumour of the anterior wall is seen; **D**. Short-axis view in the same patient, cine SSFP sequence

In children with hypertrophic cardiomyopathy CMR, in comparison to echocardiography, allowed better visualisation of focal cardiac hypertrophy, particularly if the area covered the apex of the heart**.** CMR in 92% of children confirmed the echocardiographic diagnosis of HCM, but showed greater accuracy in the evaluation of cardiac hypertrophy, LV mass, and LA area, in comparison to the echocardiography. It should be pointed out that, unlike routine transthoracic echocardiography, CMR can assess the location and extent of myocardial fibrosis in patients with HCM, which was found in 60% of the children in the study group. The results of other published studies [20, 21] had shown that the presence of myocardial fibrosis is associated with poor prognosis in children and adults with HCM. Fibrosis is an important predictor of clinical symptoms and a risk factor for sudden cardiac death, so the result of CMR-LGE should be considered in the risk stratification of sudden cardiac death and in making therapeutic decisions in patients with HCM [22]. CMR has proved particularly useful in children with suspected myocarditis. In our study, only in 33% of children with clinically suspected myocarditis CMR confirmed the diagnosis of myocarditis, while in 44% of them DCM was diagnosed without the presence of typical features for myocarditis. The results of our study are comparable with the data published by Schumm et al. [23], in which the CMR

diagnosis of myocarditis was made in 28.8% of adult patients with clinically suspected myocarditis. Assomull et al. [5] reported that among patients presenting with troponin-positive tests and with unobstructed coronaries, CMR was able to identify the cause in 65% of patients, with the commonest being myocarditis. In a study by Abdel-Aty et al. [4], in patients with unexplained cardiomyopathy, up to 10% of patients were found to have CMR findings of myocarditis. In patients with a history of myocarditis and mean follow-up of 6.5 years, a CMR study revealed the presence of pro-inflammatory scarring in 40% of children, whereas 20% of patients were diagnosed with DCMi. In studies by other authors myocarditis caused the development of DCMi in 2–25% of patients [24]. In patients with DCMi, the echocardiographic and CMR diagnosis was similar. In 75% of children CMR imaging confirmed the presence of DCMi during an average follow-up of 9.5 years post myocarditis. It is worth emphasising the usefulness of CMR in the differential diagnosis of patients with clinical and echocardiographic suspicion of ARVC. It should be noted, however, that there are no defined criteria for CMR analysis in children with suspected ARVC. Therefore, the assessment was based on adjusted CMR criteria used in adults [11], with CMR suggestive of ARVC in the case of regional wall motion abnormalities of the RV and elevated end-diastolic RV volume and/or decreased RV ejection fraction indexed for BSA. We have demonstrated that the results of echocardiography and CMR in the diagnosis of children with LVNC are consistent. In most children from the study group echocardiographic diagnosis of LVNC was confirmed by CMR. CMR is a very important diagnostic method in patients where clinical and echocardiography results suggest RCM or CP. CMR provides high-resolution imaging of the pericardium and associated structures in any imaging plane. It fuses excellent anatomic detail and tissue characterisation with accurate evaluation of cardiac function and assessment of the haemodynamic consequences of pericardial constraint on cardiac filling. Compared with echocardiography, CMR-LGE is the only method that can show *in vivo* the presence of myocardial fibrosis, which may well facilitate diagnosis of RCM resulting from infiltrative myocardial disease and have important prognostic implications [25]. Although echocardiography, CMR, and even cardiac catheterisation have been useful in this differential diagnosis [12, 15], in some patients conclusive diagnosis is very difficult, as in our study. CMR imaging is the method of choice in children with suspected cardiac tumours [1, 14]. This observation was confirmed in our study. In 57% of children echocardiographic diagnosis of cardiac tumour was confirmed by CMR. CMR also allowed the accurate determination of the location and the characteristics of the tumour tissue. It is worth emphasising that in as many as 43% of children CMR ruled out the presence of cardiac tumour, which was suspected by echocardiography.

It should be noted that the CMR study in children may be challenging in some cases, mainly in very young children (usually < 8 years of age), because of the need of general anaesthesia. The quality of images may also be hampered in the case of complex arrhythmias and small body mass.

