British Heart Valve Society

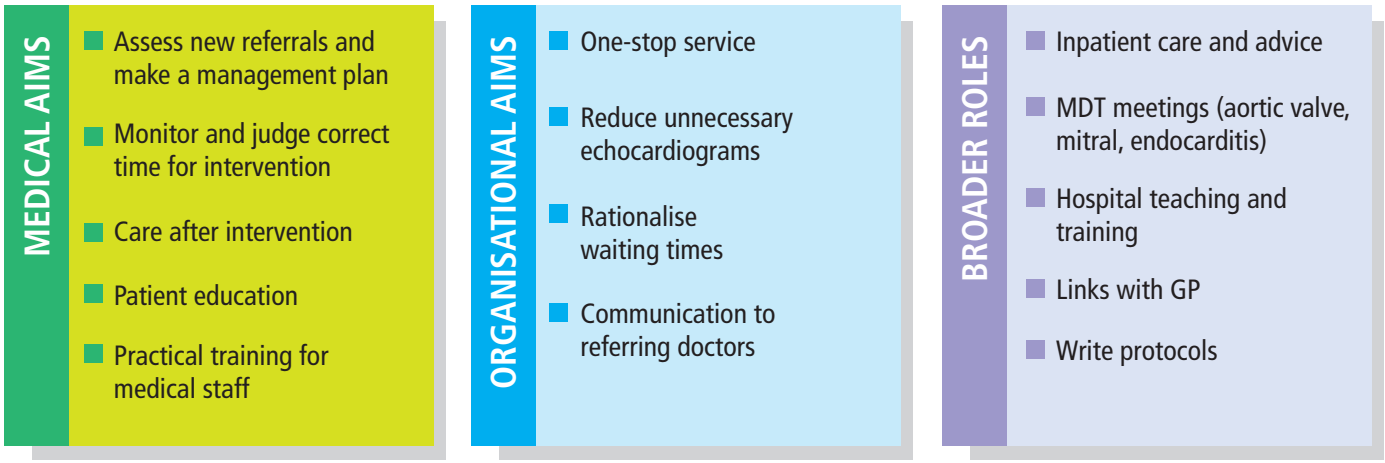
Improving Care for Patients with Heart Valve Disease

How to set up a

Introduction

- Heart valve disease is increasing in incidence and is widely regarded as a developing epidemic.[1] The number of patients with heart valve disease (HVD) is predicted to double by 2046.[2] This will have a major impact on individuals and their families, on society and on the National Health Service.
- Assessment and surveillance of patients with heart valve disease requires healthcare professionals with appropriate competency and is best done in the setting of a specialist valve clinic.
- Valve clinics improve implementation of guidelines[3] at lower cost than general cardiology clinics[4] leading to earlier recognition of symptoms and improved outcomes.[5]
- Valve clinics are core components of heart valve centres, but are equally important in district hospitals.[6,7]
- The core aims of a valve clinic are: *(Fig 1)*
  - To assess patients with a new diagnosis of HVD;
  - To follow up patients and refer for an MDT discussion about intervention before significant LV decompensation or adverse clinical events supervene;
  - To educate and inform patients;
  - To follow patients after interventions.

Figure 1: Roles of a specialist valve clinic - This includes the clinical and organisational aims of the valve clinic itself and the broader aims of a comprehensive valve service



Purpose of this document

This guide is to help and support healthcare professionals who are interested in setting up a valve clinic. The guide describes 10 steps in establishing a valve clinic *(Box 1)*. These recommendations are based on the personal experience of the authors that have been involved in setting up valve clinics in their own hospitals.

Box 1: The 10 steps in establishing a valve clinic

1. **Staffing: clinical lead; who will run the clinic- cardiologist, surgeon, nurse, physiologist/scientist?**
2. **Echo support: identify senior physiologists; organise rosters to ensure one stop clinic; train specialist valve physiologists/scientists.**
3. **Competencies: ensure qualification, experience and training of all disciplines in the clinic.**
4. **Triage: which patients will be seen and which patients will not be seen.**
5. **Protocols and alerts for intervention: this allows consistent and guideline directed care.**
6. **External communication: advertise the valve clinic service to cardiology colleagues and through-out the hospital; present goals and purpose of valve clinic at governance meetings; provide email contacts and referral pathways.**
7. **Organisation: including administrative support.**
8. **Links: set up alerts in main echo lab; other cardiac specialists; non-cardiac.**
9. **Patient information and shared decision-making.**
10. **Governance.**

It takes time to establish all steps of a comprehensive valve clinic especially in the context of increasingly limited resources. It is therefore reasonable to implement the core of the valve clinic covered in steps 1-7 at the start and add the other components later.

Some example clinics are summarised here.

Example - GSTT | Example - Leeds | Example - Manchester | Example - Southampton

Step 1. Staffing

A clinical lead is needed to have overall responsibility for the patients and for the vision and implementation of the valve clinic. A cardiologist with valve competencies is usually the best person although some clinics could be run by a surgeon. There is no place for nominal leadership from a cardiologist without valve competencies to provide apparent cover for a physiologist-led clinic.

Ideally all patients referred to the valve clinic should be the responsibility of the cardiologist running that clinic. This allows an immediate consultation if a problem is discovered in the nurse or physiologist-led clinic.

The clinic lead needs to match staff with patients. This can be done in practice in different ways. There may be a suitable nurse already in post which might direct the clinic towards a devolved nurse-led clinic as an initial step. Alternatively the cardiologist could decide on the range of patients to be seen then appoint or train the appropriate nurse and physiologists.

