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Continuation of the Revista Mexicana de Cardiología

2022

- Inter-American cardiological cooperation
- Triplane left atrial strain
- Double-orifice mitral valve in a woman with aortic coarctation and bicuspid aortic valve
- *Cor triatriatum* in a patient with CHA_2DS_2VASc 1-point atrial fibrillation
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Editorial

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Importance of inter-American cardiological cooperation

Importancia de la cooperación cardiológica interamericana

Fernando Stuardo Wyss-Quintana*

My dear friend Eduardo Meaney, editor of this magnificent journal, has invited me to write about the importance of inter-American cardiological cooperation, which has made me go back a few years ago, during my time as president in the Inter-American Society of Cardiology (SIAC, for its acronym in Spanish) and evaluate from the historical and critical point of view, my role in it, I am a faithful believer that a log does not burn alone, under this concept, I am totally convinced that the growth we have experienced in SIAC is due to the impressive work of each of the members that make up its different councils, which also constitute its scientific arm, being a core made up of extraordinary cardiologists from the continent, who have raised the Latin American cardiovascular presence on par with others in the world.

In 2009, Fernando Alonso of the Spanish Society of Cardiology invited the editors of the cardiology journals of the different Latin American societies to evaluate the concept of scientific participation and its impact on Latin American publications, an experience that remained written. In the Spanish Journal of Cardiology in 2009 «Ibero-American Cardiovascular Journals. Proposals for a much-needed cooperation», in the introduction of this publication, the authors conclude that the Ibero-American collaboration was due to the close contact that until now exists between the different societies, their scientific, academic and social initiatives, which are based on the deep common cultural roots between nations, which identify and unite us, whose best exponent are the languages we share (Spanish and Portuguese).[1]

Another aspect of great importance to emphasize is the teaching link and the great participation of great speakers of international renown who are present in the different national congresses that take place in Latin America and proudly also in other continents.

In recent years, Latin America has formed working groups, which have published guidelines and positions, which have marked the road map that many countries now take as a reference, which denotes the importance of inter-American cardiological cooperation and which I summarize below, not chronological order, but trying to give a perspective of historical, scientific impact.

In 2017, the Latin American Society of Hypertension (LASH) published updated guidelines for «Arterial hypertension and its associated comorbidities in Latin America» in the Journal of Hypertension,[2] which emphasize the importance of implementing a common policy for cardiovascular prevention in Latin America. Among the challenges common to all parts of the world is the growing global burden of morbidity and premature mortality associated with Non-Communicable Diseases (NCDs) and the financial limitations and inefficiencies that traditional models of health care have for coping with chronic diseases. Specific challenges arise from the fact that Latin America is one of the world regions with the greatest disparities in socioeconomic

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conditions and the availability of health care. A working group of 50 Latin American experts on hypertension speaks for the first time of this importance and establishes appropriate guidelines in our low-income countries.[2] SIAC in 2020, in its position with 25 experts,[3] published that they are convinced of the need to standardize the steps in which it goes from the diagnosis to the control of hypertension, establishing guidelines and standards that must be adopted in all Latin American countries. In the same way, the management of cardiovascular (CV) risk in order to achieve a substantial decrease in CV events based on the publication of LASH of the 2017.[2] Which later resulted in the creation of the SIAC program, «Cardiometabolic Prevention Units (CMPU)», which currently has more than 500 units accredited throughout Latin America with more than 800 participants.[4]

The most important participation as a Latin American unit has been carried out in the May Measurement Month (MMM), started in 2017 and led by the International Society of Hypertension (ISH), recruiting until the year 2021, almost five million people, in the Latin American survey of 2017 and published in 2020, a total of 105,246 were analyzed, reporting a prevalence of hypertension (HBP) in Latin America of 40%, which gives us a very clear idea of the current situation of the disease.[5]

Published in the Spanish Clinical Journal «Latin American Registry of Ambulatory Blood Pressure Monitoring (MAPA-LATAM):[5] an urgent need» once again unites Spain and Latin America, the use of ambulatory blood pressure monitoring (ABPM) is recommended to helping a better diagnosis, in making therapeutic decisions, and represents a better prognostic estimate than the measurements in consultation. It makes the clarification that, unfortunately, there is no global prospective ABPM registry for all Latin American countries that analyzes the prevalence of HBP, the degree of its knowledge, its percentage of treatment and the degree of control. Consequently, the authors of this article consider its implementation a priority.[6]

Undoubtedly, cardiovascular mortality, higher in our poor countries, has motivated us to learn about our differences in relation to Cardiovascular Risk Factors (CVRF) and the differences with other continents, in «The Consensus on Atherogenic Dyslipidemia: Prevalence, Causes and Treatment»[7,8] met the Latin American Lipid Association (ALALIP), SIAC and the Pan-American College of Endothelium (PACE), carrying out with a perfect modified Delphi methodology, the best consensus on the subject and which also results in two publications both in Spanish and English.[7,8]

This task force meets again in the «Consensus for Residual Risk Management»[9] giving strong conclusions and oriented to in the reduction of residual risk, therapeutic options adapted to the specific needs of the patient should be considered, based on five objectives of treatment: triglyceride-rich lipoproteins, inflammation, glucose metabolism, high blood pressure, and prothrombotic state. Comprehensive control of all cardiometabolic risk factors should be a priority to address this important public health problem and prevent premature deaths.[9]

SIAC analyzed the relationship between influenza, cardiovascular disease, and the importance of vaccination in risk groups and published it in its position published in Global Heart «Influenza Vaccination for the Prevention of Cardiovascular Disease in the Americas: Consensus document of the Inter-American Society of Cardiology and the World Heart Federation» with extraordinary conclusions and recommendations for all Latin America.[10] One of the SIAC proposals to improve the control of secondary prevention and, as far as possible, primary prevention has been the use of the polypill, recommendations that were published in the consensus and that were adapted to the Latin American reality.[11]

In order not to expand further, I must point out that Latin American cooperation in the current pandemic has made important scientific contributions: «Hydroxychloroquine, Messages from Cardiology in times of Pandemic»,[12] «Personal Safety during the COVID-19 Pandemic: Realities and Perspectives of Healthcare Workers in Latin America»,[13] Ambulatory Patients with Cardiometabolic Disease and Without Evidence of COVID-19 During the Pandemic. The CorCOVID LATAM Study (five publications now)[14-18] where topics related to psychological

impact, vaccination and cardiometabolic disease were addressed, in addition to the Latin American registry of COVID and Cardiovascular Disease, whose rationale we have published, and we are waiting for the results obtained from many Latin American research centers to give us a clear idea of the impact of the pandemic in Latin America.[19]

The future of cardiology is in the hands of young cardiologists, who are beginning their professional life, including those medical students, who from their early years give an idea of the professionals they will become. I think my best program was the SIAC Emerging Leaders, a group of at least 30 young people under 35 years old, from all over Latin America, who have shown that cooperation, research and science are guaranteed, all of them have created, together with their mentors, the NET-Heart Project «Neglected tropical diseases and their impact on cardiovascular health» with a total of 19 scientific publications, whose rationale I will cite in this editorial[20] and culminating in a book sponsored by Elsevier, is the icing on the cake of two years of intense cooperative work in Latin America.

What is my vision Eduardo? of a Latin America without borders, without differences, united by the passion of our lives «Cardiology», showing the rest of the world what we are capable of doing and, of course, showing where we are going, the answer after more than more than 30 scientific publications, the blue book (SIAC's Cardiology textbook, with more than 250 Latin American authors) and others, have shown that Latin American cooperation today is an indestructible reality and that it will surely give us great satisfaction.

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ORIGINAL RESEARCH

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Triplane left atrial strain

Strain de aurícula izquierda triplanar

Jorge Eduardo Hernández-Del Río,* Sergio Herrera-Méndez,‡ María Cepeda-Rocha,§ Tomás Miranda-Aquino,* Michel Machuca-Hernández¶

Keywords:
Left atrial, strain deformation, triplane.

Palabras clave:
Aurícula izquierda, deformación de strain, triplanar.

ABSTRACT

Left atrial strain, assessed by two-dimensional echocardiography with speckle tracking, has emerged as an important part of the evaluation of the atrial function in different pathologies. The objective was to compare the percentage of myocardial deformation of the left atrium evaluated by monoplanar, biplanar and triplanar measurement. The study was a Cross-sectional, prospective, observational, analytical and single-center, atrial deformation was examined using the syngo® Velocity Vector Imaging technology software. It was predetermined to use the apical 4, 2 and 3-chamber views to calculate myocardial deformation. Patients older than 18 without cardiovascular risk factors, without previous chronic, infectious, or congenital diseases were included. A total of 126 healthy patients were collected, of which 71 (56%) were male, the mean age of the population was 38 years (± 16). Intraobserver and interobserver variability were adequate. The different values of the left atrium were compared. For the reservoir strain, only a significant difference was found between the apical 3-chamber and apical 2-chamber values reported; in pump strain, there were no significant differences in values obtained; for the conduit strain, again the apical 3-chamber view was the lowest, finding a significant difference with the apical 4c, apical 2c and biplane views. The concordance of the reservoir strain of each apical view was independently related to the biplane and triplane views, finding that both apical 2c and 4c views had a good concordance with both biplane and triplane views. However, the apical 3c view had a lower concordance. The same was found for pump strain and conduit strain, being Apical 2c and 4c views superior. **Conclusion:** The 3-chamber view has different left atrial strain values than the other apical views, and the concordance of all other values of left atrium examination are similar; hence it is not further significant to perform a biplane or triplane examination. Based on the information obtained, the 3-chamber view should not be used, and a monoplane evaluation can be used, either the 4-chamber or 2-chamber views with similar concordance among them.

RESUMEN

El strain *de aurícula izquierda evaluado mediante ecocardiografía bidimensional con* speckle tracking *se ha convertido en una importante parte de la evaluación de la función auricular en diferentes patologías. El objetivo fue comparar el porcentaje de deformación miocárdica de la aurícula izquierda evaluado mediante medición monoplanar, biplanar y triplanar. El estudio fue transversal, prospectivo, observacional, analítico y unicéntrico, la deformación auricular fue evaluada utilizando la deformación de la aurícula izquierda, se obtuvo utilizando el software syngo® Velocity Vector Imaging technology. Se determinó utilizar la vista apical 4, 2 y 3 cámaras para poder calcular la deformación miocárdica. Pacientes mayores de 18 sin factores de riesgo cardiovascular sin enfermedades previas crónicas, infecciosas o congénitas fueron incluidos. Se recabaron en total 126 pacientes sanos, de los cuales 71 (56%) eran del género masculino, la media de edad de la población fue de 38 años (± 16). La variabilidad intraobservador e interobservador fue adecuada. Se compararon los diferentes valores de la aurícula izquierda, en el* strain *reservorio, sólo se encontró diferencia significativa entre los valores de apical 3 cámaras y el apical 2 cámaras; en el* strain *bomba no hubo diferencias significativas en los valores; en el* strain *conducto nuevamente la vista apical 3c fue la menor, encontrando diferencia significativa con el apical 4c, apical 2c y biplanar. Se relacionó la concordancia del* strain *reservorio de cada vista apical de manera independiente con biplanar y triplanar, documentando que tanto la vista apical 2c y la apical 4c tenían buena concordancia con ambas vistas, sin embargo, la vista apical 3c tenía una menor concordancia. Lo mismo se encontró en el* strain *bomba y el* strain *conducto. Siendo superiores las vistas apicales 2c y 4c.* ***Conclusión:*** *La vista de tres cámaras tiene resultados diferentes a las demás vistas y la concordancia de todos los demás valores de la aurícula izquierda es similar, por lo que no le da más valor tomarlo en biplano o triplano. Con base en la información obtenida no se debe utilizar la vista de tres cámaras y se puede utilizar una evaluación monoplanar, ya sea 4 o 2 cámaras con concordancia similar.*

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INTRODUCTION

Left atrial strain, assessed by two-dimensional echocardiography with speckle tracking, has emerged as an important part of the evaluation of diastolic function and for the estimation of left ventricular (LV) filling pressures, as well as in the prediction of adverse events, such as heart failure, atrial fibrillation (AF), and acute myocardial infarction (AMI).

The left atrium (LA) contributes to cardiac hemodynamics, modulating LV filling through the interaction of reservoir function, conduit phase, and contractile force. The reservoir function corresponds to the isovolumic contraction of the LV, its ejection and isovolumic relaxation; this depends on the systolic function of the LV, the size of the atrium and its compliance. The conduit function corresponds to the early ventricular filling phase and is modulated by atrial compliance and LV relaxation. Contractile function depends on pulmonary venous return (atrial preload), end-diastolic ventricular pressure (atrial afterload), and atrial contractile reserve.

