Prevalence of Rheumatic Heart Disease in a Public School of Belo Horizonte

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Abstract

Background: Previous studies indicate that compared with physical examination, Doppler echocardiography identifies a larger number of cases of rheumatic heart disease in apparently healthy individuals.

Objectives: To determine the prevalence of rheumatic heart disease among students in a public school of Belo Horizonte by clinical evaluation and Doppler echocardiography.

Methods: This was a cross-sectional study conducted with 267 randomly selected school students aged between 6 and 16 years. students underwent anamnesis and physical examination with the purpose of establishing criteria for the diagnosis of rheumatic fever. They were all subjected to Doppler echocardiography using a portable machine. Those who exhibited nonphysiological mitral regurgitation (MR) and/or aortic regurgitation (AoR) were referred to the Doppler echocardiography laboratory of the Hospital das Clínicas of the Universidade Federal of Minas Gerais (HC-UFMG) to undergo a second Doppler echocardiography examination. According to the findings, the cases of rheumatic heart disease were classified as definitive, probable, or possible.

Results: Of the 267 students, 1 (0.37%) had a clinical history compatible with the diagnosis of acute rheumatic fever (ARF) and portable Doppler echocardiography indicated nonphysiological MR and/or AoR in 25 (9.4%). Of these, 16 (6%) underwent Doppler echocardiography at HC-UFMG. The results showed definitive rheumatic heart disease in 1 student, probable rheumatic heart disease in 3 students, and possible rheumatic heart disease in 1 student.

Conclusion: In the population under study, the prevalence of cases compatible with rheumatic involvement was 5 times higher on Doppler echocardiography (18.7/1000; 95% CI 6.9/1000–41.0/1000) than on clinical evaluation (3.7/1000–95% CI). (Arq Bras Cardiol. 2014; 103(2):89-97)

Keywords: Rheumatic Fever / epidemiology; Prevalence; Rheumatic Heart Disease; Heart Valves; Echocardiography, Doppler.

Introduction

Acute rheumatic fever (ARF) has an extremely variable clinical presentation, ranging from mild cases with few clinical symptoms to severe and fulminant cases. Rheumatic carditis is the most important and severe manifestation of this disease because it can cause irreversible and often disabling valvular damage, which can progress to chronic rheumatic heart disease (CRHD)[1]. According to the World Health Organization (WHO), CRHD affects 15.6–19.6 million people worldwide and causes 233,000 to 492,000 deaths per year[1,2].

ARF can be prevented by early detection and adequate treatment of streptococcal pharyngotonsillitis[3]. Similarly, the progression of rheumatic valvular lesions can be minimized through secondary prophylaxis predominantly with the regular administration of penicillin G benzathine[4,5].

The use of color-flow Doppler echocardiography has been deemed adequate for the evaluation of rheumatic valvular lesions[1,6-8]. Similarly, screening studies using a portable machine in students of several countries have also shown a higher frequency of subclinical heart disease indicative of rheumatic valvular lesions[9-12].

The present study aimed to assess the prevalence of rheumatic heart disease according to physical examination and Doppler echocardiography in students of a public school of Belo Horizonte, MG.

Methods

This was a cross-sectional study conducted in a municipal school of the city of Belo Horizonte, MG, between May 2010 and November 2011. The Research Ethics Committee of UFMG and the Municipal Secretariat of Education approved this study.

The population studied comprised 267 students aged between 6 and 16 years. They were randomly selected and all students and/or their parents/legal guardians provided

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informed consent. The parents/legal guardians were contacted by post, and the letter contained information on the study and a questionnaire on signs and symptoms indicative of rheumatic fever, such as those associated with carditis, chorea, polyarthritis, arthralgia, and fever. The presence of parents at school was not possible. The students were interviewed, subjected to anamnesis and the physical examination performed by 1 of the researchers to establish the existence of previous criteria for the diagnosis of ARF with or without changes on chest auscultation, according to the Jones criteria[6].