A valve clinic often evolves. Some valve clinics initially offer components of a valve clinic such as a physiologist-led clinic or a nurse seeing patients after valve surgery parallel with a general cardiology clinic. A cardiologist with an interest in valve disease may initially see an increasing number of patients with valve disease in a general cardiology clinic. As more patients are referred the cardiologist may then find that they need to devote all their time specifically to patients with valve disease.

Although the differential salary costs and organisational efficiencies of a devolved clinic save money [3,4] compared to a conventional service there are still organisational considerations. The physiologist or scientist-led clinic takes time away from the general roster and requires back-filling. Similarly the nurse must be spared from general ward or outpatient duties.

The roles of each discipline within the clinic should be agreed and linked with the types of patients being seen *(Table 1)*. It is important to try to match the various staff skills (nurses, physiologists and doctors) to patient needs. For example a complex valve patient with multiple comorbidity may be best suited to see a cardiologist. Other patients where echo is a key focus may be best seen by a physiologists/scientist. Patients with prosthetic valves or post intervention can be followed up by a nurse. An example list of competencies for a nurse job description is given here:

Example ▶

At some centres agreement with ACHD about who sees younger patients with bicuspid valves should be agreed.

An echocardiography session in which scans indicated by valve disease (e.g. post valve replacement surgery) does not alone constitute a valve clinic.

Table 1: Roles in a heart valve clinic including those devolved to scientist or nurse

	Roles	Cardiac condition
Cardiologist	• Assess new referrals and create management plan • Discuss endocarditis prophylaxis • Follow complex valve cases • Determine risk of non-cardiac surgery • Advise on anticoagulation perioperatively • Lifestyle advice • Back-up for nurse and physiologist clinics • Communicate to referrer, GP and patient	• All new cases unless already assessed as suited to a devolved clinic • Cases with complex valve disease, other cardiac conditions or noncardiac comorbidity • First year after endocarditis

Table 1: Roles in a heart valve clinic including those devolved to scientist or nurse (continued)

	Roles	Cardiac condition
Physiologist/ Scientist	• Clinical history and examination • Echocardiography • Lifestyle advice • Discuss with cardiologist if needed (supplementary information 2) • Communicate to referrer, GP and patient	• Moderate and severe native valve disease • Aortic disease • Post intervention requiring echo
Nurse	• Clinical history and examination • Lifestyle advice • Discuss with cardiologist if needed • Communicate to referrer, GP and patient	• Post intervention • Triaging patients with new problems e.g. possible rhythm change

Setting up a devolved physiologist/scientist or nurse clinic

- A devolved physiologist/scientist-led clinic involves a clinical assessment as well as an echocardiogram. A nurse clinic only involves a clinical assessment.
- The cardiologist should only see the patient if required clinically and this occurs in approximately 10% of cases[8] although more frequently until the scientist gains experience and confidence.
  - Identifying a senior physiologist/scientist or nurse with relevant competencies;
  - Development of a dedicated letter template;
  - Identification of suitable patients *(Table 1)* e.g. patients without multiple comorbidities;
  - Clear protocols with alerts for when patients should be discussed with the cardiologist or MDT including consideration of intervention. An example is given here:

Example

  - Devolved and cardiology clinics set up in parallel. This allows:
    - Support and training;
    - Immediate consultation with the cardiologist if needed. It defeats the objective of the valve clinic if a problem detected by a nurse or physiologist requires an outpatient appointment to be seen by a cardiologist.

Other models

- Some centres run echocardiography sessions for patients with mild to moderate valve disease (e.g. aortic V max <3.5 m/s) separate from but under the auspices of a specialist valve clinic (with alerts in place).
- This is analogous to Abdominal Aortic Aneurysm surveillance.
- The patient with moderate valve disease is not expected to develop symptoms. The focus in the specialist valve clinic can then be on patients with severe valve disease.

Murmur Clinic

- A 'murmur clinic' [9] takes patients referred for open access echocardiography indicated for murmur and only performs a full study if auscultation or a basic study is abnormal.
- Patients are referred to the valve clinic if there is significant valve disease or clinical concerns.

2. Echo support

- A physiologist is required to perform TTE for the cardiologist clinic. This is separate from the physiologist/scientist running the devolved clinic.
- The TTE needs to be one-stop i.e. performed at the time of the clinical visit.
- Ideally these sessions should be staffed by dedicated physiologists/scientists. This allows valve specific training with development of a valve team ethos, specific echo protocols, advanced echo techniques and consistent reporting formats.
- Dedicated echo support can be used as a foundation to develop devolved physiology/scientist clinics at a later stage.

3. Competencies

- There is, as yet, no formal qualification to establish competency in valve disease for any medical discipline. However for all disciplines there should be adequate training, experience and specialist competencies based on the elements in *Box 2.* [10].
- Some physiologists attend MSc modules on clinical assessment.
- At some centres the physiologists sits with the consultant and, when ready, checks assessment skills (e.g. in 20 patients using a standardised proforma) (annex) before being passed as fit to run a clinic on their own.
- The nurse can be indemnified to refer directly to other services [11] e,g, obesity, respiratory, psychology, family planning, dermatology, erectile dysfunction.
- A physiologist-led valve clinic must not be seen as part of the normal roster. The physiologist must be experienced and have specialist valve competencies.
- A valve clinic is one way for a senior physiologist to demonstrate equivalence to a clinical scientist.[12].

