

Transcatheter atrioventricular valve-in-valve re-replacement with balloon-expandable prostheses: contemporary clinical relevance and place among redo valve interventions

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Abstract

Introduction: The steadily increasing number of patients with structural degeneration of bioprosthetic heart valves necessitates the search for alternatives to redo open surgery, which is associated with high operative risk due to re sternotomy, adhesions, repeat cardiopulmonary bypass, and an unfavorable comorbidity profile. In this context, transcatheter valve-in-valve re-replacement has emerged as one of the key management strategies for this patient population, especially in the technically most challenging atrioventricular positions.

Objective: To assess the contemporary clinical relevance of transcatheter atrioventricular re-replacement and define its place in the structure of redo interventions based on the clinical case series reported by R.S. Tarasov et al. and current international literature.

Results: This article reviews the technical and clinical aspects of mitral and tricuspid re-replacement using balloon-expandable prostheses. Recent meta-analyses have shown that the valve-in-valve technique is non-inferior to surgical re-replacement in terms of survival, while being associated with significantly lower rates of stroke, bleeding, and acute kidney injury. Particular attention is paid to the role of multislice computed tomography in preventing left ventricular outflow tract obstruction during mitral interventions, to the principles of balloon-expandable prosthesis positioning in the atrioventricular position, and to the possibility of minimizing anesthetic support during tricuspid re-replacement. At the same time, the limitations of the current evidence base and several unresolved issues are emphasized, including implanted device durability, the risk of residual gradients, and paravalvular regurgitation.

Conclusion: At present, transcatheter valve-in-valve re-replacement in atrioventricular positions should be regarded not merely as an alternative for patients at prohibitive risk, but as a clinically justified component of the contemporary treatment strategy capable of substantially reducing procedural burden and accelerating rehabilitation. Nevertheless, the definitive determination of its role requires prospective studies with long-term outcome assessment.

Keywords: balloon-expandable prosthesis; bioprosthetic valve dysfunction; mitral valve; redo surgery; transcatheter valve re-replacement; tricuspid valve; valve-in-valve

Транскатетерное атриовентрикулярное репротезирование по методике «клапан-в-клапан» с использованием баллон-расширяемых протезов: современная клиническая значимость и место в структуре повторных клапанных вмешательств

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Аннотация

Актуальность. Прогрессирующий рост числа пациентов с дегенерацией биологических протезов клапанов сердца требует поиска альтернатив повторным открытым операциям, сопряженным с высоким хирургическим риском вследствие рестернотомии, спаечного процесса, повторного искусственного кровообращения и неблагоприятного коморбидного профиля больных. В этом контексте транскатетерное репротезирование по методике «клапан-в-клапан» становится одной из ключевых стратегий ведения данной категории пациентов, в особенности в технически наиболее сложных атриовентрикулярных позициях.

Цель. Оценить современную клиническую значимость и место транскатетерного атриовентрикулярного репротезирования в структуре повторных вмешательств на основе анализа серии клинических случаев Р.С. Тарасова и соавт. и актуальных данных мировой литературы.

Результаты. В работе рассматриваются технические и клинические аспекты митрального и трикуспидального репротезирования с использованием баллон-расширяемых протезов. На основе метаанализов последних лет показано, что методика «клапан-в-клапан» не уступает хирургическому репротезированию по показателям выживаемости, обеспечивая значительно меньшую частоту инсультов, кровотечений и острого повреждения почек. Особое внимание уделено роли мультиспиральной компьютерной томографии в профилактике обструкции выводного отдела левого желудочка при митральных вмешательствах, принципам позиционирования баллон-расширяемого протеза в атриовентрикулярной позиции, а также возможности минимизации анестезиологического пособия при трикуспидальном репротезировании. Одновременно подчеркиваются ограниченность доказательной базы и наличие ряда нерешенных вопросов, касающихся долговечности имплантируемых конструкций, риск остаточных градиентов и парапротезной регургитации.

Заключение. Транскатетерное репротезирование «клапан-в-клапан» в атриовентрикулярных позициях сегодня является не просто альтернативой для пациентов экстремального риска, а клинически обоснованным элементом современной стратегии лечения, позволяющим существенно снизить процедурную нагрузку и ускорить реабилитацию. Вместе с тем окончательное определение его места требует проспективных исследований с оценкой отдаленных результатов.