The deformation of the atrium is a non-volumetric atrial function parameter. It evaluates its function as a muscle pump, making the deformation of atrial tissue a crucial component. Reservoir, conduit, and pump functions can be measured through longitudinal atrial strain. A low strain value orientates us towards a non-compliant, fibrous atrium, with a reduction in its contractile capacity. However, in the latest guidelines published by the American Society of Echocardiography and the European Association of Cardiovascular Imaging for diastolic function evaluation and the quantification of atrial strain function, Strain assessment was not included. The need for methodology standardization, the acquisition of more experience by the operators, more reproducible studies, and specific software for atrial strain, with more predetermined values in healthy people, are the proposed rationales.

Background. Strain, also called deformation, is interpreted as the degree of deformation of the myocardial fiber during the cardiac cycle, with negative values when it contracts and positive when the myocardium relaxes.[1] There are three techniques to calculate strain: Tissue Doppler evaluation (angle-dependent); the second is by «speckle tracking» or point tracking, being the most widely used today since it is not modified by the angle of interrogation; and the most recent is the «velocity vector imaging» (VVI) technique, which is also angle independent, but has the advantages of faster point tracking, processing, and tracking in a single frame.[2] The points to be followed on the endocardial border must be set, and the software automatically tracks these marks during the cardiac cycle.

Left atrial strain *(Figure 1)* is acquired in the apical 4-chamber, 2-chamber, and 3-chamber views. The endocardial border is traced, excluding the entrance of the pulmonary veins. Currently, it has been described that it can only be acquired in a 4-chamber view, but there is also a biplane mode analysis by adding

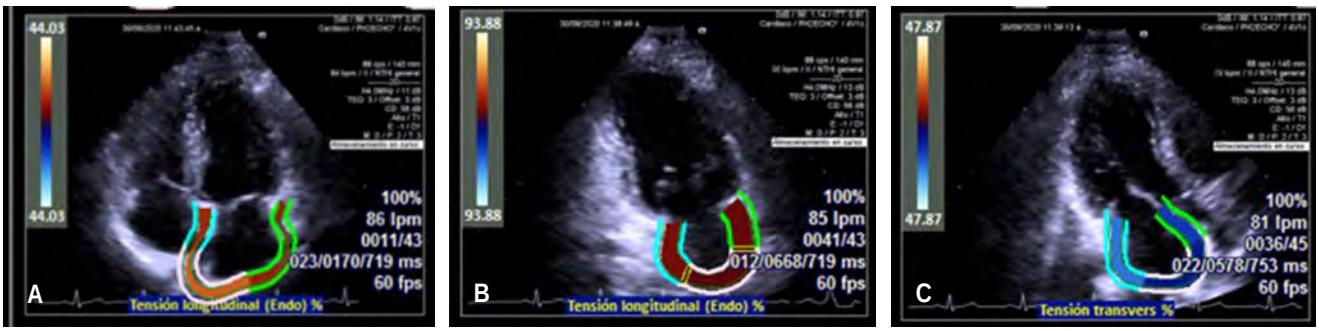

Figure 1: Representation of the tracing of the atrial border for obtaining left atrial strain in the three apical planes: **A)** 4 chambers, **B)** 2 chambers, **C)** 3 chambers.

a 2-chamber view assessment.[3] The great advantage of using the longitudinal strain of the left atrium is that the three phases of the atrial cycle are perfectly represented, and depending on the part of the electrocardiographic trace that is taken as reference, the order of representation of these phases will change.[2] All waves Will be positive when the QRS is used as the reference point. The first corresponds to the reservoir phase, it is the largest, so it has been taken as a synonym for the global strain of the left atrium. Then, the one that follows corresponds to the conduit phase and the last one to the pump phase. Quantitatively the value of the conduit phase is the subtraction of the reservoir phase and the pump phase values *(Figure 2)*. When the P wave is taken as the reference point, the first wave is negative, corresponding to the pump phase or atrial contraction, followed by the reservoir phase and finally the conduit phase. Previously, it has been shown that similar values are obtained when taking any of the two reference points.[4] The technique is highly reproducible for both novices and experts, with a concordance greater than 88% among them.[5]

Left atrial strain is correlated to diastolic function, decreasing linearly as diastolic dysfunction progresses.[1,6] One relevant point is that unlike the other phases of the atrial cycle, the pump phase increases in grade 1, and later in grades 2 and 3, it decreases along with the other phases.[6] Reduced strain values have been associated with higher filling pressures, being inversely related to the E/e' wave ratio.[7-9] It has also been associated with increased left atrial stiffness and fibrosis as left atrial strain is depressed in these conditions.[10] In addition, it has been related to an increased wedge pressure and BNP values.[11] Another point in favor is that deformation values of the atrium begin to change even before the volume of the left atrium begins to increase.[12] It correlates better than left atrial volume and E/e' to categorize diastolic dysfunction.[6] It can even reclassify, especially those patients who have an undetermined diastolic function.[13]

Normal values have been widely discussed with some variability among studies for the reservoir phase values ranging from 28 to 60%,[14] this due to the great heterogeneity in the echocardiogram equipment/software used,[15] the electrocardiographic reference point, and the view used for the assessment. In a recent meta-analysis that included 40 studies, it was reported that for the reservoir phase, the normal value was 39%, for the conduit phase 23% and 17% for the pump phase.[16] Singh et al. reported that a cut-off point below 35% could be taken as a reference point for a patient with diastolic dysfunction, and even a cut-off point lower than 19% for grade 3 diastolic dysfunction.[6]

A non-standardized aspect and the main purpose of this study is which views should be included to perform the atrial deformation analysis: if only 4-chamber view, if 2 and 4-chambers or 2, 3 and 4-chambers views. In the previously mentioned review and meta-analysis,[14] 19 studies evaluated atrial strain only in the 4-chamber view, 17 in the 2 and 4-chamber views, and only four studies in the 2, 3, and 4-chamber views, without finding significant differences in LA longitudinal strain values. In the EACVI NORRE study,[17] the 2 and 4-chamber views were included. The standardization document on the atrial strain, published in 2018 by the EACVI/ASE group,[18] recommended measuring deformation only with a 4-chamber view, taking as a valid option also to include the 2-chamber view in the analysis. Regarding the apical 3-chamber view, it can be difficult to define correctly between the ascending aorta and the anteroseptal atrial wall, a situation that can affect the measurement and strain values.[19]

In patients with ischemic heart disease, it has been observed that atrial strain decreases in relation to the progression of diastolic dysfunction.[11,20] A correlation with diastolic function has been recognized, increased mortality, reinfarction and rehospitalizations,[10,12] and in turn, an improvement in strain values has been observed with cardiac rehabilitation.[14,21,22]

Another pathology in which left atrial deformation has been widely described is its association with atrial fibrillation. Decreased values predict the onset of this arrhythmia.[23-25] After atrial fibrillation ablation, the presence of a decreased strain predicts the recurrence of atrial fibrillation.[26] The identification of

altered strain is also associated with the risk of presenting systemic embolism in patients with atrial fibrillation.[5,10,27]

In mitral valve disease, a linear relationship has been widely reported as mitral regurgitation increases with decreased left atrial strain. Moreover, it has been associated with survival.[12,25,28,29] It also predicts the development of atrial fibrillation in patients with mitral stenosis.[30]

The utility of left atrial strain in arterial hypertension,[25,31] chronic kidney disease,[32] autoimmune diseases such as lupus[33] and rheumatoid arthritis[34] has also been evaluated.

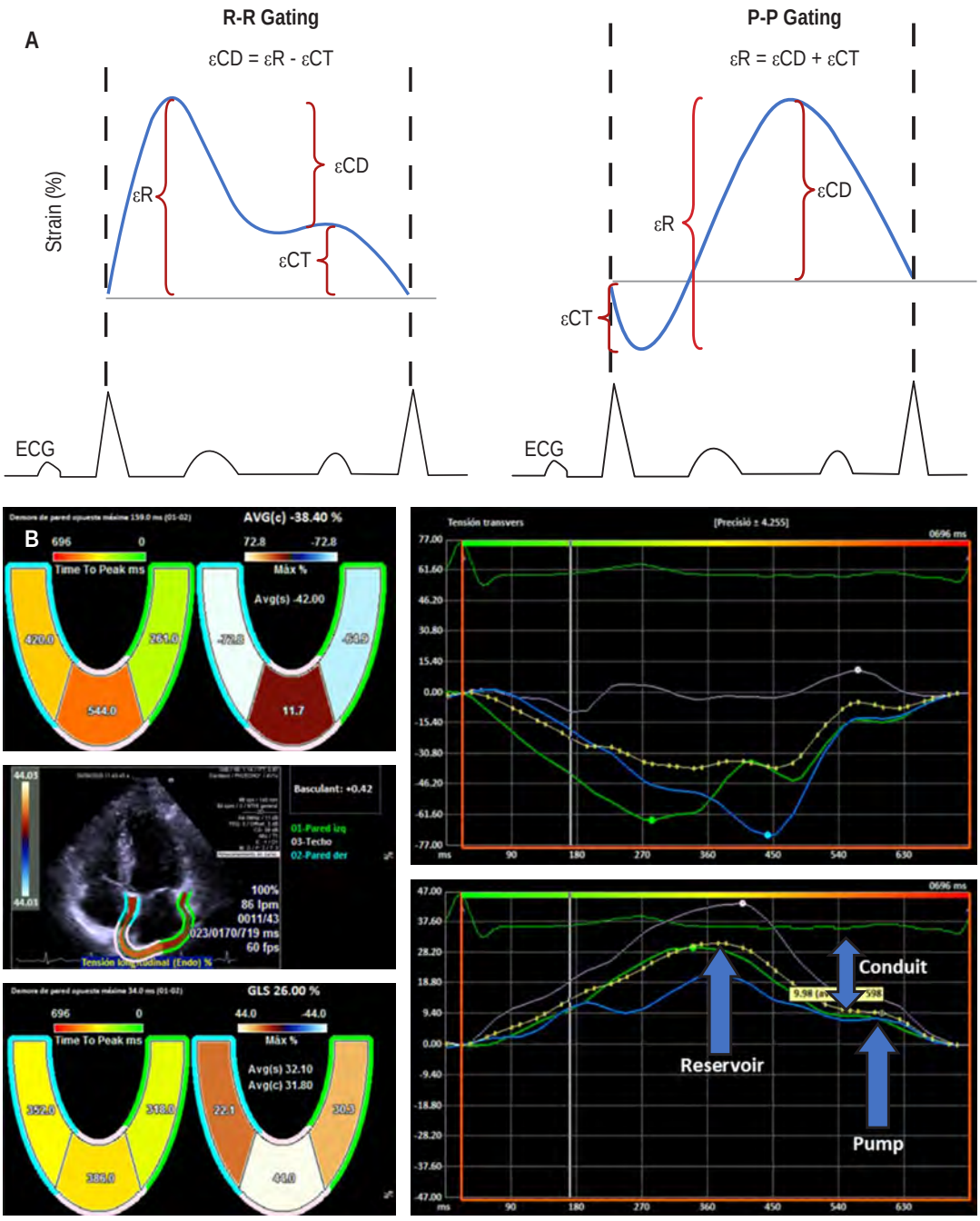

Figure 2:

A) Schematic representation of the electrocardiogram reference points (R-R, P-P) and the measurements of the different phases of atrial function measured by left atrial strain ER: reservoir strain, ECT pump strain, ECD conduit strain. **B)** Measurement of left atrial strain in Siemens Acuson equipment SC 2000.

Justification. Myocardial deformation has recently been used to assess left atrial function. The advantage of being angle-independent makes it less susceptible to errors.[6]

This technique has been studied in multiple cardiovascular diseases,[16,35] especially in atrial fibrillation, where it predicts which patients will present this arrhythmia in the near future[2] and who is at risk of developing thrombus. It has been observed that hypertensive patients show decreased myocardial deformation values,[31] and among patients with valvular heart disease, a decreased myocardial deformation is related to increased morbidity and mortality of cardiovascular cause.[16,25,27,28] The strain has also been related to cardiovascular events in ischemic heart disease.[7,30]

Myocardial deformation is closely related to diastolic function. Singh et al.[6] showed that the left atrial deformation decreased linearly with the degree of diastolic dysfunction, similarly in the reservoir, conduit, and pump phases. In turn, the authors identified that the best cut-off point to differentiate normal diastolic function from diastolic dysfunction was 35%.[6]

The importance of this study involves the relevance of determining the variability that exists between the monoplane, biplane and triplane measurement of the left atrial deformation (strain) in order to determine the appropriate method for its analysis, since this technique of evaluation is recent and specifically in atrial deformation, there is not enough evidence, especially in Latin America. The reason why it is important to establish the best analysis method.