Box 2: Methods of demonstrating specialist competencies in valve disease

TRAINING

- **Study at a specialised centre (all disciplines).**
- **Valve-related training events formally designated by accreditation points from a representative national or international body.**
- **Case-discussions on recognized platforms e.g. MedShr.**
- **For a surgeon adequate numbers and quality of results according to standards available in opinion papers and defined by national specialist societies.**
- **For physiologist/scientists and nurses participation in local or national clinical skills courses and ideally an MSc or PhD in cardiology .**

SPECIALISED PRACTICE

- **Examples of essential practice depend on discipline but include supervision of a valve clinic, performing specialist valve imaging studies, performing mitral valve repairs, being part of the endocarditis team, seeing inpatient referrals with valve disease, and writing departmental protocols.**
- **Ideal criteria include involvement in teaching and in local or multicenter research.**
- **Audit of results is a necessary part of maintaining a high quality service.**

CONTINUING PROFESSIONAL DEVELOPMENT

- **Meetings with valve-specific scientific or educational components, many organized by national or international societies.**
- **Membership of a specialist Society is encouraged, e.g. the European Society of Cardiology Council on Valvular Heart Disease, the Society of Heart Valve Disease or the British Heart Valve Society.**

4. Triage

- A triage system with inclusion criteria, exclusion criteria, prioritisation and advice and guidance should be implemented, ideally electronically. This is increasingly important as the valve clinic expands to avoid long waiting lists especially for patients that require early assessment.
- Time in work-plans need to be allotted to triage.
- The triage should also identify which discipline patients should be allocated to *(Table 1)*.
- In the COVID-era, triage also needs to determine which patients need face-to-face and which virtual appointments. [13]

Inclusion criteria

- A comprehensive valve service should include all types of valve patients including new patients diagnosed with HVD, follow up of patients, patients with prosthetic valves and patients post infective endocarditis.
- Patients after transcatheter intervention could be seen in the general or TAVI clinics.
- Some centres have a separate aortic clinic but others may decide to see patients with aortopathy in the specialist valve clinic.
- At some centres ACHD specialists may see younger patients with bicuspid aortic valves and aortopathies.

Exclusion criteria

- These should be agreed before setting up the clinic because discharging patients is harder than not including them at the start.
- Patients who will never be suitable for intervention might be better seen in another clinic e.g. elderly care. Patients with secondary mitral regurgitation might be better suited to a heart failure service. There needs to be close communication with heart failure services for example via team meetings.
- A degree of valve thickening or regurgitation is effectively normal above the age of 65 and should not be called valve disease since this risks causing health anxiety. A decision needs to be made whether these patients should be followed in a valve clinic or recommended for repeat open access echocardiography in 3-5 years if there is an aortic V max >2.5 m/s particularly in patients aged <75.
- The population prevalence of mitral prolapse is at least 2% and patients with no regurgitation or trivial to mild regurgitation are unlikely to progress unless they develop endocarditis.[14] They may not need follow up but if there is mild regurgitation there could be a 5 year open access follow-up or call-back.

5. Protocols and alerts

- Protocols to allow consistent and guideline-directed care for all patients with HVD are essential for the running of the valve clinic. A suggested template for a first visit is given *here*:

  and for a follow-up visit here:

  These can be used as a reference guide for all team members working for the valve clinic. A list of questions for each visit is suggested *here*:

  and a list of frequently asked questions is given *here*:

  Example

  Example

  Example

  Example

- All disciplines in the multidisciplinary clinic should be collecting similar information and covering similar ground (e.g. advice about prevention of endocarditis). This could be ensured using a common proforma.

  Example

  Example

- Some clinics have a 'mini-MDT at the start of the clinic before the patients are seen. This helps standardise and inform decisions, and encourages information exchange and education.

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6. External communication

- The valve clinic service needs to be communicated to potential referrers e.g. cardiologists, GPs, elderly care physicians. This can be done in different ways:
  - The valve clinic service can be advertised on echo reports that have detect significant valve disease with a simple message "consider referral to the valve clinic."
  - The valve clinic service can be advertised via email notification, presentation at governance meetings, and distribution of flyers. Key is to communicate referral pathways and contact details.
- There needs to be close communication with referring hospitals and the community to ensure that up-to-date data are shared.
- Referring hospitals must be involved in the MDT discussions face-to-face or virtually.
- Letters or electronic messages should be sent routinely to referrers and GP. Time needs to be allocated for this in work-plans.
- Some services might consider a patient passport including the surgical notes and a copy of any postoperative echocardiography report.
- Patient Initiated Follow-up (PIFU) must be possible.
  - Time must allocated in job-plans for managing Email or other contact portals;
  - Some clinics have a help-line run by the nurse, others use administrative staff who can deal with administrative concerns and refer on clinical problems usually to the last person seeing that patient;
  - Some clinics have a generic valve consultant E-mail address but these need to ensure that there is a designated consultant of the day or week to respond to avoid the problem of shared responsibility leading to uncertainty over who should respond.

7. Organisation

General principles

- A valve clinic needs departmental space and roster time. There must obviously be clinic space for all disciplines to occur simultaneously to allow immediate consultation with the cardiologist if needed.
- The clinic should be close to the echocardiography laboratory and to the exercise laboratory. Ideally it should also be close to other cardiac imaging.
- One stop working should be the norm. This should initially be put in place for echocardiography and blood tests. Once the valve clinic organisation is more advanced this should also be possible for exercise testing or CT, particularly calcium scoring.

