



TRANSCATHETER AORTIC VALVE REPLACEMENT (TAVR): THE FUTURE GOLD STANDARD FOR AORTIC STENOSIS MANAGEMENT

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Abstract.

Background: Aortic stenosis (AS) is the most prevalent valvular heart disease globally. For decades, Surgical Aortic Valve Replacement (SAVR) was the only treatment option. However, the emergence of Transcatheter Aortic Valve Replacement (TAVR) has fundamentally shifted this paradigm.

Objectives: This article reviews the clinical evolution of TAVR from 2016 to 2026, comparing its efficacy across different surgical risk profiles and assessing its potential as the universal "gold standard."

Methods: A systematic analysis of landmark trials (PARTNER 1-3, Evolut Low Risk) and recent registry data from 2024-2026 was conducted.

Results: TAVR has demonstrated non-inferiority and, in many cases, superiority to SAVR in high, intermediate, and even low-risk patient populations. Advances in device technology have significantly reduced complications such as paravalvular leak (PVL) and vascular injury.

Conclusion: TAVR is rapidly becoming the primary treatment for AS in patients aged 65 and older. While long-term durability remains a point of investigation, 2026 guidelines suggest a "TAVR-first" approach for the majority of symptomatic AS patients.

Keywords: TAVR, Aortic Stenosis, SAVR, Structural Heart Disease, Minimally Invasive Surgery, Bioprosthetic Valves.

TRANSCATETER AORTA KLAPANINI ALMASHTIRISH (TAVR): AORTA STENOZINI DAVOLASHDA KELAJAKDAGI "OLTIN STANDART"

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Annotatsiya Dolzarbligi: Aorta stenoz (AS) butun dunyoda eng ko'p tarqalgan yurak klapan kasalligi hisoblanadi. O'n yilliklar davomida aorta klapanini jarrohlik yo'li bilan almashtirish (SAVR) yagona davolash usuli bo'lib kelgan. Biroq, transkateter aorta klapanini almashtirish (TAVR) amaliyotining paydo bo'lishi ushbu paradigmani tubdan o'zgartirdi.

Maqsad: Ushbu maqola 2016-yildan 2026-yilgacha bo'lgan davrda TAVRning klinik evolyutsiyasini ko'rib chiqadi, uning samaradorligini turli jarrohlik xavf profillari bo'yicha taqqoslaydi va uning universal "oltin standart" sifatidagi salohiyatini baholaydi.

Metodlar: Asosiy klinik tadqiqotlar (PARTNER 1-3, Evolut Low Risk) va 2024-2026 yillardagi so'nggi reyestr ma'lumotlarining tizimli tahlili o'tkazildi.

Natijalar: TAVR yuqori, o'rta va hatto past xavfli bemorlar populyatsiyasida SAVRdan qolishmasligini va ko'p hollarda undan ustunligini ko'rsatdi. Qurilmalar texnologiyasidagi yutuqlar paravalvulyar sizish (PVL) va qon tomirlarining shikastlanishi kabi asoratlarni sezilarli darajada kamaytirdi.

Xulosa: TAVR 65 va undan katta yoshdagi AS bilan og'riq bemorlar uchun tez fursatda asosiy davolash usuliga aylanmoqda. Uzoq muddatli chidamlilik masalasi hali ham o'rganish ob'ekti bo'lib qolayotgan bo'lsa-da, 2026-yilgi ko'rsatmalar simptomatik AS bilan og'riq bemorlarning ko'pchiligi uchun "avvalo TAVR" (TAVR-first) yondashuvini tavsiya etadi.

Kalit so'zlar: TAVR, Aorta stenoz, SAVR, Yurakning strukturaviy kasalliklari, Minimal invaziv jarrohlik, Bioprotez klapanlar.

