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Multidisciplinary team-guided management of severe aortic stenosis: 5-year outcomes following TAVI versus conservative treatment

Jane Manning,[1] Louis J Koizia ,[1] Melanie Dani,[1] Iqbal Malik,[2] Matteo Di Giovannantonio,[3,4] Benjamin H L Harris,[1,3,4,5,6] Michael B Fertleman[1]

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For numbered affiliations see end of article.

Correspondence to
Dr Louis J Koizia; louis.koizia05@imperial.ac.uk

ABSTRACT

Objective Multidisciplinary team (MDT) meetings are central to treatment decisions in aortic stenosis (AS), particularly for borderline or high-risk patients. This study evaluates long-term, real-world outcomes according to MDT-selected management strategy within routine clinical practice in this clinically important patient group.

Methods We conducted a retrospective cohort study of all patients with severe AS discussed at a transcatheter aortic valve implantation (TAVI) MDT at a tertiary UK centre between January 2014 and December 2016. Patients were categorised as TAVI or non-TAVI (conservatively managed). Demographic, clinical and frailty data were collected, including Charlson Comorbidity Index, Clinical Frailty Scale (CFS) and number of prescribed medications. Survival was analysed using Kaplan-Meier estimates and Cox proportional hazards modelling adjusted for age, sex, frailty, comorbidity burden and medication count.

Results A total of 373 patients were included (TAVI=178; non-TAVI=195). Patients undergoing TAVI were younger (81.3 years vs 83.5 years; p=0.01) and less frail (CFS 3.9 vs 4.9; p<0.01). Survival at 1 year, 2 years and 5 years was significantly higher following TAVI (87.6%, 74.7%, 44.9%) compared with conservative management (60.8%, 44.2%, 12.1%; p<0.001). Median survival was 53 months after TAVI versus 20 months without intervention. On multivariable analysis, TAVI was independently associated with reduced mortality (HR 0.38, 95% CI 0.28 to 0.50; p<0.001).

Conclusions In patients with severe AS discussed at MDT, TAVI was associated with a substantial and durable survival advantage compared with conservative management. These findings highlight the poor prognosis of untreated severe AS and support systematic inclusion of conservatively managed patients in interventional registries to better inform MDT deliberation and shared decision-making.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Multidisciplinary team (MDT) meetings are central to decision-making in aortic stenosis, and transcatheter aortic valve implantation (TAVI) improves outcomes in selected patients; however, long-term, real-world survival data following MDT-guided management, particularly for patients managed conservatively, are limited.

WHAT THIS STUDY ADDS

⇒ This study provides long-term, real-world survival outcomes according to MDT-selected management strategy, capturing both patients undergoing TAVI and those managed conservatively within routine clinical practice.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ These findings support the prognostic relevance of MDT-guided decision-making in aortic stenosis and highlight the need for greater attention to outcomes among conservatively managed patients in future research, service planning and guideline development.

INTRODUCTION

Aortic stenosis (AS) is the most common valvular heart disease in the developed world, with incidence rising in parallel with population ageing.[1 2] In Europe and the USA, the prevalence of AS among individuals aged ≥75 years is approximately 12.4%, with severe disease present in 3.4%.[3] Despite this, underdiagnosis remains frequent, as population-level screening is not routinely performed. With continuing demographic shifts towards an ageing population, the burden of symptomatic severe AS is projected to more than double by 2050.[3]

The predominant form, degenerative AS, arises from progressive calcification of the aortic valve leaflets and annulus,[4] which restricts leaflet mobility and progressively reduces the functional valve area.[5 6] As this physiological impairment progresses, the pathological consequences extend beyond valvular outflow obstruction to include left ventricular remodelling and a cascade of secondary effects, such as mitral regurgitation,

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left atrial enlargement with atrial fibrillation, pulmonary hypertension, right ventricular dilatation and tricuspid regurgitation.[7]

Progression from asymptomatic to symptomatic severe AS is often insidious. However, once symptoms such as exertional dyspnoea, angina or syncope develop, the prognosis is known to be poor.[8] Consequently, interventions to correct AS, particularly in patients with severe symptomatic disease, have attracted considerable attention.

