BRIEF ARTICLE

Contributions of Exercise Stress Testing in the Octogenarian Population

Aportes de la ergometría en la población octogenaria

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ABSTRACT

Background: The octogenarian population has substantially increased due to higher life expectancy and quality of life. In Argentina, there is scarce information on this group of patients.
Methods: A cross-sectional, descriptive and comparative study was conducted comparing an octogenarian population with a non-octogenarian population consisting of elderly patients between 60 and 79 years of age. Cardiovascular risk factors, pharmacological treatment, reasons for performing/requesting an exercise stress test, test findings and reasons for test termination were evaluated.
Results: A total of 161 octogenarians were included in the study (mean age 82.98 years) and 94% had at least one cardiovascular risk factor. The most common requests for exercise stress testing were to certify physical fitness or in the setting of a check-up examination. We noticed some expected differences between both populations. Octogenarians were receiving more pharmacological treatment compared with non-octogenarians. There were no significant findings or complications during the test.
Conclusion: In octogenarians, exercise stress testing constitutes a valuable tool that provides useful information without complications. Probably, the subjective nature in the evaluation of dyspnea is the reason to request exercise stress testing.

Key words: Exercise Test - Risk Factors - Cardiovascular Diseases – Aged

RESUMEN

Introducción: Debido al aumento de la expectativa y calidad de vida, la población de octogenarios aumentó considerablemente. En Argentina, la información médica concerniente a este grupo de pacientes es escasa.
Materiales y métodos: Se trata de un estudio descriptivo y comparativo de corte transversal. Se realizaron comparaciones entre una población octogenaria y no octogenaria, comprendida por adultos mayores entre 60 y 79 años. Se evaluaron los factores de riesgo cardiovascular, el tratamiento farmacológico, los motivos de realización/derivación, hallazgos y criterios de detención de las pruebas ergométricas.
Resultados: Se incluyeron 161 pacientes octogenarios (media de edad 82,98 años). El 94% de los pacientes presentaba algún factor de riesgo cardiovascular. El motivo de derivación más frecuente fue en contexto de un apto físico o control de salud. Hemos observado diferencias esperables entre ambas poblaciones. Los pacientes octogenarios se encontraban recibiendo más tratamiento farmacológico que los demás. No hubo hallazgos de relevancia ni complicaciones durante el estudio.
Conclusión: En población octogenaria, la prueba ergométrica constituye una herramienta valiosa por la información que aporta y la ausencia de complicaciones. Probablemente, la subjetividad en la evaluación de la disnea motiva la solicitud de pruebas ergométricas.

Palabras Clave: Prueba de esfuerzo - Factores de riesgo - Enfermedades cardiovasculares - Anciano

Abbreviations

SD	Standard deviation	**EST**	Exercise stress test

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INTRODUCTION

The octogenarian population has substantially increased due to higher life expectancy and quality of life, resulting in a greater number of exercise tests performed in this age group. (1) Nevertheless, this group is underrepresented in large studies. (2) Over the past decade, some societies have published recommendations and consensus statements on the management of risk factors in octogenarian patients. (3) In Argentina, there is little updated information on the prevalence, monitoring and management of risk factors in this group of patients. The aim of this study was to describe the octogenarian population and compare it with a younger population to evaluate baseline characteristics and cardiovascular risk factors, reasons for requesting and for terminating the exercise stress test (EST), the concomitant pharmacological treatment used, and EST findings.

METHODS

A cross-sectional, descriptive and comparative study was conducted including older adults undergoing an EST in our institution between August 2015 and November 2018. There were no exclusion criteria. The octogenarian population was compared with a non-octogenarian population of elderly adults between 60 and 79 years of age.

Secondary prevention was considered as presence of a history of cardiovascular disease (percutaneous coronary intervention, myocardial revascularization surgery, myocardial infarction or stroke). A distinction was made between hypertensive response to exercise and exaggerated hypertension, which was considered in subjects with diagnosis of hypertension. An ST-segment depression ≥ 2mm was considered abnormal. Because the age group can be affected by mobility disorders, frailty, or impairment of functional capacity, the modified Astrand protocol was used in 97% of the tests performed with a cycloergometer, and the modified Bruce protocol in 77% of the treadmill tests.

Statistical analysis

Categorical variables were expressed as absolute values and percentages and continuous variables with normal distribution as mean and standard deviation (SD). The chi square test was used to compare discrete variables and continuous variables were analyzed using Student's t test. A p value <0.05 was considered statistically significant. All the statistical calculations were performed using Stata 11.1 software package.

