NHS England

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British Society of Echocardiography

Guide to preoperative testing: N-terminal prohormone of brain natriuretic peptide (NT-proBNP) and Echocardiography

February 2025

Supporting theatres, anaesthesia and perioperative medicine services

GIRFT is part of an aligned set of programmes within NHS England

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When to use NT-proBNP and echocardiogram at preoperative assessment

1.1 Indications for NT-proBNP

1.	Clinical signs suggestive of new heart failure (HF) i.e. in patients with shortness of breath (dyspnoea, orthopnoea) and/or peripheral oedema unless there is a definitive non-cardiac explanation
2.	In patients with known HF who are scheduled for **high-risk** non-cardiac surgery (i.e. major surgery), it is recommended to evaluate cardiac function with echocardiography **and** measurement of NT-proBNP/BNP levels, unless this has recently been performed (i.e. within 6 months) or symptoms are stable

1.2 NT-proBNP is not indicated (i.e. unlikely to clarify risk assessment)

1.	Stable exertional breathlessness in patient with known respiratory disease but no history, signs or symptoms consistent with new HF

1.3 Indications for preoperative echocardiogram

1.	Clinical history suspicious of new diagnosis of heart failure supported by raised NT-ProBNP. *If no access to NT-proBNP, patients presenting with poor functional status and shortness of breath*
2.	Abnormal ECG indicative of significant structural heart issues (for example): • Left Bundle Branch block (new) • Left Ventricular Hypertrophy with strain (anterolateral ST depression +/- T wave inversion) • New Atrial Fibrillation with signs of cardiac failure or murmur (please see appendix 2) • Pathological Q waves or other ECG suggestion of ischaemic heart disease where there is concern of Left Ventricular Systolic Dysfunction (LVSD)
3.	Where auscultation is part of routine POA practice, a new murmur in the presence of cardio-respiratory symptoms OR an asymptomatic individual in whom clinical features or other investigation suggest clinically significant structural heart disease (e.g. abnormal ECG -see above).
4.	High risk of pulmonary hypertension for example in patients with severe respiratory disease, including, for example, advanced COPD or fibrotic lung disease. **These patients will require review by a senior decision maker to decide if echocardiography is appropriate.**

1.4 Perioperative echocardiogram not indicated (i.e. unlikely to clarify risk assessment)

1.	Routine echocardiogram for any risk of surgery i.e. higher risk surgery is not, on its own, an indication for echocardiogram
2.	Echocardiogram based on age or frailty only
3.	Where a patient is under active echocardiogram follow-up (i.e. progressive valve disease or known LV dysfunction): repeat echocardiogram assessment prior to next planned echo cardiogram review with no intervening change in clinical status
4.	Atrial Fibrillation without signs of cardiac failure or murmur (please see appendix 2)
5.	Previous murmur during pregnancy without any further symptoms

Background to this guidance

Context

GIRFT reviews - along with a recent audit and work with the POA non-medical network - have shown that high levels of preoperative testing are slowing surgical pathways and increasing demand on diagnostic services.

This guidance is the first in a series aimed at ensuring preoperative diagnostic testing is only used where the results are likely to change peri-operative management. We intend to evaluate the impact of this guidance and will be seeking to collaborate with appropriate sites.

Aims

This guidance focuses on NT-pro-BNP and transthoracic echocardiogram, and builds on existing guidelines, including from NICE[1] and the British Society of Echocardiography[6]. It is motivated by audit results showing wide variation in practice with respect to ordering these tests following POA.

This guidance aims to provide pragmatic indications for testing in a POA setting. To do that, it deliberately avoids terms such as ‘consider echocardiogram’ (which may inadvertently contribute to over testing, delayed pathways and increased use of high dependency beds).

Please note that GIRFT, and colleagues in NHS England, have produced guidance on echocardiograms and NT-proBNP for initial presentations. The GIRFT team are satisfied both sets of guidance are consistent with one another where necessary, and certainly do not conflict with each other.

