

EDITORIAL COMMENT

Strategies for Paravalvular Prosthetic Leak Closure

Competing or Complementary?*

Thomas Pilgrim, MD, Anna Franzone, MD, PhD



The development of a paravalvular leak (PVL), an aberrant communication between the sewing ring of the valvular prosthesis and the surrounding native annulus, occurs in 1 of 10 prosthetic heart valve recipients at variable time points after surgical intervention, and manifests with congestive heart failure and hemolytic anemia (1-3). Extensive annular calcification, tissue fragility, previous endocarditis, type of prosthesis (mechanical vs. biological), location (mitral vs. aortic), and implantation techniques (continuous vs. interrupted sutures) have been associated with an increased risk of PVL (4). Among patients with symptomatic severe PVL, repeat surgery consisting of valve replacement or repair techniques improves survival and symptoms compared with conservative therapy, but it is invariably associated with a considerable risk of perioperative morbidity and mortality (5,6).

Pioneering experience with percutaneous PVL reduction commenced in the early 1990s, adapting the techniques originally developed for the treatment of intracardiac shunts (7). Refinement of procedural equipment in combination with accumulating operator experience facilitated the expansion of transcatheter PVL closure with several case series demonstrating acceptable safety and technical feasibility (8-11). In a meta-analysis of 7 observational studies, successful transcatheter PVL closure has been associated with a reduction of cardiac mortality

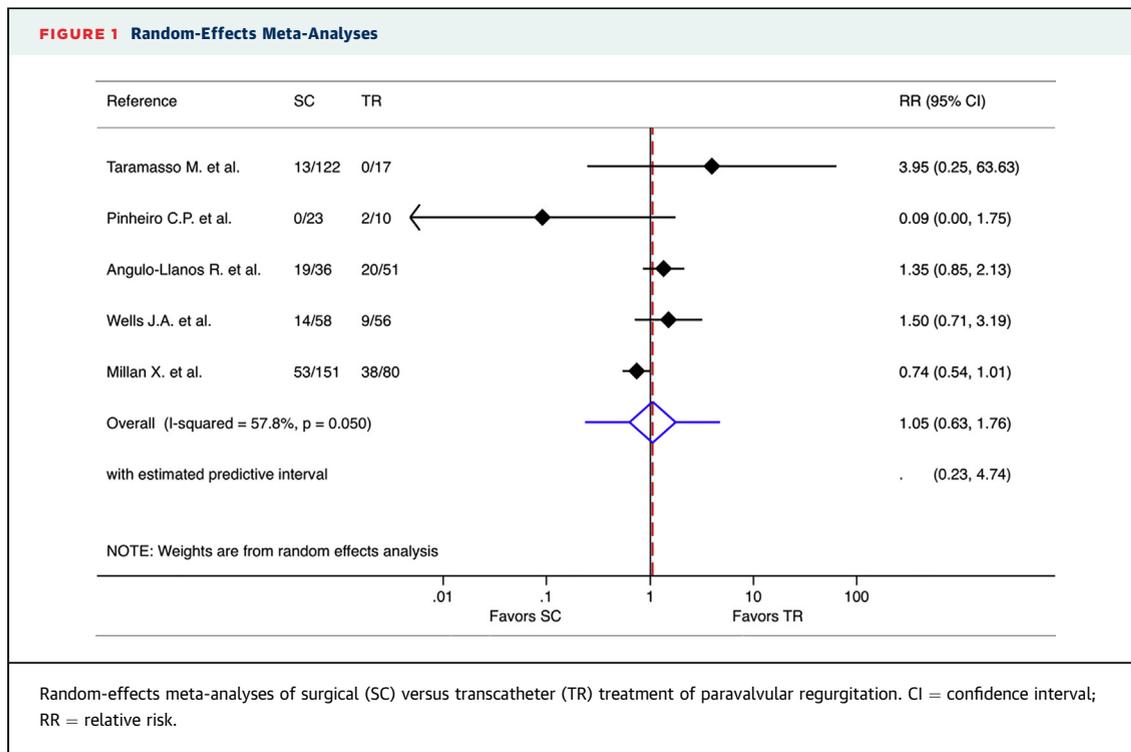
as compared with unsuccessful PVL closure (12). Current American guidelines recommend transcatheter PVL closure as an alternative to open surgery in patients with intractable hemolysis or heart failure (New York Heart Association functional class III or IV) who are at high risk for conventional intervention and have anatomic features suitable for catheter-based therapy when performed in centers with adequate expertise (Class of Recommendation IIa, Level of Evidence: B) (13).

