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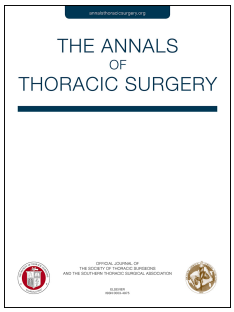

Best to Clarify to Avoid Misunderstandings in the Biomechanics of Ross Operation: Parentheses Matter

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Best to Clarify to Avoid Misunderstandings in the Biomechanics of Ross Operation: Parentheses Matter.

To the Editor:

The direction of travel in the study of pulmonary autograft(PA) durability is based on the biomechanical evaluations of root and leaflets, as testified by several reports published in Annals(1,2). In our work on biomechanical modeling of Ross Operation(3), we have often cited the study by Horer appeared in the Journal(4) as reference values for the yearly expansion of the different segments of the PA.

However, at a careful review of the mentioned paper we found few formal errors, probably due to mere mistypos, in some relevant equations describing how the diameters of the aortic annulus, sinus and sinotubular junction vary over time. Similar mistakes can be also traced in the equations describing the aortic regurgitation(AR) grade with time and *z value*. In particular, the above-mentioned errors are all concentrated in the Section "Results".

The first regards growth functions for Annulus, Sinus and Sinotubular junction:

$$\textbf{Annulus}: \ f(t) = [(1.5 \pm 0.4) + (0.1 \pm 0.1)] \times time$$

$$\textbf{Sinus}: \ f(t) = [(2.5 \pm 0.4) + (0.5 \pm 0.1)] \times time$$

$$\textbf{Sinotubolar junction}: \ f(t) = [(2.6 \pm 0.9) + (0.7 \pm 0.2)] \times time$$

The correct expressions are reported below:

$$\textbf{Annulus}: \ f(t) = (1.5 \pm 0.4) + (0.1 \pm 0.1) \times time$$

$$\textbf{Sinus}: \ f(t) = (2.5 \pm 0.4) + (0.5 \pm 0.1) \times time$$

$$\textbf{Sinotubolar junction}: \ f(t) = (2.6 \pm 0.9) + (0.7 \pm 0.2) \times time$$

In fact, the presence of the square brackets collecting together both the terms in the parentheses *de facto* significantly change the functions and the corresponding plots. Indeed, this would mean to multiply all the content in the brackets for time, producing a liner function with different (greater) slope than the actual one and also making the function(s) homogeneous with the time (e.g. passing through the origin of the axes).

Analogous error can be traced with respect to the linear model chosen to describe AR grade over time:

$$\textbf{AR grade} = [(0.69 \pm 0.05) + (0.06 \pm 0.02)] \times time$$

$$\textbf{The mean initial AR grade was estimated as } 0.69 \pm 0.02$$

Similarly, the correct formula should eliminate the square brackets:

$$\textbf{AR grade} = (0.69 \pm 0.05) + (0.06 \pm 0.02) \times time$$

The last correction should be finally incorporated modifying the three formulas introduced to estimate changes of AR against *z* values

$$\textbf{Annulus}: \textbf{AR grade } (\boldsymbol{z}\textbf{ value}) = [(0.84 \pm 0.07) + (0.03 \pm 0.02)] \times (z\ value)$$

$$\textbf{Sinus}: \textbf{AR grade } (\boldsymbol{z}\textbf{ value}) = [(0.70 \pm 0.13) + (0.22 \pm 0.02)] \times (z\ value)$$

$$\textbf{Sinotubular junction}: \textbf{AR grade } (\boldsymbol{z}\textbf{ value}) = [(0.77 \pm 0.13) + (0.05 \pm 0.02)] \times (z\ value)$$

The correct equations should read:

$$\textbf{Annulus}: \textbf{AR grade } (\boldsymbol{z}\textbf{ value}) = (0.84 \pm 0.07) + (0.03 \pm 0.02) \times (z\ value)$$

$$\textbf{Sinus}: \textbf{AR grade } (\boldsymbol{z}\textbf{ value}) = (0.70 \pm 0.13) + (0.22 \pm 0.02) \times (z\ value)$$

$$\textbf{Sinotubular junction}: \textbf{AR grade } (\boldsymbol{z}\textbf{ value}) = (0.77 \pm 0.13) + (0.05 \pm 0.02) \times (z\ value)$$

This pioneering work by Horer should be considered a cornerstone in biomechanics research on PA and will inspire further investigations in this field, but is important to work on curves with correct slopes to build valid models.

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