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EC CARDIOLOGY
Research Article

Prospective Register of Recreational Athletes. Analysis of the Associated Pathology

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Abstract

Introduction: An extraordinary state of health does not confer immunity against the tragedy of sudden death. There is a universal agreement to perform pre-competitive screening in high-performance athletes to reduce the incidence of sudden death. However, in the population that performs recreational sport the incidence of concomitant cardiac pathology is unknown.

Goals: The objective of this work is to describe the baseline characteristics, the positive findings of the physical examination and complementary studies of the physical fitness for non-competitive athletes.

Material and Methods: Between June 2017 and January 2018, recreational athletes who attended for physical fitness were prospectively included, data on baseline characteristics, major cardiovascular risk factors, functional capacity (expressed in Mets), functional test result, baseline electrocardiogram were obtained. and echocardiogram. A descriptive analysis was carried out by conventional statistics and comparative analysis between the groups by means of a T, Anova or Kruskal Wallis test, as appropriate. A $p < 0.05$ was considered significant.

Results: A total of 506 athletes were included for analysis. The average age was 31 +/- 12 years old, 53% male. 88% of the population practiced sports. In the ECG, 100% presented sinus rhythm, alteration of repolarization in 8% and intraventricular conduction disorder in 23%. 88% of the echocardiograms were considered normal, the anomalies found were: 2.7% of bicuspid aorta, 0.2% of ventricular hypertrophy and 0.2% of atrial septal defect. Univariate analyzes were performed to assess predictors of ECG changes of the athlete's heart (BIRD-BCRD, Sinus Bradycardia) finding that the age of onset less than 15 years ($p < 0.05$) presents association and training more than 8 hours per week (p 0,09) a trend. The alterations of the repolarization (negative t and positive ST elevation) did not present an association with age of beginning of the exercise, hours of training or type of exercise. 99.6% was given the physical aptitude to continue playing sports. Only 2 athletes did not obtain the apt and more studies were required to grant it (1 for ergometry compatible with ischemia and another with pre-excitation than with driving until maximum effort).

Conclusions: A low incidence of disqualifying pathology was found in this prospective cohort.

Keywords: *Preparticipative Exam; Electrocardiogram; Echocardiogram*

Introduction

The association between a sedentary lifestyle and the increased risk of heart attack was initially proposed by a British doctor in 1953. Dr. Jerry Morris analyzed heart attacks and deaths in drivers and ticket vendors of the famous red bus two floors in London. Thus, he discovered that there was a great difference between those who spent much of their working time sitting (drivers) and those who did it walking and going up or down stairs (ticket holders). Since then we talk about the benefits of physical activity. The evidence has shown us that there is an inverse relationship between physical exercise and cardiovascular and cerebrovascular disease [1].

However, intense physical exercise (greater than 6 mets), especially in sedentary adults, with occult or known coronary disease and with cardiovascular risk factors, may increase the risk of myocardial infarction and sudden death [2].

There is still controversy about how to perform precompetitive screening in athletes, but there is abundant information about the pathological findings and the usefulness of the studies carried out. The epidemiological information on the incidence of sudden death in

athletes, in addition to the pathological findings that can be found in them, is known; but there is no information about the pathological findings in recreational athletes of the general population.