Ключевые слова: баллон-расширяемый протез; дисфункция биопротеза; клапан-в-клапан; митральный клапан; повторная операция; транскатетерное репротезирование; трикуспидальный клапан

Introduction

Dysfunction of bioprosthetic heart valves is becoming an issue of increasing clinical and organizational importance. The expansion of indications for bioprosthetic valve implantation, the aging of the cardiac surgical population, and improved survival after index procedures have inevitably led to a growing number of patients requiring repeat valve replacement [1]. Particularly challenging are patients with degeneration of bioprostheses in the mitral and tricuspid positions, as redo open surgery in these settings is associated with high risk due to sternotomy, extensive adhesions, the need for repeat cardiopulmonary bypass, and a substantial burden of comorbidities [1; 2]. According to available estimates, approximately 300,000 redo valve replacement procedures are performed worldwide each year, the vast majority of which belong to the high surgical risk category.

Against this background, transcatheter valve-in-valve re-replacement has naturally come to be regarded as one of the most promising developments in contemporary structural interventional cardiology and cardiac surgery. The clinical case series presented by R.S. Tarasov et al., devoted to transcatheter atrioventricular re-replacement using balloon-expandable prostheses, deserves special attention, as it not only reflects the technical feasibility of the approach but also demonstrates its immediate clinical efficacy in high-risk patients [3]. The value of this work lies in the fact that it specifically addresses atrioventricular positions, where redo interventions have traditionally been more complex, both surgically and hemodynamically, than re-replacement in the aortic position [4]. The authors provide a detailed description of the stages of transeptal mitral and transcatheter tricuspid re-replacement, defining procedural requirements with respect to imaging, vascular access, delivery system positioning, and implantation control [3].

Expert discussion

The central concept of the study under consideration is that transcatheter atrioventricular valve-in-valve re-replacement is no longer an isolated technology confined to individual centers, but is gradually forming the basis of a new management strategy for patients with degenerated bioprostheses [3]. Whereas only a few years ago such interventions were viewed primarily as a forced alternative in patients at extremely high risk for redo surgery, the currently accumulated evidence now supports this approach as a clinically sound treatment option with several major advantages [1].

Redo open surgery on the mitral or tricuspid valve is considerably more traumatic and technically demanding than the primary procedure. Outcomes are influenced

not only by the specifics of re-entry and the complexity of explanting the previously implanted prosthesis, but also by the fact that at the time of reoperation patients are older and more likely to have chronic heart failure, rhythm disturbances, pulmonary disease, anemia, renal dysfunction, and concomitant vascular disease [1; 2]. In this regard, a minimally invasive transcatheter approach addresses several key demands of modern practice simultaneously: reduced procedural trauma, lower rates of perioperative complications, shorter hospital stay, and faster rehabilitation.

To date, the most robust evidence base has been established for transcatheter mitral re-replacement. According to the meta-analysis by Ismayl et al. [2], which included comparative studies of patients with degenerated mitral bioprostheses, the valve-in-valve technique was associated with hospital, 30-day, 1-year, and 2-year mortality rates comparable to those of redo surgical mitral valve replacement, despite the fact that patients in the transcatheter group were generally older and had a more severe comorbidity burden. At the same time, the minimally invasive approach was associated with lower rates of stroke, bleeding, acute kidney injury, arrhythmias, and permanent pacemaker implantation, as well as with shorter hospital stay. These findings are of fundamental importance: the transcatheter approach not only makes treatment feasible in a high-risk population, but also provides a more favorable perioperative safety profile without compromising survival.

Similar conclusions were reached in the more recent meta-analysis by Nasir et al., which pooled 11 studies involving 11,931 patients [5]. The authors found no statistically significant differences in 30-day or 1-year mortality between transcatheter and surgical mitral re-replacement; however, the transcatheter strategy was associated with lower in-hospital mortality and lower rates of stroke, bleeding, acute kidney injury, arrhythmias, and pacemaker implantation. At the same time, the valve-in-valve technique was associated with a higher risk of paravalvular regurgitation, underscoring the need for meticulous preprocedural planning and intraprocedural control [5]. Nevertheless, the overall balance of clinical benefit in carefully selected patients appears to favor the transcatheter approach.

