



# Optimising the Transcatheter Aortic Valve Implantation Pathway

A delivery guide based on work from James Cook University Hospital, South Tees NHS Foundation Trust

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## Executive Summary

Transcatheter Aortic Valve Implantation (TAVI) is a less invasive surgical procedure that has become an established option for patients with symptomatic, severe aortic stenosis. It is an effective option to improve the quality of life in patients who otherwise have limited choices for repair of their aortic valve.

The [2021 GIRFT National Cardiology Report](#) describes the development of TAVI as a catalyst for the reorganisation of valve disease services and the variation in the productivity of TAVI services with full day lists varying from two to five cases and differing local resourcing. Recommendations to address these variations are cited in the national report.

James Cook University Hospital (JCUH) has delivered TAVI to patients who are either at high or intermediate risk for open heart surgery with suitable anatomy for the transfemoral approach under guidance of a multidisciplinary heart team since 2009. The JCUH team list four to five cases a day and have progressively optimised the pathway from referral to discharge and follow up, resulting in efficiencies such as shorter hospital stay, lower hospital costs, increased volume of TAVI procedures, better recovery, and improved clinical outcomes for patients.

## Who should read this guide?

This guide is intended to be of interest to clinicians, organisations, and systems aiming to optimise TAVI pathways.

## Purpose of this guide

This guide explains how the team at James Cook University Hospital, South Tees Hospitals NHS Foundation Trust optimised the TAVI pathway. It describes the patient pathway, good practice points and key learning.

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# Introduction

Untreated severe aortic stenosis patients are at high risk for death and a poor quality of life. Some patients with severe Aortic Stenosis (AS) are unsuitable for surgical intervention if they have excessive risk factors such as moderate to high frailty score and comorbidities that hinder general anaesthesia.

Traditionally, the only option for treatment was surgical Aortic Valve Replacement (sAVR) but there are now viable alternative therapies including minimal access surgery and transcatheter techniques. Transcatheter Aortic Valve Implantation (TAVI) procedure has gained credibility and emerged as a default intervention for severe AS in inoperable and high-risk patients and patients at intermediate risk who are anatomically suitable for the transfemoral approach under guidance of a multidisciplinary heart team<sup>1</sup>.

With increasing experience, the James Cook University Hospital (JCUH) team have developed a better understanding of patients who may benefit from the TAVI intervention and how best to manage the pathway from referral to treatment. Currently, JCUH uses the transfemoral approach under local anaesthesia in more than 90% of patients. To increase productivity and efficiency, the JCUH team have optimised the TAVI pathway through the effective use of human resources, introduction of new clinical documentation and procedural guidelines.

Optimisation of the TAVI pathway has resulted in shorter hospital stays, lower hospital costs, increased volume of TAVI procedures, better recovery, and improved clinical outcomes for patients.

Key elements that contributed to successful optimisation of the TAVI pathway:

1. Integration of a specialist nurse as a single point of contact for patients and referring teams
2. Careful patient selection and assessment using a pre-admission clinic
3. Effective multidisciplinary TAVI team
4. Whole patient pathway approach to service improvement including consideration of devices to optimise procedure and longer-term clinical outcomes, the operating environment, mode of anaesthesia, and site of vascular access
5. Development of supporting procedural documents on how to support and care for patients in the pre-operative and post-operative phases of the pathway.

This guide will explain steps taken by the team at JCUH to embed an evidence-based TAVI pathway that incorporates recommendations from the [2021 GIRFT National Cardiology Report](#) and relevant national guidance.

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<sup>1</sup> [Extended Statement by the British Cardiovascular Intervention Society President Regarding Transcatheter Aortic Valve Implantation - PMC \(nih.gov\)](#)

## Challenges

Patients diagnosed with severe aortic stenosis can experience sudden and rapid deterioration, increased morbidity, mortality, and hospital admissions. This patient group includes a higher proportion of elderly patients with a degree of frailty and comorbidities. As a result, pathways of care for patients accessing transcatheter aortic valve implantation (TAVI) can often be long and complex requiring multiple investigations.

Through the evolution of the TAVI procedure, focus has predominantly been on the peri-procedural pathway of care with steady advances seen in the delivery of a streamlined procedure.

