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Systematic Review/Meta-analysis

Transcatheter Reduction of Paravalvular Leaks: A Systematic Review and Meta-analysis

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ABSTRACT

Background: Significant paravalvular leak (PVL) after surgical valve replacement can result in intractable congestive heart failure and hemolytic anemia. Because repeat surgery is performed in only few patients, transcatheter reduction of PVL is emerging as an alternative option, but its safety and efficacy remain uncertain. In this study we sought to assess whether a successful transcatheter PVL reduction is associated with an improvement in clinical outcomes.

Methods: We identified 12 clinical studies that compared successful and failed transcatheter PVL reductions in a total of 362 patients. A

RÉSUMÉ

Introduction : Une importante fuite paravalvulaire (PVL) suite à une chirurgie de remplacement valvulaire peut entraîner une insuffisance cardiaque réfractaire et une anémie hémolytique. Comme il est assez rare qu'une réopération soit effectuée, la suppression de PVL par une procédure transcathéter devient une option alternative, mais son innocuité et son efficacité restent incertaines. Dans cette étude, nous avons cherché à déterminer si une réduction d'une PVL par transcathéter est associée à une amélioration des résultats cliniques.

Paravalvular leak (PVL) after surgical valve replacement originates from an incomplete seal between the prosthetic sewing ring and the native valve annulus, related to calcification, infection, or suboptimal surgical technique or prosthetic sizing.[1] PVL of various severities have been detected in up to 17.6% of the aortic and 22.6% of the mitral valve replacements and patients with symptomatic PVL have a mortality rate comparable with lung cancer.[2,3] Surgical correction is currently the gold standard therapy for symptomatic PVL and is typically performed in patients with severe congestive heart failure (CHF) and/or refractory hemolytic anemia. Repeated surgeries are associated with a high rate of PVL recurrence and with a higher mortality rate than the index procedure. For this reason, only a minority of patients undergo a surgical correction, leaving a large number of individuals with the need for alternative therapies.[4-8]

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Bayesian hierarchical meta-analysis was performed using cardiac mortality as a primary end point. The combined occurrence of improvement in New York Heart Association functional class or hemolytic anemia and the need for repeat surgery, were used as secondary end points.

Results: A successful transcatheter PVL reduction was associated with a lower cardiac mortality rate (odds ratio [OR], 0.08; 95% credible interval [CrI], 0.01-0.90) and with a superior improvement in functional class or hemolytic anemia, compared with a failed intervention (OR, 9.95; 95% CrI, 2.10-66.73). Fewer repeat surgeries were also observed after successful procedures (OR, 0.08; 95% CrI, 0.01-0.40).

Conclusions: A successful transcatheter PVL reduction is associated with reduced all-cause mortality and improved functional class in patients deemed unsuitable for surgical correction.

Méthodes : Nous avons identifié 12 études cliniques qui comparaient les réductions réussies ou infructueuses de PVL par procédure transcathéther sur un total de 362 patients. Une méta-analyse hiérarchique bayésienne a été réalisée en utilisant la mortalité cardiaque comme point d'aboutissement principal. Une amélioration de la classe fonctionnelle de la New York Heart Association ou d'une anémie hémolytique et la nécessité d'une réopération, ont été utilisés comme critères secondaires.

Résultats : Une réduction réussie de PVL par procédure transcathéter a été associée à un taux plus faible de la mortalité cardiaque (ratio d'incidence approché [RIA] 0,08; intervalle de crédibilité [CrI] à 95 %, 0,01 - 0,90) et à une amélioration de la classe fonctionnelle ou d'une anémie hémolytique (RIA 9,95; CrI à 95 %, 2,10 - 66,73). Moins de réopérations ont également été observées après des procédures réussies (RIA 0,08; CrI à 95 %, 0,01 - 0,40).

Conclusions : Une réduction significative de PVL par procédure transcathéter est associée à une mortalité réduite, toutes causes confondues, et à une amélioration de la classe fonctionnelle chez les patients jugés inaptes à une réopération.

In 1992, Hourihan et al. first described the potential of transcatheter PVL reduction to improve survival and quality of life in patients deemed unsuitable for repeat surgery.[9] The interest for transcatheter PVL reduction is exponentially growing but the global experience remains limited to single-centre experience with varying procedural success rates.[10-26] Uncertainties persist on the benefits and risks associated with this technique, which precludes an appropriate case selection. To our knowledge, no group has previously systematically reviewed these data. In the present study we sought to assess the association between transcatheter PVL reduction and clinical outcomes including death, improvement in heart failure or hemolytic anemia, and requirements for repeat surgery. To this end, we systematically reviewed the literature for randomized trials and nonrandomized studies and performed a meta-analysis to appraise the feasibility, efficacy, and safety of transcatheter PVL reduction in symptomatic patients.

Methods

Objective

In this present analysis we sought to evaluate the relationship between a successful transcatheter PVL reduction and clinical outcomes. More specifically, the in present analysis we planned to estimate the odds ratios (ORs) for cardiac mortality (primary end point), for improvement in functional class or hemolytic anemia, and for the reduction in repeat surgery (secondary end points).

Identification of studies

Randomized trials are the preferred source of data for meta-analysis. However, considering the emerging nature of transcatheter PVL reduction and to obtain an appropriate reflection of the global experience we also accounted for nonrandomized studies. Studies that reported immediate and long-term clinical outcomes for successful and failed transcatheter PVL reduction were considered for the systematic review. No restrictions were applied with regard to language, sample size, technical approach (anterograde/transseptal, retrograde arterial, or transapical), or the type of device used.

Studies were searched (June 2014) using MEDLINE, EMBASE, and CENTRAL. Search strategies included the Medical Subject Heading term and text word searches (Supplemental Table S1). We manually searched reference lists of relevant studies for additional publications and we screened relevant abstracts to see whether they were followed by a complete publication. To this end, the American College of Cardiology, American Heart Association, European Society of Cardiology, Euro-PCR, Transcatheter Cardiovascular Therapeutics, Society for Cardiac Angiography and Interventions, and Canadian Cardiovascular conference proceedings were queried from the years 2008 to 2014. In addition, trial registers including the World Health Organization International Clinical Trial Registry Platform, clinicaltrials.gov, the ISRCTN (**I**nternational **S**tandard **R**egistered Clinical/Soc**i**al S**t**udy **N**umber) register, and the *Meta*Register were searched for ongoing or completed studies with potential publication. Preliminary reports were excluded from the systematic review. Relevant studies were reviewed to exclude duplicate reports and selected articles were read entirely. When multiple publications from the same study population were found, the one with the largest sample or the longest follow-up was selected. In case of incomplete data in published studies, authors were contacted and asked for missing information.

Data abstraction and quality assessment

To avoid that knowledge of the results biased the perception of the methods' quality, data from the methods and results sections were abstracted on separate forms. To reduce bias, 2 independent abstractors (X.M. and S.S.) independently extracted variables describing the study population, the procedural characteristics, and clinical outcomes. A third reviewer (E.M.J.) resolved discrepancies between abstractors. At all times, abstractors were blinded to information believed to possibly influence their judgement (authors, titles, journal, institution, or country of origin).