An important strength of the article by R.S. Tarasov et al. is that the authors do not limit themselves to the general statement that the method is less invasive, but instead elucidate the specific mechanisms by which safety and efficacy are achieved [3]. In the presented case of mitral re-replacement in a 73-year-old woman with obstructive dysfunction of a UniLine-28 bioprosthesis (NeoCor, Russia), multislice computed tomography

proved decisive, with assessment of bioprosthesis diameters (26.4 and 27.7 mm), the aortomitral angle (61.6°), and the left ventricular outflow tract (LVOT) area (361.1 mm²), i.e., a targeted evaluation of the risk of neo-LVOT obstruction, the principal procedure-specific threat during transseptal mitral intervention. Implantation of a 27.5-mm MyVal balloon-expandable prosthesis (Meril, India) under transesophageal echocardiographic guidance, with correct transseptal puncture, sequential septal dilatation, and rapid pacing, yielded an excellent immediate result: peak gradient 6 mm Hg, mean gradient 3 mm Hg, with no significant regurgitation. This sequence of actions fully corresponds to contemporary concepts of safety in transseptal mitral interventions.

Particular attention should be paid to a methodological detail rightly emphasized by the authors and arguably representing the most practically valuable element of the article, namely, the principle of prosthesis positioning whereby approximately 75%–80% of the prosthesis length is deployed on the ventricular side and 20–25% on the atrial side [3]. It is precisely this proportion that determines the reliability of anchoring, minimizes the risk of device migration, and ensures an optimal hemodynamic profile; moreover, it provides a directly reproducible landmark for centers adopting the technique.

No less important is the reported experience with transcatheter tricuspid valve re-replacement [3]. This position has attracted growing interest in recent years because redo open tricuspid surgery has traditionally been associated with a high rate of complications and unsatisfactory early outcomes in a proportion of patients. In contrast to mitral intervention, tricuspid re-replacement is technically feasible under substantially less aggressive conditions under local anesthesia, with spontaneous breathing, without transesophageal echocardiography, and without rapid pacing because the right-sided chambers belong to a low-pressure system. In the described case, a 52-year-old patient with stenosis of a KemKor-32 bioprosthesis (KemKor LLC, Russia) (effective orifice area 0.5 cm²) successfully underwent implantation of a 32-mm MyVal prosthesis (Meril, India) after balloon valvuloplasty, resulting in a final mean gradient of 3.1 mm Hg and a peak gradient of 5.6 mm Hg. This provides a convincing illustration of the concept of minimizing procedural burden in a comorbid patient.

Although comparative studies of tricuspid valve-in-valve re-replacement remain far fewer in number, the overall trajectory of the field appears compelling. Panaich and Eleid [6] described transcatheter tricuspid valve re-replacement as an evolving standard of care for failed tricuspid bioprostheses. In light of accumulated clinical experience, this definition now appears even more

justified. For patients with severe concomitant disease, prior interventions, and high risk of repeat surgery, the transcatheter strategy may become not merely an alternative, but the preferred therapeutic pathway.

The presented case series should also be interpreted in the context of current guideline recommendations [3]. The ESC/EACTS Guidelines for the management of valvular heart disease emphasize the importance of a Heart Team approach in selecting the strategy for redo intervention, the mandatory role of detailed imaging, and the need for individualized decision-making based on anatomy, clinical status, and the risk of open surgery [1]. In this respect, the article is fully aligned with contemporary standards: in both cases, the decision was made within the framework of a multidisciplinary Heart Team after comprehensive assessment of patient status and computed tomography findings, reflecting evidence-based clinical practice.

Limitations and unresolved issues

Interpretation of these results should remain balanced. A series of two clinical cases, even if methodologically impeccable, does not by design permit conclusions regarding efficacy in the strict sense: the reported outcomes reflect procedural success and immediate hemodynamic result, but not clinical effectiveness, which requires long-term follow-up and is absent from the study. No randomized trials of atrioventricular valve-in-valve re-replacement are currently available, and most comparative data derive from retrospective registries and meta-analyses of observational studies subject to selection bias. In addition, several technique-specific issues remain relevant: durability of implanted devices in the atrioventricular position, the risk of elevated residual gradients in the setting of a small initial surgical bioprosthesis, the likelihood of paravalvular regurgitation, and, in the mitral position, the risk of left ventricular outflow tract obstruction [5; 7]. The tricuspid case also warrants separate discussion: implantation into a stenotic bioprosthesis following valvuloplasty in an anatomically variable position raises questions regarding durability and specific mechanisms of structural failure that remain unresolved given the currently available volume of evidence. All of this necessitates further data accumulation and standardization of approaches.