Ethical considerations

All the patients gave their informed consent to undergo the EST. The physicians involved were committed to follow the Declaration of Helsinki (World Medical Association, as amended in 2013 in Fortaleza, Brazil), and the National Personal Data Protection Act Nº 25 326 (Habeas Data law).

RESULTS

Among 1,634 EST performed, 161 (9.85%) corresponded to octogenarian patients. Mean age was 82.98 years (SD 2.63) and 52.79% were men. The octogenarian population was compared with 827 elederly adults between 60 and 79 years of age. Baseline characteristics of octogenarian versus non-octogenarian populations are described in Table 1. Only 9 patients did not present any risk factor.

The octogenarian population was receiving more pharmacological treatment compared with non-octogenarians: statins, 39.75% vs. 31.8% (p = 0.05); angiotensin-converting enzyme inhibitors/angiotensin II receptor blockers (ACEI/ARB), 54.04% vs. 42.44% (p = 0.007); beta blockers, 44.72% vs. 28.17%; (p < 0.001); amlodipine, 14.91% vs. 8.22% (p = 0.008); amiodarone, 6.83% vs. 2.30% (p = 0.002); furosemide, 3.73% vs.1.09% (p = 0.01); and aldosterone antagonists, 6.83% vs. 2.18% (p = 0.001), respectively. There were no significant differences in the indication of ezetimibe and fibrates.

The most common reasons for requesting an EST in octogenarians were to certify physical fitness or in the setting of a check-up examination (31.68% vs. 33.66% in non-octogenarians; p = 0.62) which doubled the request to evaluate coronary heart disease (13.04% vs. 7.63%, p = 0.02) or dyspnea (13.04% vs. 7.75%; p = 0.02), respectively. Other reasons to assess octogenarians were chest pain (9.94%), atypical chest pain (6.83%), in the setting of a cardiovascular rehabilitation program (6.21%) and respiratory rehabilitation (3.73%). The remaining 15% included other reasons as palpitations or cardiovascular risk factors.

The most common reasons for terminating the test in octogenarians compared with non-octogenarians were fatigue (67.5% vs. 69.43%), dyspnea (16.45% vs. 17.23%) and joint pain (7.5% vs. 11.01%), respectively. None of the tests were terminated due to angina or ST-segment changes. Exercise stress test findings in the octogenarian and non-octogenarian populations are presented in Table 2.

DISCUSSION

Octogenarians constitute a heterogeneous group of patients, with different degrees of comorbidities, functional capacity and cognitive ability. There is no evidence of an age limit at which people do not gain any benefit from physical exercise. In this age group, independence and the best functional capacity should be preserved for the longest possible time. (4, 5) In addition, many situations coexist in this population, as physiological changes related to aging, polymedication, cardiovascular diseases and, in many cases, clinical inertia. Therefore, the diagnostic methods should be part of an individualized process based on adequate clinical judgment and a comprehensive assessment to ensure the most appropriate therapeutic decision. (6)

The estimation of cardiovascular risk is of limited use with the available scores, as they have poor calibration in older adults > 75 years, and in addition they do not take into account functional capacity, thus resulting in low predictive capacity. (7) Nevertheless, there are some publications that, even though they were developed in the setting of stress echocardiography, highlight the prognostic value of the EST in octogenarians. (8, 9) In our experience, we agree

Table 1. Baseline characteristics of octogenarians versus non-octogenarians

	Octogenarians (n = 161)	Non-octogenarians (n = 827)	p value
Male sex	52,7% (n=83)	39,0% (n=323)	
Female sex	48,4% (n=78)	60,9% (n=504)	
Age (years)	82,9 (SD 2,6)	68,9 (SD 5,1)	<0,001
Weight (kg)	69,6 (SD 12,5)	73,8 (SD 14,0)	<0,001
Height (cm)	157,6 (SD 30,0)	162,2 (SD 53,8)	0,294
HT	74,5% (n=120)	62,8% (n=520)	0,005
Dyslipidemia	52,1% (n=84)	62,8% (n=520)	0,010
Diabetes mellitus	18,0% (n=29)	19,1% (n=158)	0,746
Smoking habit	4,3% (n=7)	7,2% (n=60)	0,179
Former smoker	34,7% (n=56)	34,7% (n=287)	0,984
Sedentary lifestyle	27,9% (n=45)	25,7% (n=213)	0,562
Family history of coronary artery disease	3,7% (n=6)	8,4% (n=70)	0,039
COPD	11,1% (n=18)	7,7% (n=64)	0,147
CKF	1,8% (n=3)	0,6% (n=5)	0,103
Dilated cardiomyopathy	3,1% (n=5)	1,5% (n=13)	0,183
Atrial fibrillation	7,4% (n=12)	1,9% (n=16)	<0,001
Pacemaker	8,7% (n=14)	1,4% (n=12)	<0,001
CHF	2,4% (n=4)	1,2% (n=10)	0,210
Pulmonary hypertension	0	0,2% (n=2)	0,532
CTD	0,6% (n=1)	1,8% (n=15)	0,273
Chagas disease	1,2% (n=2)	4,1% (n=34)	0,075
Secondary prevention:			
Coronary artery disease	19,8% (n=32)	12,9% (n=107)	0,020
- Stroke	3,7% (n=6)	2,3% (n=19)	0,284
- Peripheral vascular disease	4,3% (n=7)	2,1% (n=17)	0,108
- CABGS	8,0% (n=13)	4,7% (n=39)	0,080
- PCI	8,7% (n=14)	7,6% (n=63)	0,641
- AMI	14,2% (n=23)	5,8% (n=48)	<0,001