Prerequisites and scope

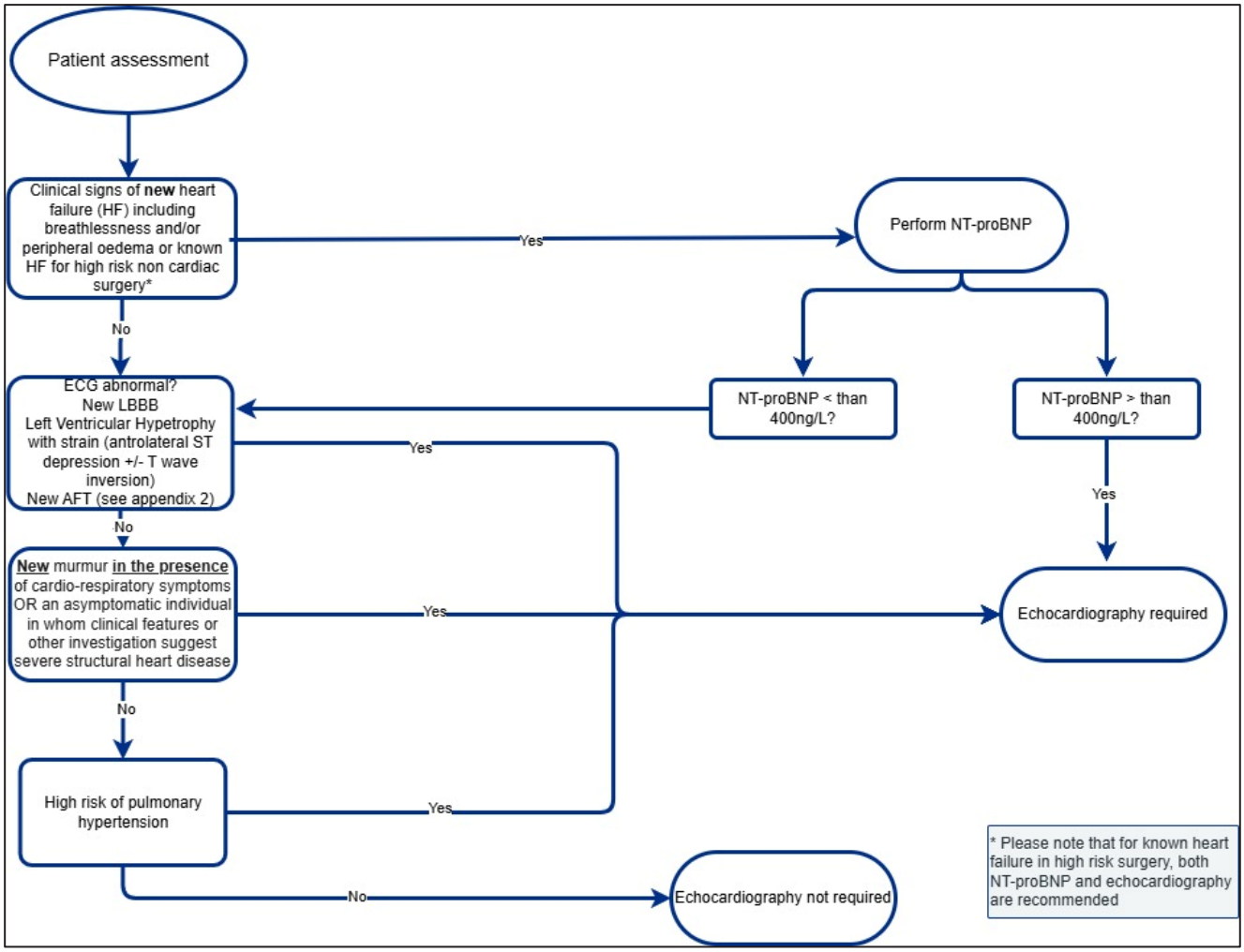
This guidance assumes that all POA services have access to echocardiography and NT-proBNP testing, and that echocardiography is targeted based on clinical assessment of the patient. Given the relative frequency with which cardiac complications can occur after complex surgery, multidisciplinary meetings with cardiology input for high-risk patients are also encouraged.