Nevertheless, publications such as the article by R.S. Tarasov et al. provide the foundation for further development of the field [3]. In a setting where the success of such interventions depends not only on device availability but also on the precision of every procedural step, a detailed methodological description may be no less important than the clinical outcome itself.

Conclusion

The presented clinical case series convincingly demonstrates that transcatheter atrioventricular valve-in-valve re-replacement using balloon-expandable prostheses is a clinically justified, technically feasible, and promising treatment option for dysfunction of previously implanted mitral and tricuspid bioprostheses in patients at high surgical risk. The particular practical value of the article lies in its detailed step-by-step methodology and reproducible technical landmarks, especially the principle of ventricular-to-atrial prosthesis positioning and the CT-based planning algorithm for neo-LVOT assessment.

At present, the valve-in-valve technique in atrioventricular positions should be regarded not as a rare technical alternative, but as an important component of the modern strategy for redo valve interventions. Further development of the field will depend on the accumulation of prospective data, evaluation of long-term outcomes, standardization of preprocedural planning, and refinement of patient selection criteria. Even at the current stage, however, it is evident that transcatheter re-replacement is assuming an increasingly solid place in clinical practice and has the potential to substantially change treatment approaches in patients with degeneration of biological valve prostheses.

References

1. Vahanian A., Beyersdorf F., Praz F., Milojevic M., Baldus S., Bauersachs J., Capodanno D., Conradi L., De Bonis M., De Paulis R., Delgado V., Freemantle N., Gilard M., Haugaa K.H., Jeppsson A., Jüni P., Pierard L., Prendergast B.D., Sádaba J.R., Tribouilloy C., Wojakowski W.; ESC/EACTS Scientific Document Group. 2021 ESC/EACTS Guidelines for the management of valvular heart disease: Developed by the Task Force for the management of valvular heart disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). *Rev Esp Cardiol (Engl Ed)*. 2022;75(6):524. English, Spanish. PMID: 35636831. <https://doi.org/10.1016/j.rec.2022.05.006>
2. Ismayl M., Abbasi M.A., Mostafa M.R., Aboeata A., Vora A.N., Bendor I., Anavekar N.S., Goldsweig A.M. Meta-Analysis Comparing Valve-in-Valve Transcatheter Mitral Valve Replacement Versus Redo Surgical Mitral Valve Replacement in Degenerated Bioprosthetic Mitral Valve. *Am J Cardiol*. 2023;189:98–107. <https://doi.org/10.1016/j.amjcard.2022.11.027>
3. Tarasov R.S., Ganyukov I.V., Danilovich A.I., Ganyukov V.I. Valve-in-valve methodologies in transcatheter atrioventricular re-replacement using balloon-expandable prostheses: a series of clinical cases. *Patologiya krovoobrashcheniya i kardiokhirurgiya = Circulation Pathology and Cardiac Surgery*. 2026;30(2):67–76. (In Russ.) <https://doi.org/10.21688/1681-3472-2026-2-67-76>
4. Vaijyanath P., Thangavelu S.V. Structural Challenges in Native Atrioventricular Valves Replacement. *Cardiol Clin*. 2024;42(3):403–415. PMID: 38910024. <https://doi.org/10.1016/j.ccl.2024.04.001>
5. Nasir M.M., Amir S., Shahid A., Rehman W.U., Haris M., Ikram A., Mubarez M., Ahmed J., Khan U., Iqbal A.G., Saeed H., Noori M.A.M. Valve-in-valve transcatheter mitral valve replacement versus redo-surgical mitral valve replacement for degenerated bioprosthetic mitral valves: A systematic review and meta-analysis. *Int J Cardiol*. 2024;415:132448. PMID: 39153510. <https://doi.org/10.1016/j.ijcard.2024.132448>
6. Panaich S.S., Eleid M.F. Tricuspid valve-in-valve implantation for failing bioprosthetic valves: an evolving standard of care. *Ann Transl Med*. 2016;4(20):410. PMID: 27867962; PMCID: PMC5107395. <https://doi.org/10.21037/atm.2016.10.44>
7. Marin-Cuarteras M., de Waha S., Saeed D., Misfeld M., Kiefer P., Borgner M.A. Considerations for Reoperative Heart Valve Surgery. *Struct Heart*. 2022;7(1):100098. PMID: 37275309; PMCID: PMC10236806. <https://doi.org/10.1016/j.shj.2022.100098>