In this study, the continuous variables were measured with the Kolmorov Smirnov test and compared with the ANOVA test, determining the agreement between values and later, the agreement was compared independently in each view of the left atrium.

General objective. To compare the percentage of myocardial deformation of the left atrium evaluated by monoplane, biplane and triplane measurements.

MATERIAL AND METHODS

Cross-sectional, prospective, observational, analytical, single-center study. All patients older than 18 who attended the Hospital Civil de Guadalajara «Fray Antonio Alcalde» cardiology department without cardiovascular risk factors, without previous chronic, infectious, or congenital diseases were included.

Demographic variables of patients were age and gender. Echocardiographic variables related to the left atrium were reservoir, conduit and pump strain, end-diastolic volume, end-systolic volume, ejection fraction and stroke volume.

The echocardiogram equipment used was a Siemens ACUSON SC2000 prime with a 2.5 MHz sectorial 4v1c probe. The ejection fraction of the left atrium was determined using the biplanar method in the traditional apical 4 and 2-chamber views (Simpson method). The tele-diastolic and tele-systolic volume of the left atrium was calculated at the end of systole and at the end of ventricular diastole, respectively, by tracing the entire atrial border starting at the medial side of the mitral annulus and ending at the lateral mitral annulus in the 4-chamber view and for the 2-chamber in the lower region of the mitral annulus and ending in the anterior mitral annulus, using the biplanar Simpson method.

Atrial deformation was examined using the syngo® Velocity Vector Imaging technology software. It was predetermined to use the apical 4, 2 and 3-chamber views to calculate myocardial deformation. The left atrial endocardium was traced at end-systole, following the endocardial borders trace during the cardiac cycle. The R-R interval of the electrocardiogram was used as the reference point for the deformation calculation. A maximum global longitudinal strain value was obtained, represented by the value of the longitudinal strain of the reservoir phase (rALS), and in addition, two other values were obtained: the conduit (cALS) and pump strain (pALS). The rALS is represented by the maximum value of the reservoir phase, the pALS at the highest point of the pump phase and the cALS by the difference between rALS and pALS.

Upon admission to the cardiology department, informed consent was given of the procedures to be performed if required. Every patient admitted to the cardiology cabinet service undergoes an echocardiogram in accordance with the recommendations of the European Society of Cardiac Imaging and the American Society of Echocardiography

guidelines. The ethical statutes of the Declaration of Helsinki were followed.

Inclusion criteria

1. Healthy patients older than 18 years of age.
2. Transthoracic echocardiogram performed in the Cardiology department of the Hospital Civil de Guadalajara Fray Antonio Alcalde
3. Good acoustic window.
4. Electrocardiographic trace at the time of echocardiographic images capture.
5. Have a complete clinical record that allows the acquirement of demographic variables.
6. Heart rate less than 100 beats per minute
7. Echocardiographic images acquired at 40-70 frames per second to calculate the left atrium myocardial deformation.

Exclusion criteria

1. Patients who have not had an echocardiogram.
2. Poor acoustic window.
3. Do not have an electrocardiographic trace at the time of echocardiogram examination.
4. Presence of any cardiovascular risk factor
5. Previous chronic, congenital, or infectious disease
6. Previous cardiovascular disease
7. Atrial fibrillation or any supraventricular arrhythmia present at the study time.
8. Heart rate greater than 100 beats per minute.
9. Less than 40 or greater than 70 frames per second at the image acquisition time to calculate the left atrium myocardial deformation.
10. Incomplete medical record.
11. Refusal to sign the informed consent.

Specific objectives

1. To assess the left atrium deformation in the 4-chamber, 2-chamber, and 3-chamber views.
2. To compare the percentage value of strain of the LA according to the number of planes used to collect them.

Statistical analysis

Continuous variables are described with mean and standard deviation, according to the normality of the variables were measured with the Kolmogorov Smirnov test. Continuous variables were compared with the ANOVA test. Concordance between the values of the left atrium variables was determined using the intraclass correlation coefficient. The concordance in each view of the left atrium was then independently compared with the intraclass correlation coefficient. Statistical significance is described with a $p < 0.05$. Statistical analysis was performed using the medcal 15.0 software.

RESULTS

A total of 126 healthy patients were included, of which 71 (56%) were male. The mean age of our population studied was 38 years (± 16).

Table 1: Comparison of results of left atrial values.

Value	4c	2c	3c	Biplane	Triplane	p
Reservoir	52.3 ± 19	53.4 ± 16*	47.1 ± 17*	52.9 ± 13	50.9 ± 12	0.01
Pump	20.2 ± 10	20.3 ± 9	20.2 ± 10	20.2 ± 7	20.2 ±7	NS
Conduit strain	32.5 ± 14*	32.9 ± 14*	26.8 ± 13*	32.7 ± 11*	30.7 ± 10	< 0.001
End-diastolic volume	13.5 ± 11	14.2 ± 11	12.5 ± 11	13.8 ± 9	13.4 ± 9	NS
End-systolic volume	46.9 ± 16*	51.9 ± 21*	41.2 ± 18*	49.1 ± 17*	46.5 ± 15	< 0.001
Ejection fraction	75.3 ± 13	72.9 ± 14	75.3 ± 13	74.2 ± 11	73.7 ± 11	NS
Stroke volume	35.7 ± 13*	37.5 ± 16*	29.2 ± 12*	36.7 ± 13*	34.2 ± 11	< 0.001

* significant statistical difference between the left atrial values, $p < 0.05$

Intra-observer variability was 0.92 for reservoir strain, 0.89 for pump strain, and 0.91 for the conduit strain. The inter-observer variability by the kappa method was 0.93.

The different values of the left atrium were compared *(Table 1)*. For the reservoir strain, only a significant difference was found between the apical 3-chamber and apical 2-chamber values reported; in pump strain, there were no significant differences in values obtained; for the conduit strain, again the apical 3-chamber view was the lowest, finding a significant difference with the apical 4c, apical 2c and biplane views. No significant differences were found in the end-diastolic volumes; however, in the end-systolic volume, it was lower for the 3c apical view. Similar values for ejection fraction were documented among all three views. The stroke volume was lower in the apical 3c view.

When comparing the concordance between the apical 2c, 3c, 4c, biplane and triplane views, it was found that all three parameters of the left atrial strain had a very good concordance *(Table 2)*. The Reservoir strain was 0.83 *(Table 3)*, 0.81 for pump strain *(Table 4)*, and 0.85 for conduit strain *(Table 5)*.

The concordance of the reservoir strain of each apical view was independently related to the biplane and triplane views *(Table 3)*, finding that both apical 2c and 4c views had a good concordance with both biplane and triplane views; however, apical 3c view had a lower concordance. The same was found for pump strain *(Table 4)* and conduit strain *(Table 5)*, being Apical 2c and 4c views superior *(Tables 4 y 5)*.

Table 2: Concordance between the left atrium values among all views.

Value	k	IC95%
Reservoir strain	0.83	0.78-0.87
Pump strain	0.81	0.75-0.85
Conduit strain	0.85	0.81-0.89

DISCUSSION

The intra-observer variability was adequate. We achieved a very good concordance between the left atrium values in all views. The values of left atrial deformation found in our population of healthy subjects are comparable to the values reported in the literature.[17] In our study, deformation values of the three phases of atrial function were compared, finding lower values for the 3-chamber apical view in both reservoir and conduit strain, without differences in pump strain. Atrial volumes showed similar behavior, finding lower values for the 3-chamber view, although this difference was only significant in the end-systolic volume but insignificant for the end-diastolic volume. The ejection fraction did not have a significant difference between the three views, unlike the stroke volume, which did present a behavior similar to the deformation and end-systolic volume with lower values.

These results are consistent with the previously described difficulty of delimitation in the 3-chamber view between the ascending aorta and the anteroseptal wall of the atrium, making it difficult to assess both deformation and atrial volumes.[19]

When matching the concordance of the reservoir, conduit or pump strain of each apical view independently with biplane and triplane

Table 3: Concordance of reservoir strain in each view of the left atrium.

Value	2c	3c	4c	Biplane	Triplane
2c		0.46 (0.2-0.6)	0.37 (0.1-0.5)	0.86 (0.8-0.9)	0.81 (0.7-0.9)
3c	0.46 (0.2-0.6)		0.25 (0.1-0.5)	0.42 (0.2-0.6)	0.79 (0.7-0.9)
4c	0.37 (0.1-0.5)	0.25 (0.1-0.5)		0.87 (0.8-0.9)	0.76 (0.6-0.8)
Biplane	0.86 (0.8-0.9)	0.42 (0.2-0.6)	0.87 (0.8-0.9)		0.93 (0.9-1.0)
Triplane	0.81 (0.7-0.9)	0.79 (0.7-0.9)	0.76 (0.6-0.8)	0.93 (0.9-1.0)	

Table 4: Concordance of pump strain in each view of the left atrium.

Value	2c	3c	4c	Biplane	Triplane
2c		0.37 (0.1-0.6)	0.19 (0.1-0.4)	0.80 (0.7-0.9)	0.74 (0.6-0.8)
3c	0.37 (0.1-0.6)		0.35 (0.1-0.5)	0.43 (0.2-0.6)	0.79 (0.7-0.9)
4c	0.25 (0.1-0.4)	0.35 (0.1-0.5)		0.85 (0.8-0.9)	0.76 (0.7-0.8)
Biplane	0.80 (0.7-0.9)	0.43 (0.2-0.6)	0.85 (0.8-0.9)		0.93 (0.9-1.0)
Triplane	0.74 (0.6-0.8)	0.79 (0.7-0.9)	0.76 (0.7-0.8)	0.93 (0.9-1.0)	

Table 5: Concordance of conduit strain in each view of the left atrium.

Value	2c	3c	4c	Biplane	Triplane
2c		0.51 (0.3-0.7)	0.41 (0.2-0.6)	0.87 (0.8-0.9)	0.83 (0.8-0.9)
3c	0.51 (0.3-0.7)		0.37 (0.1-0.6)	0.52 (0.3-0.7)	0.81 (0.7-0.9)
4c	0.41 (0.2-0.6)	0.37 (0.1-0.6)		0.87 (0.8-0.9)	0.80 (0.7-0.9)
Biplane	0.87 (0.8-0.9)	0.52 (0.3-0.7)	0.87 (0.8-0.9)		0.95 (0.9-1.0)
Triplane	0.83 (0.8-0.9)	0.81 (0.7-0.9)	0.80 (0.7-0.9)	0.95 (0.9-1.0)	

assessments, something similar to that found with strain and atrial volumes was observed, that is, lower values of concordance with the 3-chamber view, as opposed to the 4-chamber and 2-chamber views that match both views appropriately.

CONCLUSIONS

The 3-chamber view has different left atrial strain values than the other apical views, and the concordance of all other values of left atrium examination are similar. Hence it is not further significant to perform a biplane or triplane examination. Based on the information obtained, the 3-chamber view should not be used, and a monoplane evaluation can be used, either the 4-chamber or 2-chamber views with similar concordance among them.

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Double-orifice mitral valve in an asymptomatic young adult woman with aortic coarctation and bicuspid aortic valve

Doble orificio de válvula mitral en mujer asintomática joven con coartación aórtica y válvula aórtica bicúspide

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Keywords:
Double-orifice mitral valve (DOMV), congenital malformations, multimodal imaging techniques.

Palabras clave:
Doble orificio mitral, malformaciones congénitas, técnicas de imagen multimodal.

ABSTRACT

Congenital heart disease in Mexico ranks second among congenital malformations in newborns, with an incidence of 0.8-1.4%. Double orifice mitral valve (DOMV) is rare congenital heart disease, with a reported incidence of 0.05%. This malformation consists of the anatomical presentation of two mitral orifices, commonly associated with other congenital malformations such as septal defects, complete or partial malformations of the atrioventricular canal, aortic coarctation, tetralogy of Fallot, atrial or interventricular communication, Ebstein's anomaly and patent ductus arteriosus. The clinical characteristics are variable and can even go unnoticed and be diagnostic until adulthood. We present the case of an asymptomatic young woman with a diagnosis of arterial hypertension. During a routine control was diagnosed with multiple congenital heart diseases whose relationship is little described in the literature, this being the third case reported. At present, multimodal imaging techniques allow a greater characterization of lesions of both the valve and the valve apparatus, intending to carry out a comprehensive diagnostic and therapeutic approach to offer the greatest benefit to the patient.