Beyond these points, all POA services can use the guidance. It may be particularly beneficial where chest auscultation is not routinely performed, as the tests provide diagnostic value without the need for that examination.

It is assumed non-medical POA clinicians are competent in initiating both NT-proBNP testing and echocardiography under clinic protocol, training for which should include:

- Knowledge and skill in clinical history taking.
- Knowledge of conditions causing shortness of breath, both related to respiratory and cardiovascular disease.
- Competency to perform targeted examination to identify new heart murmurs where this is indicated.
- Competency in interpretation of ECG.
- Understanding of functional capacity in relation to metabolic equivalent activity (MET).

Summary NT-proBNP and echocardiograph flow chart



Clinical scenarios illustrating when to use the tests

1.1 Scenario where NT-proBNP is indicated and results indicate need for echocardiography and further specialist assessment

Patient X is having a POA in preparation for an abdominal procedure. When taking a clinical history, they are identified as having recent onset of shortness of breath, bilateral ankle swelling and limited functional capacity which appears to be new. As this is major surgery, patient X may benefit from an NT-proBNP test to identify if this could potentially be a sign of heart failure. The NT-proBNP result is elevated, so an echocardiography is requested to assess for signs of heart failure prior to surgery. If the NT-proBNP is not elevated, patient will require assessment by senior decision maker to look at other potential causes.

1.2 Scenario where echocardiography and NT Pro-BNP are not indicated

Patient Y is 80 years old and is having an elective Total knee replacement. Functional capacity is limited due to knee pain only. An ECG is performed and shows no abnormality. There are no complaints of shortness of breath or any other cardio-respiratory concerns. An echocardiography is not indicated.

1.3 Scenario where echocardiography is indicated

Patient Z is having prostate surgery and has severe COPD. They have limited function, on triple inhaler therapy and have had numerous hospital admissions within the last year. An ECG shows severe RVH (Large R wave in V1 +/- strain pattern). An echocardiogram (alongside other investigations) is requested to assess for signs of pulmonary hypertension.

Further information

NT-proBNP is a protein that plays a crucial role in diagnosing and monitoring heart conditions, particularly heart failure. Elevated NT-proBNP can be used as the first step investigation for patients presenting with heart failure signs and symptoms. Doing so may reduce demand for echocardiogram pre-operatively.

Echocardiography is a non-invasive imaging test, used to examine the heart and nearby blood vessels by looking at the structure of the heart including chambers and valves and assessing cardiac output. Echocardiography can be unreliable at ruling out perioperative risks, and the screening to assess the need for it can be impractical due to the surgical condition.

Decisions to refer to cardiology or postpone surgery should involve shared decision making for both tests. When echocardiogram results suggest delaying surgery, a senior decision maker should engage in shared decision making with the patient and multidisciplinary team to determine the appropriate plan. If the echocardiogram results are normal and there are no other concerns, a skilled senior member of the non-medical POA team can conduct the review.

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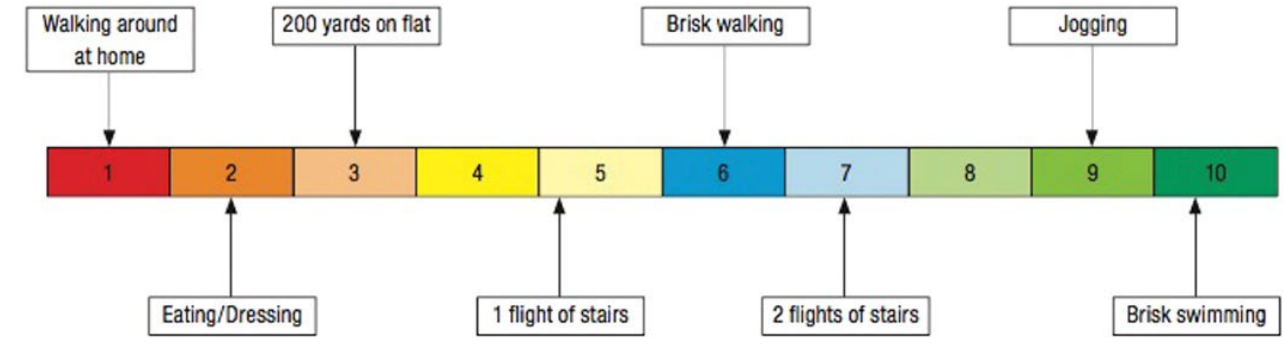
Appendix 1: Decision support tools

