

ELECTROCARDIOGRAPHIC AND ECHOCARDIOGRAPHIC ASPECTS OF 35 STUDIED TEENAGE BASKETBALL PLAYERS (FEMALE) IN ST. LOUIS (SENEGAL)

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ABSTRACT

Cardiological assessment of sports players is rarely effective. This is more problematic in Sub-Saharan Africa due to the relatively short supply of cardiologists. The objectives of this study were to describe the electrocardiographic and echocardiographic aspects of the athlete's heart on a specific population, which is female basketball players aged between 13 to 23, in the region of Saint Louis in Northern Senegal.

KEYWORDS: Cardiological assessment, girls, basketball players, Senegal.

INTRODUCTION

The physical examination of no contraindication to the practice of sports justifies, according to the European recommendations, from the age of 12 years the realization of a complete clinical and electrocardiographic examination. The objective of this evaluation is to limit the risk of sudden death due to an underlying unrecognized heart disease. It may be supplemented by echocardiography or other cardiological explorations.^[1,2,3] Several racial features of the athlete's heart have been described in the black subject.^[4] The boundary between physiological and pathological findings is sometimes difficult to establish.

The cardiological evaluation of athletes, even of competition, is rarely effective. This is more problematic in sub-Saharan Africa because of the relatively insufficient number of cardiologists. The objectives of this work were to describe the electrocardiographic and echocardiographic aspects of the athlete's heart in a specific population, which is that of young female basketball players between 13 and 23 years old from the Saint Louis region in Northern Senegal.

Patients and methods

This is a cross-sectional study carried out between August 2013 and January 2014 at the Regional Hospital Center of Saint Louis in Senegal. It was held as part of the annual visit of a basketball team, and involved 35 subjects. The inclusion criteria were the feminine gender, aged between 13 and 23, regular basketball practice in the various clubs in the Saint Louis area. The informed consent of the athletes and the various club leaders was

imperative. Those who did not consent to participate in the work were not included.

The studied parameters were clinical

-At the interview : the socio-demographic aspects, the personal and family history, the cardiovascular risk factors, the number of hours of training per week, the number of sessions per day and the seniority.

On physical examination we assessed the hemodynamic constants, weight, size and examination of the cardiovascular system.

The 12-lead ECG recording with a Schiller device was routine. We were interested in rhythm, frequency, the axis of the heart, the different waves and segments, the overload indices, the rhythm and conduction disorders.

All the girls had a transthoracic echocardiography. It was made with an Ivis 60 Expert device with time motion (TM) mode, two-dimensional and pulsed, continuous and color Doppler with a multi-frequency (2.5-4.9 MHz) probe. The parameters studied are:

- Left atrium (LA) diameter in millimeters (normal : 18 – 40mm)
- Left atrium area in cm² (normal ≤ 17cm²)
- Right atrium (RA) area) in cm² (normal ≤ 17cm²)
- Left ventricular (LV) end-diastolic diameter (LVED) in mm (normal : 38 – 56 mm)
- Left ventricular (LV) end-systolic diameter (LVSD) in mm (normal : 22 – 40 mm)
- Right ventricular (RV) end-diastolic diameter (RVED) in mm (normal : 7 – 28 mm)

- LV ejection fraction (EF), TM mode in % (normale : 50 – 69%)
- Left ventricular mass (LVM), according to the formula of Devereux and Reichek

$$LVM = 1,04 [(LVED+IVSTd+PWTd)^3 - (LVED)^3] - 13,6$$

LVM= Left ventricular mass in grams

IVSTd= Interventricular septum thickness in diastole (millimeters)

PWTd= Posterior wall thickness in diastole (millimeters)

Left ventricular hypertrophy was defined as a left ventricular mass greater or equal to 160 g, or a left ventricular mass indexed to the body surface area (BSA) greater or equal to 120g/m²

- IVC = Inferior Vena Cava in diastole in mm (normal: 12 - 21mm)
- MAPSE (Mitral Annular Plan Systolic Excursion) in mm (normal \geq 10mm)
- TAPSE (Tricuspid Annular Plan Systolic Excursion) in mm (normal \geq 15mm)
- The mitral profile across the E / A ratio (normal \leq 1)
- PASP (Pulmonary Artery Systolic Pressure) in mm Hg (normal \leq 35mm Hg)

The measurements were carried out by a single operator according to the ESA convention.