Subsequently, on the same day, the students underwent Doppler echocardiography using an Acuson® (CV-Cypress) portable machine with a 3U2c probe. This procedure was performed in the school by a second researcher who was blinded to the findings of the previous anamnesis and the physical examination. This procedure was aimed to provide a diagnostic screening and assess the presence and the degree of AoR and MR, in at least 2 distinct planes. Changes indicative of rheumatic heart disease were analyzed according to the criteria defined by WHO/2004 to identify lesions, even if mild, and distinguish them from physiological findings[6,13]. After this assessment, the students who exhibited changes indicative of rheumatic valvular involvement were referred to the echocardiography laboratory of the Hospital das Clínicas of the Universidade Federal of Minas Gerais (HC-UFMG) for a more detailed evaluation. A Philips IE 3 device and commercially available hardware and software were used as well as multichannel electronic high-frequency resolution transducers (3.0–8.0 MHz). The same researcher who performed the screening test also performed this test. The tests were recorded in DVD and later analyzed by 2 additional experienced examiners, who were blinded to the clinical history and previously observed Doppler echocardiographic changes. The examiners issued their opinions regarding the findings and classified the changes as either physiological or pathological.

The presence of MR and/or AoR observed in at least 2 distinct planes and associated with the following changes was considered as valvular lesions indicative of rheumatic valvular involvement[14]:

- Length of regurgitation jet > 2.0 cm for MR and > 1.0 cm for AoR
- Pansystolic and pandiastolic regurgitation jet
- Regurgitation jet velocity > 3 m/s

Associated or not with morphological changes:

- Thickening of the mitral valve leaflets > 4 mm
- Thickening of the mitral subvalvular apparatus
- Narrowing of the mitral and/or aortic valve opening.

The regurgitations were defined as physiological when the Doppler echocardiography findings of mitral and/or aortic valvular dysfunction did not meet the criteria described above.

The diagnosis of subclinical rheumatic valvular involvement was made when there were no changes on cardiac auscultation suggesting valvular regurgitation but the Doppler echocardiography showed MR and/or AoR with nonphysiological characteristics, with or without the thickening and restriction of valvular mobility. The test to define these characteristics was performed by 1 of the researchers and assessed by 2 other experienced examiners. Only those cases in which there was agreement between the 3 examiners were considered.

After the assessment of the characteristics of valvular involvement, the students were distributed into 3 groups according to the classification shown in Table 1[14].

Figure 1 shows the sequence of evaluations performed on the selected school population.

Students with valvular changes consistent with rheumatic involvement were referred to the Rheumatic Fever Outpatient Clinic of HC-UFMG for monitoring and/or prescription of secondary prophylaxis.

Statistical Analysis

Data were stored in a database that was created for the study using the Excel software. Data validation was performed through descriptive analysis and the results were presented in the form of graphs and tables; the absolute values and percentages were determined for the qualitative variables and the mean (standard deviation) and median were calculated for the quantitative variables. The analysis was performed using SPSS version 13.0 software.

Results

Of the 267 students assessed, 140 (52.4%) were girls. Age ranged between 6 and 16 years (median: 13 years) and the majority were aged between 13 and 14 years (55.1%). Eight (3%) individuals had a history of heart disease; however, only 1 had RF, having presented 1 major and 2 minor manifestations of Jones criteria during the acute phase (carditis, arthralgia, and fever).

During the physical examination, 28 students (10.5%) exhibited murmur on cardiac auscultation. Of these, 26 were characterized as innocent. One student exhibited regurgitation murmur compatible with the diagnosis of interventricular communication and another exhibited mitral and aortic regurgitation murmurs.

Doppler echocardiography performed at the school with a portable machine showed that 23 (8.6%) of students had mild MR and 2 (0.8%) had combined MR and AoR. Of the latter, 1 had mild MR and AoR, with characteristics defined as nonphysiological, and the other had moderate MR and AoR. No lesions indicative of physiological AoR and/or aortic stenosis were observed.

Of the 23 students in whom Doppler echocardiography showing valvular regurgitation, 16 went to the HC-UFMG to undergo a new test to confirm the findings of the screening test. Of these, only 1 (6.2%) exhibited moderate MR and AoR, with thickening of both valves, in addition to the decreased mobility of the posterior leaflet and dome opening of the anterior leaflet of the mitral valve. Among the remaining students, 1 (6.2%) had mild degree combined MR and AoR, with normal valvular morphology and 3 (18.7%) exhibited isolated MR with thickening of the mitral valve. No student showed valvular stenosis.