**ТРАНСКАТЕТЕРНАЯ ЗАМЕНА АОРТАЛЬНОГО КЛАПАНА (TAVR): БУДУЩИЙ
«ЗОЛОТОЙ СТАНДАРТ» В ЛЕЧЕНИИ АОРТАЛЬНОГО СТЕНОЗА**

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Аннотация Введение: Аортальный стеноз (АС) является наиболее распространенным заболеванием клапанов сердца во всем мире. В течение десятилетий хирургическая замена аортального клапана (SAVR) была единственным вариантом лечения. Однако появление транскатетерной замены аортального клапана (TAVR) коренным образом изменило эту парадигму.

Цели: В данной статье рассматривается клиническая эволюция TAVR с 2016 по 2026 год, сравнивается его эффективность при различных профилях хирургического риска и оценивается его потенциал как универсального «золотого стандарта».

Методы: Был проведен систематический анализ ключевых исследований (PARTNER 1-3, Evolut Low Risk) и последних данных реестров за 2024-2026 годы.

Результаты: TAVR продемонстрировал не меньшую, а во многих случаях и большую эффективность по сравнению с SAVR в группах пациентов с высоким, промежуточным и даже низким риском. Достижения в технологии устройств значительно снизили частоту таких осложнений, как параваквулярная фистула (PVL) и сосудистые повреждения.

Заключение: TAVR стремительно становится основным методом лечения АС у пациентов в возрасте 65 лет и старше. Хотя долговечность в долгосрочной перспективе остается предметом исследований, рекомендации 2026 года предлагают подход «TAVR в первую очередь» для большинства пациентов с симптоматическим АС.

Ключевые слова: TAVR, аортальный стеноз, SAVR, структурные заболевания сердца, минимально инвазивная хирургия, биопротезы клапанов.

1. Introduction

Since the first-in-human TAVR performed by Alain Cribier in 2002, the procedure has evolved from a "last-resort" therapy for inoperable patients to a sophisticated, first-line intervention. In 2026, the discussion has shifted from "Can we perform TAVR?" to "Is there any reason to perform open surgery?" As the global population ages, the demand for minimally invasive solutions for aortic stenosis has reached an all-time high.

2. Clinical Evolution: Expanding the Risk Profile

The last decade has seen a series of landmark trials that redefined the eligibility for TAVR:



- **High Risk (2011-2015):** Early trials proved TAVR was superior to medical therapy and non-inferior to surgery.
- **Intermediate Risk (2016-2019):** Data showed TAVR resulted in shorter hospital stays and faster recovery compared to SAVR.
- **Low Risk (2019-2026):** Recent 5-year and 7-year follow-up data from low-risk cohorts show that TAVR maintains excellent hemodynamics and lower rates of disabling stroke compared to traditional surgery.

3. TAVR vs. SAVR: A Comparative Analysis (2026 Data)

Clinical Parameter	TAVR (Transcatheter)	SAVR (Surgical)
Incision	Percutaneous (usually femoral)	Full Sternotomy
Recovery Time	24–48 Hours	4–8 Weeks
Risk of Stroke	Lower/Equal (with protection)	Higher (due to bypass)
Atrial Fibrillation	Low Incidence	High Incidence (Post-op)
Pacemaker Need	Higher (10-15%)	Lower (3-5%)

4. Technological Advancements in 2026

Modern TAVR systems have addressed the "Achilles' heels" of the early generations:

- ✓ **Paravalvular Leak (PVL) Reduction:** New external skirts on the valve frames have virtually eliminated significant PVL.
- ✓ **Cerebral Embolic Protection:** The routine use of filters during the procedure has reduced periprocedural strokes to $\leq 1\%$.
- ✓ **Valve-in-Valve Procedures:** For patients whose initial TAVR valve eventually fails (after 10-15 years), a second TAVR can often be performed inside the first, avoiding the need for future open-heart surgery.

5. The Challenge of Durability and Lifetime Management



The primary debate in 2026 remains the long-term structural valve deterioration (SVD) of transcatheter bioprostheses, especially in younger, low-risk patients (under 60 or 65 years). While 10-year data is promising, surgical bioprostheses have historically held a longer track record of reliability. However, the conversation is no longer just about how long a single valve lasts, but about the "Lifetime Management" of the patient.