This has involved a significant transition, moving the gradient of anaesthesia down to local with sedation, making refinements in the delivery equipment and reducing requirement for additional invasive lines, which has resulted in improved outcomes and reduced risk for patients.

With the rapid expansion of the TAVI service and increasing number of eligible patients, the need for a single point of contact to co-ordinate patient care from referral to post procedure follow up became apparent.

A whole patient pathway approach to service improvement was required to improve access to treatment, and optimised admission through to discharge. This includes a failsafe process for managing referrals; optimisation of the screening phase; a streamlined procedure and early discharge without compromising clinical outcomes.

## Approach – Pathway Optimisation

The sections below describe JCUHs approach to optimising the TAVI pathway, from the introduction of the specialist nurse role, and subsequent refinement to processes across the patient pathway and the development of clinical documentation and procedural guidelines.

### The Specialist Nurse Role

The specialist nurse role is endorsed in several papers including the '*British Cardiovascular Intervention Society: Service Specification for Transcatheter Aortic Valve Implantation*<sup>2</sup> for the single point of contact in the TAVI programme. This role with support from the multidisciplinary meeting (MDM) co-ordinator is pivotal in ensuring that referrals are logged and tracked; providing clinical support to the multidisciplinary team; and supporting patients through the pathway.

The TAVI specialist nurse role was initiated at James Cook University Hospital (JCUH) in 2016 with a focus on enhancing the process of care and clinical triage. Three main functions required to optimise the TAVI pathway include: clinical co-ordination, TAVI service delivery, and service development. To maintain an efficient service, the specialist nurse input must match the annual patient case load and the unique needs of the service. A sample job description for the specialist nurse can be found [here](#).

#### Clinical co-ordination

- Communication with referring teams
- Co-ordination of diagnostic work-up
- Co-ordination of communication among the TAVI team
- Wait list management

#### Service delivery

- Patient clinical assessment
- Patient and family education
- Patient follow up

#### Service development

- Development of pathway and documentation guidelines
- Data collection to support audit and research

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<sup>2</sup> [BCIS- Service Specification for Transcatheter Aortic Valve Implantation](#)

## Referral

Patients may be referred to the service in any of the following ways:

1. Patients identified during hospital admission with aortic stenosis (AS) under the care of a cardiologist.
2. Patients with a confirmed diagnosis of AS attending cardiologist-led outpatient clinics.
3. Patients from non-surgical centres (e.g., district general hospitals) with a confirmed diagnosis of AS.

The referral process for patients accessing aortic valve treatments was reviewed to ensure a streamlined referral to treatment pathway. This identified the need for the following:

- A single point of referral
- Specialist nurse triages patients into appropriate groups for discussion using agreed protocol and collects the minimum dataset
- Patients are allocated to one of three potential groups based on their comorbidities and frailty– TAVI, sAVR, both option feasible or the role of intervention uncertain

Triage criteria aligns with evidence-base and can be altered as evidence-base changes.<sup>3,4</sup>

## Multidisciplinary Meeting

All referrals for aortic intervention are discussed at the relevant sub-specialist MDM<sup>5</sup> made of TAVI cardiologists, specialist nurse, imaging cardiologist, cardiac surgeon, and a TAVI fellow. Referring clinicians are also invited to join the meeting remotely.

The specialist nurse along with the MDM co-ordinator ensures that the minimum dataset (see Appendix 1 of the [JCUH TAVI clinical guidelines](#)) is collected for all patients. Other responsibilities at the MDM include:

- Supports the review of all patients by the MDM
- Participates in the MDM and gains understanding of the unique challenges and/or requirements of upcoming TAVI cases to facilitate patient care planning

<sup>3</sup> [2021 ESC/EACTS Guidelines for the management of valvular heart disease \(escardio.org\)](#)

<sup>4</sup> [2020 ACC/AHA Guideline for the Management of Patients with Valvular Heart Disease: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines \(ahajournals.org\)](#)

<sup>5</sup> [Getting the best from the Heart Team: guidance for cardiac multidisciplinary meetings \(bmj.com\)](#)

## Pre-admission

JCUH introduced a nurse-led pre-admission clinic as the first major change, run by specialist nurses with prescribing abilities to assess and optimise patients ahead of admission. These clinics ensure resources are used effectively by clinically optimising patients in advance of their admission and highlighting risks which may compromise their planned admission<sup>6</sup>.