Table 1 – Classification of the clinical and Doppler echocardiography findings according to criteria cases of used to identify definitive, probable, and possible rheumatic heart disease[14]

Definitive Rheumatic Heart Disease	Probable Rheumatic Heart Disease	Possible Rheumatic Heart Disease
Previous history of acute rheumatic fever with clinical manifestation of carditis	Absence of previous history compatible with acute rheumatic fever	Absence of previous history compatible with acute rheumatic fever
MR and AoR murmurs	Normal cardiovascular examination	Normal cardiovascular examination
Change on Doppler echocardiography	Change on Doppler echocardiography:	Change on Doppler echocardiography:
Nonphysiological MR and/or AoR	Nonphysiological MR and/or AoR	Nonphysiological MR and/or AoR without morphological changes, or
Valvular thickening with or without mobility restriction, with or without change in the subvalvular apparatus.	Valvular thickening with or without mobility restriction, with or without change in the subvalvular apparatus	Morphological change in the mitral and/or aortic mitral valve, with physiological MR and/or AoR.

MR: Mitral regurgitation; AoR: Aortic regurgitation.

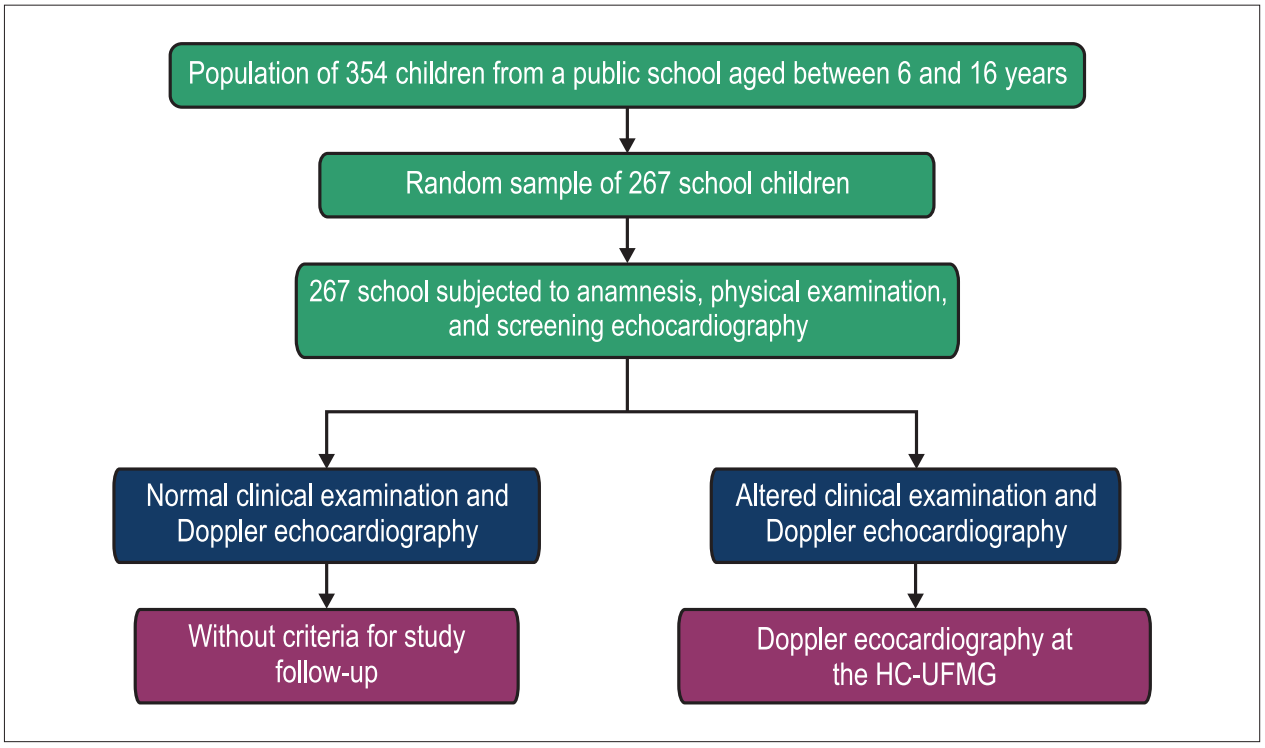


Figure 1 – *Sequence of evaluations performed on the school population selected for the study.*

Figure 2 shows the flow chart used to identify cases of rheumatic heart disease in a public school of Belo Horizonte.