HT: Hypertension. COPD: Chronic obstructive pulmonary disease. CKF: Chronic kidney failure. CHF: Chronic heart failure. CTD: Collagen tissue disease. CABGS: Coronary artery bypass graft surgery. PCI: Percutaneous coronary intervention. AMI: Acute myocardial infarction.

with the concept of Chokshi et al., who showed that patients who underwent pharmacological testing had higher annual mortality; therefore, just the ability to perform treadmill exercise portends a benign prognosis. In a relatively recent study performed on octogenarians, the Duke treadmill score was found to be a significant predictor of late revascularization. (10, 11)

We have noticed some expected differences between both populations. The reduction in weight in older people is probably explained by their lower muscle mass. The prevalence of hypertension, atrial fibrillation, implanted pacemaker, and history of coronary artery disease was significantly higher in octogenarians.

The results of the EST were also expected, with a hemodynamic response according to the age group and the concomitant pharmacological treatment, resulting in a lower double product. Although dyspnea was more common in octogenarians during exercise testing, it was not a major reason for terminating the test and the difference was not statistically significant compared with the younger group.

The fact that our study analyzed octogenarians who were referred for an EST, somehow suggests that the referring physician had conducted an indirect assessment of frailty, which could explain the reasons for test termination and the absence of complications. Considering that we have conducted a strictly observational analysis about the safety and feasibility of exercise testing, we can extrapolate the results reported in the Brazilian publication by Abreu et al., in which patients achieved maximum heart rate with absence of chest pain. (12)

CONCLUSION

In our study, we tried to demonstrate the importance of the EST for the evaluation of octogenarian patients, and it proved to be a useful tool for the assessment of functional capacity both in individuals with cardiovascular risk factors and in candidates starting cardiovascular rehabilitation programs and their subsequent and follow up.

Although octogenarians are considered to be poorly studied, none of the symptoms should be underestimated, but at the same time, we must bear in mind the subjective nature of dyspnea during the in-office

	Octogenarians (n = 161)	Non-octogenarians (n = 827)	p value
Baseline HR (bpm)	69,1 (14,4)	75,1 (33,3)	0,025
Maximum HR (bpm)	110,3 (24,7)	126,6 (22,4)	<0,001
Percentage of maximum HR	82,5 (18,0)	85,3 (15,1)	0,039
Baseline SBP (mm Hg)	134,0 (22,6)	129,6 (18,5)	0,008
Baseline DBP (mm Hg)	77,4 (12,4)	79,5 (10,7)	0,022
Maximum SBP (mm Hg)	164,4 (30,3)	171,8 (26,6)	0,001
Maximum DBP (mm Hg)	81,8 (14,6)	87,2 (13,2)	<0,001
DP	17959,2 (5536,0)	22034,8 (14364,6)	<0,001
Kilogram-meters	253,4 (191,3)	266,0 (263,5)	0,561
METs	6,6 (9,4)	9,7 (13,4)	0,005
Unspecific ST-segment depression	7,4% (n=12)	7,5% (n=62)	0,982
Significant ST-segment depression	3,7% (n=6)	3,9% (n=32)	0,875
Dyspnea	18,0% (n=29)	12,3% (n=102)	0,052
Angina	1,2% (n=2)	1,6% (n=13)	0,678
Hypertensive response to exercise	3,7%	6,0%	0,243
Exaggerated hypertension	11,8%	15,9%	0,179

HR: Heart rate. SBP: Systolic blood pressure. DBP: Diastolic blood pressure. DP: Double product. METs: Metabolic equivalent of task.

Table 2. Stress test findings in octogenarians versus non-octogenarians

assessment that motivated the request for exercise testing or during the test. In our experience, the EST constitutes a valuable tool that provides useful information without complications.

Conflicts of interest

None declared.

(See authors' conflicts of interest forms on the website/ Supplementary material)

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