Imaging and tests

- Other imaging techniques and biomarkers must be available *(Table 2).*

Table 2: Tests needed for valve clinic
Blood tests
Including B-type Natriuretic Peptide (BNP) and blood cultures - A BNP level 3 times the upper limit of normal is a class IIa indication for aortic valve replacement[15] and upward trends may corroborate adverse changes in other measurements. It is also useful when there are multiple causes of breathlessness to help differentiate the effect of valve disease and non-cardiac conditions. Blood cultures should also be feasible.
Exercise test
This is indicated in all patients with severe asymptomatic disease. [15,16]
Stress echocardiogram
This is indicated for a patient with symptoms despite moderate aortic stenosis.
Cardiopulmonary exercise test
This is not essential but can be useful to differentiate cardiac and respiratory causes of breathlessness.
Lung function
For the investigation of breathlessness of uncertain origin and assessment before surgery.
Computerised tomography
This is needed for the assessment of the aorta particularly if the echo-cardiographic images are suboptimal as well as planning for transcatheter techniques.
Magnetic resonance scan
This is useful to assess aortic diameter, branch pulmonary artery stenosis or right ventricular volumes in severe pulmonary regurgitation. It is occasionally useful if mitral or aortic regurgitation is of uncertain grade on the echocardiogram.

- The frequency of echocardiograms needs to be decided for each patient individually. Some patients may only be suitable for intervention in the event of clear symptoms so it may not be necessary or appropriate to perform regular echocardiograms. The frequency can be reduced in low moderate aortic stenosis (Vmax<3.5 m/s).
- Guideline default frequencies based on international guidelines in the COVID era[13] are given in *Tables 3 and 4.* These frequencies may need to be revised as the effect of ongoing infections and the back-log of patients recede.

Table 3: Managing mitral valve disease in the context of COVID-19

Mitral stenosis	Recommendations
Mild	Discharge
Moderate	Annual virtual follow-up with 2 yearly echocardiography
Severe	Symptomatic → refer for MDT discussion & work-up for valve replacement Asymptomatic → annual follow-up with echocardiography
Mitral regurgitation	**Recommendations**
Mild	Discharge
Moderate	Primary MR → Annual virtual follow-up with 2 yearly echocardiography Secondary MR → Consider discharge with contact details in case of deterioration
Severe	Symptomatic → refer for MDT discussion & work-up for valve replacement <u>Asymptomatic:</u> ***Candidate for surgery*** Extend time interval from 6 to 9 monthly follow-up with echocardiography ***Candidate for MitraClip only*** Virtual clinic follow-up at 9 monthly intervals ***Not a candidate for any intervention*** Discharge with appropriate advice to patient and GP regarding management of symptoms

Table 4: Managing aortic valve disease in the context of COVID-19

Aortic stenosis	Recommendations
Mild	Consider discharge in patients >75 years; follow-up scan in 3 years for patients with bicuspid valve or patients <75years that are realistic candidates for future valve intervention
Moderate	**Vmax 3.0 – 3.5m/s** → Virtual consultation in 2 years **Vmax 3.5 – 4.0m/s** → Virtual consultation in 1 year
Severe	**Patients eligible for sAVR or TAVI** • Symptomatic → refer for MDT discussion & work-up for valve replacement • Asymptomatic → 6 monthly in-person follow up with echocardiogram +/- exercise test • Use risk stratification markers (e.g. BNP level, Vmax >5.0m/s) to identify high risk patients • Patients with V_{max} > 4.5 m/s - have low threshold for referral earlier rather than later as there are likely to be delays in diagnostic and surgical pathways over the next 12-18 months • If any doubts about symptoms consider exercise test, especially in sedentary patients **Patients who are only considered for TAVI** • Omit echocardiogram and do 6 monthly phone clinic alone as main indication for intervention is symptoms • Back-up contact phone number to contact if symptomatic deterioration
Aortic regurgitation	**Recommendations**
Mild	Discharge
Moderate	Annual virtual follow-up with 2 yearly echocardiography
Severe	6 monthly virtual follow-up with annual echocardiography

- Follow-up is recommended after inpatient care for endocarditis at 1, 3, 6 and 12 months and thereafter depending on the residual valve disease.[17] However this frequency can be reduced for moderate residual regurgitation after a relatively noninvasive organism.

Administrative support

- Administrative support for booking outpatients and monitoring waiting lists is essential. The need for tests including TTE should be decided for individual patients by discussion between the cardiologist, nurse or physiologist.
- The decision for face-to-face vs virtual appointments must also involve discussion with the patient.
- An electronic booking system needs ideally to be flexible enough to accommodate individual variation e.g. reducing appointment length when an echo is not needed.

8. Links

Within cardiology

- Set up a system of alerts in the main echo lab for significant valve disease.
- Referrals from GPs for known valve disease can be triaged to the valve clinic.
- Many patients with valve disease have arrhythmias so there should be communication for advice and formal referrals to the EP clinic.
- Two-way communication with the heart failure service is needed since secondary MR complicates many cases with heart failure but other valve diseases may also present with heart failure.[18] High BNP as a result of valve disease is a common cause of referrals to a heart failure service.
- Referral hospitals and cardiothoracic centres should have combined MDT discussions.
- There need to be service-level agreements with other centres offering assessments or treatments not available locally e.g. PET or percutaneous closure of paraprosthetic regurgitation.[7]

Outside cardiology

- There need to be links to the respiratory department for breathlessness of uncertain cause or preoperative risk assessment of patients with both valve and pulmonary disease. Other essential services for management opinions are renal medicine, ITU, and elderly care.
- There should be links with services like weight-loss, dental surveillance and clinical psychology.
- Blood cultures should be easily obtained.

