Heart Valve Society
Aortic Valve
Database

Heart Valve Society Aortic Valve Database research proposal

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Type of cusp fusion and commissural orientation as a predicting factor of aortic valve repair failure in patients with bicuspid aortic valves

Introduction

In the past 25 years, aortic valve repair has been the favored surgical intervention to treat cardiac burden in patients with a bicuspid aortic valve (BAV)[(1)]. Bicuspid aortic valve incidence is common: approximately 1-2% of the general population has a BAV, but it is often unnoticed.[(2)] Severe burden from BAV in young patients is often related to valve regurgitation, or stenosis in older patients.[(1)] Consequently, surgical intervention is required to preserve valve function, and reduce risks of concomitant aortic instability such as aortic aneurysm or dissection.[(3, 4)]

The most commonly used classification to describe the bicuspid aortic valve is the Sievers classification.[(5)] This classification is based on three elements: numbers of raphes, spatial position of the cusps or raphes and the functional state of the valve.[(6)] A raphe can be recognized as an upward indentation between two fused cusps. Raphe arise when fusion occurs between the left and right coronary cusp (L-R), the right and non-coronary cusp (R-N) or the left and non-coronary cusp (L-N). As a consequence of these abnormal shapes of the aortic valve, the commissural orientation changes. Commissural orientation is dependent on the partial or complete fusion of two cusps. Conclusively, commissural orientation affects the functional state of the valve: the third element of the Sievers classification.

According to De Kerchove et al.[(7)], the current Sievers classification is lacking proper insight as the phenotype of a bicuspid valve can vary a lot. Therefore, it is assumed that this classification is lacking information that is required for a successful surgical approach. Hence, De Kerchove pleads for a new classification, that is more anatomically and repair-oriented.

In order to achieve a more accurate insight in the relevance and the need of a new classification, it is necessary to understand the consequences of an intervention that is determined by the classification. Besides that, long term data on success rates of bicuspid aortic valve repair are lacking. Therefore, an investigation is necessary that focuses on the type of cusp fusion and the corresponding commissural orientation in relationship to the outcomes of bicuspid aortic valve repair. Accordingly, this study will

assess the success rates of bicuspid aortic valve repair for patients based on the different types of cusp fusion and commissural orientation.

The question that arises given the information provided can be formulated as follows:
Is the type of aortic cusp fusion and commissural orientation a predicting factor for failure of aortic valve repair in BAV patients?

Aim of study:

The aim of this research is to identify anatomical factors that could predict 30-day and late post-operative aortic valve repair failure in relationship to cusp formation and commissural orientation. The hypothesis is that no significant difference can be identified based on anatomical cusp fusion and commissural orientation.

Methods

This study will be a multi-center retrospective cohort study as the data from patients included come from an internationally maintained and updated database known as the *Aviator database*. Due to the relatively low incidence of severe insufficiency related to BAV for which a surgical intervention is indicated, the retrospective character of the research is most efficient, cost-effective and comprehensive.

Inclusion criteria

Patients will be included if they underwent bicuspid aortic valve repair with or without aortic root replacement. Besides that, patients with an intention to repair, although resulting in per-operative repair failure and requiring aortic valve replacement (AVR), will also be included. Aortic root replacement was defined as tubular aorta replacement, partial root replacement, or valve sparing root replacement in the form of a David or Yacoub procedure.

Exclusion criteria

Patients will be excluded if they were operated for unicuspid valves, due to a unicuspid's own particular pathophysiology and natural history.[1] Last, patients with concomitant aortic (hemi)arch procedures were excluded as these procedures are also associated with other pathophysiology and carry different neurological, hemodynamic and vascular risks.[8, 9]

Primary outcome

The primary endpoint will be defined as the time until repair failure occurs or reoperation on the aortic valve is needed, based on echocardiographic data

Secondary outcome

Secondary endpoints will be defined by death, endocarditis, bleeding, thrombus formation, and aortopathy such as aortic dissection or aortic aneurysm.

Data collection

Cut-off values that will be used to identify aortic valve repair failure are based on the most recent guidelines by ESC/EACTS [10] [11]. Translated to outcomes for aortic valve repair, that can be concluded from data from the Aviator database, the cut-off values will be defined as follows:

- **Moderate failure**: Moderate new (grade 2) or worsening aortic valve regurgitation (increase of 1 degree)
- **Severe failure:** Severe new (grade 3 or grade 4) or severe worsening aortic valve regurgitation (increase of ≥2 degrees)

Post-operative grade 1 regurgitation will not be seen as repair failure.

Aortopathy will be defined as secondary aortic dilation with a diameter of ≥50mm, or aortic dissection.

Statistical methods

All data will be entered into Open Clinica and analyzed using Rstudio. A Cox proportional hazard model will be used to analyze the risk of aortic valve repair failure and+ death over time. For our remaining secondary outcomes, including 30-day mortality, a multivariate logistic regression model will be needed.

Variables needed

Research population: aortic valve repair for bicuspid aortic valve

Baseline:

- Gender
- Age
- Height + weight
- NYHA class
- Other morbidities (Rheumatic valve disease, connective tissue disease, COPD, IDDM, dialysis, Poor mobility etc.)
- Ascending aortic aneurysm, if yes: + location + maximum diameter
- Main reason for referral
- Urgency of operation

Operation

- Bicuspid type
- Fused cusp
- Commissural orientation (pre-op)
- Commissural orientation (post-op)
- Comments for cusp analysis
- Intention to repair
- Type of aortic valve repair + type of valve sparing root replacement
- Cusp repair
- Comments for cusp repair
- Effective height
- Coapt height
- Annuloplasty + specifications
- Additional procedures performed
- Duration (first) cross-clamping
- Concomitant procedures + type
- Echo pre-operative: EF, LVEF, LVEDD, LVESD, aortic valve regurgitation, jet direction, effective height, Ao-mean gradient, annulus, sinus, STJ, tubular aorta.
- Echo intra-operative post-repair: EF, LVEF, LVEDD, LVESD, aortic valve regurgitation, jet direction, effective height, Ao-mean gradient, annulus, sinus, STJ, tubular aorta

Post-operative

- Complications
- AV-related re-intervention + date + specification + main reason + type of valve dysfunction
- Non-AV related reoperation + specification
- Status at discharge
- Oral coagualants at discharge
- Echo at discharge: EF, LVEF, LVEDD, LVESD, aortic valve regurgitation, jet direction, effective height, Ao-mean gradient, annulus, sinus, STJ, tubular aorta.

Follow-up:

- NYHA-class
- Echo follow-up: EF, LVEF, LVEDD, LVESD, aortic valve regurgitation, jet direction, effective height, Ao-mean gradient, annulus, sinus, STJ, tubular aorta.
- Survival/Death + cause of death
- Other complications
- AV-related re-intervention + date + specification + main reason
- Other cardiac reoperation

Time schedule

Week 1-2: *Introduction, material, method and research protocol.*
Pubmed literature search, specifying research question, formulating hypothesis and submit first version research protocol.

Week 3: *METC application, Aviator application, KL-APP application (LUMC).*

Week 4-12*: Data replenishing with missing patients and follow-up from own center (Erasmus MC).*

Week 13-19: *Data collection, analyzing and processing results.*

Week 19-24*: Writing results, discussion, abstract, submit first draft version to LUMC supervisor (J.Braun).*

Week 25-26*: Fine tuning of report, submit final version.*

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