Table 2 shows the frequency distribution of diagnoses of mitral and aortic valvular disease indicative of rheumatic involvement according to clinical findings and Doppler echocardiography performed in HC-UFMG.

The frequency of valvular changes consistent with rheumatic involvement was higher on Doppler echocardiography than on physical examination (5 times higher for MR and 2 times higher for AoR).

Graph 1 shows the frequency of diagnosis of cases with nonphysiological MR and AoR according to physical examination and Doppler echocardiography.

According to the clinical exanimation, the prevalence of clinically observed heart disease (MR and AoR murmurs) was 1 case (prevalence of 3.7/1000). However, Doppler echocardiography assessment showed nonphysiological AoR in 2 students (prevalence of 7.5/1000 CI 95%, 1.2/1000-24.5/1000) and nonphysiological MR in 5 students (prevalence of 18.7/1000, CI 95% 6.9/1000-41.0/1000).

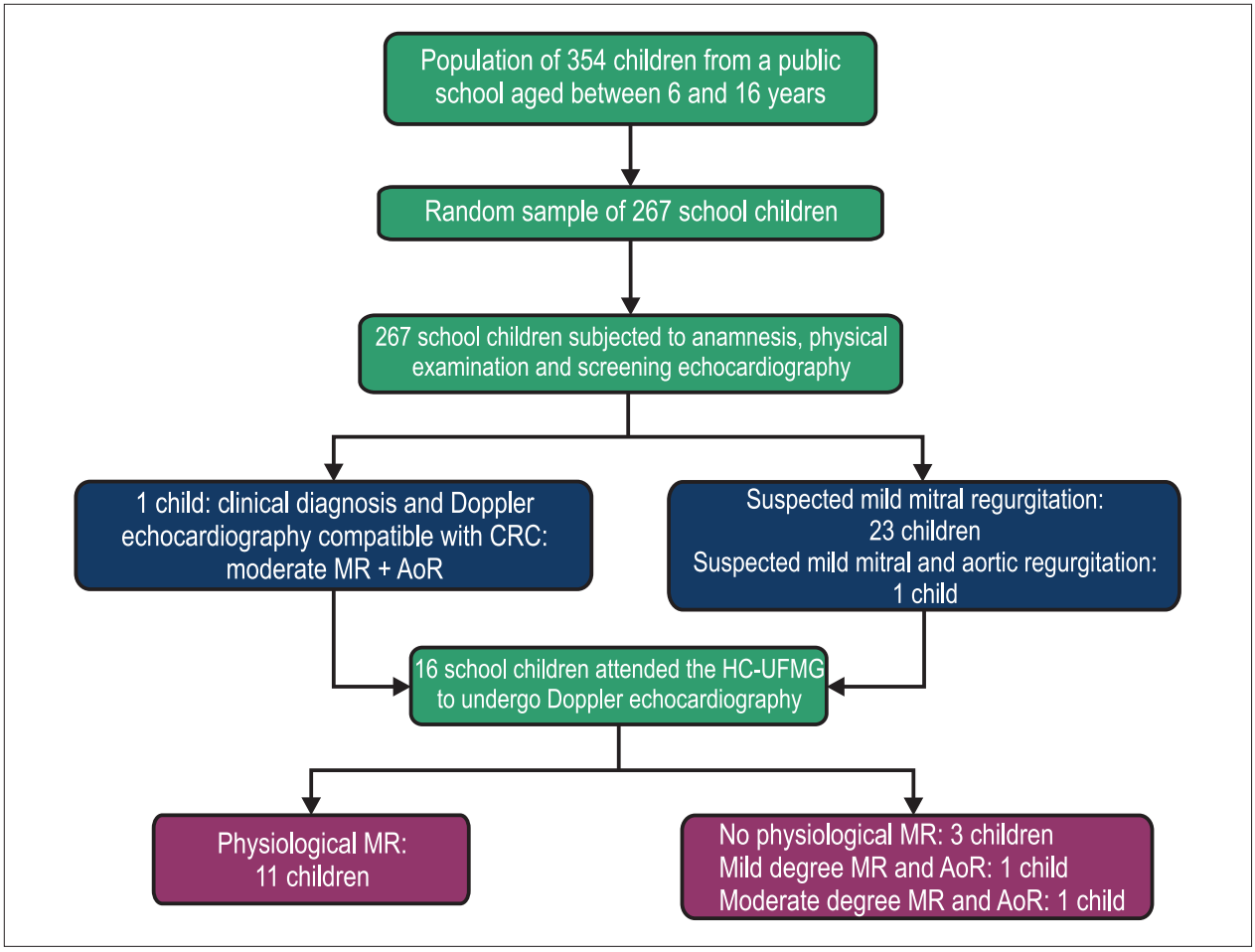


Figure 2 – *Identification of cases of rheumatic heart disease in a public school of Belo Horizonte.*

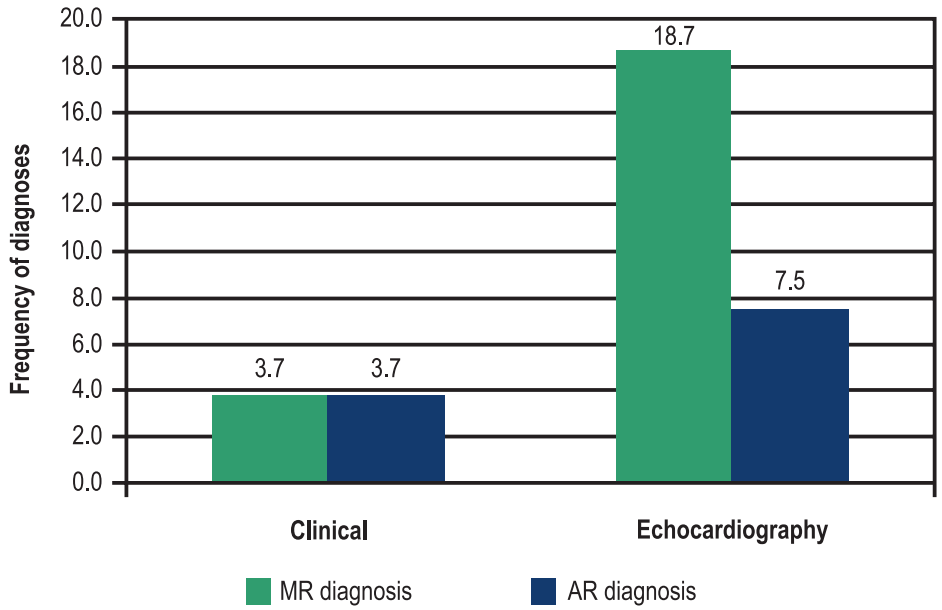
Table 2 – Frequency distribution of diagnoses of mitral and aortic valvular disease indicative of rheumatic involvement according to clinical evaluations and Doppler echocardiography performed at the Hospital das Clinicas of UFMG (absolute frequency/267*1000)

