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Transcatheter Valve Interventions in High-Risk Populations: Assessing Long-Term Efficacy and Safety

Lukas Weber*

Department of Cardiology, University of Vienna, Vienna, Austria

Introduction

Transcatheter Valve Interventions (TVIs) have revolutionized the treatment of valvular heart diseases, especially in patients who are considered high-risk for traditional open-heart surgery. With advancements in technology, TVIs such as Transcatheter Aortic Valve Replacement (TAVR) and Transcatheter Mitral Valve Repair (TMVR) have become established treatment options for patients with severe valvular dysfunction, including aortic stenosis, mitral regurgitation, and tricuspid regurgitation. These procedures offer less invasive alternatives to surgical valve replacement, with significantly reduced recovery times, lower risk of complications, and the potential to improve quality of life for patients who would otherwise be inoperable due to comorbidities or advanced age. [1]

While the short-term benefits of TVIs, including improved hemodynamics and symptom relief, have been well established in high-risk populations, the long-term efficacy and safety of these interventions are still under investigation. High-risk populations, including elderly patients, those with multiple comorbidities, or frail individuals, present unique challenges. The long-term durability of transcatheter valves, the risk of complications such as valve thrombosis, paravalvular leaks, and endocarditis, as well as the potential for restenosis or reoperation, must all be carefully considered. This paper reviews the current evidence on the long-term outcomes of transcatheter valve interventions in high-risk populations, assessing their safety, efficacy, and the evolving role of these procedures in clinical practice. [2]

Description

Transcatheter valve interventions, particularly transcatheter aortic valve replacement (TAVR), have become a mainstay in the management of high-risk patients with severe aortic stenosis (AS), a condition often seen in elderly populations with multiple comorbidities. TAVR has been shown to provide excellent short-term outcomes, including significant symptom relief, improved exercise tolerance, and enhanced quality of life. However, for high-risk patients, especially those with frailty, advanced age, or multiple organ dysfunction, the long-term results of TAVR are critical in determining the overall efficacy and safety of the procedure. Long-term studies have demonstrated that TAVR improves survival in patients with severe AS compared to medical therapy, with favorable results even in the most frail patients. Data from large, multicenter registries and randomized trials have shown that the survival benefit of TAVR persists over several years, with a survival rate of approximately 70–80% at 3 to 5 years post-procedure, depending on the patient's baseline risk and comorbid conditions. While the long-term durability of TAVR valves remains a key concern, current evidence suggests that the risk of valve degeneration and the need for reoperation remains low in patients who receive TAVR, especially in those with well-functioning valves at the 5-year follow-up. [3]

***Address for Correspondence:** Lukas Weber, Department of Cardiology, University of Vienna, Vienna, Austria; E-mail: lukas.weber@univie.ac.at*

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While the long-term benefits of TAVR have been well-documented, the procedure is not without risks, particularly in high-risk populations. Complications such as paravalvular leaks, which occur when there is a gap between the implanted valve and the native valve annulus, can lead to significant morbidity and require subsequent interventions. Although advances in valve design and deployment techniques have minimized the incidence of significant leaks, mild-to-moderate paravalvular regurgitation remains a common issue. Furthermore, the risk of stroke, which is primarily associated with embolic events during valve implantation, continues to be a major concern, with a stroke rate of approximately 2–3% in the early stages post-TAVR, which decreases over time. Valve thrombosis is another potential complication, particularly in patients with a history of atrial fibrillation or those on inadequate anticoagulation. The development of thrombotic events can lead to valve dysfunction and may require reintervention. Additionally, vascular complications, including access site hematomas, bleeding, and arterial dissection, remain risks for patients undergoing TAVR. Despite these risks, studies indicate that the benefits of TAVR in high-risk populations often outweigh these potential complications, especially when the procedure is performed in centers with high procedural volume and experience. [4]

The advent of transcatheter mitral valve repair (TMVR) has further expanded the scope of minimally invasive valve interventions for high-risk patients, particularly those with severe mitral regurgitation (MR), a condition often complicated by left ventricular dilation and dysfunction. TMVR procedures, such as the MitraClip, have demonstrated efficacy in reducing mitral regurgitation and improving symptoms in patients with functional MR, which is commonly seen in the context of heart failure. Long-term studies suggest that while the immediate benefits of TMVR are promising, the durability of the results may vary, especially in patients with progressive left ventricular dilation or worsening heart failure. Although TMVR has shown to improve survival rates and quality of life in high-risk MR patients, the long-term efficacy, particularly in terms of preventing recurrent mitral regurgitation or rehospitalization due to heart failure, is still being studied. The risk of restenosis or valve failure, as well as the need for repeated procedures, is a consideration in the management of these patients, and ongoing follow-up is critical. The overall safety of TMVR, particularly in elderly or frail patients, remains favorable, though careful patient selection is paramount to ensuring optimal outcomes. [5]

Conclusion

Transcatheter valve interventions (TVIs), including transcatheter aortic valve replacement (TAVR) and transcatheter mitral valve repair (TMVR), have revolutionized the management of high-risk populations with valvular heart diseases. These procedures provide significant short-term benefits in terms of symptom relief, improved quality of life, and survival, and have become the standard of care for many elderly and comorbid patients who are not suitable candidates for traditional surgery. Long-term data on TAVR and TMVR, however, suggest that while these interventions are effective, they are not without risk. Valve durability, particularly in TAVR, remains a crucial issue, although the need for reoperation or valve degeneration appears low in patients who have a well-functioning valve at follow-up. The risk of complications such as paravalvular leaks, stroke, valve thrombosis, and vascular complications continue to pose challenges, particularly in high-risk patients. In the context of TMVR, the long-term benefits of the MitraClip and other emerging therapies are promising, but the durability of these interventions in preventing

recurrent mitral regurgitation and rehospitalization for heart failure is still under investigation. Despite these concerns, the benefits of TVIs in high-risk populations far outweigh the risks, especially when performed at high-volume centers with experienced operators. Moving forward, further studies will be necessary to define the long-term safety and efficacy of these procedures, identify optimal patient selection criteria, and refine strategies for managing complications. As technology advances, and with improvements in valve design, procedural techniques, and post-procedural care, TVIs will likely play an even more significant role in the management of valvular heart diseases, improving long-term outcomes and quality of life for patients who would otherwise have limited treatment options.

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