Decision support tools for chest pain and presenting clinical symptoms i.e. shortness of breath

Clinical history taking questions:

Onset	When did it start?
Location	Where is it?
Duration	How long have you had it?
Character	What is it like?
Aggravating factors	What makes it worse?
Relieving factors	What makes it better?
Treatment	Are you on treatment?

Function and Metabolic activity score:



Estimated METS Score: .....

Appendix 2: Further information and background (long read version)

1. N-terminal prohormone of brain natriuretic peptide (NT-proBNP)

NT-proBNP is a protein that plays a crucial role in diagnosing and monitoring heart conditions, particularly heart failure. NT-proBNP is produced by the heart under stress or when it is working harder. NT-proBNP is released into the bloodstream where it acts as a hormone that helps regulate blood pressure, fluid balance and signals the blood vessels to dilate. It prompts the kidneys to excrete excess water and salt through urine to reduce the workload on the heart.
Elevated NT-proBNP can be used as the first step investigation for patients presenting with heart failure signs and symptoms. NICE guidelines relating the use of NT-proBNP[2] assay in the assessment of heart failure and its role in guiding further investigations were updated in January 2024.

The guidelines from the European Society of Cardiology (ESC) and the European Society of Anaesthesiology recommend the use of NT-proBNP as a preoperative test for patients with suspected heart failure (signs and symptoms) undergoing non-cardiac surgery and the use of NT-proBNP plus echocardiogram for patients with known heart failure undergoing high risk non-cardiac surgery[3]. One study showed the use of NT-ProBNP had prognostic value around 30-day mortality and cardiac events after major surgery[4] . In the same way as NT-proBNP has the potential to reduce echocardiogram testing in the cardiology speciality, its use in the POA setting could usefully guide the need for further cardiac investigation before surgery.

2. NT-proBNP in POA

All patients attending POA should be assessed for heart failure by asking background screening questions that will include shortness of breath and exercise tolerance and clinical examination should include assessment for HF signs – oedema, elevated JVP, ascites.

Patients with previously diagnosed heart failure should have an echocardiogram and NT-proBNP prior to surgery, unless they have had a recent echocardiogram or their symptoms are stable.

In patients without documented history of heart failure, but with positive response to the appropriate screening questions, a more specific history, including degrees of dyspnoea (difficult or laboured breathing), orthopnoea (shortness of breath when lying flat) and clinical examination (e.g. peripheral oedema) may be required to further elicit any degree of undiagnosed heart failure. If these results are deemed positive, an NT-proBNP test should be performed, unless there is a plausible definitive non-cardiac explanation.

3. NT-proBNP results

If the NT-proBNP is less than 400ng/L, the patient and clinician can be reasonably assured that there is no clinically significant heart failure. A level of above 400ng/L should prompt referral for echocardiography prior to surgery. In accordance with NICE guidelines, those with an NT-ProBNP >2000ng/L should be assessed, including echocardiography (within 2 weeks) and those with an NT-ProBNP of 400-2000ng/L within 6 weeks.

Patients found to have a new diagnosis of heart failure should then be referred to cardiology services, in accordance with local protocols for management. Whether heart failure optimisation should delay surgery is dependent on shared decision processes, including the urgency of the surgery and the severity of the heart failure.

4. Echocardiography

Echocardiography is a non-invasive imaging test, used to examine the heart and nearby blood vessels by looking at the structure of the heart including chambers and valves and assessing cardiac output. The British Society of Echocardiography (BSE) have recently updated the POA echocardiogram guidance for elective and semi elective non-cardiac surgery[6] .