Since its first successful introduction in 1960,[9] surgical aortic valve replacement (SAVR) was for many decades the standard interventional treatment for aortic stenosis. The procedure necessitates open-heart surgery under general anaesthesia with cardiopulmonary bypass and is associated with substantial perioperative risk and prolonged recovery. Many elderly patients with severe AS are too frail to tolerate such an approach.

At the turn of the millennium, this paradigm began to shift. The first successful transcatheter aortic valve implantation (TAVI) was performed by Cribier and colleagues in Rouen, France, in 2002.[10] This minimally invasive procedure has since revolutionised the management of severe AS, providing a viable alternative for elderly or frail patients deemed unsuitable for open surgery.[11] However, TAVI is not without risk. Patients undergo a rigorous consent process similar to that for SAVR, as complications may include arrhythmias requiring permanent pacemaker implantation, paravalvular leak, vascular injury, major bleeding, conversion to open surgery and stroke.[12–14]

The initial randomised controlled trial of TAVI in patients considered too high-risk for SAVR demonstrated a significantly lower 1-year mortality rate compared with standard medical therapy (30.7% with TAVI vs 50.7% on medical therapy).[15] Subsequent real-world evidence from large registries has corroborated these findings, demonstrating sustained improvements in survival among TAVI patients, exemplified by data from severe AS cohorts in the United Kingdom (UK) TAVI Registry.[16]

However, such registries rarely capture outcomes for patients who do not undergo TAVI, and real-world comparative data between TAVI and conservatively managed cohorts with severe AS remain limited. One of the few studies addressing this question, conducted in Japan, reported a 2-year survival rate of 83.2% in the TAVI group compared with 63.4% among those managed conservatively ($p<0.001$).[17] Follow-up in that study, however, was restricted to 2 years. A study in Israel comparing TAVI with conservative management in patients with chronic kidney disease and 5-year follow-up showed survival rates of approximately 85% versus 55% at 1 year, 75% versus 40% at 2 years, 65% versus 25% at 3 years, 60% versus 15% at 4 years and 55% versus 10% at 5 years, respectively.[18]

In the UK, TAVI multidisciplinary team (MDT) meetings are a key component of the patient care pathway. These meetings typically discuss borderline or high-risk cases of severe aortic stenosis, for whom the optimal management strategy remains uncertain. Decision-making in older adults with complex disease often involves balancing procedural risk against expected longevity, symptom burden and patient priorities, with functional status frequently outweighing chronological age in shaping treatment preferences.[19] MDT meetings commonly include interventional cardiologists, cardiac surgeons, anaesthetists and imaging specialists, with geriatricians providing expert input for more complex or frail patients. The mix of specialists reflects the collaborative nature of decision-making in contemporary TAVI practice. Despite their central role, limited evidence exists on the outcomes of patients following this MDT-led decision-making process, particularly regarding those subsequently managed conservatively.

Here, we aim to describe long-term survival outcomes among patients with severe AS discussed at TAVI MDT meetings at a tertiary centre in the UK. This analysis does not compare MDT decision-making with alternative care pathways, but evaluates outcomes following routine MDT-guided selection of treatment strategy. Specifically, we compared 5-year survival between patients who underwent TAVI and those managed conservatively, providing a real-world description of outcomes following MDT-guided management decisions.

METHODS

Study population

Data were obtained from two prospectively maintained databases housed on secure servers within the Cardiology Department at Hammersmith Hospital, a tertiary referral centre for TAVI in the UK. Patients were referred via general practitioners or secondary care cardiologists from local NHS trusts for assessment of suitability for intervention. After initial assessment by a cardiologist specialising in TAVI, the patients were discussed at the MDT. No patient was listed for TAVI without an MDT discussion. MDT discussion represented standard clinical practice during the study period, and no non-MDT comparator group was available. All patients discussed at the weekly TAVI MDT meetings or who were considered for TAVI between January 2014 and December 2016 were eligible for inclusion.

