

# The transvalvar gradient after the aortic porcine stented valve replacement can be predicted?

*O gradiente transvalvar resultante de troca valvar porcina com suporte pode ser previsto?*

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## Abstract

**Objective:** This work aimed at establishing scientific criteria using the valve size mismatch to predict the transvalvar gradient resultant of aortic valve replacement.

**Method:** Thirty-one consecutive patients who survived aortic valve replacement surgeries using Labcor porcine stented prosthesis, in the period from March 1993 to June 2002 were studied. Each patient was submitted to an echocardiogram within three postoperative months at the same institution. The mean transvalvar gradient pressure was compared with the diameter of the prosthesis and the patient's body surface area.

**Results:** The p-value for the diameter of the prosthesis was 0.81 and 0.59 for the R Index.

**Conclusion:** No relation at all was found to help to predict the postoperative pressure gradient, based on the prosthesis size and the body surface area of the patients.

**Descriptors:** Heart valve prosthesis implantation. Heart valve diseases. Aortic valve, surgery.

## Resumo

**Introdução:** Este estudo foi feito buscando estabelecer critérios científicos de proporção entre a prótese aórtica e o

paciente. Seria desejável a previsão dos gradientes transvalvares aórtico pós-operatórios.

**Método:** Foi estudada, retrospectivamente, uma série consecutiva de 31 sobreviventes de troca valvar aórtica isolada, com prótese porcina com suporte Labcor, no período de março de 1993 a junho de 2002. Foram aceitos pacientes submetidos à troca valvar aórtica isolada, sem sinais de endocardite, que usaram prótese de um mesmo modelo, para que a amostra fosse comparável. Todos foram submetidos a estudo ecocardiográfico nos primeiros três meses de pós-operatório, em uma mesma instituição. Comparamos os gradientes de pressão transvalvares médios encontrados, no pós-operatório, com os diâmetros das próteses e a superfície corporal de cada paciente.

**Resultados:** O valor de p para o diâmetro da prótese isolado foi de 0,81 e para o índice R foi de 0,59.

**Conclusão:** Não foi encontrada nenhuma correlação nesta amostra, onde possamos prever um gradiente transvalvar pós-operatório baseado no tamanho valvar relacionado ou não com o tamanho do doente.

**Descritores:** Implante de prótese de valva. Doenças das valvas cardíacas. Valva aórtica, cirurgia.

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## INTRODUCTION

Aortic valve replacement aims to obtain a competent valve with a transvalvar gradient equal to zero. In practice, we see in the post-operative period, systolic ejection murmurs and the existence of residual transvalvar gradients.

Transvalvar gradients can result in left ventricular hypertrophy with its implications. With the objective of reducing these gradients, techniques of aorta and left ventricular outflow enlargement are used, as well as the use of special valve replacements. As there is no scientific model, we are guided by impressions and not by precise criteria [1]. It is well known that left ventricular hypertrophy is associated with diastolic restriction and, consequently congestive heart disease, as well as being a trigger factor for arrhythmia and myocardial ischemia.

SHWARZ et al. [2] demonstrated that patients with left ventricular masses of greater than 300 g/m<sup>2</sup> have lesions in cellular organelles and subsequent myocardial deterioration. With ventricular masses of between 200 and 300 g/m<sup>2</sup> some lesions can already be evidenced. Residual aortic stenosis in the post-operative period can trigger this process.

We retrospectively studied 31 patients to try to determine what ratio of porcine prosthesis diameter: body surface area of the patient can determine an elevated gradient.

## METHOD

We operated on 392 patients to replace the aortic valve from March 1993 to June 2002 in our departments in the Vera Cruz and University Hospitals in São José de Belo Horizonte. For this analysis, we selected only survivors of aortic valve replacement surgeries that used the traditional Labor porcine stented valves and who had the mean transvalvar gradient in the post-operative period assessed by echocardiography performed in the Ecocenter of the Vera Cruz Hospital reported in their records. Patients evaluated in other institutions or who did not have mean gradient were excluded from the study. We considered only the echocardiograms which were performed within the first three post-operative months in order to minimize the effects of scarring.

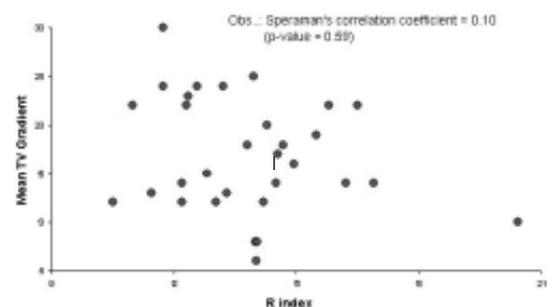
We created an index, R, which is the ratio between the external diameter of the prosthesis in millimeters, divided by the body surface area of the patient. The body surface area was calculated using Boyd's formula:  $\text{area m}^2 = \exp(-2.3779 + 0.7389 \times (\text{weight in kg})^{0.9728})$ . We compared the R-index with the post-operative transvalvar gradient.