The calculations were performed using SPSS Software Version 18.0. Only values of p less than 0.05 were considered significant.

RESULTS

The average age was 16.79 years (range: 13 and 21 years). Most of the players, 71.4%, were enrolled till secondary school; 8.6% were only in the Koranic school. The family history was mainly hypertension (54.3%) and diabetes (51.4%). Four cases of sudden death in the family had been recorded. A history of recurrent angina and polyarthralgia in childhood existed in 28.6% and 22.9%, respectively.

No cases of smoking or drinking were noted.

Sixty percent of subjects had more than 30 months of seniority in sport (Figure 1). Thus 93.55% practiced at least 10 hours of training per week, the others between 8 and 10 hours per week (Figure 2).

The average size was 1.67 meters (standard deviation: 0.81) with extremes ranging from 1.50 to 1.87 meters. The average BMI was 19.18 kg / m² (standard deviation 3.02).

Functionally, 34.3% reported dyspnea stage II; 28.6% for palpitations and 34.3% for precordialgies to the effort. The average heart rate was 81 bits per minute with extremes ranging from 61 to 120 beats per minute. Blood pressure was on average 120.57 mmHg systolic and 70.28 mmHg diastolic.

The physical examination found an apex and aortic systolic murmur of moderate intensity in one case and a loudness of the second pulmonary noise in another player.

At the electrocardiogram the rhythm was sinus in all cases. There was an extension of the PR interval to 210 ms in one case. In another case, it was a short PR at 100 ms without associated delta wave. The duration of the QRS complex and the QT interval calculated according to the Bazett formula were normal in all cases (Table I). A subjacent PQ segment was noted in a girl. In 17.1% of the subjects, we observed negative V-waves isolated in V1; They were biphasic from V1 to V4 in 17% of the cases. One aspect of early repolarization was noted in 10%.

In Doppler echocardiography, dilation of the LV to 65 mm was noted in one case. The inferior vena cava was dilated to 24 mm in a girl. The average left ventricular mass was 123.3 g (standard deviation: 33.81). It was higher on five players.

The E / A ratio was normal or supranormal in all cases with an average E / A ratio of 1.94 (standard deviation: 0.60).

The bi-ventricular function was normal in all cases, as well as the pulmonary arterial pressure.

Moderate valvular leakage on mitral and rheumatic aortic cusps in a case without cavitory dilation were noted. The various echocardiographic measurements are summarized in Table II.

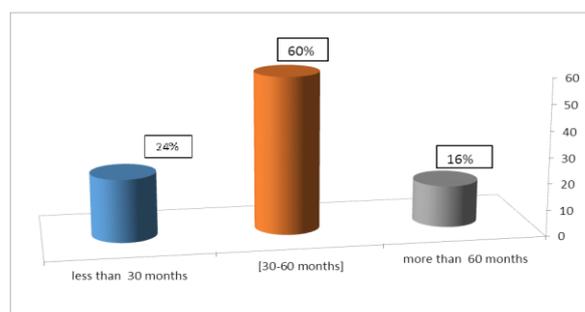


Figure 1 : Duration in the practice of sport.

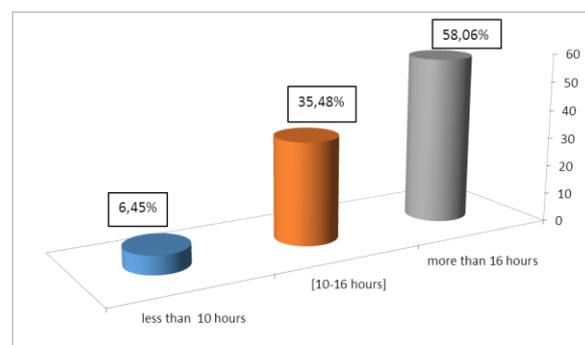


Figure 2 : Number of hours by week in the sports practice.