Diagnoses of valvular disease	Clinical	Echocardiography at HC-UFMG	CI (95%) - Echocardiography
Mitral Regurgitation	1 (3.7)	5 (18.7)	(6.9/1000) - (41.0/1000)
Aortic Regurgitation	1 (3.7)	2(7.5)	(1.2/1000) - (24.5/1000)

The images of Doppler echocardiography performed on the students at HC-UFMG are shown below. (Figures 3, 4, and 5)

Discussion

Diagnosis of carditis in ARF traditionally depends on changes observed on cardiac auscultation, such as the occurrence or exacerbation of a MR and/or AoR murmurs, with possible signs and symptoms of heart failure and/or findings suggestive of pericarditis, in addition to chest X-ray and electrocardiographic findings[5,6,15-17]. However, regurgitation murmurs are not always present or accurately detected, especially those of the mitral valve. A study conducted by Vijayalakshmi et al[18] involved 108 patients with Doppler echocardiography findings consistent with valvitis who did not have related cardiac auscultatory findings, and only 56 of the 108 patients were diagnosed with ARF, according to the Jones criteria[17,18]. It is estimated that more than 70% patients diagnosed with chronic rheumatic carditis (CRC) do not receive secondary prophylaxis because they do not show clinical manifestations of ARF[16]. Clinical evaluation by even experienced clinicians may not diagnose carditis, especially subclinical valvitis because there is no definitive laboratory test that establishes this diagnosis[16].