Pre-admission clinics are held one week prior to admission with an hour dedicated for each patient. These clinics enable patients to be admitted on the day of the procedure.

The review includes:

1. Clinical assessment of patients
2. Blood work including full blood count, urea and electrolytes, and group and save
3. Review of images
4. Optimisation of patient medication
5. Identification of barriers to early discharge e.g., care at home support; patient transport requirement; and pharmacy reconciliation to meet holistic patient requirement.
6. Nurse-led consent where risks and benefits are discussed. Patients lacking capacity to give consent are referred to the consultant.
7. Preparation of patients for admission. Includes provision of information about the procedure and their admission and a contact number for the specialist nurse should they need to speak to a member of the team. See an example from JCUH [here](#).
8. Completion of paperwork for admission.

The pre-admission clinic facilitates the early identification of issues that may affect the procedure such as:

1. Increasing pulmonary oedema which requires up-titration of diuretic therapy in advance of the procedure.
2. Infections or unearthing of other medical conditions or symptoms.

Benefits of an optimised pre-admission pathway:

- Assurance that patient is clinically, physically, and mentally fit for the procedure
- Enhanced case planning
- Reduced length of stay due to robust admission and discharge planning
- Fewer cancellations
- Cost effective

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<sup>6</sup> [The role of nurses in ensuring a patient-focused TAVI service - Cardiovascular News](#)



## Peri-procedure

JCUH carry out a minimally invasive approach TAVI procedure which is safe and effective.

1. Case planning before the procedure includes:
  - a. Determining the valve choice based on anatomical factors seen on planning CT scan and TAVI echo.
  - b. Analysis of CT scan and angiogram images by implanting to explore favourable access for transfemoral.
  - c. Percutaneous bail-out management of vascular closure failure using guide catheters, balloons, and covered stents.
  - d. Noting challenges for example body habitus and respiratory concerns
  
2. Local anaesthesia (LA) is the preferred option for transfemoral TAVI. The preferred alternative access site is transaxillary, which is also performed percutaneously under local anaesthesia. General anaesthesia is rarely used and reserved for alternative access via the chest wall or breastbone. The main benefits of performing TAVI under LA include:
  - a. Patients tend to be haemodynamically more stable with less need for inotropic agents.
  - b. Monitoring of patient's neurological status is possible during the procedure.
  - c. Pain assessment during certain phases of the procedure as pain can signal risk for vascular complication.
  - d. Reduced procedural time.
  - e. No need for intensive care unit stay, faster recovery to independence on ward.
  - f. Reduced length of hospital stay.
  - g. Reduced incidence of post-procedural delirium and quicker overall recovery.
  - h. Better reported patient experience.
  
3. Optimisation of femoral access
  - a. Careful evaluation of the planning CT scan to pre-select the optimal puncture point.
  - b. Punctures for all patients are ultrasound guided to reduce vascular complications.
  - c. Use of TRAXI panniculus retractor to facilitate access to the femoral puncture site in morbidly obese patients.

Benefits of an optimised peri-procedure pathway:

- Planning for efficient patient flow and resource utilisation
- Good patient experience
- Procedural safety and complication management
- Streamlined procedure to enhance recovery

## Post-procedure

1. Patients are moved into the cardiology day unit or coronary care unit to recover depending on clinical requirement and bed availability. The staff are experienced in the recovery of patients undergoing a range of cardiac procedures and are equipped to recognise and manage complications and understanding when to escalate issues. Staffing ratios in these clinical areas are generally 1:6 which supports the recovery pathway.
2. Patient recovery is monitored, and mobilisation supported as per the procedural protocol by a nurse.
3. The TAVI operator and specialist nurse carry out early medication review and assess the patient's appropriateness for discharge using the same day discharge protocol.
4. Patients are provided with post-procedure information included in the patient booklet and contact details including an out of hours contact, should they have any queries post discharge e.g., wound site observations.
5. **For same day discharge patients only:** a request for blood review at 48 to 72 hours post discharge is sent to the GP.
6. The specialist nurse reviews the blood results and takes relevant action if abnormal (e.g., repeat blood test or flag to the consultant team).

