

"Having Mate*" with the Normal Values of the Thoracic Aort

"Mateando" con los valores normales de la aorta torácica

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Ascending aorta dilatation has important diagnostic, management and prognostic consequences in numerous cardiovascular diseases. In Marfan syndrome, aortic dilatation is a major diagnostic criterion and in the rest of genetic diseases it has clear prognostic implications. The incidence of aortic dilatation in Marfan syndrome ranges from 60% to 70% and in bicuspid aortic valve disease it occurs in over 75% of cases. Other diseases are associated with lower frequency of ascending aorta dilatation as hypertension, aortic insufficiency or atherosclerotic disease. Most studies defining the normal aortic values present limitations such as marked heterogeneity of inclusion criteria, small sample size (below 800 cases), absence of methodological standardization in echocardiographic measurements and lack of inclusion of non-Caucasian populations. (1)

The MATERA registry (2) is a national, prospective, multicenter Argentine registry that clears many of the previously considered limitations. It included 1,000 apparently healthy adults. In the exclusion criteria the authors specify most of the pathologies that might influence aortic dilatation, highlighting among risk factors, hypertension, diabetes, smoking, total cholesterol or situations with increased cardiac output such as pregnancy. Therefore, the MATERA registry has an adequate design that avoids confounding factors and has interesting aspects as the non-exclusion of the obese population and the inclusion of Caucasian and non-Caucasian populations.

From the echocardiographic point of view, the study provides the significant novelty of measuring the thoracic aorta at 6 levels: aortic annulus, aortic sinus, sinotubular junction, proximal ascending aorta, aortic arch and proximal descending aorta. Although the reliability of echocardiography to assess the aorta at the level of the aortic arch and the proximal descending aorta can be questionable, it may, nonetheless be useful in several clinical scenarios.

Most published studies show that the maximum aortic diameter is related to body surface area, age, and sex. (3-5) Therefore, the need to normalize measurements by body size and age is obvious. Aortic dilatation increases with age in all the aortic segments except the annulus. The aorta dilates with age progressively and regularly at a rate of nearly 1 mm per decade. There is great controversy to define the normal values of the thoracic aorta in both sexes, and the best approach is to normalize diameters by body size. The MATERA registry analyzes the influence of sex on normal aortic values. (2) As expected, absolute aortic diameter values were higher in men than in women. However, when they were normalized by body surface area, women had significantly greater values than men in the 6 aortic segments. Paradoxically, when the indexing was performed by height the differences disappeared except for the aortic annulus, Valsalva sinuses and sinotubular junction, whose segments had higher values in men than in women. Evidently, this inconsistency in results when indexed by body surface area or height compels us to find possible explanations. One explanation could be that the calculation of body surface area for men and women is not comparable and that the influence of height and weight in men and women is different to assess it. The calculation of body surface area may be subject to some limitations. (6) It is not infrequent to observe that despite some variables are normalized to body surface area, height or weight still appear as independent variables. Another question is whether in variables of anatomical parameters as those of the aorta, the indexation could be more robust if height instead of body surface area were used, as changes in weight modify the body surface area but not necessarily the size of aortic structures. Regardless of this controversy, the MATERA registry (2) evidenced that 95% of subjects without cardiovascular disease had maximum aortic diameter indexed by height and body surface area below 21

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* MATEAR (the name of the registry) in Spanish means "having mate" (mateando), a beverage made with yerba mate filling a hollow calabash gourd and sipped with a metal straw.

mm/m and 21 mm/m², respectively.

This registry provides very interesting information about the size of the aorta in overweight or obese patients. In patients with body mass index (BMI) >35 kg/m², the correlation between diameters and body surface area was no longer significant. In patients with increased BMI, body surface area lost predictive value of aortic dimensions in the Valsalva sinuses, while height was not affected by BMI. One of the important conclusions of the study is that in overweight patients (BMI >25 kg/m²) it is more appropriate to index by height than by body surface area to avoid underestimating aortic dilatation.

Another relevant aspect of the MATEAR registry (2) is that the size of the proximal aortic segment is greater in men than in women, especially when this diameter is normalized by height. Some clinical studies have described a greater prevalence of aortic root dilatation in men despite normalizing the diameter by body surface area or height. This trend has been described in bicuspid aortic valve where the morphological type (aortic root dilatation greater than tubular dilatation) is clearly more frequent in men than in women. In aortic disease, the incidence of aortic aneurysm or dissection is clearly higher in men than in women, with a 3:1 relationship.

A transcendent aspect of the MATEAR registry (2) is the greater aortic size evidenced in the Argentine population with Caucasian compared with Native American ancestry. This greater aortic size did not normalize when indexing diameters by body surface area or height, so it appears to be a racial difference. Surprisingly, few studies have analyzed racial differences in normal aortic size values. (7) In the MESA study (8), Chinese participants had a mean aortic diameter that was 1.5 mm higher and African Americans 0.5 mm lower than that of subjects of Caucasian ancestry. These interracial differences are not surprising when most studies analyzing normal values of the aorta adjusted by age, sex, and body size report that this adjust only explains 25% of variance, with coefficient of determination between 0.25 and 0.30. (5) Therefore, there must be biological factors that influence aortic size which are not only explained by demographic or anthropometric variables. In this sense, a large study that included first order relatives adjusted by age, sex, height, weight and systolic and diastolic blood pressure showed that at

least 26% of the total aortic size variance was due to the genetic contribution. (9)

The study of the MATEAR registry by Carrero et al. (2) thus provides interesting information by demonstrating that in overweight patients the best normalization of aortic diameters is obtained indexing by height and not by body surface area. It also shows greater aortic root diameter in men than in women when considering the diameter index normalized by height, and the important difference in aortic size depending on racial factors, which are not corrected when adjusted by anthropometric variables

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