9. Patient information and shared decision-making

- Communication with patients to foster engagement is essential and allows informed consent to be a cumulative and progressive process. If necessary use special communication tools to aid comprehension. The following should be covered as a minimum:
  - Surgery - what symptoms to look out for, how surgery is timed, the importance of mitral valve repair, the possible reasons for choosing a TAVI in place of a surgical valve and what types of surgical valves are available.
  - Family planning - In women of child-bearing age discussion about contraception and timing of pregnancy in relation to valve or aortic surgery need to be routine.

  - Endocarditis - Ways of reducing the risk of developing infective endocarditis including dental surveillance are important. The conclusion of a discussion about antibiotic prophylaxis should be recorded and communicated with the GP and dentist for example using a card *(see annex 5)*.
  - Anticoagulation - The need for bridging from warfarin to heparin in patients having non-cardiac surgery with mechanical valves is not widely appreciated and local protocols should be discussed.

- Concerns of individual patients should be addressed e.g. newspaper articles or blogs, recent experience of family or friends.
- Digital or written information should be available and provided. Weight control leaflets, and infective endocarditis information are available on the BHVS website.
- Patients should be cautioned against the unreliability of information in social media, some newspapers and websites other than NHS sites.[19]

10. Governance

- Maintaining a data base is encouraged. Even a basic database capturing information such as age, valve pathology, severity and aetiology is helpful for business cases and audits.
- There should be an MDT meeting ideally weekly to discuss difficult cases or refer to a surgeon or interventional cardiologist (BCS and BHVS blueprint).
- Audits and patient-satisfaction surveys should be routine.
- Regular discussions should occur of complaints, unexpected deaths or discordance of clinical assessment with findings at operation.
- Educational meetings should be set up. There should also be an opportunity to discuss new research papers or emerging guidelines and ideas for service improvement.
- Ask a patient to 'feed back' key information before they leave the clinic.

Some clinics have a ‘mini-MDT’ at the start of the clinic before the patients are seen. This helps standardise and inform decisions, encourages information exchange and education.

Summary

Despite a lack of good quality research there is reasonable consensus on important aspects of valve care. The major challenge is to ensure that these inform direct patient care since physicians and cardiologists in general clinics tend not to follow established guidelines. It is therefore vital that care is delivered by specialists with competencies in valve disease and that interventions are delivered at heart valve centres defined by recognized standards.

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Example: Guy's and St Thomas' Hospitals valve clinic

Staff

Three cardiologist sessions (2 cardiologists), 4-6 physiologist sessions (4 physiologists in rotation) and two nurse sessions.

Who has care of the patients

The valve clinic cardiologist.

Patients

Moderate or severe native disease, bicuspid aortic valve, aortic disease and post-intervention, post endocarditis.

Referral

GPs, other cardiologists and clinics, DGH cardiologists

Links

TAVI, and transcatheter mitral clinics, psychologist, dental clinics, penicillin allergy testing.

Unusual features

Murmur clinic feeds patients with definite valve disease from GP open access requests. Telephone help-line. Clinic bookings by clinic manager not hospital system allowing careful control of time and tests required. One-stop treadmill exercise tests.

Meetings

At the start of the main weekly clinic and an additional departmental meeting once a week attended by general cardiologists and cardiac surgeons. Links to transcatheter, mitral, aortic and endocarditis MDT meetings

Barriers

There was initial resistance but referrals were encouraged by writing to fellow cardiologists picked up during triage of echo requests. Physiologists to provide studies for the cardiologist sessions strained the system managed by focussing the studies for stable follow-up studies. Lack of clinical space and echo capacity

Example: Leeds Teaching Hospital valve clinic (1 of 2)

Staff

6-7 cardiologist sessions (4 cardiologists), 4 physiologist sessions (3 physiologists in rotation) and two nurse sessions.

Who has care of the patients

The valve clinic cardiologist.

Patients

Moderate or severe native disease, post-intervention, post endocarditis. Rapid assessments.

Referral

GPs, other cardiologists and clinics, DGH cardiologists

Links

TAVI and transcatheter mitral clinics, psychologist, dental clinics, cardiac surgical clinics

Unusual features

- After initial review by a doctor most moderate valve disease patients are monitored in the echo surveillance clinic where patients only receive echo but no clinical assessment (similar to the surveillance of patients with AAA). Once patients either progress to severe valve disease (or in aortic stenosis to high moderate) or volunteer symptoms they are referred back to a doctor valve clinic and/or a physiology led clinic where they receive additional clinical assessment
- Telephone help-line staffed by admin and nurse.
- Dedicated admin support for valve clinic booking
- One cardiology consultant session dedicated to triage, short phone clinic and support of physiology and SpR at time of valve clinic day
- Use of cardio-pulmonary exercise testing for risk stratification
- Use of bike stress echo for risk stratification

Meetings

- Pre clinic 'mini MDT' prior to every valve clinic with physiologists, trainee and all consultants to review all imaging and discuss management of all patients seen in valve clinic that day. Very popular and excellent for education, consistency in management and team building
- Twice weekly valve/TAVI MDT attended by valve Cardiologist, surgeons and interventionalists
- Fortnightly mitral valve MDT
- Twice yearly valve governance

Example: Leeds Teaching Hospital valve clinic (2 of 2)

Barriers

- Lack of clinic space for echo and expanding staff numbers in valve clinic required negotiation with other specialties
- Physiology support for valve clinic, needed expansion of work force
- Inappropriate patients with multi-morbidity were triaged into physiology led and nurse clinics often overwhelmed physiologists/nurses and required increasing doctor input. This was helped by improved and dedicated triage time and support time for one the consultants present at the clinic.
- Overbooking of clinics and increasing waiting times led to reduced support of physiologists and juniors, more stressful working environment and excess waiting times especially for patients that needed early assessment. Restructuring of clinic, improved triaging, improved admin support, diverting patients that did not benefit from face to face or clinical assessment to phone clinics or echo surveillance clinics has helped this.