Echocardiography may be appropriate to help to investigate a newly found disturbance in the patient's cardiac health (e.g. abnormal electrocardiography - ECG), a clinical history suggesting valvular disease (e.g. aortic stenosis) or a new instability in existing cardiac disease (e.g. heart failure). In these instances, the use of echocardiography prior to surgery will retain the same indication as in any patient not having surgery.

Preoperatively, echocardiograms are frequently ordered to define a patient's functional capacity related to cardiac function, which may have impact on perioperative risk during and after non-cardiac surgery. However, there is minimal evidence base to support the use of echocardiographic investigation to define perioperative risk[5] (poor negative predictive value). In addition, where surgical disease (e.g. osteoarthritis) prevents subjective clinical assessment of functional capacity, echocardiographic screening for poor cardiac function has low sensitivity and specificity. In many cases, the postponement of surgery whilst waiting for echocardiographic evidence of functional adequacy is not justified.

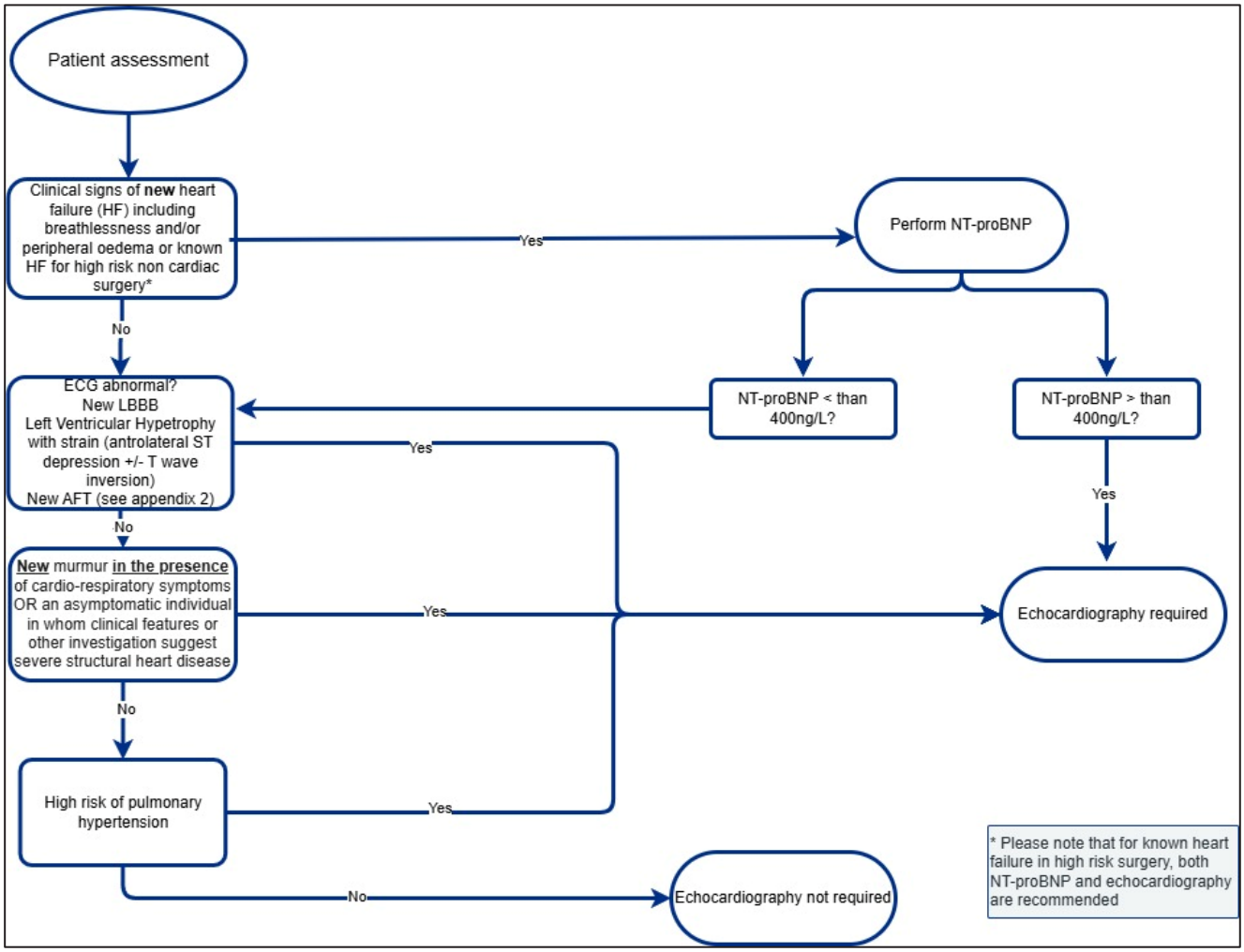
5. Atrial Fibrillation (AF) and echocardiography