Data

Two local databases were used for this study: the MDT database and the TAVI procedural database. All patients discussed for potential intervention between 2014 and 2016 were eligible for inclusion. The MDT database was systematically reviewed and cross-referenced against the TAVI procedural database to ensure accurate cohort classification and to eliminate duplicate or misclassified entries. Each record was subsequently triple-verified using local electronic health records (Cerner) and Summary Care Records to confirm demographic details, diagnosis

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of severe AS, treatment pathway (TAVI or conservative) and survival status.

The final dataset included demographic characteristics (age, sex), Clinical Frailty Scale (CFS) scores, Charlson Comorbidity Index (CCI) values, number of prescribed medications and survival outcomes. The CFS is a nine-point clinical tool used widely in UK healthcare to assess frailty based on a patient's functional status and cognition, whereas the CCI predicts 10-year mortality based on weighted comorbidities.

The primary outcome was all-cause survival, measured in months from the date of MDT review (non-TAVI cohort) or TAVI procedure (TAVI cohort) to death or censoring at last follow-up.

Statistical analysis

Continuous variables were summarised as means±SD and compared using Mann-Whitney U test when non-normally distributed (normality tested with Shapiro-Wilk test). Categorical variables were expressed as frequencies and percentages, with between-group comparisons performed using the χ^2 test. All descriptive analyses were conducted using Python V.3.11.5.

Survival outcomes comparing TAVI with conservative management were analysed using Kaplan-Meier (KM) estimation over a 5-year period, followed by multivariate analysis with the Cox proportional hazards (CPH) model. The KM estimator, a non-parametric statistic, was used to derive survival functions from time-to-event data, with differences between groups assessed using the log-rank test. KM estimation was performed using Lifelines V.0.26.4 in Python V.3.11.5. CPH modelling was also conducted using the same package in Python. The proportional hazards assumptions were evaluated using Schoenfeld residuals. Observation time was measured from baseline to death or the end of the 5-year follow-up period. Multivariate models were adjusted for age group (reference group: >85 years), sex (reference group: female), CFS (continuous), CCI (continuous) and number of medications (continuous). All analyses were conducted within an MDT-discussed cohort and were not intended to assess the performance of MDT decision-making relative to other models of care.

RESULTS

Between 2014 and 2016, a total of 178 patients with severe AS underwent TAVI, while 199 were managed conservatively. In 2014 and 2015, the proportion of TAVI to conservatively managed cases was approximately equal (figure 1a). By 2016, however, the number of conservatively managed patients had risen relative to those receiving TAVI. Despite this, the number of TAVI procedures increased steadily each year (figure 1a).

On average, patients in the non-TAVI cohort were older than those who underwent TAVI (83.5 years vs 81.3 years; p=0.01) and were more frequently female (p=0.01), whereas the TAVI group included a higher proportion of men (figure 1b–c; online supplemental table S1). The CCI was borderline significantly higher among conservatively managed patients, with a median of approximately 3 (p=0.05; figure 1d). CFS scores were significantly higher

