REVIEW ARTICLE

Updates on transcatheter aortic valve replacement: Techniques, complications, outcome, and prognosis

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Transcatheter aortic valve replacement (TAVR) initially emerged as a therapeutic option for high-risk patients with severe aortic stenosis. Advancement in technologies since the first era of TAVRs, experience from previous obstacles, and lessons learned from complications have allowed the evolution of this procedure to the current state. This review focuses on the updates on the most current devices, complications, and outcomes of TAVR.

Keywords: Aortic stenosis, Transcatheter aortic valve implantation, Transcatheter aortic valve replacement

Contents

Disclosure: Authors have nothing to disclose with regard to commercial support.
Received 31 March 2018; revised 10 July 2018; accepted 21 July 2018.

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Peer review under responsibility of King Saud University.
URL: www.ksu.edu.sa
https://doi.org/10.1016/j.jsha.2018.07.002

Production and hosting by Elsevier

1. Introduction

Transcatheter aortic valve replacement (TAVR) is the procedure of introducing a nonnative aortic valve into the aortic valve position via catheters thereby without removing the native valve [1]. TAVR was initially developed to treat patients who suffered from severe aortic stenosis (AS) but were not candidates for surgical intervention [2]. Calcified AS is the most prevalent acquired valvular disorder in developed countries affecting up to 4% of elderly adults [3,4]. Surgical aortic valve replacement (SAVR) was considered the standard of care for symptomatic patients with severe AS as it had been shown to improve survival in those who were good surgical candidates without multiple comorbidities [5–7]. Nevertheless, TAVR now holds a class I recommendation in the current American College of Cardiology/American Heart Association (ACC/AHA) guidelines for management of AS in patients who have a prohibitive risk for SAVR. The first human balloon-expandable TAVR was performed by Cribier et al. [6]. It was not long afterward that Grube et al. [7] performed the first self-expanding TAVR in 2004. TAVR technologies have since then continued to evolve and improve. In this article, we will review the updates on the most current indications, devices, complications, and outcomes of TAVR.

Abbreviations

ACC/AHA	American College of Cardiology/American Heart Association
AS	aortic stenosis
BAV	balloon aortic valvuloplasty
ES	Edwards Sapien
ESC	European Society of Cardiology
FDA	Food and Drug Administration
PPI	permanent pacemaker implantation
PVL	paravalvular leak
SAVR	surgical aortic valve replacement
STS	Society of Thoracic Surgeons
TAVR	transcatheter aortic valve replacement

2. Methods

PubMed was searched for articles on AS and TAVR. Search was limited to English-language publications, and used the following search strategy: (Transcatheter aortic valve replacement) OR (TAVR) OR (Transcatheter aortic valve implantation) OR (TAVI) AND ((indications) OR (techniques) OR (complications) OR (strategies) OR (Aortic Stenosis). The references of retrieved articles were inspected for related relevant articles. These were selected and reviewed.

2.1. Patient selection

ACC/AHA recommendations for the choice of AVR or TAVR among patients who met indications for surgery depend mainly on the patient's surgical risk quantified by the Society of Thoracic Surgeons (STS) score, and the predicted mortality is ≥10%. Surgery risk is considered low if the STS score is <3%, intermediate if 3–8%, high risk if >8%, and prohibitive if the 30-day surgical morbidity and mortality is ≥50% because of comorbidity or serious irreversible condition [2]. An alternative tool that can be used to quantify the predicted risk of operative mortality is the Euroscore, which has similar predications when compared with the STS tool [8]. The presence of a multidisciplinary heart team is also a requirement for patient selection. The aim of the heart team, which is primarily composed of interventional cardiologists, cardiac surgeons, cardiac imaging specialists, and cardiac anesthesia specialists, is to direct the best management approach. Currently, the heart valve team is identified to play a central role in the management of severe aortic valve stenosis and is a class I recommendation as per AHA guidelines [2]. Vandvik et al. [9] evaluated TAVR versus SAVR for patients with severe symptomatic AS at low to intermediate perioperative risk. TAVR was strongly suggested over SAVR for patients aged 85 years and older even if the patient is eligible for AVR. By contrast, SAVR was strongly recommended over TAVR for patients aged 65 years and younger [9]. The role of TAVR in lower-risk patients is currently being investigated with ongoing trials including PARTNER (Placement of Aortic Transcatheter Valves) 3, which is assessing the safety and effectiveness of using the Edwards SAPIEN 3 valve (one of the newer generation valves) in patients who are at low risk for operative SAVR. This trial is expected to be completed by 2027 [10]. Moreover, another trial, ''Medtronic Transcatheter Aortic Valve Replacement in Low Risk Patients,'' is currently underway and is estimated to finish by 2026. This trial is assessing the safety and effectiveness of the Medtronic TAVR system and if it is noninferior to SAVR in the treatment of severe AS in patients with low predicted risk of operative mortality for SAVR [11].

Absolute and relative contraindications for TAVR includes the following: estimated life expectancy of less than a year, unlikely improvement of