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A few studies compared the performance of a transcatheter versus a surgical strategy for PVL closure and yielded conflicting results (14-17). The work by Millán et al. (18), published in this issue of *JACC: Cardiovascular Interventions*, includes the largest available cohort of patients with PVL (N = 231) undergoing surgical or transcatheter intervention. Procedural success was achieved in 80.1% and 55.0% of patients in the surgical and transcatheter cohorts, respectively (p < 0.001). Perioperative mortality was higher after surgery than transcatheter procedures; however, at a median follow-up of 8.8 years, surgery resulted in a significantly lower risk of the composite of all-cause death or hospitalization for heart failure compared with transcatheter PVL closure (hazard ratio: 0.28, 95% confidence interval: 0.18 to 0.44; p < 0.001). Lower rates of the primary study endpoint in the surgical compared with the transcatheter group were consistently observed at 1 year and 3 years, in both unadjusted and adjusted analyses. Surgery resulted in complete resolution of hemolytic anemia in all cases, better improvement of clinical status, and less need for reintervention at follow-up. Nevertheless, neither surgical nor transcatheter PVL closure restored a survival prognosis similar to age- and

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sex-matched patients undergoing their first surgical valve replacement. This observation is instrumental to guide a reappraisal of the optimal timing for PVL treatment. Even though multivariable models and sensitivity analyses have been used to account for differences in baseline characteristics and procedural success, respectively, the findings of the present analysis need to be interpreted with caution and in the context of previous reports.

In the absence of randomized trials, observational studies provide the basis for appropriate clinical decision-making. Available comparisons of a surgical versus a transcatheter strategy for the treatment of PVL are limited by selection bias, modest sample size and large variability in definitions of outcomes and length of follow-up (14-18). A random effects meta-analysis including a total of 604 patients from 5 observational studies showed no significant difference between the 2 treatment strategies in terms of all-cause mortality (risk ratio: 1.05, 95% confidence interval: 0.63 to 1.76) with a moderate degree of heterogeneity ($I^2 = 57.8\%$) (Figure 1). Accumulated evidence remains inconclusive, because both 95% confidence and prediction intervals suggest both harmful and beneficial effects of the 2 procedures. Considerable heterogeneity with regard to location of the paravalvular leak (mitral prosthesis in 61% to 80% of cases; aortic prosthesis in 21% to 40% of cases) and the transcatheter technique applied

(transfemoral retrograde or antegrade with transseptal puncture; transapical) further complicate interpretation. Surgical and transcatheter treatment strategies may be, in fact, complementary rather than competing, depending on etiology, localization, accessibility, and size of the PVL. Studies comparing the performance of different treatment strategies according to valve location and PVL characteristics are, therefore, warranted, and dedicated devices need to be investigated in larger populations.

The expansion of transcatheter valve therapies anticipates a paradigm shift in the treatment of PVL. Moderate or severe PVL occurs more frequently after transcatheter as compared with surgical aortic valve replacement, and has been associated with an increased risk of mortality (19,20). At the same time, the success rate of PVL closure may be lower in the transcatheter aortic valve replacement population, which is potentially related to the remaining native leaflets and the bioprosthetic valve stent (21). Treatment of PVL, therefore, represents a moving target, and dedicated devices, refined imaging techniques, and tailored algorithms are needed to meet the new challenges in this emerging field.

ADDRESS FOR CORRESPONDENCE: Dr. Thomas Pilgrim, Department of Cardiology, Swiss Cardiovascular Center, Bern University Hospital, CH-3010 Bern, Switzerland. E-mail: thomas.pilgrim@insel.ch.

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