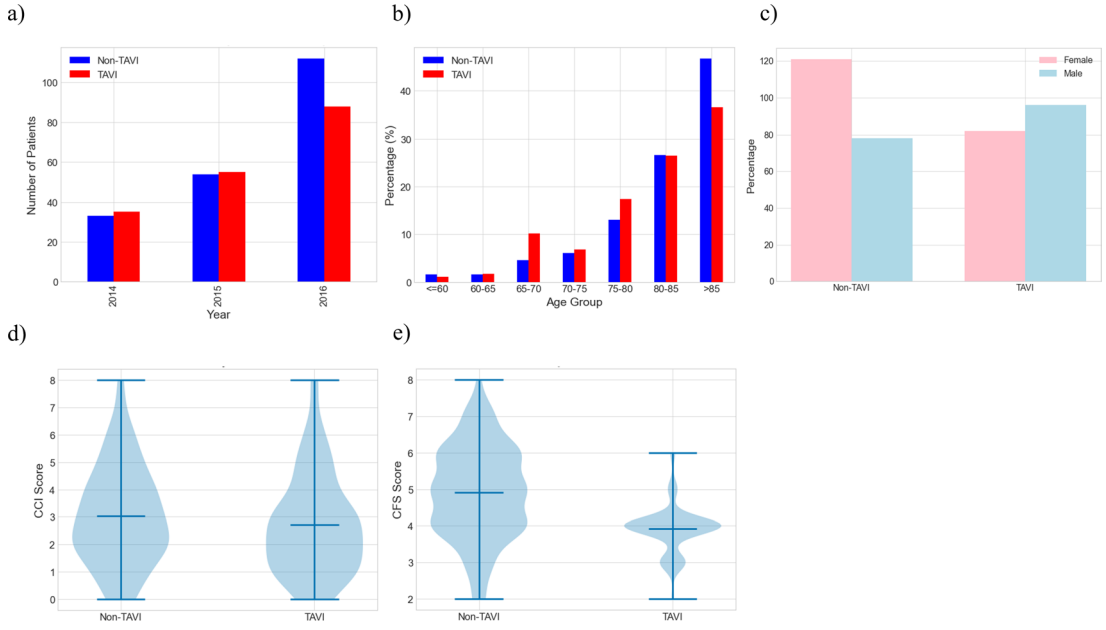


Figure 1 Baseline characteristics of patients discussed by the TAVI multidisciplinary team (MDT) between 2014 and 2016. (a) illustrates the temporal distribution of patients discussed, showing a steady increase in both TAVI procedures and MDT reviews over the study period. (b) demonstrates that conservatively managed patients were generally older, with a higher proportion aged over 85 years. (c) shows the sex distribution, revealing that women were more frequently managed conservatively. (d) compares Charlson Comorbidity Index (CCI) scores, which were broadly similar between groups, suggesting comparable comorbidity burdens. Finally, (e) presents Clinical Frailty Scale (CFS) scores, highlighting greater frailty among patients managed conservatively. TAVI, transcatheter aortic valve implantation.

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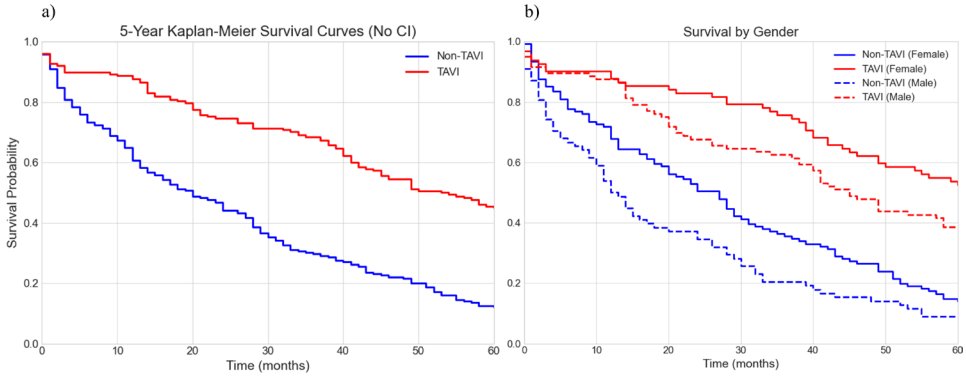


Figure 2 Kaplan-Meier survival curves comparing TAVI and conservatively managed patients with severe aortic stenosis. (a) displays overall survival for patients who underwent TAVI (red line) versus those managed conservatively (blue line). A clear and early divergence in survival curves is evident, with TAVI conferring a sustained long-term survival advantage over the 5-year follow-up period. (b) presents sex-stratified survival curves, showing higher survival probabilities among women than men, regardless of management approach. The greatest benefit was observed in female TAVI recipients. TAVI, transcatheter aortic valve implantation.

in the conservatively managed cohort compared with the TAVI group (conservative management mean: 4.9, TAVI mean: 3.9; p<0.001), indicating greater baseline frailty among patients not selected for intervention (figure 1e). The mean number of prescribed medications, which can perhaps be used as a proxy for comorbidity burden, was similar between the two groups (mean=7; online supplemental table S1).