RESUMEN

Las cardiopatías congénitas en México ocupan el segundo lugar de malformaciones congénitas en los recién nacidos, con una incidencia de 0.8-1.4%. El doble orificio de la válvula mitral (DOVM) es una cardiopatía congénita rara, con una incidencia reportada de 0.05%. Esta malformación consiste en la presentación anatómica de dos orificios mitrales comúnmente asociada a otras malformaciones congénitas como defectos septales, malformaciones completas o parciales del canal atrioventricular, coartación aórtica, tetralogía de Fallot, comunicación interauricular o interventricular, anomalía de Ebstein y persistencia del conducto arterioso. Las características clínicas son variables e incluso pueden pasar desapercibidas y ser diagnosticadas hasta la edad adulta. Se presenta el caso de una mujer joven el cual se encuentra asintomática con diagnóstico de hipertensión arterial, que durante una revisión de rutina fue diagnosticada con múltiples cardiopatías congénitas, de las cuales, su relación está poco descrita en la literatura, siendo este el tercer caso reportado. En la actualidad las técnicas de imagen multimodal permiten la mayor caracterización de las lesiones tanto de la valva como del aparato valvular, con la intención de realizar un abordaje diagnóstico y terapéutico integral para ofrecer el mayor beneficio al paciente.

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INTRODUCTION

The double-orifice mitral valve (DOMV) is a rare congenital disease first described in 1876 by Greenfield[1,2] DOMV has been associated with atrioventricular septal defects, partial or complete atrioventricular canal malformations, aortic coarctation, tetralogy of Fallot, atrial or ventricular septal defect, Ebstein's anomaly, and patent ductus arteriosus. We present this case to add relevant evidence to the use of multiple imaging modalities for congenital heart diseases, particularly for complex valvular heart disease.

CASE PRESENTATION

A 29-year-old woman with a 5-year history of hypertension who presented without symptoms since diagnosis. During the control and physical examination, a systolic murmur was found in the left parasternal border as well as a systolic-diastolic murmur in the interscapular area with decreased femoral pulses; CT angiography revealed a coarctation of the thoracic aorta near the left subclavian artery *(Figure 1)*.

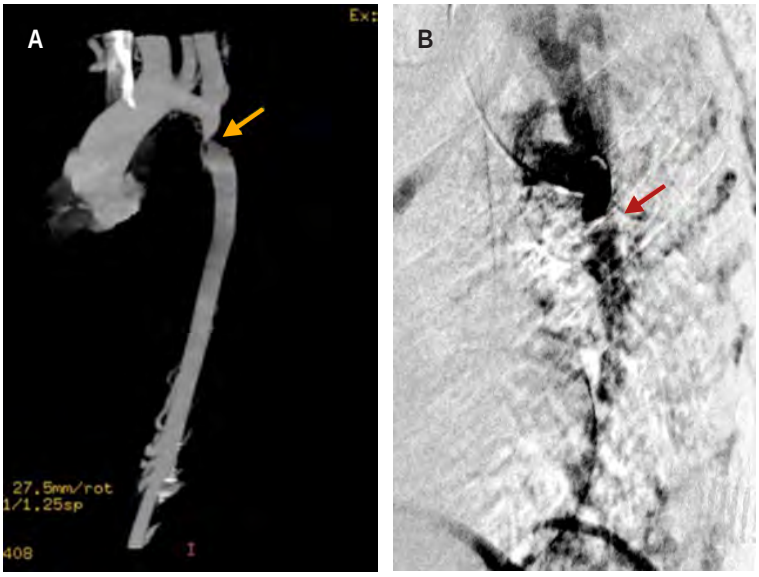

Figure 1: Reconstructed CT aortogram showing localized narrowing of the aorta. **A)** Reconstruction of the coronal angio-tomography, the projection shows the coarctation site that is 21 mm from the left subclavian artery. **B)** Digital subtraction angiography showing the thoracic aorta with coarctation.

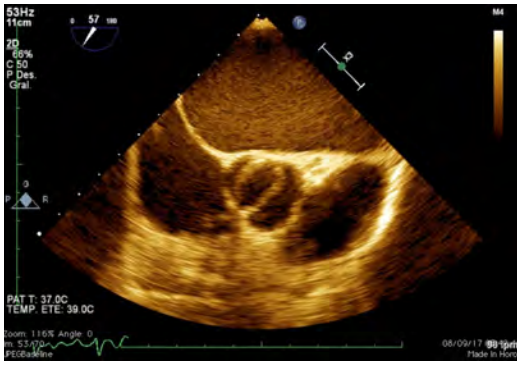

Figure 2: 2D transesophageal echocardiography at the mild esophageal projection at 57º showing the bicuspid aortic valve.

Echocardiography was performed using the ACUSON SC2000™ ultrasound system (Siemens, Munich, Germany), which showed a bicuspid aortic valve *(Figure 2)* with moderate stenosis (maximum velocity of 3.4 m/s, maximum gradient of 31 mmHg) and a double-hole mitral valve with thickened valves, insufficient chordae tendineae and two papillary muscles. The posteromedial muscle was hypoplastic and two cords were inserted into the anterolateral muscle, with a mean gradient of 4 mmHg, a mitral valve area of 1.3 cm^2, and a severely insufficient eccentric jet through the posterolateral wall of the atrium left with the Coanda effect. The mitral valve orifices were a small orifice in the middle and a larger lateral orifice, which according to the classification of Baño-Rodrigo, can be classified as type 5 or type 2 and is not associated with defects of the atrioventricular canal[3-5] *(Figure 3)*. A CMR was performed to confirm the bicuspid aortic valve and double-hole mitral valve *(Figures 4 and 5)*. The patient underwent surgical mitral valve replacement and was discharged without complications after five days. One month after surgery, the patient was asymptomatic in NYHA class I.

DISCUSSION

Aortic coarctation has been reported to be associated with bicuspid aortic valves in 30 to 80% of cases; in the present case, the patient also had a congenital malformation

of the mitral valve, which is rare and occurs in only 0.05% of all congenital heart diseases. DOMV has been widely associated with septal defects and with a complete or partial atrioventricular canal in 0.05% of cases.[6] In this particular case, in addition to the aortic coarctation and the bicuspid valve, the patient was asymptomatic; This association has been rarely described in the literature, and as far as we know, this is the third case reported to date.

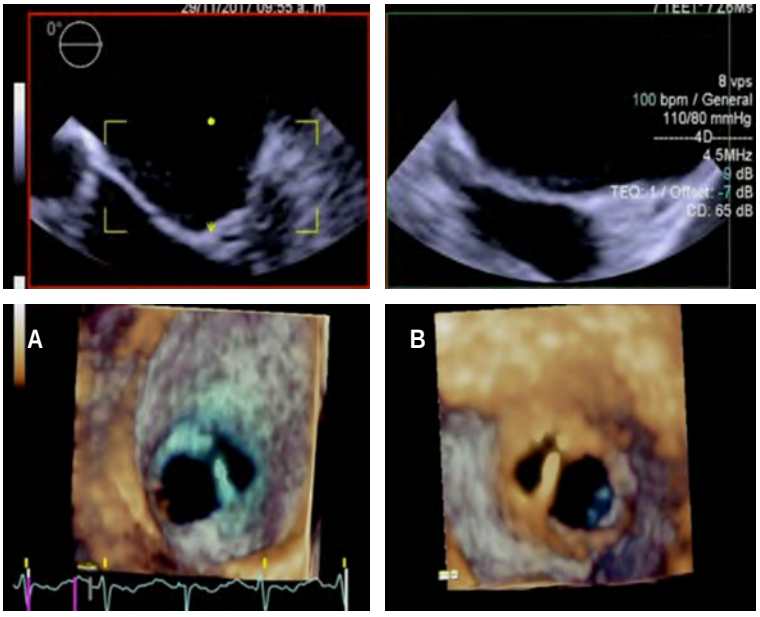

Figure 3: Real-time 3D transesophageal echocardiography of **A** atrial face and **B** ventricular face. It is an eccentric type of double port mitral valve with a larger main port and a smaller accessory port located at the anterolateral commissure.

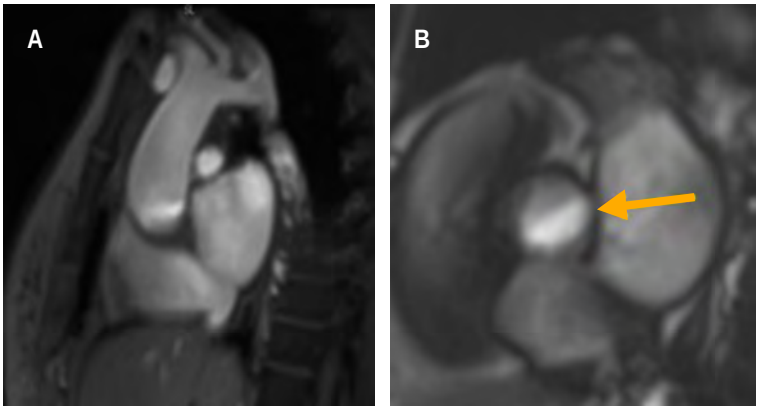

Figure 4: A) A rendered image of the 3D contrast magnetic resonance angiogram showing the thoracic aorta. **B)** Cine CMR image of the bicuspid aortic valve in systole (yellow arrow).

DOMVs can be anatomically classified into central, valvular, and commissural categories according to their structures or conditions; DOMV can also be classified by two-dimensional echocardiography as follows: 1) complete bridge (15% of cases), both orifice openings are circular and visible from the edge of the valve, with normal subvalvular system and papillary muscles; 2) incomplete bridge, missing valve connection and can only be visualized on the edge of the valve; and 3) hole type (most common), typically a minimally sized accessory hole in the posteromedial or anterolateral commissure.[7,8] In this particular patient, the VMOV was diagnosed as type 2 according to the Baños-Rodrigo classification, since the accessory orifice (the smallest) is located in the posteromedial commissure.[5]

Accessory holes are made by different mechanisms that result in DOMV:[5]

1. Ring of strings
2. Subdivision of the muscular crest
3. Fused papillary muscle
4. Crossing of strings
5. Central fibrous subdivision

The bicuspid aortic valve has not been related to DOMV, and although its coexistence has been described in up to 50% of cases, there is no relationship in adults; therefore, this case presents this rare anomaly and associated congenital malformations.

This case exemplifies the importance of the different cardiac imaging techniques since the patient was referred for probable aortic coarctation. The CT aortogram was the initial imaging study performed. Then a transthoracic echocardiogram was performed; because the bicuspid aortic valve and DOMV were found, MR was necessary and useful to determine the timing and definitive surgical treatment.

CONCLUSIONS

DOMV is a rare congenital malformation that can be associated with structural cardiac

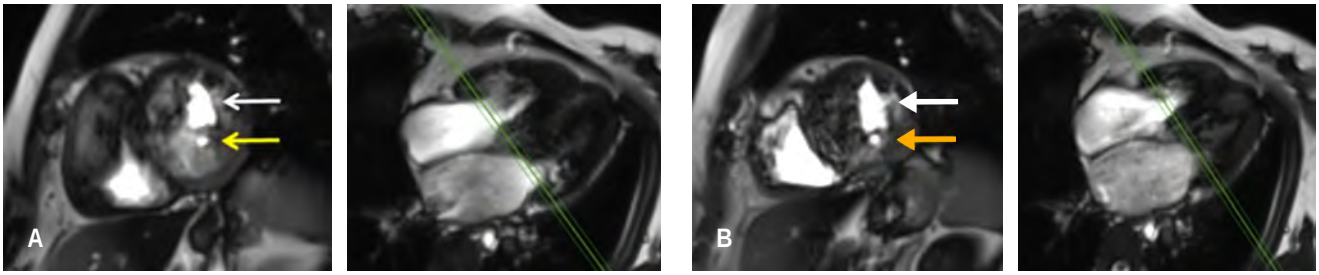

Figure 5: Cardiac magnetic resonance image (Siemens Verio 3T). **A)** Image acquired with the SSFP sequence showing the mitral valve in diastole and the double orifice of the mitral valve (white and yellow arrows). Along the short axis, where the tips are in diastole, the image shows the double mitral orifice, where the posterior orifice is the most minor (yellow arrow) with an area of 0.17 cm^2, and a smaller accessory orifice it is located anterolaterally commissure. **B)** Images of the SSFP sequence along the short axis at the apical level of the double mitral foramen (white and yellow arrows). Parallel green dashed lines indicate the cut-off position to image valve tips to assess the valve area.

abnormalities. We have presented strong evidence for the use of multiple imaging modalities to fully assess congenital heart disease and the added value of 3D transesophageal echocardiography.

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Clinical case

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Clinical case of *Cor triatriatum* in a patient with CHA_2DS_2VASc 1-point atrial fibrillation

Caso clínico de Cor triatriatum *en un paciente con fibrilación auricular* CHA_2DS_2VASc *de 1 punto*

Ana G Múnera E,* Juan S Rodríguez Z,‡ Natalia Correa V,§ Jorge A Bermúdez M¶

Keywords:
Cor triatriatum, atrial fibrillation, congenital cardiac anomaly.