Patients who have a new diagnosis of AF at POA should follow a specific AF pathway of care. Echocardiography will not be useful for those patients with fast AF until rate has been controlled. Once rate is controlled and if the surgery is urgent priority, **and** in the absence of any other concerning factors, patients can proceed to surgery.

6. Management of echocardiogram results

Results of echocardiograms booked by POA must be reviewed by POA staff and appropriate referrals for ongoing management/review arranged according to local protocols. Where surgery may need to be delayed, a senior anaesthetist should be involved in shared decision making with the patient and multidisciplinary team to decide upon the timing of surgery.

If an echocardiogram has been requested and the results of this are entirely normal, and there are no other areas of concern necessitating anaesthetic review, it is acceptable for a senior member of the non-medical POA team who has suitable skill mix to review. See flow chart below for further clarification on interpreting results.



References

#	Recommended document	Author	Overview
Research and studies			
1	Overview | Routine preoperative tests for elective surgery | Guidance | NICE	NICE	Published 2016. NICE guideline covering routine preoperative tests for people aged over 16 who are having elective surgery.
2	How to assess | Diagnosis | Heart failure - chronic | CKS | NICE	NICE	Published 2018, revised 2024. Clinical Knowledge Summaries – How to assess a person with suspected heart failure.
3	2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery | European Heart Journal | Oxford Academic (oup.com)	European Heart Journal	Published 2022. ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery.
4	Khurshaidi MN, Waqar A, Asghar MS, Kiran A, Tariq A, Kanwal N, Jawed R, Rasheed U, Hassan M, Mazhar A. Prognostic Value of Preoperative Pro-B-Type Natriuretic Peptide: Early Predictor of Cardiovascular Complications and Mortality After Major Abdominal Surgery. Cureus. 2020 Nov 5;12(11):e11338. doi: 10.7759/cureus.11338. PMID: 33304674; PMCID: PMC7719483.	Cureus	Published 2020. Prognostic Value of Preoperative Pro-B-Type Natriuretic Peptide: Early Predictor of Cardiovascular Complications and Mortality After Major Abdominal Surgery
5	Park JH, Park YH, Lee B, Shin SH, Oh D, Moon SH, Ko MJ. Effect of performing preoperative	Medicine (Baltimore)	Published 2022. The effect of performing echocardiography on intraoperative anaesthetic

	echocardiography in patients with cardiovascular risk on intraoperative anaesthetic management and postoperative outcomes: A retrospective study. Medicine (Baltimore). 2022 Aug 26;101(34):e30160. doi: 10.1097/MD.0000000000030160. PMID: 36042594; PMCID: PMC9410677.		management and postoperative outcomes in patients with cardiovascular risk.
6	New poster on clinical indications and triage of echocardiography for out-patient requests (bsecho.org)	British Society of Echocardiography	Published 2024. Updated resources designed to assist with triaging of echo referrals for out-patient requests (excluding the follow-up of established valve disease)

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.

GIRFT Academy has also published other pathways and case studies which are available via FutureNHS. These are available at: *Anaesthesia and Pre-Operative Medicine (APOM) - Getting It Right First Time - FutureNHS Collaboration Platform*

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