Benefits of an optimised post-procedural pathway:

- Early complication recognition and management
- Continuity of care
- Structured recovery guided by evidence based protocols
- Increased patient satisfaction and confidence
- Shorter hospital stay
- Lower cost to the hospital

## Discharge and Follow up

Discharge planning is initiated at the pre-admission clinic and led by the specialist nurse.

1. Barriers to early discharge (e.g., frailty, comorbidities, and other social factors) are identified at the pre-admission clinic and measures taken to navigate potential delays to discharge. Patient and family involvement in this process elicits a sense of ownership and reassurance.
2. The specialist nurse discusses subsequent recovery and is the point of contact for the patient providing continuity of care.

3. A same day discharge (SDD) programme has been developed for a select patient group. See [Appendix 8](#) in the JCUH TAVI clinical guidelines for a checklist for expedited/same day discharge post TAVI.
4. Most patients are discharged the day after their procedure, with 25% of cases discharged home the same day. JCUH median length of stay is one day.
5. A discharge letter is given to the patient and sent to the patients GP, and referrer.

Nurse-led follow up is arranged for all patients at a 6-8 week interval following their TAVI procedure.

A repeat echocardiogram is performed at the appointment. Virtual or telephone follow up with an echocardiogram at the referring centre is arranged for patients who live further away or are unable to travel to the appointment and can be offered if this is the patients request.

Other aspects of the follow up clinic includes:

1. Symptom review.
2. Medication review and optimisation.
3. Clinical examination.
4. Provides an opportunity to revisit aspects of the procedure, answer patient queries and explain the plan for ongoing review.
5. Letter to the referring team to support the transition of care back to the local hospital.
6. Referral to cardiac rehab team to meet ongoing needs.

## **Clinical documentation and procedural guidelines**

The TAVI specialist nurse co-ordinated the development of clinical documentation to support staff caring for the patients throughout the pathway, including prompts to ensure relevant checks are performed. It is designed as a multidisciplinary document so that medical and Allied Health Professional notes are held collectively.

The [pathway document](#) is started at the pre-admission clinic and follows the patient through each clinical areas during their hospital stay. It details procedure-specific checks to ensure patients are appropriately optimised and monitored post-operatively.

[Procedural guidelines](#) set a standard of care for patients undergoing TAVI encompassing pre-operative aspects of care such as fasting; skin preparation; and antibiotic prophylaxis; and post-operative interventions such as the removal of invasive lines and early mobilisation of the patient.

The specialist nurse provides a continuous programme of support and education for the integration of guidelines throughout the pathway and addresses concerns relating to patients and their care.

## Achievements

Optimisation of the pathway and the integration of the specialist nurse has yielded several benefits.

The most significant include:

1. Significant reduction in length of stay, from 4.9 to 1 day (compared to expected length of stay of between 2 to 5 days in other centres).
2. Significant reduction in 'on the day cancellations' (11% vs 2%)<sup>7</sup> due to the effective use of pre-admission clinics resulting in greater efficiency of catheter laboratory slots compared to the standard care group.
3. Procedural planning and scheduling optimised catheter laboratory time with the ability to list more cases.
4. Pre-admission clinic supporting discharge planning resulting in same day discharge where appropriate, and efficient use of beds and recovery areas.

Data suggests the efficacy of TAVI (versus sAVR) across the spectrum of risk in patients with AS. As with any medical procedure, there is a possibility of complications. The most serious risks include death, stroke, vascular complications, and life-threatening bleeding event as a result of left ventricular perforation and annular rupture. The data below indicates the rates for common complications at JCUH compared with data from systematic review<sup>8</sup> and other data sources.

