

## Normal Dimensions of Cardiac Valves: What do Normative Bases Tell us?

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It is difficult to overestimate the importance of the normative base of cardiac valve's dimensions for cardio-surgical practice. The normative base allows: 1. To assess the degree of deviation from the normal value; 2. To eliminate disproportion between the altered dimension the normal value during the correction of a congenital heart defect; 3. To predict the results of surgical correction as well as its impact on the development of the heart after surgical intervention, which is especially important for the pediatric population; 4. To assess the efficacy of a surgical correction during the follow-up.

However, it remains unclear, which morphometric normative base should be used for the assessment of cardiac valves. Morphometry can be performed on fixed as well as non-fixed preparations. Methods of measurement differ from one study to another. Many publications, especially those that are devoted to congenital heart defects, contain normative data in control group only. Usually, due to the specific aim of a given study, this group is not large and includes a narrow age range.

Normative values of cardiac valves for children are most thoroughly presented in the work of Schulz DM et al. [1]. The authors performed morphometry on 1845 preparations of non-fixed pediatric hearts of different age groups starting from prenatal period to 15 years of age. They performed statistical analysis of data that are distributed according to age and gender. The study by Capps SB et al. [2] presents diameters of semilunar valves corresponding to different values of body surface area.

The study by Falc AA et al. [3] for fetuses and children below the age of 17 is performed on fresh preparations; and despite the absence of statistical analysis, is relevant because the material (199 preparations) is carefully selected and prepared for morphometry. Moreover, all data are presented in accordance with age and gender.

Another study performed on non-fixed preparations of children's heart preparations belongs to De la Cruz MV et al. [4]. The material is grouped according to age (19 groups): by months and years of life from newborns to 12 years. Results of measurements of preparations in children's hearts from 6 to 12 months of age are combined into one group by the authors. The practical use of data is limited because they are presented as mean values and range. In 1992, Finnish investigators Sairanen H et al. [5] published a study of postmortal measurement of the diameters of cardiac valves in normally developed children from 0 to 14.6 years of age. As a result of their mathematical and statistical analysis, the authors suggested equations for calculation of predicted values of these cardiac parameters.

The most popular normative base of the dimensions of cardiac valves for fixed preparations is the one presented by Rowlatt UF et al. [6]. The latter found a correlation between the perimeter of cardiac valves on the one hand and age and anthropometric data on the other. They suggested 8 equations for calculation of the normative dimensions of each valve.

Thus, it is very important to perform a comparative assessment of the accuracy of calculations of normative values of cardiac valves obtained by different methods. This assessment leads to a conclusion that equations suggested by Rowlatt UF et al. [6] are not universal, because they provide a wide range of standard deviations that depends

on type of valve and age group. A good example is the equation for calculation of the perimeter of the aortic valve including body weight and body length as variables. This equation gives different values of standard deviation for newborns, infants, children and adolescents that are equal to 1%, 9.3%, 1.7% and 15.8% from the mean, respectively. This is also typical for other equations suggested for calculations of the perimeter of cardiac valves [7,8]. That is why an equation that gives the smallest value of standard deviation should be chosen in each particular situation.

Normative data on the dimensions of atrioventricular valves in adults are most thoroughly presented in the work of Kitzman DW et al. [9]. This is a study of 765 fixed cardiac preparations of adult age groups that range from 20 to 99 years. Normative data are presented as average values for each decade of life in accordance with gender. The authors show the difference in absolute value of the length of valvular circumference between men and women. It was larger in men of all decades of life. Interestingly enough, that length of valvular circumference indexed to the body surface area increases with age both in men and women, and there are no gender differences. However, this phenomenon can be characterized as a tendency only, because the statistical analysis was not performed. That is why practical use of these data is limited. There is a normative base for semi lunar valves suggested by Capps SB et al. [2]. That investigation is performed on non-fixed cardiac preparations and includes statistical analysis of data. Data are there presented as mean and standard deviation in accordance with body surface area and are convenient for practical use.

Thus, several normative bases can be successfully used for the assessment of the valve's dimensions. However, inconsistency of results that occurred in certain percentage of cases suggests the rationale at least two different normative bases in each particular case.

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