Patients who underwent TAVI vs those managed conservatively demonstrated a marked survival advantage. At 1 year, 2 years and 5 years, the estimated survival probabilities were 87.6%, 74.7% and 44.9%, respectively, for the TAVI group, compared with 60.8%, 44.2% and 12.1% for conservatively managed patients (figure 2a). The divergence in survival curves became evident within the first year and continued to widen over time, highlighting the sustained benefit of TAVI over conservative management throughout the 5-year follow-up period.

The difference in survival distributions between the two groups was statistically significant (figure 2a, log-rank test statistic=64.23, p<0.001). Median survival was 53.0 months following TAVI compared with 20.0 months in the conservative management group.

When stratified by sex, survival differences between TAVI and non-TAVI patients persisted in both men and women (figure 2b). Across the 5-year follow-up, women demonstrated higher survival probabilities than men, irrespective of treatment approach. However, the benefit of TAVI over conservative management remained evident in both sexes, with female TAVI recipients showing the most favourable survival profile. The difference in survival between TAVI and non-TAVI groups was slightly more pronounced among women, suggesting that female patients may derive relatively greater benefit from intervention compared with their male counterparts (female log-rank test statistic=37.03, p<0.001, male log-rank test statistic 35.19, p<0.001).

In the multivariable CPH model, undergoing TAVI was associated with a significant reduction in mortality (HR 0.38, 95% CI 0.28 to 0.50, p<0.005, online supplemental table S2). The age group 80–85 years showed a significant survival advantage over the reference category 85+ years (HR 0.63, 95% CI 0.46 to 0.87, p=0.01, online supplemental table S2). The other age groups did not show a statistically significant difference in survival, which may reflect their smaller sample sizes relative to the reference group. Male sex was borderline significantly associated with poorer survival compared with females (HR 1.30, 95% CI 1.00 to 1.71, p=0.05; online supplemental table S2).

Among clinical covariates, the CCI emerged as significant (HR 1.16, 95% CI 1.08 to 1.25, p<0.005, online supplemental table S2), whereas CFS and number of prescribed medications were not significantly associated with outcome. Collectively, these findings indicate that after adjusting for age, sex, comorbidity, frailty and medication burden, TAVI conferred a substantial survival benefit over conservative management in severe AS patients.

DISCUSSION

This retrospective analysis is among the first to describe real-world outcomes of patients discussed at TAVI MDT meetings in the United Kingdom. These findings reflect outcomes following MDT-guided management within routine care rather than a comparison of MDT decision-making with alternative clinical pathways.

Our results highlight both the significance of untreated severe AS and the transformative impact of transcatheter intervention when guided by multidisciplinary decision-making. Median survival was more than twice as long among those undergoing TAVI (53 months versus 20 months), with survival curves diverging within the first year and continuing to separate over time. The 2-year outcome on medical therapy of less than 50% survival is remarkably similar to the data historically presented by Braunwald *et al*, despite advances in medical therapy.

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Furthermore, in multivariable analysis, TAVI remained independently associated with improved survival after adjustment for age, comorbidity, frailty and medication burden.