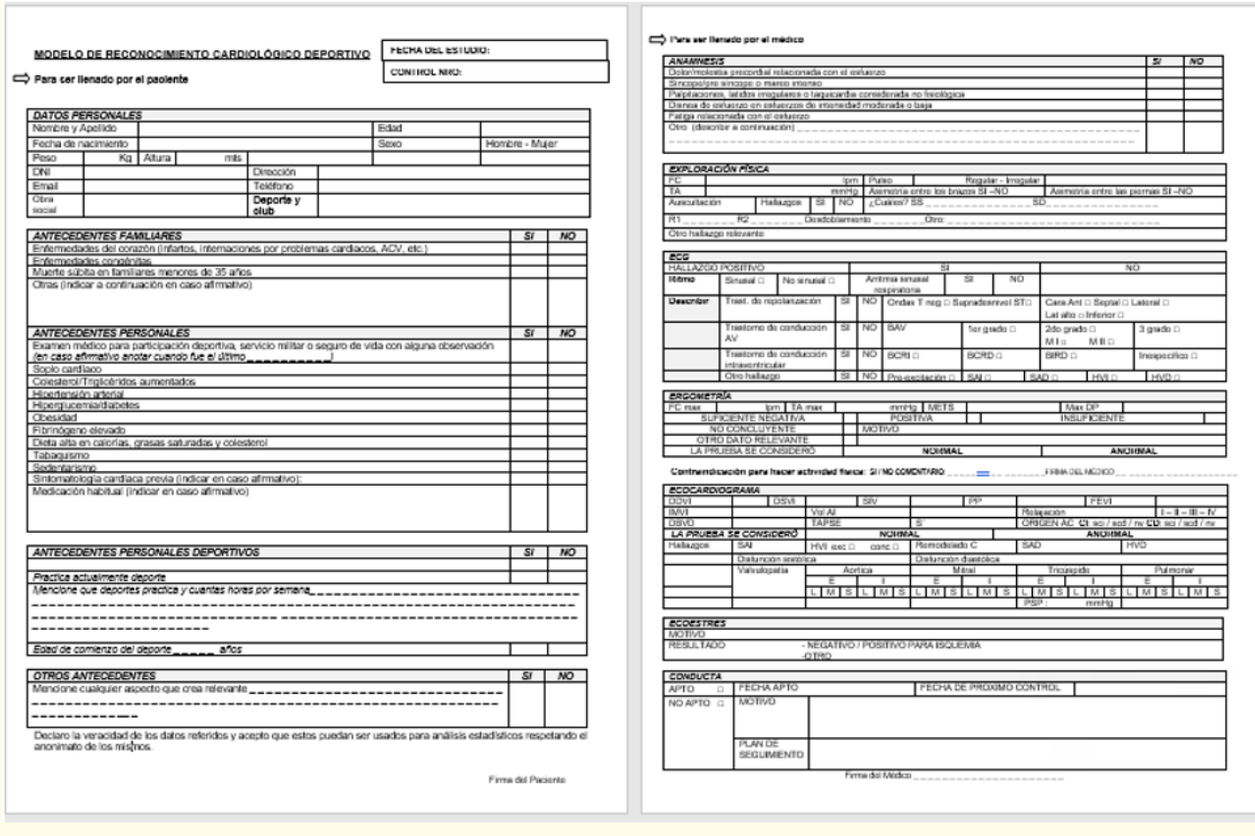
Objective of the Study

The objective of this work is to describe the characteristics found in the Pre-sports screening where they practice Sport in a recreational way.

Material and Methods

Prospectively included 506 Patients who attended between June 2017 and January 2018, to fit Pre-sports physician at a sports institute in the city of Mendoza-Argentina.

The data load was carried out through a tab specially designed to perform the pre-sports medical evaluation (Figure 1). The missing data were taken from the electronic medical history.


MODELO DE RECONOCIMIENTO CARDIOLÓGICO DEPORTIVO

FECHA DEL ESTUDIO:

CONTROL NRO:

Para ser llenado por el paciente

DATOS PERSONALES

Nombre y Apellido | Edad

Fecha de nacimiento | Sexo | Hombre - Mujer

Peso | Kg | Altura | mts

DNI | Dirección

Email | Teléfono

Obra social | Deporte y club

ANTECEDENTES FAMILIARES	SI	NO
Enfermedades del corazón (infartos, internaciones por problemas cardiacos, ACV, etc.)		
Enfermedades congénitas		
Muerte súbita en familiares menores de 35 años		
Otras (indicar a continuación en caso afirmativo)		

ANTECEDENTES PERSONALES	SI	NO
Examen médico para participación deportiva, servicio militar o seguro de vida con alguna observación (en caso afirmativo anotar cuando fue el último _____)		
Soplo cardiaco		
Colesterol/Triglicéridos aumentados		
Hipertensión arterial		
Hiperglucemia/diabetes		
Obesidad		
Fibrinógeno elevado		
Dieta alta en calorías, grasas saturadas y colesterol		
Tabaquismo		
Sedentarismo		
Sintomatología cardíaca previa (indicar en caso afirmativo):		
Medicación habitual (indicar en caso afirmativo)		

ANTECEDENTES PERSONALES DEPORTIVOS	SI	NO
Practica actualmente deporte		
Mencione que deportes practica y cuantas horas por semana_____		
Edad de comienzo del deporte _____ años		

OTROS ANTECEDENTES	SI	NO
Mencione cualquier aspecto que crea relevante _____		

Declaro la veracidad de los datos referidos y acepto que estos puedan ser usados para análisis estadísticos respetando el anonimato de los mismos.