Graph 1 – *Frequency of diagnosis of cases with nonphysiological MR and AoR according to clinical evaluation and Doppler echocardiography performed at HC-UFMG, considering the 267 students assessed (absolute frequency/267*1000).*

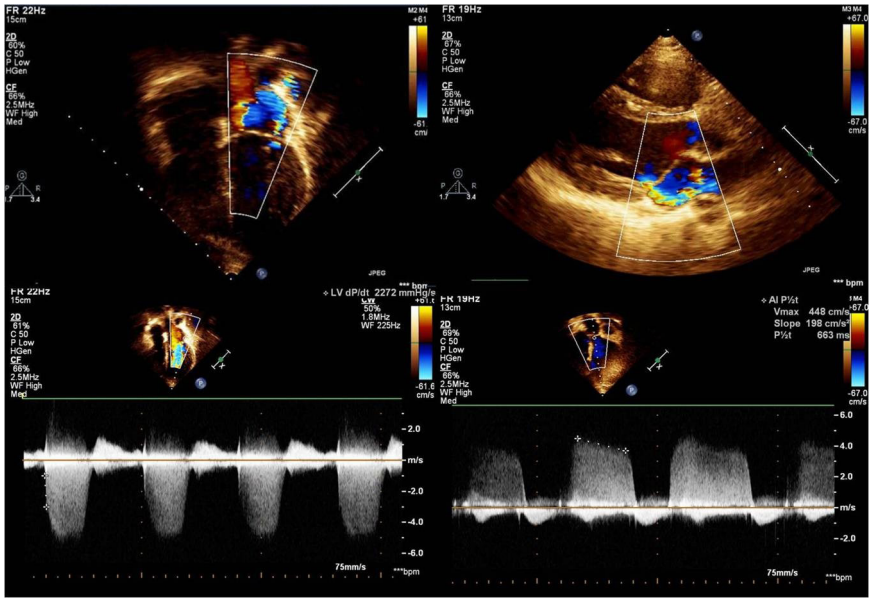


Figure 3 – *Image of the Doppler echocardiography of a patient diagnosed with definitive rheumatic heart disease.*

Several studies have proposed the implementation of Doppler echocardiography for the diagnosis of CRC in suspected cases without history of the acute phase, in which only valvular sequelae are observed[7,9,12,14,18-22]. However, the exclusive use of this method for the diagnosis of CRC in individuals without a clinical history of ARF and without apparent cardiac involvement is still controversial. This is mainly because there is a risk of abusive use of Doppler echocardiography testing for this purpose and because its use by less experienced examiners can lead to excessive diagnoses and unnecessary exposure to secondary prophylaxis[7,18]. Many authors have presented studies using portable Doppler

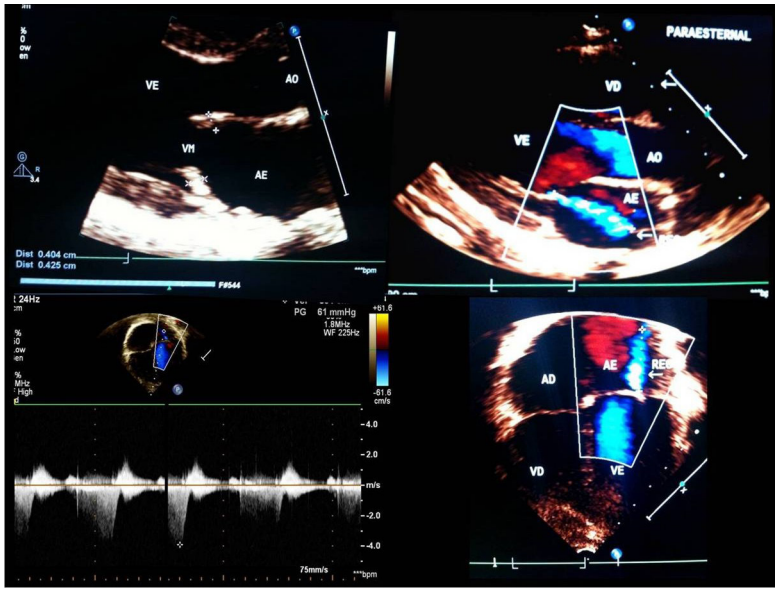


Figure 4 – *Image of the Doppler echocardiography of a patient diagnosed with probable rheumatic heat disease.*