Palabras clave:
Cor triatriatum, fibrilación auricular, anomalía cardiaca congénita.

ABSTRACT

Cor triatriatum sinistrum (CTS) is a rare congenital cardiac anomaly with an incidence of 0.1% of all hereditary heart diseases, and its finding is more infrequent in adulthood. It is characterized by presenting a left atrium divided into two chambers by a fibromuscular membrane that may have or not have fenestrations. It has been reported that severe obstruction is indicated by maximum Doppler velocity greater than 2 m/s or a trans-membranous pressure > 10 mmHg. In this article, we present the case of a 68-year-old male patient, who presented *de novo* an atrial fibrillation episode in the context of infectious disease, with a transesophageal echocardiogram showing CTS and a CHA_2DS_2VASc score of 1 point, raising the question of whether it should be anticoagulated, given that the evidence in this setting is limited.

RESUMEN

El Cor triatriatum *sinistrum (CTS) es una anomalía cardíaca congénita rara con una incidencia del 0.1% del total de las cardiopatías congénitas y aún más infrecuente es su hallazgo en la edad adulta; se caracteriza por presentar una aurícula izquierda dividida en dos cámaras por una membrana fibromuscular que puede presentar o no fenestraciones. Se ha informado que la obstrucción grave está indicada por una velocidad Doppler máxima superior a 2 m/s o una presión transmembrana > 10 mmHg. En este artículo presentamos el caso de un paciente masculino de 68 años, quien presenta episodio de fibrilación auricular de novo en el contexto de cuadro infeccioso, con ecocardiograma transesofágico que evidencia CTS, con un puntaje de CHA_2DS_2VASc 1 punto, generando la interrogante si debía ser anticoagulado, dado que la evidencia en este tema es limitada, finalmente tomando la decisión de anticoagulación con DOACS.*

INTRODUCTION

Cor triatriatum sinistrum (CTS) is a congenital heart anomaly in which the left atrium is divided into a «posterior superior» and an «anteroinferior» chamber by a fibromuscular membrane that usually contains one or more fenestrations that allow the passage of the blood.[1] First described in 1868 by Church[2] and its echocardiographic characteristics described by Ostman-Smith in 1984[3] where they specify that, generally, the chamber into which the pulmonary veins drain is dorsal and obliquely inferior to the chamber of the left ventral atrium with the subdivided membrane bulging upwards and forwards, although this is not always true. Furthermore, the most common site for a single membrane defect was inferior and medial behind the posteromedial commissure of the mitral valve. There is a classification according to Loeffler that divides the CTS into types 1, 2 and 3. Type 1 is characterized by the lack of communication in the membrane itself, type 2 due to having one or more small perforations in the membrane, and type 3 due to a wide opening.[4] It represents 0.1-0.4% of all congenital heart malformations.[5] It generally involves the left atrium in approximately 83% and rarely the right atrium *Cor triatriatum dexter* (CTD).[6] The clinical manifestations

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depend on the degree of obstruction of the pulmonary venous return and vary from asymptomatic to pulmonary hypertension.[7] Surgical management is indicated in patients with a significant obstruction. This clinical case presents a patient with a complicated urinary tract infection (UTI), *de novo* atrial fibrillation (AF) CHA_2DS_2VASc 1 point, and, as an incidental finding on echocardiogram, a CTS.

CASE PRESENTATION

A 68-year-old male patient, native from Venezuela, mixed-race, have a history of benign prostatic hyperplasia being managed with Tamsulosin 0.4 mg orally every day. The patient is a heavy smoker (pack-year 50), who consulted for one day of evolution of atypical chest pain that began at rest, oppressive, of moderate intensity, not irradiated, lasting 30 minutes, self-limited, associated with palpitations, without vasovagal symptoms. Concomitantly, the patient presented obstructive and irritative urinary symptoms. An electrocardiogram was performed, reporting AF with a rapid ventricular response, administered metoprolol tartrate 100 mg PO single dose, and redirected to our institution. On admission, clinically stable, arrhythmic, tachycardic heart sounds, without murmurs, with pulse deficit, without the presence of congestive or low output signs. The following tests and diagnostic aids were requested *(Table 1 and Figure 1)*.

Chest radiography on admission: no pathological findings *(Figure 2)*.

A *de novo* initial diagnosis of complicated UTI and paroxysmal AF was made with CHA_2DS_2VASc 1 point and HAS-BLED 1 point. Empirical antibiotic management was initiated according to institutional guidelines with aztreonam and blood cultures, urine culture, renal ultrasound, Holter, and transesophageal echocardiography were requested to define possible cardioversion and anticoagulation.

Transthoracic and transesophageal echocardiography

Findings: Moderate dilation of the left atrium with a moderate increase in left atrial volume. Small left atrial appendage, without thrombi, with average Doppler velocities. A membrane's presence in the left atrium divides the cavity into two chambers, one containing the left atrial appendage and continuing towards the left ventricle and another chamber containing the pulmonary veins. This membrane does not present obstruction to flow due to two fenestrations that communicate in both chambers. *Cor triatriatum sinistrum* type 2.

Table 1: Laboratory tests.

Hemoglobin	14.3 mg/dL (13-17)	pH	7.432	
Hematocrit	43% (39-52)	pCO_2	32.9	
Leukocytes	20.100 (3.600-10.200)	pO_2	64.3	
Neutrophiles	89% (45-65%)	HCO_3	21.4	
International normalized ratio	1.27 (0.5-1.5)	BE	-2.9	
Thyroid stimulating hormone	1.4 (0.465-4.68)	Lactate	1.5	
C-reactive protein	38.9 (< 1)	Urinalysis	Proteins	100
Troponin #1	0.041 (upper limit 0.034)		Leukocytes	15 × cap
Troponin #2	0.059 (upper limit 0.034)		Erythrocytes	4-6 × cap
Sodium	136 (137-145)		Bacteria	Low amount
Potassium	4.0 (3.5-5.1)	Aspartate aminotransferase	31.6 (17-59)	
Magnesium	2.0 (1.6-2.3)	Alanine aminotransferase	19 (< 50)	

Electrocardiogram on admission: arrhythmic rhythm, variable RR interval, normal axis, heart rate 110 bpm, absent P wave, baseline variation.

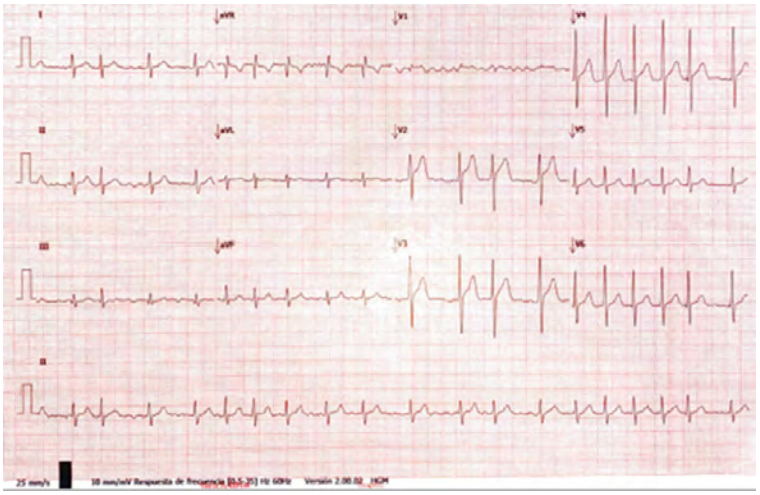

Figure 1: Electrocardiogram.

The other cardiac structures were typical. See supplementary data for video material and their explanations *(Figure 3)*.

24-hour Holter EKG: baseline sinus rhythm, normal PR interval, QRS complex, and QTc interval. It alternates with multiple episodes of AF with a rapid ventricular response, with pauses after AF cessation. Some episodes of AF with aberration (Ashman phenomenon). Some suggestive episodes of atrial flutter. A mild increase in supraventricular and ventricular automatism *(Figure 4)*.

Report of renal ultrasound finding a prostate enlargement (vol. 95.8 cm^3) and a positive blood culture for *E. coli* ESBL +. Antibiotic management was adjusted according to the antibiogram. The case is evaluated in conjunction with electrophysiology, considering anticoagulation due to cardiac anomaly. Subsequently, the patient resolved bacteremia associated with the UTI and was discharged with a strategy of rate control and anticoagulation with DOAC (direct oral anticoagulant) and outpatient control with Cardiology and Urology.

DISCUSSION

Cor triatriatum (CT) is a rare congenital heart defect whose incidence is estimated to correspond to 0.1% of all congenital heart disease.[5] The sinistrum variant is the most frequent and has a more significant association with AF and cerebrovascular attack than CTD.[6] The communication between the separate atrial cavities can be wide, small, or null, depending on the fenestrations' size, presenting as mitral stenosis, generating increased pressure and pulmonary vascular resistance, giving rise to pulmonary arterial hypertension.[8] In the literature, symptoms have been attributed to CT only if the transmembrane pressure is > 10 mmHg, and these consist of fatigue, dyspnea, chest pain, palpitations, syncope, exercise intolerance, or even arrhythmias.[9] As a diagnostic method, color Doppler echocardiography is the non-invasive modality of choice to identify CT and its hemodynamic impact and recognize associated congenital anomalies and the transmembrane gradient.[10] Surgical treatment should be considered when the hemodynamic behavior of the membrane resembles mitral stenosis.[11] On the other hand, an incidence of 14.65 vs 12.5% of AF in CTS and CTD, respectively, has been reported in the literature.[6] This association is due to the distortion of the architecture and derangement of the muscle fibers in the left atrium, producing remodeling, mechanical and electrical alterations, which ultimately predispose to arrhythmias and thrombus formation.[12] The three pillars of AF management are rate control, rhythm control, and anticoagulation. The latter is defined according to the CHA_2DS_2VASc

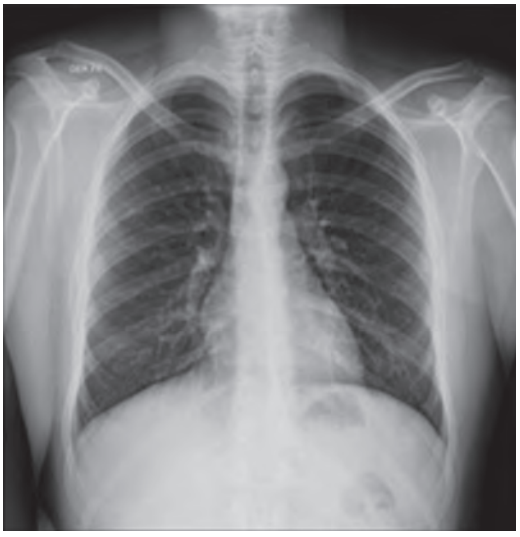

Figure 2: Chest radiography.

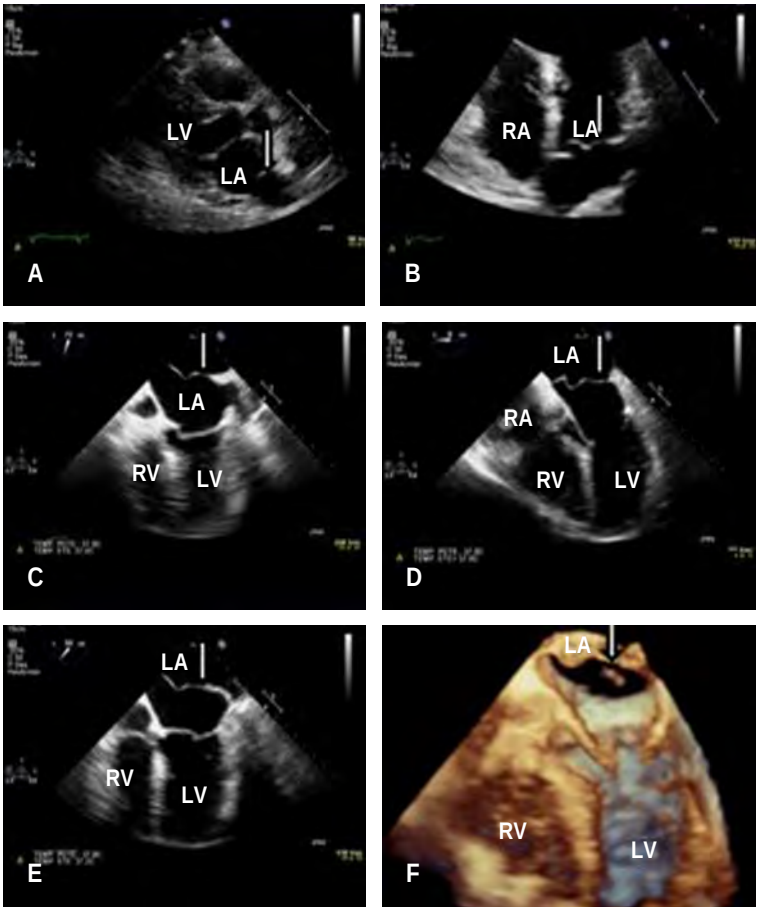

Figure 3: Transthoracic and transesophageal echocardiography. The Arrow points to the membrane that divides the left atrium. **A)** Transthoracic echocardiography, parasternal long axis showing membrane in the left atrium. **B)** Atrial-focused Transthoracic echocardiography. **C-E)** Transesophageal image, where the four cardiac cavities are appreciated, in the left atrium, the presence of a membrane that divides is observed. **F)** Three-dimensional image, showing the membrane in the left atrium. LA = left atrium, LV = left ventricle, RA = right atrium, RV = right ventricle.