The greater frailty burden among conservatively managed patients suggests appropriate MDT triage, reflecting the cautious approach often adopted for high-risk populations. However, the marked survival gap underscores the limitations of medical therapy alone and supports considering intervention even in borderline-risk cases when clinically feasible. Given the poor prognosis without valve replacement, MDTs may wish to re-examine how frailty and comorbidity thresholds are interpreted in borderline candidates. Dynamic frailty assessments and prehabilitation strategies may enable more patients to benefit from intervention who might otherwise be declined. Frailty and functional capacity should therefore be viewed as dynamic rather than fixed states, with adaptation, reassessment and sustainability over time supporting more inclusive decision-making in older adults.[20] In our institution, this has been operationalised through structured re-evaluation of more frail patients in clinic with geriatrician input following a period of rehabilitation and recovery.

To gain a more comprehensive understanding of outcomes in severe aortic stenosis, national and international registries should systematically include patients managed conservatively, not only those undergoing TAVI. From a value-based care perspective, restricting outcome evaluation to interventional cohorts risks privileging procedural metrics over patient-centred outcomes, underscoring the need for broader, value-sensitive approaches to data capture and registry design.[21]

While postprocedural datasets and analyses, such as of the UK TAVI Registry,[22] provide invaluable insights into procedural safety and outcomes, they present only one side of the clinical picture. Parallel inclusion of conservatively managed patients would enable a more holistic view of disease trajectories and help refine patient selection criteria. Moreover, linking these registries with real-world pharmacological and comorbidity data may illuminate adjunctive medical strategies that influence survival, symptom burden and quality of life in this complex, high-risk population.

Several limitations warrant consideration. First, the retrospective, single-centre design limits generalisability and may introduce selection bias. It is not a randomised trial of these two strategies. Second, although data were meticulously verified, incomplete capture of cause-specific mortality and echocardiographic parameters could have influenced results. Third, the study period (2014–2016) predates newer-generation TAVI devices and refinements in procedural technique, potentially underestimating contemporary outcomes.[23] In addition, TAVI has expanded into lower risk cohorts, broadening the pool of patients treated beyond those that are frail or not suitable for TAVI. Fourth, unmeasured confounding from variables such as functional status, cognition or socioeconomic context may have persisted despite adjustment. Fifth, frailty and comorbidity measures were derived from existing records rather than prospective assessment, which may underestimate functional limitations. Finally, data on quality of life, reasons for conservative management and rehospitalisation were unavailable, and no non-MDT comparator cohort from the same patient population was available.

Despite these limitations, this analysis offers robust, real-world evidence demonstrating a clear and sustained survival benefit of TAVI compared with conservative management in patients with severe AS. Future research could prospectively evaluate MDT-guided decision-making relative to alternative models of care, including potential influences of group decision-making on treatment selection. We hope that the survival data from this study will help support more informed and balanced shared decision-making between clinicians and patients facing similar clinical circumstances.

Author affiliations
[1]Cutrale Perioperative and Ageing Group, Department of Bioengineering, Imperial College London, London, UK
[2]Hammersmith Hospital, Imperial College Healthcare NHS Trust, London, UK
[3]Department of Oncology, University of Oxford, Oxford, UK
[4]Institute for Liver and Digestive Health, Division of Medicine, University College London, London, UK
[5]Department of Psychosocial Rehabilitation, Medical University of Lodz, Lodz, Poland
[6]Collaborating Centre for Values-based Practice, St Catherine's College, Oxford, UK

Contributors JM contributed to data collection, data verification, and drafting of the manuscript. LJK contributed to study conception and design, data acquisition and analysis, interpretation of results and drafting and critical revision of the manuscript and acts as the guarantor of the work. MD contributed to data collection, clinical interpretation, and manuscript revision. IM contributed to clinical oversight, interpretation of findings, and critical revision of the manuscript. MDG contributed to statistical analysis and interpretation of results. BHLH contributed to study design, data analysis, interpretation of findings, and critical revision of the manuscript. MBF contributed to study conception, senior clinical oversight, and critical revision of the manuscript. MBF and BHLH are joint last authors.

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ORCID iD

Louis J Koizia https://orcid.org/0000-0003-4074-6926

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