Example: Wythenshawe Hospital valve clinic (1 of 2)

Staff

3 WTE senior nurses (2 x Band 6, 1 x Band 5), 1 Consultant Cardiac Scientist, 1 Consultant, 1 WTE admin (Band 3)

Who has care of the patients

The valve clinic cardiologist.

Patients

Moderate or severe native disease, post-intervention, post endocarditis. Rapid assessments.

Referral

GPs, other cardiologists and clinics, DGH cardiologists

Links

TAVI and transcatheter mitral clinics, psychologist, dental clinics, cardiac surgical clinics, ICC clinic, aortic clinic, surgical clinics, endocarditis team.

Unusual features

- All patients have to be seen by a Consultant Cardiologist (or Cardiac Surgeon if post op) as an initial referral. Then if they fulfil criteria they can be referred into nurse-led service.
- Nurse-led service is for uncomplicated valve disease in straightforward patients. Patients have echo performed by physiologist (with exception of mechanical valves) and then either nurse teleconsult (for moderate valve disease or bioprosthetic / TAVI follow up) or face to face nurse appointment (for severe disease or mechanical valves).
- Consultant available for on-site review of face to face patients if required due to change in condition
- If there is any change in echo or clinical state, this is discussed with Consultant Cardiologist
- 6 monthly BNP and ETT performed for all with severe asymptomatic disease
- All information (including echo parameters etc) recorded on computer database.
- Copy letters sent to all patients
- Extensive patient information leaflet collection available, all patients given leaflet on their condition, as well as leaflet on how to contact valve service and generic leaflet on endocarditis prevention.
- 'Letter to dentist' template letter given to patients requiring antibiotic prophylaxis for dental procedures (according to SCEDP guidance)

Example: Wythenshawe Hospital valve clinic (2 of 2)

Unusual features (continued)

- Complex Valve Assessment Clinic is a joint Consultant / Physiologst clinic for rapid assessment of patients with complex or severe symptomatic disease with the aim of 'one-stop' decision maing and diagnostics – patient has teleconsult on week of referral with Consultant Physiologist then joing Physiology / Valve Consultant review following week with on-site diagnostics including advanced echo, CT calcium score of AV, 6MWT, ETT, Bloods, bike stress echo, cardiac monitoring as required.
- Telephone help-line staffed by admin and nurse.
- Dedicated admin support for valve clinic booking
- Dedicated structural bike stress echo list

Meetings

- Weekly aortic valve MDT
- Weekly complex valve / Mitral MDT
- Weely stress echo meeting for review of structural stress echo

Barriers

- Staff sickness / shielding during COVID pandemic meant service can easily become overwhelmed
- Protocol led nurse clinic means patients followed up when clinically unnecessary (ie moderate mitral regurgitation stable for many years)
- Lack of typing support means that valve nurses spend a huge amount of time typing rather than reviewing patients
- Overarching Consultant has potential to be overwhelmed with reviews of complex patients requiring Consultant input for large nurse-led valve clinic
- Complex area to train – one nurse takes a long time to train (over one year) due to new skillset required – has issues with regard to workforce planning (ie unable to cross-cover from other sites, medics required to step in in case of shortage).

A: Valve Clinic Nurse Competencies

- Physical assessment skills particularly cardiovascular and respiratory system
- Heart Sound auscultation including prosthetic valve variations
- ECG / pacing interpretation
- Understanding of anticoagulation with mechanical valves
- Understanding abnormal valve pathology & physiology & surveillance required
- Understanding of echocardiography analysis
- Knowledge of prosthetic valve types & surveillance required
- Knowledge of information resources pertinent to Valve Disease (e.g Guidelines, dental, suitability for imaging, aortopathy)
- Understanding of cardiac medication
- IT competent – to maintain Audit database & use Trust applications
- Understanding implications of pregnancy with valve patients.
- Understanding of implications of non cardiac surgery in valve patients
- Understanding of endocarditis treatment & prevention
- Be able to manage own case load of patients, giving results, planning and altering treatment and care

B: Sonographer and Nurse Led Clinics: Alerts and Frequency of visits (1 of 2)

SOUTH LONDON CARDIAC NETWORK NHS

Mitral Stenosis

Severe: every 6 months (ETT annually)
Moderate: every 1-2 years
Mild: every 2 years

Echocardiographic alerts:
- New PA hypertension or rise in PA systolic pressure towards 50 mmHg
- RV dysfunction

Other alerts:
- Symptoms
- INR > 4.0 or < 1.5 in last 6 months
- New atrial fibrillation
- TIA or stroke
- Patient request
- Suggestion of endocarditis

Mitral Regurgitation

Severe: every 6 months + annual ETT
Moderate: every 1-2 years
Mild: not followed

Echocardiographic alerts:
- LVSD approaching 40 mm
- LV EF approaching 60%
- PA systolic pressure approaching 50mmHg

Other alerts:
- Symptoms
- New arrhythmia
- Patient request
- Suggestion of endocarditis