risk score indicating anticoagulation with 2 points in men and 3 points in women. There has been frequent discussion about whether patients with 1-point CHA_2DS_2VASc in men and 2-point in women benefit from anticoagulation. Recently, the European Society of Cardiology (ESC) established a reclassification of the risk of cerebrovascular attack in patients with CHA_2DS_2VASc of 1 point in men and 2 points in women, adding other risk factors such as > 65 years, type 2 diabetes mellitus, persistent or permanent AF, BMI > 30, proteinuria (> 150 mg/24 h), eTFG 1400, positive I/T troponins, enlarged left atrium (volume > 73 mL or diameter > 4.7 cm) and atrial appendage velocity.[13]

In our patient, CTS's diagnosis was made late in the seventh decade of life and incidentally due to its little or no hemodynamic impact. The symptoms are not attributed to this cardiac anomaly but its frequent association with arrhythmias such as AF. During the approach to managing his *de novo* AF to define his criteria for cardioversion, a transesophageal echocardiogram was performed in which CTS was detected. The membrane did not present obstruction flow due to two fenestrations that communicate both chambers, classified as CTS type I. The CHA_2DS_2VASc risk score was performed, obtaining 1 point indicating no need for anticoagulation due to its low risk of present cerebrovascular events. However, since cerebrovascular attack incidence in patients with AF and CTS/CTD is close to 6.5%, in terms of CHA_2DS_2VASc, it is equivalent to a score of 4-5 points, so it is decided to anticoagulant

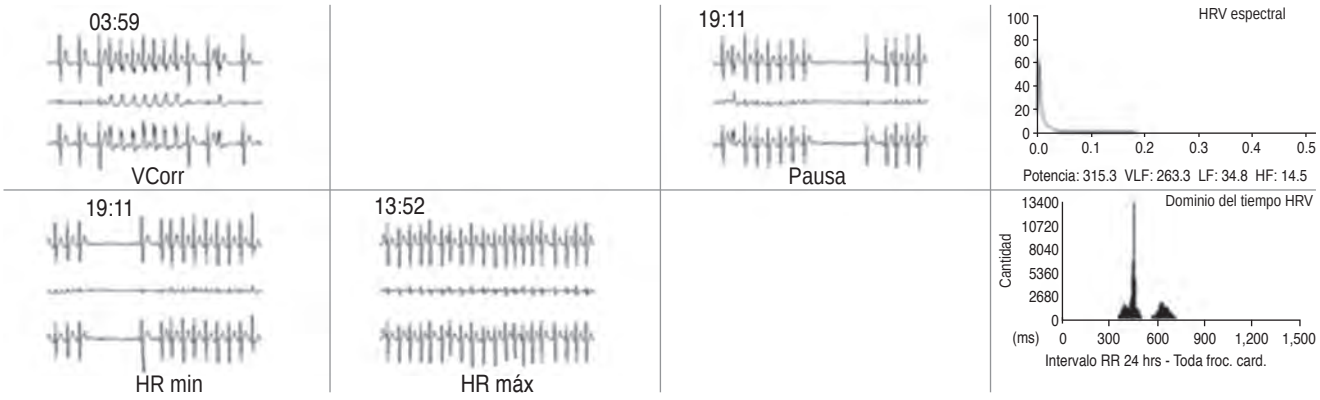

Figure 4: Holter electrocardiogram.

with DOAC. There are 13 case reports in the literature in which CTS is associated with cerebrovascular events of cardioembolic origin and evidence of blood stasis or thrombus.[12] However, there is still uncertainty about the indication for anticoagulation in this context, given that this cardiac malformation is not frequently considered among the risk factors, which leads to therapeutic dilemmas.

CONCLUSIONS

Cor triatriatum is a rare but increasingly recognized congenital cardiac anomaly. Management of this condition depends on the degree of obstruction between the LA chambers seen mainly on Doppler echocardiography. Physiological alterations are like those that occur in mitral stenosis, with alterations in atrial size, volume, and the presence of AF. Current tools or scales for anticoagulation do not consider these types of structural cardiac malformations, as presented in this case.

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Spontaneous coronary artery dissection associated with exercise as a cause of cardiac arrest

Disección coronaria espontánea asociada a ejercicio como causa de parada cardíaca

Jhon Edwar García-Rueda,* Angélica María Bermúdez-Flórez,‡
Ricardo Londoño-García,* Yesid Alberto Saavedra-González§

Keywords:
Spontaneous coronary artery dissection, acute coronary syndrome, coronary artery disease.

Palabras clave:
Disección coronaria espontánea, síndrome coronario agudo, arteriopatía coronaria.

ABSTRACT

Spontaneous coronary artery dissection (SCAD) is a rare cause of acute myocardial infarction, mainly occurring in young and middle-aged people without cardiovascular risk factors. The clinical presentation depends on the degree of involvement and can range from chest pain in 85-96% of cases, acute coronary syndrome with ST-elevation (STEACS) in 20-50%, ventricular arrhythmias in 3-5%, cardiogenic shock in 2%, sudden death or cardiac tamponade. Some predisposing factors include female gender, pregnancy, age. Coronary angiography is the method of choice for diagnosis and classification. Regarding its treatment, conservative management is preferred in stable patients. The case of a patient with STEACS and cardiac arrest secondary to spontaneous coronary dissection while performing a physical activity is presented.

RESUMEN

La disección coronaria espontánea (DCE) es una causa poco frecuente de infarto agudo de miocardio, principalmente se presenta en personas jóvenes y de edad media sin factores de riesgo cardiovascular. La presentación clínica depende del grado de afectación y puede ir desde dolor torácico en 85-96% de los casos, síndrome coronario agudo con elevación del ST (SCACEST) en 20-50%, arritmias ventriculares en 3-5%, choque cardiogénico en 2%, muerte súbita o taponamiento pericárdico. Existen algunos factores predisponentes como sexo femenino, embarazo, edad < 50 años, tratamiento hormonal, enfermedades del tejido conectivo (síndrome de Ehlers-Danlos vascular, síndrome de Marfan) y displasia fibromuscular. Así mismo, se han identificado algunos factores desencadenantes como el estrés emocional y físico, ejercicio intenso isométrico y levantamiento de pesas. La angiografía coronaria es el método de elección para hacer el diagnóstico y clasificación. Con relación a su tratamiento, se prefiere en la mayoría de los casos un manejo conservador sobre la revascularización en pacientes estables. Se presenta el caso de un paciente con SCACEST y parada cardiaca secundaria a disección coronaria espontánea mientras realizaba actividad física.

INTRODUCTION

Spontaneous coronary dissection (SCAD) is an unusual cause of acute myocardial infarction. It is characterized by a separation of the coronary artery wall, not associated with trauma, iatrogenesis or atherosclerotic plaque.[1] It occurs predominantly in young and middle-aged people without risk factors, manifesting clinically as acute coronary syndrome (ACS), arrhythmia, or sudden cardiac death.[2]

Some predisposing factors such as female gender, pregnancy, age < 50 years, hormonal treatment, connective tissue diseases (vascular Ehlers-Danlos syndrome, Marfan syndrome)

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and fibromuscular dysplasia have been identified. Related triggers are emotional and physical stress, intense isometric exercise, and weight lifting.[3]

The case of a patient with ST-elevation acute coronary syndrome (STEACS) and cardiac arrest secondary to spontaneous coronary dissection while performing physical activity is presented.

CASE PRESENTATION

49-year-old male patient with no known history. While the patient was doing aerobic physical activity in the gym –running on a band– the patient presented an altered state of consciousness for which he was transferred to a health center where he entered cardiorespiratory arrest, with an initial rhythm of ventricular fibrillation. Advanced cardiopulmonary resuscitation was performed, with which he returned to sinus rhythm and was referred to a more complex center.

The patient was admitted hemodynamically stable and with a Glasgow coma scale of 8/15. A 12-lead electrocardiogram was taken showing ST-segment elevation in aVR and ST-segment depression in DI, DII, DIII, aVL and V2-V6, which was interpreted as a pattern suggestive of left main coronary artery involvement *(Figure 1)*.

Medical treatment was started with a single 300 mg loading dose of acetylsalicylic acid and, subsequently, 100 mg every 24 hours, a single 600 mg loading dose of clopidogrel, a single 40 mg loading dose of subcutaneous nadroparin every 24 hours, single 80 mg dose of atorvastatin and subsequently 40 mg every 24 hours, 50 mg metoprolol every 12 hours and amiodarone infused at 1 mg/min for 6 hours and subsequently at 0.5 mg/min due to the arrest rhythm presented. Coronary angiography was performed, showing type 2a spontaneous coronary dissection of the distal third of the circumflex artery, the second obtuse marginal artery (OM2) with TIMI 3 residual flow and extensive intramural hematoma (IMH) *(Figure 2)*. His care was continued in the special care unit, where he remained stable and had no recurrence of arrhythmias. A control electrocardiogram was taken that showed the resolution of the electrocardiographic alterations *(Figure 3)*. Transthoracic echocardiography reported a slightly reduced ejection fraction (50%) and akinesia with the remodeling of the basal segment of the inferior wall, without other relevant findings. Magnetic resonance angiography of abdominal vessels was performed without evidence of changes in intra-abdominal visceral arteries for fibromuscular dysplasia.

In-hospital cardiac rehabilitation was started, and on the fifth day, the patient was discharged with 100 mg acetylsalicylic acid every 24 hours, 75 mg clopidogrel every 24 hours, 50 mg metoprolol succinate every 24

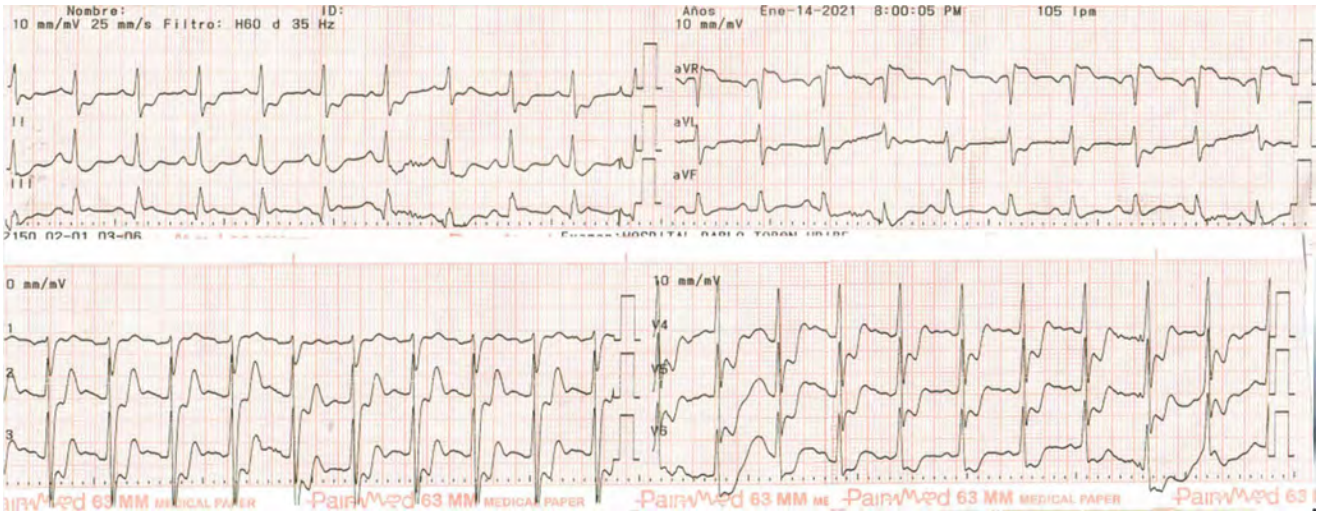

Figure 1: ST-segment elevation in the derived aVR and ST-segment depression in DI, DII, DIII, aVL and V2-V6. Source: Own creation.

hours, 20 mg omeprazole every 24 hours, 200 mg amiodarone every 24 hours, cardiac rehabilitation for 24 sessions.