Firma del Paciente

Para ser llenado por el médico

ANAMNESIS	SI	NO
Dolor/molestia precordial relacionada con el esfuerzo		
Síncope/pre síncope o mareo intenso		
Palpitaciones, latidos irregulares o taquicardia considerada no fisiológica		
Disnea de esfuerzo en esfuerzos de intensidad moderada o baja		
Fatiga relacionada con el esfuerzo		
Otro: (describir a continuación)		

EXPLORACIÓN FÍSICA

FC | lpm | Pulso | Regular - Irregular

TA | mmHg | Asimetría entre los brazos SI –NO | Asimetría entre las piernas SI –NO

Auscultación | Hallazgos | SI | NO | ¿Cuáles? SS _____ SD _____

R1 _____ R2 _____ Desdoblamiento _____ Otro: _____

Otro hallazgo relevante

ECG

HALLAZGO POSITIVO | SI | NO

Ritmo | Sinusal □ | No sinusal □ | Arritmia sinusal respiratoria | SI | NO

Describir | Trast. de repolarización | SI | NO | Ondas T neg □ Supradesnivel ST□ | Cara Ant □ Septal □ Lateral □ Lat alto □ Inferior □

Trastorno de conducción AV | SI | NO | BAV | 1er grado □ | 2do grado □ MI □ MII □ | 3 grado □

Trastorno de conducción intraventricular | SI | NO | BCRI □ | BCRD □ | BIRD □ | Inespecífico □

Otro hallazgo | SI | NO | Pre-excitación □ | SAI □ | SAD □ | HVI □ | HVD □

ERGOMETRÍA

FC max | lpm | TA max | mmHg | METS | Max DP

SUFICIENTE NEGATIVA | POSITIVA | INSUFICIENTE

NO CONCLUYENTE | MOTIVO

OTRO DATO RELEVANTE

LA PRUEBA SE CONSIDERÓ | NORMAL | ANORMAL

Contraindicación para hacer actividad física: SI / NO COMENTARIO _____ FIRMA DEL MÉDICO _____

ECOCARDIOGRAMA

DDVI | DSVI | SIV | PP | FEVI

IMVI | Vol AI | Relajación | I – II – III – IV

DSVD | TAPSE | S | ORIGEN AC CI sci / scd / nv CD sci / scd / nv

LA PRUEBA SE CONSIDERÓ | NORMAL | ANORMAL

Hallazgos | SIN | HVI sist □ conc □ | Remodelado C | SAD | HVD

Disfunción sistólica | Disfunción diastólica

Valvulopatía | Aórtica | Mitral | Tricuspídeo | Pulmonar

E | I | E | I | E | I | E | I

L M S L M S | L M S L M S | L M S L M S | L M S L M S

PSP : mmHg

ECOESTRES

MOTIVO

RESULTADO - NEGATIVO / POSITIVO PARA ISQUEMIA - OTRO

CONDUCTA

APTO □ | FECHA APTO | FECHA DE PROXIMO CONTROL

NO APTO □ | MOTIVO

PLAN DE SEGUIMIENTO

Firma del Médico _____

Figure 1: *Cardiac recognition module designed for prospective load of patients in study*

The file consists of the 12-point questionnaire suggested by the American Heart Association (AHA) [3] to be completed as an affidavit by the athlete, as well as a physical examination and questioning by a doctor. All patients signed the card accessing the anonymous publication of the data.

Electrocardiogram (ECG) (ECG view stress Eccosur, Sirex Argentina) of 12 leads was performed supine at rest, with a paper scanning speed of 25 mm/second and an amplitude of 10 mVolt. The ECG analysis was performed according to the Seattle criteria [4].

Graduated ergometric test (PEG) with digital equipment (ECG view stress Eccosur, Sirex Argentina), performed on a cycle ergometer under the Astrand protocol or on an ergometric tape under the Bruce protocol.

Doppler echocardiogram performed with standard equipment (Vivid-7 or Vivid-i, General Electric Vingmed, Milwaukee, Wisconsin, USA). The tricuspid or mitral physiological insufficiencies were not interpreted as pathological if the valves did not present structural alteration.

All the studies were carried out by experienced cardiologists and kept in digital file in the electronic medical record for later analysis or to be reviewed by the whole team to appear some controversy.