Aortic Stenosis

V max >4.0 m/s or EOA < 1.0cm^2	every 6 months + consider annual ETT
V max 3.5 – 4.0 m/s + AV Calcium	every 6 months
V max 3.0 – 4.0 m/s or EOI 1.0 – 1.5cm^2	every year + ETT at baseline, when becomes severe, and consider every year after this if early surgery clinically appropriate
V max 2.5 – 3.0 m/s	every 3 years

Echocardiographic Alerts
- Any reduction in LV ejection fraction
- EOI $\leq$0.6cm^2
- V max $\geq$5.0m/s
- Rapid progression of V max > 0.3 m/s per year
- New diastolic dysfunction (pseudonormal or restrictive)
- Aortic root dilated to 45 mm (Marfan's), 55 mm (other)

Other Alerts
- Spontaneous symptoms
- New arrhythmia
- Patient request
- Suggestion of endocarditis

Aortic Regurgitation

Severe: every 6 months or every 3 months at request of cardiologist if LV significantly dilated (consider ETT annually)
Moderate: every 1-2 years
Mild: not unless aortic root dilated

Echocardiographic alerts:
- LVSD approaching 50 mm or LVDD 70 mm
- LVSD change (>5mm from previous study) or volume increase since last study
- LVEF approaching 50%

Other alerts:
- Spontaneous symptoms
- New arrhythmia
- Patient request
- Suggestion of endocarditis

Pulmonary Stenosis

Severe: every year
Moderate: every 1-2 years
Mild: no follow up unless indicated

Echocardiographic alerts:
- New RV dilation
- Velocity > 3.5 m/s

Other alerts:
- Spontaneous symptoms
- New arrhythmia
- Suggestion of endocarditis
- Patient request

Tricuspid / Pulmonary Regurgitation

Severe: every 6 months
Moderate: every 1-2 years

Echocardiographic alerts:
- Progressive RV dilatation
- New RV hypokinesis

Other alerts:
- Spontaneous symptoms
- New arrhythmia
- Suggestion of endocarditis
- Patient request

B: Sonographer and Nurse Led Clinics: Alerts and Frequency of visits (2 of 2)

SOUTH LONDON CARDIAC NETWORK NHS

Mitral & Tricuspid Valve Repair

– Echo at 12 months –
If repair, competent, continue clinical surveillance annually in nurse-led clinic.

If repair impaired, continue echo surveillance per native dysfunction.

Echocardiographic alerts:

- Worsening regurgitation – see MR/TR sections
- Systolic anterior motion

Other alerts:

- Spontaneous symptoms
- New arrhythmia
- Patient request
- Suggestion of endocarditis

Aortic Root Dilatation

Marfan: annually unless dilated to > 40 mm, then every 6 months
Non-Marfan: annually
Bicuspid: annually

Echocardiographic alerts:

- Marfan 45 mm or change > 3 mm in one year
- Bicuspid valve 55 mm or change > 3 mm in one year
- Non-Marfan 55 mm or change > 3 mm in one year
- Worsening AR

Other alerts:

- Chest pain, dysphagia or change in voice
- New arrhythmia
- Patient request
- Suggestion of endocarditis

Post-Endocarditis (non-operated)

Echocardiogram at 1, 3, and 6 months
Then according to residual pathology

Biscuspid Valve (no AS/AR)

Every 3 years

Replacement Heart Valves

Every valve once postoperatively if not performed before discharge

Mechanical valves annually only if there is any of the following:

- Associated root dilatation (see specific guide)
- LV dilatation
- More than mild paraprosthetic regurgitation
- More than moderate TR

New designs of biological aortic valve every year after 5 years (e.g. Trifecta)

Established aortic biological designs every year after 10 years

Biological mitral valves every year after 5 years

Ross procedures every year

AVR native root monitoring (previous bicuspid AV)
(Dimensions on post-op echo)

<40 mm	No routine surveillance
40 – 45 mm	Echo at 5 yearly then review
>45 mm	Annual echo

AVR with Aortic Root Replacement (Marfans/ Ehlers Danlos)
Per valve type above
2 yearly CMR or CT scanning (renal bloods needed prior to scan)

Echocardiographic alerts:

- New or worsening regurgitation
- Obstruction – reduction of EOA by 25%
- Change in LV or systolic function (or RV for right-sided valves)

Other alerts:

- Exertional symptoms
- TIA
- INR > 4.0 or <2.0 during last 6 months
- New arrhythmia
- Patient request
- Suggestion of endocarditis

C: Valve Study Group

valve study group

Guy's and St Thomas' NHS
NHS Foundation Trust

FIRST VISIT

(**Attach Patient Identification Label**)	**Valve Study Group** 5th Floor, East Wing St. Thomas' Hospital London SE1 7EH Tel 020 7188 0726 Fax 020 7188 0728
Date:	**Primary Consultant**: Consultant / Nurse / Sonographer
Referral Source: Tertiary / Trust / GP / Other	**Valve Pathology**: AS / AR / Mixed MS / MR / Mixed AVR / MVR / Other
Reason for Visit:	**PMH:**
Symptoms & Events: NYHA : I II III IV SAS: 1 2 3 4 Exertional SOB: N / Y Syncope/Presyncope : N / Y Chest Pain : N / Y New arrhythmia : N / Y New ankle swelling N / Y TIA/CVA: N / Y ACS : N / Y Endocarditis: N / Y Other Events : N / Y	**Comments**:
Investigations in Clinic: Echo: N / Y ECG: N / Y Bloods: N / Y Specify: BNP: N / Y Result: Exercise Test: N / Y Result: Pacemaker Check N / Y EP Opinion N / Y	**Examination**: BP : H(cm): Wt(kg): Heart Sounds: Chest Auscultation:
Medication:	**Advice**: Dental: Y / N Antibiotic Prophylaxis: Y / N Contraception: Y / N/ n/a INR therapeutic: Y / N / n/a
Plan: **Rebook** : 3mnths / 6mnths / 1 Year / Other : Consultant/ Nurse / Sonographer **Instructions**: Echo / BNP / Ex Test / ECG / Bloods **Medical Referral**: Yes / No 1 = event/change in symptoms 2 = echo threshold reached 3 = patient request 4 = sonographer/nurse request 5 = change in medication	**Signature**: **Designation**: **Date**:

