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ORIGINAL ARTICLE

Echocardiographic assessment of aortic root dilatation in adult patients after tetralogy of Fallot repair☆

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KEYWORDS
Aortic dilatation;
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Abstract
Introduction: Transthoracic echocardiography is an important tool after tetralogy of Fallot repair, of which aortic root dilatation is a recognized complication. In this study we aimed to assess its prevalence and potential predictors.
Methods: We consecutively assessed adult patients by transthoracic echocardiography after tetralogy of Fallot repair, and divided them into two groups based on the maximum internal aortic diameter at the sinuses of Valsalva in parasternal long-axis view: group 1 with aortic root dilatation (≥38 mm) and group 2 without dilatation (<38 mm).
Results: A total of 53 patients were included, mean age 32±10 years, with a mean time since surgery of 23±7 years. An aortopulmonary shunt had been performed prior to complete repair in 25 patients, and a transannular patch was used in 19 patients. Aortic root measurement was possible in all patients. Aortic root dilatation was identified in eight patients (15%), all male. Male gender (p=0.001), body surface area (1.93±0.10 vs. 1.70±0.20 m^2, p=0.003) and increased left ventricular end-diastolic diameter (p=0.005) were predictors of aortic root dilatation. None of the surgical variables studied were predictors of aortic root dilatation.
Conclusions: The prevalence of aortic root dilatation in this cohort was low and male gender was a predictor of its occurrence. The type of repair and time to surgery did not influence its occurrence.
Quantification of aortic root diameter is possible by transthoracic echocardiography; we suggest indexing it to body surface area in clinical practice.

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PALAVRAS-CHAVE
Dilatação da aorta;
Ecocardiograma transtorácico;
Tetralogia de Fallot

Avaliação ecocardiográfica da dilatação da raiz da aorta em doentes adultos operados a tetralogia de Fallot

Resumo
Introdução: O ecocardiograma transtorácico é fundamental na avaliação de doentes operados a tetralogia de Fallot. A dilatação da raiz da aorta é uma complicação descrita. Neste estudo, avaliámos a sua prevalência e potenciais preditores.
População e métodos: Estudo consecutivo de adultos operados a tetralogia de Fallot. O diâmetro interno máximo da aorta ao nível dos seios de Valsalva (DAo) foi avaliado por ecocardiograma transtorácico, em paraesternal eixo longo. Definimos dois grupos: grupo 1 com dilatação da raiz da aorta (DAo $\geq$38 mm) e grupo 2 sem dilatação (DAo <38 mm).
Resultados: Incluímos 53 doentes (idade média 32 $\pm$ 10 anos); intervalo médio desde a cirurgia 23 $\pm$ 7 anos. Vinte e cinco doentes tinham um *shunt* sistémico pulmonar prévio e 19 tinham *patch* transanular. Foi possível medir a raiz da aorta em todos os doentes. Em 8 (15%) doentes, todos homens, foi identificada dilatação da raiz da aorta, sendo seus preditores o sexo masculino (p = 0,001), a superfície corporal (1,93 $\pm$ 0,10 versus 1,70 $\pm$ 0,20 m^2, p = 0,003) e um maior diâmetro telediastólico ventricular esquerdo (p = 0,005). Nenhuma das variáveis cirúrgicas estudadas influenciou a dilatação da raiz da aorta.
Conclusões: A prevalência de dilatação da raiz da aorta foi baixa, sendo o sexo masculino um preditor da sua ocorrência. O tipo de cirurgia ou o tempo até à cirurgia não influenciaram o seu aparecimento.
A quantificação do diâmetro da raiz da aorta é possível por ecocardiograma transtorácico, sugerindo-se a indexação à superfície corporal na prática clínica.

List of abbreviations

AoD	aortic root diameter
AP	aortopulmonary
BSA	body surface area
CHD	congenital heart disease
LV	left ventricular
RA	right atrial
RV	right ventricular
TOF	tetralogy of Fallot
TTE	transthoracic echocardiography

Introduction

Tetralogy of Fallot (TOF) is the most common cyanotic congenital heart disease (CHD) with survival to adulthood, and international guidelines recommend regular, long-term follow-up in centers specialized in adult CHD.[1]

Even after complete surgical repair, these patients present significant residual lesions, and are at risk of developing hemodynamically significant lesions, including dilatation of the right ventricle and pulmonary trunk, pulmonary and/or tricuspid regurgitation, ventricular dysfunction and potentially fatal arrhythmias.[2] While less common, progressive aortic root dilatation may also occur,[3,4] leading to aortic regurgitation and risk of aneurysmal dilatation and dissection of the thoracic aorta, which can be fatal[5,6] and may require surgical intervention.[7] Aortic dilatation appears to be due to intrinsic histological abnormalities[8–11] that result in elastic and hemodynamic changes in the aorta, and to previous aortic volume overload.[12–14]

Transthoracic echocardiography (TTE) plays an important role in aortic assessment after TOF repair. Although new imaging techniques are increasingly used, particularly computed tomography and cardiovascular magnetic resonance imaging,[15,16] their cost/benefit ratios mean that they should be used sparingly.

In this study we aimed to assess by TTE the prevalence of aortic root dilatation in adult patients with repaired TOF and to determine the demographic, clinical, surgical and imaging parameters that may be potential predictors.

Methods

The study included 53 out of a total of 71 consecutive patients with TOF, aged $\geq$18 years, followed in the adult congenital heart disease clinic at the Centro Hospitalar São João, Porto, between March and December 2011. All patients gave their written informed consent in accordance with the Helsinki Declaration and the study was approved by the hospital's ethics committee.

Patients who had not been operated for anatomical reasons or who had refused surgery were excluded, as were those with moderate to severe valve aortic stenosis or regurgitation (one patient with moderate valve stenosis and two with aortic valve mechanical prostheses) or with genetic syndromes (10 with Down syndrome and one with DiGeorge syndrome); four women were also excluded due to pregnancy.