Complication rates			
	sAVR	TAVI	JCUH (TAVI)
Permanent pacemaker insertion*	7%	12% (balloon-expandable) & 18% (self-expandable)	5-10%
Stroke*	2.4%	5.5%	1-2%
Mortality <sup>9</sup>	2%		1%
Major vascular complications <sup>10</sup>	2.3%	10.1%	1%

<sup>7</sup> [136 Same-day admission facilitated by a nurse led pathway reduces hospital length of stay for transfemoral transcatheter aortic valve implantation | Heart \(bmj.com\)](#)

<sup>8</sup> [Benefits and limitations of transcatheter vs. surgical aortic valve replacements \(openaccessjournals.com\)](#)

<sup>9</sup> [Aortic valve replacement - Risks - NHS \(www.nhs.uk\)](#)

<sup>10</sup> [Effect of Transcatheter Aortic Valve Implantation vs Surgical Aortic Valve Replacement on All-Cause Mortality in Patients with Aortic Stenosis: A Randomized Clinical Trial | Valvular Heart Disease | JAMA | JAMA Network](#)

## Summary of Good Practice Points from the Pathway Overview

Pathway component	Key good practice points
Referral	<ul style="list-style-type: none"> <li>• Single point of referral via the specialist nurse and the MDM co-ordinator</li> <li>• Active triage of patients by specialist nurse</li> </ul>
Multidisciplinary Meeting	<ul style="list-style-type: none"> <li>• All patients are discussed at sub-specialty MDM</li> <li>• Referring clinicians are invited to join the MDM remotely</li> </ul>
Pre-admission	<ul style="list-style-type: none"> <li>• Discharge planning is initiated</li> <li>• One-stop assessment of patients</li> <li>• Optimisation of patients</li> </ul>
Peri-procedure	<ul style="list-style-type: none"> <li>• Case planning to support procedural safety and good patient experience</li> <li>• Ensure access to emergency vascular surgeons and interventional radiologists if expertise for percutaneous bail-out is lacking in the team</li> <li>• Onsite access to cardiac surgery</li> </ul>
Post-procedure	<ul style="list-style-type: none"> <li>• Nurse-led recovery at ward level</li> <li>• Protocol guided to ensure standard of care is consistent and evidence-based</li> </ul>
Discharge & follow up	<ul style="list-style-type: none"> <li>• Barriers to discharge identified earlier in the pathway (pre-admission phase)</li> <li>• Clear guidelines for same day discharge</li> <li>• Nurse-led follow up</li> </ul>

## Resources

Recommended document	Author	Overview
<a href="#">2021 GIRFT National Cardiology Report</a>	GIRFT	The cardiology report presents a detailed review of the ways in which services are delivered and who is delivering them. It makes 25 recommendations aimed at closing gaps in provision, improving clinical pathways and improving access to imaging and workforce.
<a href="#">GIRFT Academy Resources</a>	GIRFT	Best practice resources, pathways and clinical guidance can be sourced via the Academy resources.
<a href="#">Aortic Stenosis Pathway</a>	GIRFT	Best practice pathway developed by GIRFT and endorsed by the British Cardiovascular Society.
<a href="#">Extended Statement by the British Cardiovascular Intervention Society President Regarding Transcatheter Aortic Valve Implantation</a>	BCIS	The BCIS has issued guidance on how to manage patients with AS and a service specification as to how TAVI should be performed.

## Acknowledgements

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## **About GIRFT and the GIRFT Academy**

Getting It Right First Time (GIRFT) is an NHS programme designed to improve the quality of care within the NHS by reducing unwarranted variation. By tackling variation in the way services are delivered across the NHS, and by sharing best practice between trusts, GIRFT identifies changes that will help improve care and patient outcomes, as well as delivering efficiencies such as the reduction of unnecessary procedures and cost savings.

The GIRFT Academy has been established to provide easily accessible materials to support best practice delivery across specialties and adoption of innovations in care.

Importantly, GIRFT Academy is led by frontline clinicians who are expert in the areas they are working on. This means advice is developed by teams with a deep understanding of their discipline, generated by the management of services on a daily basis.

The GIRFT programme is one element of the government's response to the recommendations of Lord Carter's report on operational productivity and performance in NHS acute trusts in England, published in 2016. The Carter Report highlighted the GIRFT programme within its theme on quality and efficiency, outlining the orthopaedic GIRFT pilots which identified the scale of benefit to tackling unwarranted variation.

**For more information on the GIRFT programme, visit our website at:**

[www.gettingitrightfirsttime.co.uk](http://www.gettingitrightfirsttime.co.uk)

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