We also compared the diameter of the prosthesis in millimeters in isolation with the mean post-operative transvalvar gradient. The etiology of the aortic valve disease was not considered. Patients submitted to valve replacement for endocarditis, any technique of enlargement of the aortic root, correction of aortic aneurysms or dissections and associated operations were excluded.

## RESULTS

No correlation was demonstrated between the R-index, and the transvalvar gradients. With the same R-Index, we can see different transvalvar gradients (table 1)

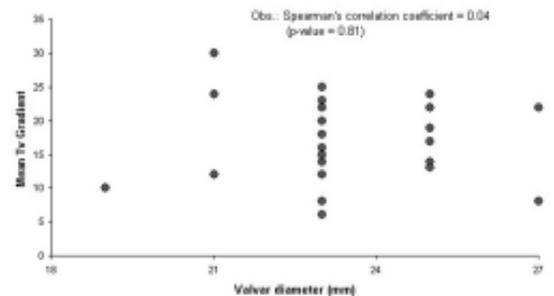
Table 1. Relationship between the mean transvalvar gradient and the R-index



The Spearman's correlation coefficient was 0.10, and the p-value was 0.59.

The external diameter of the biological prosthesis compared to the mean transvalvar gradient in the post-operative period in isolation also did not show any statistical correlation giving, as we see in table 2 (a p-value of 0.81 and a Spearman's correlation coefficient of 0.04).

Table 2. Relationship between the mean transvalvar gradient and the diameter of the valvar prosthesis



## COMMENTS

The sample, although it is small, should be considered statistically relevant. The absence of an association was very clear and was proven by the Spearman's index. Due to the rigorous inclusion criteria, our selection of patients was taken over 8 years and 4 months, however the uniformity of the prostheses, the technique and examinations remained the same over this period. This length of time was necessary so that the criteria were satisfied and the sample was statistically significant.

We observed the absence of a direct relationship between the diameter of the valvar prosthesis and the resulting

transvalvar gradient, and also between the R-index and the transvalvar gradient. The R-index is an attempt to create a connection between the patient and prosthesis. Thus, we confirmed that the transvalvar gradient should be used for other variables.

Myocardial hypertrophy before the surgery, the ventricular cavity, the left ventricle outflow, conformation of the aorta, the sanguine viscosity, as well as other possible as yet unknown factors, might be determinants in the absence of this association.

Obesity or cachexia of the patients can interfere excessively in the calculation of body surface area and so, altering the evidenced results, based on the R-index. We can study the patients basing the calculations on the lean fat, but in this sample this is impossible due to the absence of these data at the time of surgery.

COHEN et al. [3] concluded that, although stentless valves are a good option, in this randomized study, these prostheses did not prove to be superior to stented valves in the post-operative period until the 12<sup>th</sup> month of follow up. This conclusion confirms our thought that there are other factors involved in the hemodynamic behavior of the left ventricle outflow.

The routine use of enlargement of the aortic root, as has been proposed by CASTRO et al. [4], was not supported by the results of this study. We verified that even small diameters could result in satisfactory hemodynamic performance. SOMMERS & DAVID [5] demonstrated that the enlargement of the aortic annulus increases surgical mortality, however, patients submitted to this technique remain free from deaths related to the valve replacement.

The work published by MEDALION et al. [6] observed results similar to this study, that is, no evidence of a direct association between the diameter of the prosthesis and the post-operative transvalvar gradient.

HANAYAMA et al. [7] believed that the size of the prosthesis might be irrelevant. KNEZ et al. [8] recently demonstrated that even small prostheses present satisfactory hemodynamic performance. FREED et al. [9] demonstrated that aged patients normalized their ventricular mass in the post-operative period even with 19-mm prostheses. There is no evidence that a small prosthesis can accelerate this degenerative process [8].

Enlargement of the aortic annulus or the use of a stentless prosthesis should be considered carefully. These techniques should only be utilized in special cases with pronounced disproportion between the patient and the aorta, as there are works demonstrating an increase in the operative mortality in the group of patients using stentless prostheses [9].

Our attempt to create an R-index so that we could predict the resulting gradient in the post-operative period was also investigated by HANAYAMA et al. [10], using a different method but with a similar result.

## CONCLUSION

In this study we did not evidence any data that we could use to predict the mean aortic transvalvar gradient resulting after an aortic valve replacement operation using stented porcine prostheses.

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