Table I : Electrocardiographic variables.

Variables	Mean	Standard deviation	Minimum	Maximum
PR_ECG (ms)	140	31,4	100	210
QTc_ECG (ms)	390,54	24,72	330	444
Sokolow Lyon index (mV)	28,14	6,63	15	42
Cornell index (mV)	9,66	5,25	0	24
ECG axis (degree)	54,43	22,19	-20	80

ECG : electrocardiogram.

Table II : Electrocardiographic characteristics.

Variables	Minimum	Maximum	Mean	Standard deviation	% abnormalities
LA area	8	26	12,71	3,38	8,5
RA area	6	22	11,71	3,12	2,8
LA diameter	23	40	30,71	4,36	0
LVED	37	65	44,31	5,07	2,8
LVES	18	46	27,89	5,16	2,8
IVSTd	4,5	11	6,65	1,32	0
PWTd	10	11	7,67	1,96	0
LVM	72,1	235	123,3	33,8	14,28
EF TM	53	88	73,71	9,38	0
TAPSE	15	31	22,43	3,85	0
MAPSE	11	23	16,4	3,07	0
IVC	4	24	14,15	3,45	2,8
E wave	0,65	1,88	1,03	0,23	0
A wave	0,31	1,15	0,51	0,15	0
E/A ratio	0,3	3	1,94	0,60	0

LA : Left atrium, RA : right atrium, LVED: left ventricular end-diastolic diameter, LVES: left ventricular end-systolic diameter, IVSTd: interventricular septum thickness in diastole, PWTd: posterior wall thickness in diastole, LVM: left ventricular mass, EF TM: ejection fraction in time motion mode, TAPSE: tricuspid annular plan systolic excursion), MAPSE: mitral annular plan systolic excursion, IVC: inferior vena cava

DISCUSSION

This study, carried out among young Senegalese sportswomen, is of a certain specificity since it is interested in a population of black teenagers practicing a regular physical activity. This raises the question of the realization of a cardiac assessment in Africa among young athletes due to a lack of financial means and the insufficient number of cardiologists mainly concentrated in the big cities.

This serie again allowed to show the high prevalence of hypertension and diabetes as described by Kane and al.^[5] in his study on cardiovascular risk factors in the general population of Saint Louis of Senegal.

The rheumatic endemic situation in sub-Saharan Africa still accounts for the high incidence of recurrent angina and polyarthralgia during childhood.

The few cases of palpitations reported by the girls have also been found in other series.^[4,6] it is important not to ignore them since they can translate a disturbance of rhythm and should invite to seek taking of excitants, or evoke doping. The ECG Holter and the effort ECG allow to better explore these palpitations.

Some complained of stage I dyspnea and precordialgia, the most important being to differentiate the dyspnea or the pathological precordialgias of cardiac or respiratory origin from the dyspnea or the pathological precordialgias due to the poor adaptation to the effort on a healthy heart, which simply requires advice of modifications of the training.

Our results show that in the vast majority of cases, the ECG of adolescent feminine athletes is very common.

The average PR interval was at 147 ms (only one had a PR at 210 ms). This could be related to the excellent classical nodal conduction in young and athletic subjects.^[4,7,8]

No teenager was bradycarde, the average FC for the entire series was at 81 beats per minute. Although the majority of the series show a more frequent sinus bradycardia in athletes,^[9,10] some others,^[4,11,12] do not show it either. This can be attributed to the young age of our population, which, by definition, has less seniority in training, but also to the fact that the upper limbs are more involved in basketball sports activities (during training or competitions), and that there is a preponderant intervention of the dynamic composition of basketball.^[13]

The QRS were low (less than 120 ms) in all girls, as in other studies that did not show significant differences between athletes and non-athletes.^[10,14]

The QT corrected by Bazett was normal for all; If Bazett's QT was high, the Hodges formula, which is a linear formula recommended by the ACC / AHA 2009, would have been used to the detriment of Bazett's formula which was too sensitive to the variations of heart rate.^[15]

Repolarization disorders with negative T-wave types from V1 to V4 could be part of an early repolarization syndrome, but also the atypies of repolarization found in black subjects.^[6]

The prevalence of this atypia of repolarization in young adults is 3 to 4%.^[16] According to recent studies, this prevalence does not seem significantly different in adolescents.