CONCLUSIONS

CMR imaging is increasingly recognised as an important tool in the investigation of myocardial disease and should be part of routine clinical work-up. CMR imaging is of particular diagnostic and prognostic value in the diagnosis and monitoring of the inflammatory process in the myocardium. CMR provides an additional diagnostic technique to assess the presence or exclusion of an active myocarditis. In children with clinical and echocardiographic suspicion of LVNC, ARVC, RCM, CP, and cardiac tumours CMR can conclusively confirm the presence of the disease.

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Conflict of interest: *none declared*

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Przydatność obrazowania metodą rezonansu magnetycznego u dzieci z chorobami mięśnia sercowego

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Streszczenie

Wstęp: Obrazowanie serca metodą rezonansu magnetycznego (CMR) jest klinicznie sprawdzoną i niezawodną metodą diagnostyczną służącą do oceny morfologii, funkcji i właściwości tkanki mięśnia sercowego u pacjentów z chorobami miokardium. Zastosowanie gadolinowych środków kontrastowych stworzyło nowe możliwości oceny tkanki mięśnia sercowego u pacjentów z podejrzeniem lub rozpoznaniem kardiomiopatii, zapalenia mięśnia sercowego i guzami serca.

Cel: Celem pracy była ocena przydatności CMR w diagnostyce chorób miokardium u dzieci oraz porównanie wyników badania CMR i innych nieinwazyjnych metod kardiologicznych, w tym echokardiografii.

Metody: Badaniami objęto 112 dzieci, w wieku średnio 12 ± 4,64 roku, z różnymi formami patologii mięśnia sercowego; 63 dzieci z kardiomiopatią przerostową (HCM), 9 z podejrzeniem zapalenia mięśnia sercowego, 5 po przebytym zapaleniu mięśnia sercowego, 4 z kardiomiopatią rozstrzeniową (DCM), 9 z podejrzeniem arytmogennej kardiomiopatii prawej komory (ARVC), 6 z niescalonym mięśniem lewej komory (LVNC), 9 z podejrzeniem kardiomiopatii restrykcyjnej (RCM), do różnicowania z zaciskającym zapaleniem osierdzia (CP) i 7 z guzami serca.

Wyniki: Wyniki CMR potwierdziły echokardiograficzne rozpoznanie HCM u 92% dzieci i wykluczyły u 8% pacjentów, u 3 dzieci stwierdzono przerost mięśnia koniuszka serca. Na podstawie CMR ujawniono obecność włóknienia mięśnia sercowego u 60% chorych z HCM. U 33% dzieci z klinicznym podejrzeniem zapalenia mięśnia sercowego wyniki CMR potwierdziły to rozpoznanie, podczas gdy u 44% z nich stwierdzono cechy DCM. Spośród 5 dzieci po przebytym zapaleniu mięśnia sercowego u 1 pacjenta w CMR wykonanym 13 lat po zapaleniu mięśnia sercowego stwierdzono cechy pozapalnej DCM. U 75% pacjentów z echokardiograficznym rozpoznaniem pozapalnej DCM wynik CMR był zgodny. W CMR wykluczono obecność ARVC u 89% dzieci. Rozpoznanie LVNC na podstawie echokardiografii i CMR było zgodne u 67% dzieci. Wyniki CMR potwierdziły kliniczne i echokardiograficzne podejrzenie RCM u 63% pacjentów, u 1 dziecka stwierdzono CP. Za pomocą CMR potwierdzono obecność guza serca u 57% dzieci, a wykluczono — u 43% pacjentów.

Wnioski: CMR jest uznawane za niezwykle ważną metodę w badaniu pacjentów z chorobami mięśnia sercowego i powinno być częścią rutynowego klinicznego postępowania diagnostycznego. CMR dostarcza dodatkowych możliwości oceny obecności lub wykluczenia aktywnego zapalenia mięśnia sercowego. U dzieci z klinicznym i echokardiograficznym podejrzeniem LVNC, ARVC, RCM, CP i guzów serca CMR może jednoznacznie potwierdzić obecność choroby.

Słowa kluczowe: rezonans magnetyczny serca, zapalenie mięśnia sercowego, kardiomiopatia przerostowa, kardiomiopatia rozstrzeniowa, dzieci

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