DISCUSSION

The first record of SCAD is from 1931 by Dr Harold C. Pretty, who described it in the autopsy of a 42-year-old woman with sudden death.[4] It is defined as a non-traumatic and non-iatrogenic separation of the coronary artery wall that can occur between the intima and media or between the media and the adventitia, creating a false lumen with an intramural hematoma decreases blood flow and generates ischemia.[5] Its worldwide incidence varies from 0.1 to 0.28%, but a series of recent cases show a prevalence between 0.1 and 0.24%.[6,7]

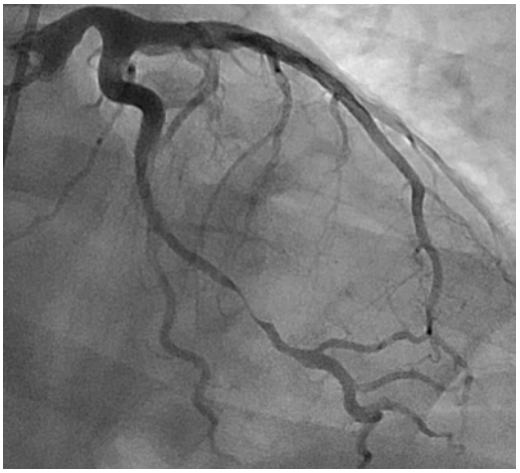

Figure 2: Type 2a spontaneous coronary dissection of the distal third of the circumflex artery and the second obtuse marginal artery. Source: Own creation.

One of its main manifestations is acute myocardial infarction, which occurs in more than 90% of patients, of which 20-50% are STEACS, and less than 5% have cardiogenic shock and ventricular arrhythmias.[8]

The cause of SCAD is unknown, but predisposing conditions such as fibromuscular dysplasia, peripartum period, connective tissue diseases such as Marfan syndrome, vascular Ehlers-Danlos syndrome, Loeys-Dietz syndrome, systemic inflammatory diseases such as systemic lupus erythematosus, Crohn's disease, sarcoidosis, and polyarteritis nodosa. However, the prevalence of inflammatory disorders in patients with SCAD is low, with reports accounting for less than 5% of cases.[8-10]

Likewise, precipitating factors have been associated, such as activities involving the Valsalva´s maneuver, labor, drug abuse such as cocaine, hormonal therapy, emotional stress and physical stress such as intense exercise.[11]

The test of choice for diagnosis is coronary angiography. This is used to detect the dissection site and define its characteristics and severity. It also allows identifying other anatomical alterations and performing percutaneous coronary intervention, if necessary. According to the angiographic appearance, a defined classification has been established as the presence of a tear of the intima with a false lumen **(type 1)**, presence of intramural hematoma with diffuse narrowing > 20 mm

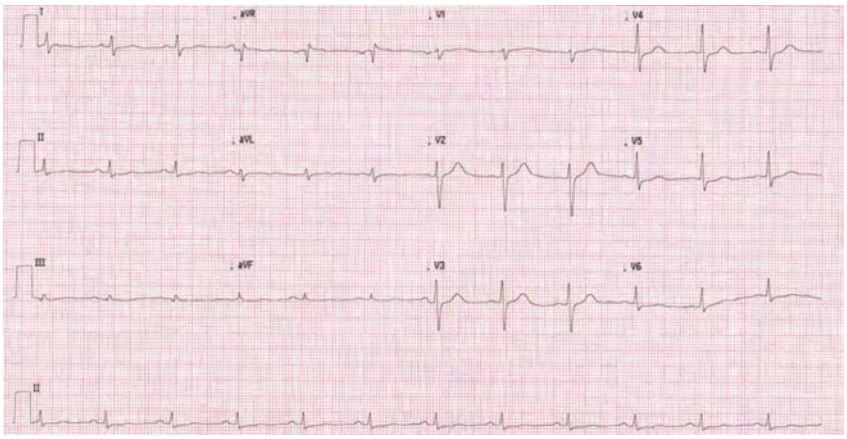

Figure 3:

Control electrocardiogram was taken two days after coronary angiography. Source: Own creation.

that recovers its caliber distal to the lesion **(type 2a)** or without recovering its size up to the distal coronary artery **(type 2b)**, focal stenosis **(type 3)**, abrupt occlusion without a lesion proximal to it **(type 4)**. Type 2 dissection is the most common one reported and is observed in 67% of cases, followed by type 1 in 29.1% and type 3 in 3.4%.[12]

Regarding treatment, although there is no strong consensus in favor, it can be concluded according to several series that percutaneous coronary intervention (PCI) for SCAD is associated with worse short-and long-term results than those presented with PCI for atherosclerotic lesions.[13,14] Technically, PCI can be a challenge in these patients since long lesions may require the use of multiple stents, coronary wires can enter the false lumen and cause occlusion of the vessel or being in the presence of tortuous coronary arteries can be prone to iatrogenic injury. Likewise, when faced with a hematoma, there is the possibility of expansion resulting in the loss of distal permeability or retrograde extension to more proximal vessels.[15-17] These factors contribute to the success rates of PCI ranging between 47 and 72% in cohort studies. Therefore it is reserved for patients with high-risk characteristics such as involvement of multiple proximal vessels, main left coronary artery involvement or anterior descending artery ostium.[17-19]

In addition to the above, with medical management, a high probability of spontaneous cure is defined as restoration of blood flow and a decrease in the severity of the stenosis (evaluated angiographically), which ranges between 70 and 97% of patients cases.[8] Said medical management is based on the administration of beta-blockers and antiplatelet agents. Beta-blockers reduce shear stress and significantly reduce the risk of recurrence, which is why they are recommended in all patients, especially those with high blood pressure. Regarding antiplatelet therapy, there is still controversy over the best strategy to follow due to the lack of solid clinical studies. According to recent reviews, dual antiplatelet management is suggested in patients undergoing PCI with an estimated duration of up to 12 months, but this recommendation is based on expert recommendations. If this strategy is chosen, the use of acetylsalicylic acid and clopidogrel is recommended.[19] Randomized clinical trials are currently underway to determine the best treatment method. With regard to statins, some studies have shown that they increase the risk of recurrence of SCAD, and their pathophysiology is not mediated by atherosclerotic plaque rupture, so their use is not recommended unless the patient meets another indication for it.[20]

There is no clarity on which patients should be provided with medical management; however, it has been proposed that candidates should have a TIMI flow > two and hemodynamic stability with hospital surveillance between 5-7 days, since the extension of the intramural hematoma, or IMH, can occur in the 5-10% of cases.[21] In our case, we present a type 2a SCAD of the distal third of the circumflex artery and the second obtuse marginal artery (OM2) that generates long tubular stenosis, in some segments of 90%, with residual TIMI three flow and extensive intramural hematoma. Our report agrees with that found in the literature, where the main precipitant in men is physical activity, with studies showing a presentation of 44% vs 2.8% in women.[11]

Likewise, our patient presented compromise in the distal third of the circumflex artery, which coincides with several reports where only 10% affect the proximal coronary artery.[12] In the case of our patient, it presented with sudden death and ventricular arrhythmia; this is an unusual presentation that occurs in less than 5% of cases, as a precipitating event it was associated with aerobic exercise with only two other case reports in the literature.[22,23]

CONCLUSIONS

SCAD should be considered in young patients and in the absence of cardiovascular risk factors that present with suspected ACS. It is necessary to identify the predisposing factors and conditions that have been described so far. Regarding its management, a conservative approach is preferred, and revascularization is reserved for those patients with high-risk

characteristics. Appropriate recognition of this entity will allow better treatment for patients, thus avoiding the recurrence of new major cardiovascular events.

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Huge right ventricular mass in a 25-year-old male patient

Enorme masa ventricular derecha en un paciente masculino de 25 años

Luiz Alberto Cerqueira Batista Filho,* Marcelo Rocha Coimbra,‡ Waleria Garcia Cordeiro de Almeida,§ Denise Lemes de Freitas¶

Keywords: Cardiac tumors, sarcoma, cardio-oncology, myxoma, echocardiography.

Palabras clave: *Tumores cardiacos, sarcoma, cardio-oncología, mixoma, ecocardiografía.*

ABSTRACT

A young male patient came to the emergency department of Hospital Santa Marcelina de Cidade Tiradentes with signs of congestive heart failure and loss of appetite. A two-dimensional echocardiogram was performed, and a huge right ventricular mass was detected. Cardiac masses are always a challenge, and this article provides an overview of the subject.

RESUMEN

Un joven varón acudió al Servicio de Urgencias del Hospital Santa Marcelina de Cidade Tiradentes con signos de insuficiencia cardíaca congestiva y pérdida de apetito. Se realizó un ecocardiograma bidimensional y se detectó una enorme masa ventricular derecha. Las masas cardíacas son siempre un desafío, y este artículo proporciona una revisión sobre el tema.

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CASE REPORT

A 25-year-old male came to the emergency room of Hospital Santa Marcelina de Cidade Tiradentes with dyspnea on slight exertion, nausea, loss of appetite and mucous skin pallor. He had jugular turgescence, and his oxygen saturation fluctuated between 85-90%. The symptoms started 02 months ago, with progressive worsening. Expressive enlargement of the right chambers was detected in the two-dimensional transthoracic echocardiogram (TTE), with the anomalous movement of the septum, as well as a heterogeneous echogenic image measuring 66.22 × 55.14 mm *(Figure 1)*. The mass nearly occluded the entire right ventricle from its inlet, with extension through the tricuspid valve *(Figure 2)*, obliterating the flow in some cycles and generating hemodynamic repercussions. The left chambers had no significant abnormalities other than being compressed and flattened by the right ventricle mass *(Figure 3)*. The left ventricular ejection fraction (EF) was 59%, and the pulmonary artery pressure was estimated at 60 mmHg. Due to right ventricular insufficiency, the patient was admitted to the hospital's Intensive Care Unit and clinically stabilized with dobutmine and small fluid trials. A chest computed tomography was performed, demonstrating mediastinal lymph node enlargement, reaching 24 × 17 mm, beside the right ventricular cardiac mass with 96 mm in its largest diameter, invading the right atrium and pulmonary artery trunk *(Figure 4)*. There was a delayed contrast enhancement of the mass. No signs of neoplasms were found in the contrasted abdominal computed tomography, and deep vein thrombosis was absent in the lower limb venous ultrasonography. As cardiac surgery was not available at the hospital, the patient was referred for evaluation in another service. Sadly, after 37 days of hospital admission, the patient passed away, waiting for cardiac surgery, in a sudden episode of coma, followed by cardiac arrest in pulseless electrical activity. This mass is one of the largest right ventricle masses ever described.[1,2]

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DISCUSSION

According to surgery and autopsy reports, primary cardiac tumors are responsible for 0.3 to 0.7% of all cardiac tumors.[3] Benign tumors are approximately 90% of primary cardiac tumors, and 10% are malignant. TTE continues to be the first diagnostic path to evaluate contours, mobility, size, site of attachment and hemodynamic repercussions.[4] Employing myocardial contrast during the exam is helpful, since it can provide important information on the perfusion pattern of the mass, differentiating vascular tumors from avascular thrombus, for example.[5] Transesophagic echocardiography (TEE) is also fruitful, whereas this technique provides better imaging of structures that could be difficult to evaluate transthoracically. Complementing the investigation with cross-sectional imaging methods, such as computed tomography (CT) and cardiac magnetic resonance (CMR), is very important to establish the extent of disease and better characterize the tumor.[6]

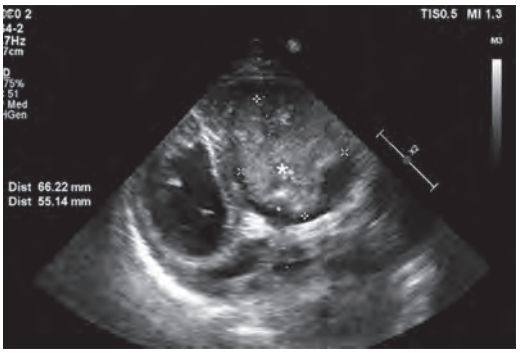

Figure 1: Heterogenous echogenic mass occupying the entire right ventricle.

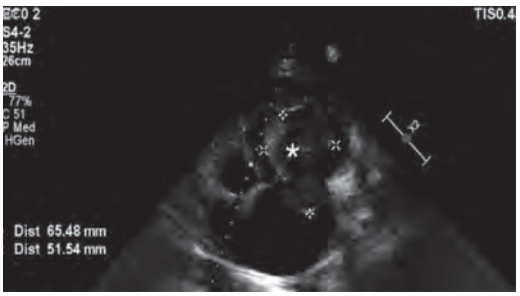

Figure 2: Apical window of the bidimensional echocardiogram revealing a huge mass in the right ventricle, protruding through the tricuspid valve into the right atrium.