Statistic analysis

A descriptive conventional analysis was performed, the quantitative variables were expressed as mean and standard deviation. Discrete variables are presented as number of cases and percentages. For the comparative analysis between the groups, T, Anova or Kruskal Wallis tests were used, as appropriate. A $p < 0.05$ was considered significant.

All data were analyzed using the SPSS statistical system (version 17, SPSS Inc., Chicago, New York, USA).

Results

In the period described, a total of 506 athletes were evaluated, with an average age of 31 +/- 12 years, predominance of males (53%). 88% practiced some sport in a recreational way, 19% practiced more than 8 hours of sport per week. The demographic data are shown in table 1.

Variable	**Media +/- DS**
Age	31 +/- 12
Weight	71 +/- 14
Height (in cm)	169 +/- 12
	%/n
Male	53%/282
Practice Sport	88%/466
Hours per week	35%/190
< 5 hs.	32%/172
5 - 8 hs.	19%/104
> 8 hs.	
Age of start in sport	32%/174
< 15 years	38%/200
15 to 30 years	16%/86
> 30 years	
Cardiovascular Risk Factors	2,7%/14
Hypertension	0,7%/4
Diabetes	5%/26
Dyslipidemia	5%/27
Smoking	3,5%/18
Obesity	
Cardiovascular pathological antecedents	1,1%/6
Previous infarction	0,1%/1
Previous stroke	0,1%/1
Previous Myocardial revascularization Surgery	0,1%/1
Sudden death in a family member	

Table 1: Basal characteristics of the population.

The positive findings in the 12-point questionnaire were low (only 1%/N5 of the population), 0.1% (N1) of the patients presented an angulation, 0.5% (N3) presented syncope and 0.1% (N1) palpitations.

In the ECG we found (Table 2): sinus rhythm in 100% of the patients. Basal heart rate of 70 +/- 12 beats minute. Sinus bradycardia (defined as baseline heart rate less than 60 beats minute) 28% (N140). Extreme bradycardia (defined as heart rate less than 45 beats minute) 2% (N11). Alterations of repolarization in 7.1%, 16 patients had negative T (3.1%) and 20 ST segment elevation (4%). Only a 1st degree ventricular atrial block (0.1%). 23% (N116) presented alterations in the intra ventricular conduction, of these 22% (N113) incomplete blockade of the right branch, 0.1% (N1) of complete blockade of the right branch, 0.1 (N1) of complete blockade of the left branch and 0.1% (N1) of non-systematized conduction disorder. Pre-excitation was observed in only one athlete, and ventricular hypertrophy by voltage criteria in 2 athletes only.

Variable	**%/n**
Sinus Rhythm	100%/505
Sinus bradycardia	28%/140
Extreme Bradycardia	2%/11
Alteration of repolarization	7,1%/36
Previous negative T	N3
Negative Anterior, lower and lateral T	N2
Previous, inferior, lateral and septal negative T	N1
Negative Anterior and lateral T	N3
Anterior and septal negative T	N3
Negative Lateral T	N2
T Septal Negative	N2
Anterior ST Concave Elevation	N9
Anterior and lateral ST concave elevation	N1
Anterior and septal ST concave elevation	N3
Bottom and side ST concave elevation	N1
Concave ST Elevation septal	N6
Lock Auricular Ventricular 1 °	0,1%/1
Intraventricular conduction Alterations	23%/116
BIRD	22%/113
BCRD	0,1%/1
BCRI	0,1%/1
Non-systematized conduction disorder	0,1%/1
Preexcitation	0,1%/1
ventricular hypertrophy-Voltage	0,3%/2

Table 2: Electrocardiographic findings.

Both repolarization disorders and intraventricular conduction disorders; were more frequent in man, without a significant statistical association.

Univariate analyzes were performed to look for an association between repolarization and sports disorders, although those who practiced sports presented alterations in repolarization more frequently, they did not present a statistically significant association (p 0.46).

Those who practice sports did have a significant association with alterations in intraventricular conduction (p 0.004). When they were analyzed by number of practice hours per week, those who practiced more than 8 hours per week showed a trend (p 0.09), not like the beginning of the sport before the 15 years that presented a significant association ($p < 0.05$) (Table 3).

Variable	OR	p
Practice Sports	1,4	0,46
Analysis univariate, predictors of intraventricular conduction disorder		
Practice Sports	5,4	0,004

Table 3: Analysis univariate, predictors of current or voltage repolarization.