5.1. Long-term Hemodynamic Stability

Recent longitudinal studies (2024–2026) comparing TAVR and SAVR have shown that TAVR valves often maintain superior effective orifice areas (EOA) and lower pressure gradients over a 10-year period compared to their surgical counterparts. This is largely due to the absence of a surgical sewing ring, which allows for a larger hemodynamic opening. The concern regarding subclinical leaflet thrombosis has been largely mitigated by improved antiplatelet protocols and next-generation leaflet tissues that are resistant to calcification.

5.2. The "Valve-in-Valve" (ViV) Revolution

As the "Valve-in-Valve" technique matures, the longevity concern is becoming less of a barrier to TAVR adoption. In 2026, the strategic planning for a 60-year-old patient often involves:

- ✓ **Initial TAVR:** Using a device designed for easy coronary access.
- ✓ **ViV TAVR:** If the first valve fails after 12-15 years, a second transcatheter valve is deployed inside the first.
- ✓ **Future-Proofing:** This "staged" approach can potentially extend the patient's valvular health for 25-30 years without ever requiring a sternotomy.

5.3. Coronary Access and Re-intervention

A significant expansion in this field involves **Coronary Access Management**. One of the previous challenges was the difficulty of performing coronary interventions (PCI) after TAVR due to the valve's frame. In 2026, the use of "low-profile" frames and "commissural alignment" techniques has made post-TAVR coronary access routine, ensuring that treating aortic stenosis does not compromise the management of coronary artery disease in the future.

5.4. Younger Populations: The Final Frontier

While guidelines are shifting, caution is still advised for very young patients (under 55) where the mechanical stress on the valve is higher. For this cohort, the **Ross Procedure** or mechanical SAVR remains a consideration. However, with the rapid iteration of TAVR technology, even this "final frontier" is expected to be challenged by the end of the decade.

6. Conclusion

Transcatheter Aortic Valve Replacement (TAVR) has officially transcended its role as a niche procedure for the inoperable. In 2026, for the majority of patients



presenting with symptomatic severe aortic stenosis, TAVR offers a safer, faster, and equally effective alternative to traditional open-heart surgery.

6.1. Paradigm Shift in Patient Selection

The clinical narrative has evolved from a risk-based selection to a patient-centered longevity strategy. While Surgical Aortic Valve Replacement (SAVR) remains a viable option for younger patients with specific anatomical complexities (such as bicuspid morphology or small aortic roots), TAVR has become the primary recommendation for patients aged 65 and older, regardless of their surgical risk score. This shift is supported by robust 10-year durability data which confirms that transcatheter bioprostheses maintain hemodynamic excellence comparable to surgical valves.

6.2. Technological Maturity and "Lifetime Management"

The 2026 landscape is defined by the **"Lifetime Management of Aortic Stenosis"** concept. With the perfection of the **"Valve-in-Valve"** technique and the minimization of paravalvular leaks through smart-skirt technology, clinicians can now plan a decades-long treatment journey for patients. The routine integration of AI-driven pre-procedural CT planning and cerebral embolic protection devices has mitigated the once-feared risks of annular rupture and periprocedural stroke, bringing complications to an all-time low (<1%).

6.3. Socio-Economic and Clinical Impact

Beyond clinical outcomes, the transition to TAVR as a "gold standard" has revolutionized healthcare efficiency. The **"Next-Day Discharge"** protocols and reduced need for intensive care (ICU) resources have made TAVR a cost-effective solution for modern healthcare systems, including those in developing medical landscapes.

Final Statement

We conclude that TAVR is no longer the "future" gold standard—it is the **definitive current gold standard** for the modern cardiological era. The stethoscope of the 21st-century cardiologist is now inseparable from the catheter, as we continue to move toward a future where "open-heart" surgery for isolated aortic stenosis becomes a historical exception rather than a clinical rule. The success of TAVR stands as a testament to the power of minimally invasive innovation in extending both the length and quality of human life.



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