D: Valve Study Group

valve study group

Guy's and St Thomas' NHS
NHS Foundation Trust

FOLLOW – UP VISIT

(**Attach Patient Identification Label**)	**Valve Study Group** 5th Floor, East Wing St. Thomas' Hospital London SE1 7EH Tel 020 7188 0726 Fax 020 7188 0728
Date:	**Primary Consultant**: Consultant / Nurse / Sonographer
Visit: Scheduled / Unscheduled	**Valve Pathology**: AS / AR / Mixed MS / MR / Mixed AVR / MVR / Other
Reason for Visit:	
Symptoms & Events: NYHA : I II III IV SAS: 1 2 3 4 Exertional SOB: N / Y Syncope/presyncope : N / Y Chest Pain : N / Y New arrhythmia : N / Y New ankle swelling N/Y TIA/CVA: N / Y ACS : N / Y Endocarditis: N / Y Other Events : N / Y	**Comments**:
Investigations in Clinic: Echo: N / Y ECG: N / Y Bloods: N / Y Specify: BNP: N / Y Result: Exercise Test: N / Y Result: Pacemaker check N / Y EP Opinion N / Y	**Examination**: BP : Heart Sounds: Chest Auscultation:
Medication:	**Advice** : Dental : Y / N Antibiotic Prophylaxis : Y / N Contraception : Y / N/ n/a INR therapeutic : Y / N / n/a
Plan: **Rebook** : 3mnths / 6mnths / 1 Year / Other : Consultant/ Nurse / Sonographer **Instructions**: Echo / BNP / Ex Test / ECG / Bloods **Medical Referral**: Yes / No 1 = event/change in symptoms 2 = echo threshold reached 3 = patient request 4 = sonographer/nurse request 5 = change in medication JAN 2016	**Signature**: **Designation**: **Date**:

E: Points to cover in the routine annual follow-up includes native and post repair or replacement surgery

History

- New symptoms? Change in exercise capacity? Slowing down?
- Psychological or cognitive issues including understanding of condition
- What to look out for (TIA, bleeding, fever, breathlessness)
- Management of other conditions e.g. COPD
- Medication check

Examination

- New AF? Blood pressure?
- Progression of valve disease?
- Evidence of heart failure?
- Post surgery scar problems: keloid, pain, wire protruding

Anticoagulation

- INR control: Stable? Frequency of testing? Diet if INR variable. Bleeding? Home testing?
- Correct INR range?
- Could a NOAC be indicated (valve disease other than mechanical prosthesis or mitral stenosis)
- When can warfarin stop after surgery?
- Perioperative anticoagulant bridging
- Planning pregnancy

Endocarditis advice

- Dental surveillance and need for antibiotic prophylaxis
- Other advice e.g. tattoo, piercing
- What symptoms to look out for

Life-style advice

- Smoking cessation
- Weight loss

F: Frequently asked questions from the clinics and help-line for operated patients (1 of 2)

How long will my valve last?

Patients outside valve clinics are sometimes told that mechanical valves only last 10 years.

How can I prolong the life of my biological valve?

Needs a discussion of blood pressure and diabetes control and avoidance of endocarditis

Is my valve disease hereditary?

There is an approximately 10% prevalence of bicuspid valve/dilated aorta in first degree relatives compared with 1% in the general population. There is a 2% population prevalence of mitral prolapse in the population and severe calcific aortic stenosis occurs in 3% of people aged over 75 so these conditions are so common they might occur in families without there being a genetic link.

How can I prevent endocarditis?

(see endocarditis card in supplementary annex 5)

Valve noise

This is noticed by 72% early after surgery and regarded as a nuisance by 22% but fades within a year (21). Some find it reassuring to be reminded that the valve is working.

Compatibility with magnetic resonance or CT

All valves are compatible with both but this still causes concern.

Non-cardiac surgery

Needs an assessment of the state of valve and heart and a discussion of anticoagulation bridging.

Pregnancy

Family planning needs careful discussion in all women of child-bearing age with respect to contraception, and anticoagulation. As appropriate more detailed discussions with the closest cardiac-obstetric team will be needed.

Sex

This includes when to restart after surgery but also new erectile dysfunction.

Exercise

Usually this requires common-sense advice about avoiding contact sports, weight-lifting (not weight training) or other extremes of exercise.

Flying

This is not usually a problem in stable patients before or after valve surgery, but needs discussion of insurance and INR testing. Certificates are sometimes needed if holidays have to be cancelled for cardiac surgery. It should usually be avoided in symptomatic patients being referred for surgery.

F: Frequently asked questions from the clinics and help-line for operated patients (2 of 2)

Symptoms

New symptoms sometimes trigger an early appointment but usually only emerge at a routine appointment. What symptoms to watch out for?

Frequency of echocardiography