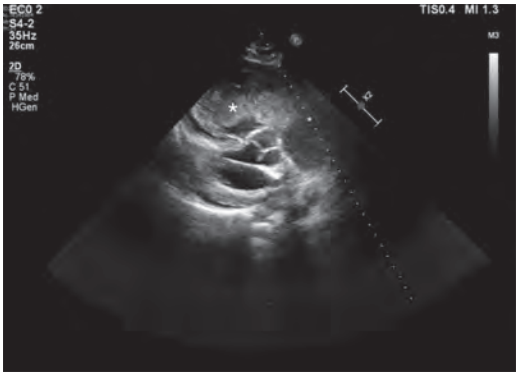

Figure 3: Parasternal long axis revealing huge mass in the right ventricle compressing the left ventricle.

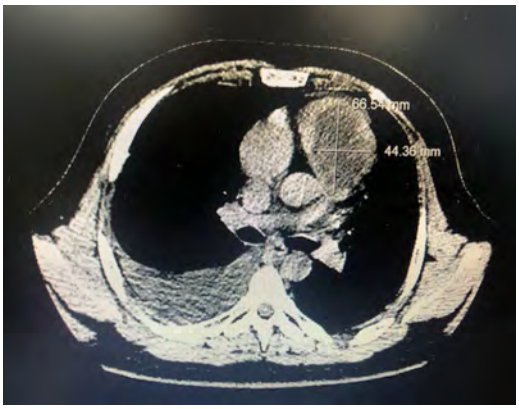

Figure 4: Thorax computed tomography scan demonstrating right ventricular mass.

Amongst the benign cardiac tumors, myxoma is the most prevalent, with nearly half of the benign masses in the adult population.[7] They appear as finger-like projections with a smooth surface and areas of calcification, mainly in the left atrium (80%), in individuals between the fourth and sixth decade of life.[8] Furthermore, these tumors appear «hypointense» to myocardium on T1-weighted images and «hyperintense» on T2-weighted images in CMR. Most myxomas are sporadic, but they are also associated with a rare familial syndrome, called Carney Complex, caused by defects in the PRKAR1A gene. It is an autosomal dominant syndrome, with multiple endocrine neoplasia

and lentiginosis, associated with myxomas of the heart, breast and other sites, in addition to a predisposition to various malignancies.[9] Other benign cardiac tumors include fibromas, lipomas, papillary fibroelastomas, cystic tumors of the atrioventricular node and paragangliomas. Rhabdomyomas are the most common benign cardiac tumor in children, accounting for 40-60% of cases.[10] Surgical resection of all symptomatic benign cardiac tumors is mandatory, except for rhabdomyomas, since they often spontaneously regress or could be treated with mTOR complex 1 inhibitor.[11] Nevertheless, surgical treatment should always be considered, even for small and incidental tumors, especially left-sided and endocavitary lesions, due to embolic risk. Right-sided and asymptomatic tumors without septal defects could be assessed with a strict echocardiographic follow-up.

Malignant cardiac tumors have an exophytic characteristic that distinguishes them from benign tumors. Amongst them, 75% are sarcomas,[12] with various types: myxosarcoma, liposarcoma, angiosarcoma, fibrosarcoma, leiomyosarcoma, osteosarcoma, synovial sarcoma, rhabdomyosarcoma (most common in children), undifferentiated sarcoma, reticulum cell sarcoma, neurofibrosarcoma and malignant fibrous histiocytoma.[13] They typically present in the right side of the heart and rapidly invade the primary structures, such as valves and walls, obstructing the blood flow. Angiosarcoma is the most common type of malignant cardiac tumor in adults, comprising 40% of the cardiac sarcomas,[14] and affecting individuals aged 40-50 years, but have been described in all ages.[15] Considering the rarity of cardiac sarcomas, there is little guidance for its treatment. Surgery with negative margins is associated with increased survival and is the mainstay treatment, although complete resection is possible in fewer than half of patients.[16] Failure to achieve local control of the disease is the most likely cause of death since metastatic progression tends to appear later.[17] Large (> 5 cm) and high-grade tumors are the ones with the highest metastatic potential, and the lungs are the preferred metastatic site.[18] A contrasted CT of the thorax should be performed as the principal systemic staging investigation. Cardiac sarcomas typically have devastating consequences and poor outcomes, with a median survival time of fewer than ten months without treatment.[19] Indeed, even if the tumor is completely resected, patients frequently develop recurrent disease. Nonetheless, a 34 patient surgical cohort treated at Mayo Clinic over 32 years showed median survival improvement when complete resection was possible (17 × 6 months when complete resection was not possible).[20] Adjuvant chemotherapy and radiotherapy brings questionable benefits.

Even though most doctors consider cardiac metastases rare, their incidence ranged from 2.3 to 18.3% amongst all neoplasm detected in autopsy series in the literature. There are few papers published on the subject, but Bussani et al. reported that the tumors that had the highest rate of cardiac metastases were the following, by order: pleural mesothelioma, melanoma, lung adenocarcinoma, undifferentiated carcinomas, lung squamous cell carcinoma, breast carcinoma, ovarian carcinoma, lymphomyeloproliferative neoplasms, bronchoalveolar carcinomas, gastric carcinomas, renal carcinomas and pancreatic carcinomas.[21]

Cardiac thrombi typically occur in the posterior wall of the left atrium or within the left atrial appendage in patients with atrial arrhythmias. Patients with systolic heart failure often happen to develop thrombi in the left ventricular apex. The occurrence of thromboembolism in the right side of the heart is predominantly related to mobilized deep venous thrombi, especially from the iliofemoral veins. Atrial fibrillation, acute right ventricular myocardial infarction, prosthetic valves, congenital abnormalities, genetic and acquired thrombotic disorders, prosthetic valves and cardiac surgery may also be the cause of right-sided cardiac thrombus.[22] Generally, thrombi are serpiginous mobile clots, but they can also present as immobile masses. Treatment possibilities are anticoagulation, thrombolytic therapy and surgical removal of the clots.

The diagnostic imaging exams and clinical data strongly suggest that this patient had a primary malignant cardiac mass, notwithstanding that it was impossible to obtain a biopsy. Unfortunately, the hospital is located in the most poverty-stricken neighborhood of the Greater Sao Paulo area,[23] where resources are scarce, such as CMR, and cardiovascular surgery is not easy to perform.

CONCLUSION

Primary cardiac malignancies are extremely rare and have disappointing outcomes, even when complete surgical resection is performed. The use of echocardiography, CT, and CMR is very important to a better characterization of the lesion and to determine the extent of disease. Patients eventually die from the local progression of the tumor rather than by metastatic invasion. However, clean margin resection can improve survival time and should always be considered.

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*Algunos pacientes responden con una dosis inicial de 12.5 mg/día sola o combinada con otros antihipertensivos.

**Algunos pacientes responden al tratamiento intermitente (en días alternos o de tres a cinco días/semana).

Pacientes pediátricos con hipertensión arterial: Dosis pediátrica usual: 2.5 mg/kg/día en dos tomas. Lactantes <6 meses: hasta 3.5 mg/kg/día en dos tomas. Niños hasta 2 años: 12.5-37.5 mg/día en dos tomas. Niños 2-12 años: 37.5-100 mg/día en dos tomas. Muy pocos pacientes requieren de dosis altas sostenidas. **12. Manifestaciones y manejo de la sobredosificación o ingesta accidental:** además de la diuresis esperada, la sobredosis de ROFUCAL® puede producir grados variables de letargia, la cual puede progresar al coma en pocas horas con mínima depresión de las funciones respiratorias y cardiovasculares y sin evidencia de cambios en los electrolitos séricos o deshidratación. Además del lavado gástrico y del tratamiento de apoyo para el estupor o coma, puede ser necesario tratamiento de los efectos gastrointestinales. No se ha establecido claramente el grado en que la hidroclorotiazida es eliminada por hemodiálisis. Se debe mantener la hidratación y el equilibrio hidroelectrolítico, la respiración, las funciones cardiovascular y renal. **13. Presentaciones:** Caja de cartón con 15, 30 o 60 tabletas de 12.5 mg en envase de burbuja. Caja de cartón con 20 o 30 tabletas de 25 mg en envase de burbuja. **14. Leyendas de protección:** su venta requiere receta médica. No se deje al alcance de los niños. No se use durante el embarazo ni en mujeres en periodo de lactancia. Literatura exclusiva para médicos. Reporte las sospechas de reacción adversas al correo: farmacovigilancia@cofepris.gob.mx Para mayor información del producto o para reportar eventos adversos comuníquese al teléfono en la ciudad de México 4040-7671 0 LADA nacional sin costo al 01800-200-0170 o correo electrónico: farmacovigilancia@probiomed.com.mx **15. Nombre y domicilio del laboratorio:** PROBIOMED S.A. DE C.V. Yácatas No 307, Colonia Narvarte, Delegación Benito Juárez 03020 México, D.F. **16. Número de registro del medicamento ante la secretaría:** Reg. No. 74276 SSA IV.

Sies®

HIDROSMINA

- La hidrosmina, en la insuficiencia venosa periférica, adecúa el flujo sanguíneo de retorno
- Regula el proceso filtración-absorción a nivel de la unidad microcirculatoria y aumenta la resistencia del capilar

INDICACIONES :

- Várices
- Hemorroides
- Edema del embarazo

SIES-01A/ter-09
No. de entrada: 093300203A2312

Cetus

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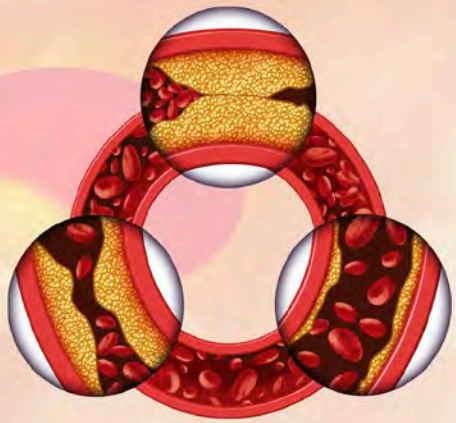
Gantena

(Rosuvastatina)

Controla eficazmente



Las **enfermedades cardiovasculares** son la primera causa de muerte en el mundo y el factor común de estas entidades es la **elevación del colesterol LDL.**

- ***Infarto al miocardio***
- ***Accidente vascular cerebral***
- ***Coronariopatía***

GANT-01A/ter-18
No. de entrada: 183300202C1385

Cetus

Senosiain

OKSEN®

OK EN **HIPERTENSIÓN**

Porque la **hipertensión** es un problema de salud global que daña órganos blanco y que tiene como consecuencia:

- **Insuficiencia cardiaca**
- **Daño renal**
- **Retinopatía**
- **Demencia vascular**

OKSEN Es la cápsula de contenido líquido que da el **OK en hipertensión**

+ **Telmisartán Hidroclorotiazida**

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IPAL

Senosiain

Aligere la vida de su paciente.

En monoterapia o en combinación,

Rofucal®

Hidroclorotiazida

Cuida tu corazón.

Es el diurético de primera línea
y **piedra angular** del tratamiento antihipertensivo.[1]

Los **diuréticos tiazídicos** han demostrado que en **monoterapia** o **combinación**, **reducen** el **riesgo** de **cardiopatía**, enfermedad **vascular cerebral** e **infarto** de **miocardio**.[1]

Es **ideal** para usarse en **terapia combinada,** ya que tiene efecto **aditivo** o **potencializador** con otros antihipertensivos.[2,3]

Indicado en el **tratamiento** del **edema** asociado a **insuficiencia cardíaca congestiva** y/o **cirrosis hepática**.[2]

Dosis recomendadas:[2]

HTA*: 25 mg/día dosis única o repartida en varias tomas. **Dosis máxima:** 50 mg diarios.
Edema: 25 a 100 mg/día en una o dos tomas. **Dosis máxima:** 100 mg diarios.

***HTA:** Hipertensión Arterial.

Referencias: 1. Bell K, *et al.* Hypertension: the silent killer: Updated JNC-8 Guideline Recommendations (2015). Alabama Pharmacy Association; 1:1-8. **2.** Información para prescribir amplia. Rofucal®. **3.** Uchiwa, H., Kai, H., Iwamoto, Y., Anegawa, T., Kajimoto, H., ... Fukuda, K. (2017). Losartan/hydrochlorothiazide combination is safe and effective for morning hypertension in Very-Elderly patients. Clinical and Experimental Hypertension, 40(3), 267–273.

Flucogrel

Flujo continuo

- En el **manejo y prevención** de eventos **aterotrombóticos**

SALVAVIDAS

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