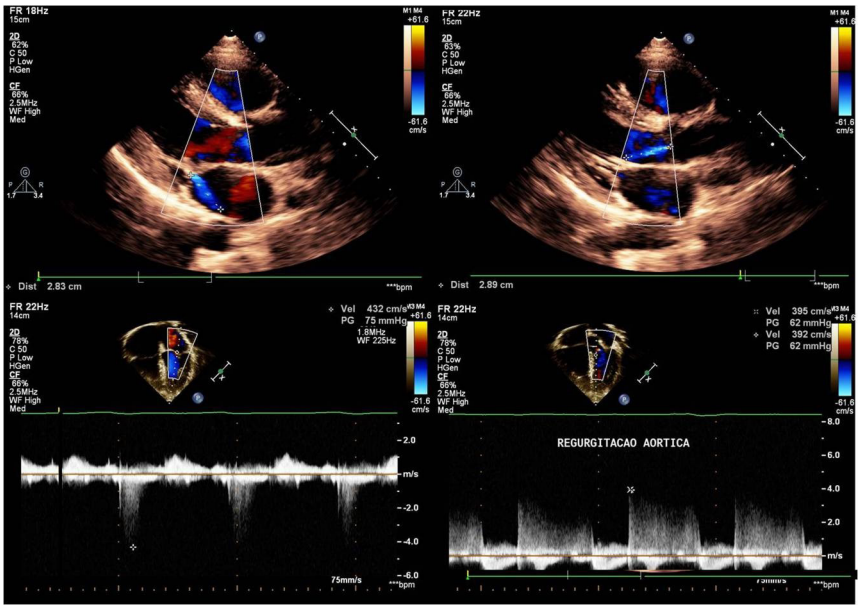


Figure 5 – *Image of the Doppler echocardiography of a patient diagnosed with possible rheumatic heart disease.*

echocardiography to perform screening tests, mainly in students, to screen subclinical cases of rheumatic valvular involvement without clinical expression[7,9,10,20,23-27].

In the present study, of the 267 students evaluated in the school, only 1 (0.4%) was diagnosed with CRC through anamnesis (history of carditis, arthralgia, and fever) and the physical examination (presence of mitral and aortic regurgitation murmurs). On the other hand, with the use of the portable Doppler echocardiography machine, mild MR was detected in 23 cases (8.6%) and mild aortic regurgitation was detected in 1 case (0.4%), with characteristics defined as nonphysiological. Only the student who had a previous history of FRA exhibited moderate MR and AoR. It was thus

possible to conclude that the Doppler echocardiographic study was more effective than physical examination in the identification of valvular dysfunction, as had already been demonstrated in several studies of valvular disease screening in students[9,10,14,23-27].

Studies conducted during the last decade used Doppler echocardiography for the validation of the clinical diagnosis of CRC and demonstrated a prevalence of 0.6–0.8/1000[25,26], similar to that obtained with clinical diagnosis reported in the study by Saxena et al[8]. More recent studies have shown that the prevalence of valvular disease indicative of rheumatic involvement identified using Doppler echocardiography is 5-10 times higher than that identified on physical examination[9,12,14].

A similar observation was made in the present study. Among the 16 students referred for more detailed Doppler echocardiography at HC-UFMG, only 1 (6.25%), with cardiac auscultatory findings showing significant MR and AoR murmurs had moderate MR and AoR in addition to valvular morphology changes. Of the 15 students with normal cardiac auscultation, 1 (6.25%) had nonphysiological combined mild MR and AoR and 3 (18.75%) had nonphysiological isolated mild MR in addition to valvular morphology changes. Therefore, the frequency of valvular changes consistent with rheumatic disease was 5 times higher on Doppler echocardiography evaluation (18.7/1000, 95% CI 6.9/1000–41.0/1000) than on clinical evaluation (3.7/1000); moreover, it was higher with for MR (18.7/1000, 95% CI 6.9/1000–41.0/1000) than for AoR (7.5/1000, 95% CI 1.2/1000–24.5/1000). In previous screening studies with students this distinction between the frequency of involvement of mitral and aortic valves had not been made[2,10,18,23-27].