Nevertheless, these disorders should be interpreted with caution and should seek cardiopathy, particularly hypertrophic cardiomyopathy.^[7,8,10]

Most of the studies in the literature refer to subjects aged between 18 and 35, which is why we targeted a population aged between 13 and 23. Age is one of the important variables of an athlete's heart. In 1994, Pelliccia's study of 947 athletes of different ages and sports disciplines showed a 0.2 mm increase of TDLV per additional year and a 0.1 mm increase of the interventricular septum per additional year.^[13] The duration of exposure limited to physical training of children or adolescents compared to adult athletes may be one explanation for the observed difference. Similarly, the immaturity of the autonomic nervous system with a lower catecholergic response as well as a lack of testosterone in the pre-pubertal subject certainly play a role in the less pronounced increase of the cardiac dimensions of the pre-pubertal athlete.^[12]

The thickness of the septal wall was normal in all subjects (11 mm or less), although it was necessary to eliminate hypertrophic cardiomyopathy if it was more than 11 mm in an adolescent athlete.^[17,1]

The size of the left atrium appears to be normal ; the dilatation of the atrium is significantly more pronounced in adult athletes, showing the effect of physical training over time.^[18,19,20]

Sex is one of the determinants of these changes. One of the largest studies of female athletes was conducted by Pelliccia and al in 1996, comparing 600 female athletes with 735 male athletes of the same age and practicing the same sporting disciplines. It showed significantly greater hypertrophy and left ventricular dilatation in men (23% for Interventricular Septum (IS) and 11% for TDLV). Women showed average values of 8.2 +/- 0.9 mm for IS

(never exceeding 12 mm, unlike men) and 46 +/- 3 mm for the TDLV.^[15] The same finding was made in adolescents, in the study by Sharma and al in 2002: IS and TDLV were significantly more important in male subjects.^[1] This observed difference can be explained by a higher plasma concentration of testosterone and a higher anabolic hormone in Men.

One subject had minimal dilatation of LV in systole and diastole with correct biventricular function and absence of abnormality of diastolic function to eliminate dilated cardiomyopathy.

However, it should be remembered that an increase in the LV diastolic diameter is commonly reported in young athletes compared to non-athletic subjects of the same age.^[4,9,14]

The average E / A ratio was 1.94; few studies [20, 21, 22, 23] have investigated the diastolic function of the young athlete's left ventricle; those available are mostly found in adolescent athletes with an increased E / A ratio compared to non-athlete adolescents.

On another subject, the echocardiography noted an MI and a moderate AI on a rheumatic attack, the prevalence of rheumatic valvulopathies remaining elevated in our regions.^[24]

The body surface also influences the TDLV and the IS: the bigger the surface is, more increased they are.^[13] It is therefore justified to report these measures to this individual variable.

Moreover, the standards of the athlete's heart were mainly defined in the Caucasian subjects. Several recent studies have shown that black athletes have greater left ventricular hypertrophy than Caucasian athletes, including female athletes.^[14,15] Ethnicity is therefore a factor influencing the changes that define the athlete's heart. In our study, five girls had an increase of the left ventricular mass.

CONCLUSION

As in adults, the adolescent athlete's heart is a healthy heart, as our study shows.

Depending on clinical and electrocardiographic findings during a non-contraindication visit to the practice of competing sports, the additional realization of an echocardiography may be necessary in order to limit the risk of sudden death due to an underlying unrecognized cardiac disease.

Conflicts of interest None.

Limitations

They are represented by the absence of a control group that would have made it possible to reinforce the relevance of the values and by the fact that all the

adolescent girls were of black race (atypia of the black subjects), preventing extrapolation to the other teenagers of the different races.

Our population was limited to thirty-five adolescent girls.

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