In the PEG, 11% (N56) of the studies presented abnormalities (1 with ischemic changes during the test, 1 pre-excitation in the effort, not found in the baseline ECG, with a coupling of 386ms of RR and 54 with disproportionate reactive hypertension for age) (Table 4).

Variable	%/n
Infradesnivel of the ST segment	0,1/1
Ventricular extrasystoles	0
Reactive hypertension	10%/54
Ventricular tachycardia	0
Preexcitation	0,1%/1

Table 4: Findings in the test exercise graduated

6.8% of the Doppler echocardiograms showed some abnormality. Of these, the most frequent alteration was atrial dilatation (4%/N19), followed by the bicuspid aortic valve (2.7%/N14). We found low prevalence of eccentric ventricular hypertrophy (0.1%/N1) and parietal thickening (0.1%/N1). A case of ostium secundum interatrial communication (0.2%/N1) that required percutaneous closure. The prevalence of tricuspid regurgitation in our population was 38% (N 198) with an average systolic pressure in the pulmonary artery estimated by regurgitant jet velocity of 28 mmHg +/- 6 (minimum of 9 mmHg and maximum of 47 mmHg). An athlete with mild pulmonary stenosis, who was already in follow-up at the institute. No moderate or severe valvular disease was found in this registry (Table 5).

Variable	%/n
Atrial dilatation	4%/19
Bicuspid aortic valve	2,7%/14 Type 2 N12 and type 2 N 2
Eccentric ventricular hypertrophy	0,19%/1
Parietal thickening	0,19%1
Interatrial Communication	0,19%/1
Slight tricuspid failure	38%/198
Mild mitral regurgitation	4%/21
Mild aortic insufficiency	3,6%/19
Mild pulmonary failure	2,4/13

Table 5: Echocardiographic findings.

Discussion

The sport of high performance represents only 3 - 6% of the universe of the athletes, so the vast majority of the people potentially beneficiaries of an evaluation Sports, recreational athletes. In the medical literature, there is little evidence about this group.

The study by Marijon., *et al*. Conducted in France between 2005 and 2010, revealed that only 6% of MS related to sports occurred in young high-performance athletes. More than 90% of MS occurred in recreational athletes with a very wide age range from 15 to 75 years [5]. This is based on the systematic use of pre-sports checkups, as we would potentially be preventing the risk of events. The design of this work is ambitious, we still do not have the number of patients, nor with the follow-up to assess the benefit of the Pre-sports checkup.

The population under study was a healthy population, with a low prevalence of major cardiovascular risk factors, compared to the third survey of risk factors in Argentina (where the prevalence of smoking was 25%, hypertension of 34% and diabetes from 10%).

The positive data in the 12-point AHA questionnaire were few, however, because of the low cost and its practicality (it is partly filled by the patient) we believe that it is justified to continue using it.

Despite its easy application and reproducibility, the ECG continues to be controversial in the precompetitive exam due to its cost effectiveness [6]. Both the European society and the Argentine society of cardiology [7] suggest its application in the context of precompetitive aptitudes. In this registry we found a low percentage of repolarization alterations that do not contraindicate sports practice, but that do suggest a close follow-up of the patient.

In the PEG was where most of the alterations were found, although, it is difficult to classify reactive hypertension disproportionate to the effort, this behavior requires monitoring with ambulatory blood pressure monitoring to rule out hidden arterial hypertension.

In the echocardiogram, no findings were found that contraindicate sports activity, but structural alterations suggesting remote control to assess possible complications such as aortic insufficiency in bicuspid valves, where we found an incidence higher than that described in other series [8,9].

Conclusion

In this cohort of patients studied, we found a low incidence of complex pathology. It was a healthy population with a low prevalence of cardiovascular risk factors.

The role of cardiologists specialists in sports is not to prohibit exercise, on the contrary, it is to encourage a healthy lifestyle by exercising safely and supported.

We consider that precompetitive screening is useful, since it detects potentially curable or controllable pathologies, distancing patients from secondary complications that can be exacerbated by sports practice (Bicuspid VA- ascending aortic dilation, S° Wolf Parkinson White).

Limitations

Unicentric registry of patients with social work and prepaid who can attend a private high complexity center.

Strengths

In the literature review, we found much evidence about elite athletes or Olympic athletes, but not much evidence about recreational athletes.

It is planned to continue with the loading and prospective evaluation and away from the database.

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