On the basis of screening test performed in students, Marijon et al[28], added morphological criteria for valvular structure to the already existing Doppler criteria used to diagnose subclinical CRC in populations with high ARF prevalence. They concluded that with this addition there was a better characterization of valvular lesions consistent with rheumatic disease, allowing a more careful diagnosis and with a lower risk of loss of subclinical cases[28]. In the present study, among the 22 patients with normal cardiac auscultatory findings and MR and/or AoR detected with the portable Doppler echocardiograph, 3 (13.6%) exhibited alterations of the mitral valvular morphology. No individual showed changes in the morphology of the aortic valve, as was described by Marijon et al (2009)[28].

Marijon et al[9] suggested that the use of Doppler echocardiography screening allows CRC epidemiology to be redefined with regard to its identification. They stated that the early diagnosis of CRC and initiation of penicillin prophylaxis can decrease the clinical impact of the disease[9]. However, they propose that long-term monitoring of individuals with a diagnosis indicative of rheumatic heart disease is necessary, considering the estimates made in previous studies that indicate a favorable evolution in patients with subclinical valvitis[11,29-33].

In a study conducted in New Zealand involving 1142 children, Webb et al[14] observed that the use of Doppler echocardiography screening, as a method complementary to physical examination, is very important for a more accurate diagnosis. Valvular lesions, excluding congenital or physiological causes, can indicate rheumatic involvement and favor the use of secondary prophylaxis. The authors concluded that Doppler echocardiography is more sensitive and specific than cardiac auscultation in the detection of nonphysiological MR, without correspondence with clinical examination. In our study we observed a similar finding: higher prevalence of mitral and aortic valvular disease indicative of rheumatic involvement with the use of Doppler echocardiographic criteria than with the exclusive use of clinical criteria.

According to WHO[6], in regions where ARF is endemic, Doppler echocardiography should be performed routinely in cases with suspected cardiac changes indicative of rheumatic involvement, even without associated clinical evidence. Moreover, it recommends that those patients should be followed until a different diagnosis is made[6]. In the presence of valvular changes that are consistent with rheumatic disease but do not meet the criteria that confirm this etiology, patients should be monitored. In the reviewed literature, there is no consensus regarding practices to address these cases of subclinical valvular disease[12,14,17,34,35].

Limitations of the Study

Because this is a study of prevalence, the ideal would be to collect data in various schools and of a larger number of students. However, the sample size was calculated considering the prevalence of RF obtained in a clinical study also conducted in a school in Belo Horizonte[36] and the higher detection of valvular disease using Doppler echocardiography evaluation, according to the results of several screening studies conducted in schools[1,9,10,23-27,37-40]. The study sample was selected centrally in a single school.

Another limitation of the study was the number of students lost to follow up. Of the 23 students whose screening echocardiography showed nonphysiological MR and/or AoR, only 16 attended HC-UFMG for the confirmation of the findings. Therefore, the observed prevalence may have been underestimated.

Conclusion

The present study highlights the importance of Doppler echocardiography, over the physical examination, in the identification of cases of valvular lesions consistent with rheumatic involvement in students. In agreement with the assumption, a higher prevalence of nonphysiological MR and AoR was observed with the use of Doppler echocardiography criteria. In accordance with similar studies, this study identified 5 times more cases of rheumatic valvular disease, which enabled a careful follow-up of this cases and implementation of secondary prophylaxis. These measures decrease the risk of sequelae and the morbidity and mortality rates, which are still high in certain areas of our country.

The present study identified 1 case of definitive CRC and 4 cases of subclinical heart disease along with 3 cases of probable CRC and 1 case of possible CRC. Secondary prophylaxis was recommended for the cases of probable CRC, monitoring with primary prophylaxis was recommended for the case of possible CRC, and monitoring reinforcement and secondary prophylaxis was recommended for the case of definitive CRC.

Author contributions

Conception and design of the research: Miranda LP, Camargos PAM, Torres RM, Meira ZMA; Acquisition of data: Miranda LP, Torres RM, Meira ZMA; Analysis and interpretation of the data: Miranda LP, Meira ZMA; Statistical analysis: Miranda LP, Camargos PAM; Writing of the manuscript: Miranda LP; Critical revision of the manuscript for intellectual content: Miranda LP, Camargos PAM, Meira ZMA.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

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