

SYNTHESIS

WHICH ROUTINE TESTING SHOULD BE PERFORMED BEFORE ELECTIVE NON-CARDIOTHORACIC SURGERY?



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■ FOREWORD

Our first clinical practice guideline on preoperative tests already dates from more than twelve years ago. It was, by the way, the very first guideline to be developed by the – at that time – young KCE. In the meantime quite a lot has changed. Most striking perhaps was the retraction of the recommendation to administer beta blockers peri-operatively, after it became apparent that this recommendation was based on fraudulent research.

However, not only the scientific views have continued to evolve over the past twelve years. Do you remember what your cell phone looked like back in 2004? The boldest in that period started to use bedside applications on a Blackberry, a Palm or another more or less user-unfriendly PDA. The first iPhone appeared no earlier than 2007, the first Android smartphone the year after. And we almost forgot that the first iPad was launched only six years ago. Because, nowadays, applications on a tablet or smartphone have almost become commonplace in healthcare.

And therefore, we too have decided to take our first tentative steps in the exciting world of mobile health. It is with some pride that, in parallel with this update of our guideline, we present an accompanying app today. We are very curious if it indeed will find its way to daily clinical practice. Any feedback is more than welcome!

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■ SYNTHESIS

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1. INTRODUCTION

1.1. Background

Surgery is never entirely without risk, despite the currently safe conditions in which it can be carried out in the Western world. Small or serious complications during or after surgery, such as pneumonia, heart failure, or even death, can still not be completely avoided. To limit these risks as much as possible, it seems logical to perform a series of preoperative tests on a patient, such as an electrocardiogram, medical imaging and/or laboratory tests. In this way, clinicians want to evaluate which patients are at a higher risk of complications and death, and therefore who needs additional preparation, care and/or monitoring.

But are these tests all and always necessary? Already thirty years ago, studies showed that routine preoperative tests offer little added value in reducing the surgical risk of the patient, and that many of these tests were not cost-effective. In addition, several studies, both in Belgium and abroad, showed that there was a medically unexplained variability and an ineffective use of preoperative tests.

In 2004, KCE developed a first clinical practice guideline on preoperative tests that should (not) be performed before elective non-cardiothoracic surgery, and on the perioperative use of beta blocking agents. In June 2005, the National Council for Quality Promotion (NRKP/CNPQ) provided every Belgian hospital with feedback on their use of preoperative tests. This feedback was accompanied by the KCE guideline. Furthermore, based on the same guideline, the NIHDI (RIZIV/INAMI) developed an online tool that allows to evaluate which preoperative tests are required for a specific patient. Today (fall 2016), this tool is still in use.^a

^a <http://www.riziv.fgov.be/nl/professionals/individuelezorgverleners/artsen/kwaliteit/feedback/Paginas/preop-flowchart-praktische-wegwijzer-onderzoeken.aspx#.V4T0CGfoupo>; accessed on July 12th 2016).

Meanwhile, medical science has evolved and the 2004 guideline is more than 10 years old. Furthermore, the feedback report of the NRKP/CNPQ showed a large variability between hospitals, and this situation has likely not changed. Therefore, a new version is urgently needed.

1.2. Scope of the guideline

This guideline focusses **on adult patients (i.e. 18+) undergoing elective surgery^b, with the exception of transplantation, heart and lung surgery.** Since a recent *KCE has read for you^c* already focused on the perioperative use of beta blocking agents, the present guideline will only cover **the routine use of preoperative tests.** A routine test is performed on all (even asymptomatic) patients, without distinction. On the other hand, a test on indication is performed because of certain clinical signs, or when the patient has a specific medical history. Tests - in preparation of the operation - to obtain technical information (e.g. lung or liver function tests to evaluate the postoperative function of the non-removed part of the organ) are not covered by this guideline either.

The guideline is intended for all care providers involved in the preoperative and perioperative management (incl. anaesthesiologists, surgeons, cardiologists, radiologists, clinical biologists, general practitioners, etc). Its use should contribute to an improvement of the quality of health care and a decrease in unnecessary or even harmful interventions. Clinicians who follow our recommendations should of course also take into account the individual situation and the preferences of the patient. Significant deviations from this guideline should be mentioned and explained in the patient records. The present guideline can also be of interest to patients and their families, hospital managers and policy makers.

^b In this synthesis, surgery means: a planned surgery with the exception of transplantation, heart, lung and emergency surgery

^c <http://kce.fgov.be/news/perioperative-beta-blockers-for-preventing-surgery-related-mortality-and-morbidity>



Our recommendations apply to:

- routine preoperative tests on
- patients > 18 years,
- who will undergo elective surgery
- with the exclusion of transplantation, emergency and cardiothoracic surgery

1.3. NICE guideline as a starting point

Before the actual start of this project, the British agency NICE (National Institute for Health and Care Excellence) had already started the update of their guideline on preoperative tests, and a draft guideline was already available. We assessed the methodological quality of the NICE guideline with the AGREE II tool. In an early stage of the project already, we decided to adapt the NICE guideline to the Belgian context with the ADAPTE methodology (for more details on the methodology, see Scientific report, chapter 2).

The updated NICE guideline also includes several general principles which we fully endorse: **a thorough assessment of the operative risk first implies a complete medical history, followed by a clinical examination. In other words, "Back to basics"**. NICE also recommends that the results of preoperative tests, conducted in primary care, should be transferred upon referral of the patient to a preoperative consultation. In addition, it advises to take into account the drugs taken by the patient when considering a preoperative test. **For a complete understanding of the literature (incl. the evidence and GRADE tables) the KCE guideline should be read together with the NICE guideline.**

1.4. Which tests are addressed?

In the NICE guideline, several preoperative tests are already addressed. We largely adopted this list, and it was complemented with some additional tests by the multidisciplinary Guideline Development Group (GDG, see appendix 1), in consultation with representatives of the professional associations and patients. We conducted a literature review for the clinical questions that were not included in the NICE guideline. Based on the results of the literature review (either from NICE or from KCE), we formulated recommendations based on the GRADE approach.

Our guideline includes the following preoperative tests:

- Resting electrocardiogram
- Resting echocardiogram
- Cardiopulmonary exercise testing
- Chest radiograph
- Polysomnography
- Lung function tests (incl arterial blood gas analysis)
- Full blood count tests
- Kidney function tests
- Haemostasis tests
- Glycated haemoglobin test (HbA1c)
- Liver function tests
- Urinalysis
- Stress echocardiography
- Myocardial scintigraphy
- Coronary CT angiography



For each test, the following two questions were asked:

- **Clinical benefit:** Does the routine use of the preoperative test improve patient outcomes after surgery?
- **Prognostic value:** To what extent does the preoperative test predict the patients' prognosis?

Chapter 2 of this synthesis provides a brief description of each test (for the patient), a brief discussion of its impact on the clinical outcome and its prognostic value, and a recommendation about its routine preoperative use.

1.5. Distinction based on ASA classification of the patient and surgery grade

For our recommendations a clear distinction was made between patients based on the health status before surgery. We used the ASA classification that was developed by the American Society of Anesthesiologists (ASA) and which is used worldwide.

Table 1 – ASA classification of the patient ^d

ASA grade	Definition
ASA grade 1	A normal healthy patient.
ASA grade 2	A patient with mild systemic disease (e.g. current smoker, social alcohol drinker, pregnancy, obesity [BMI 30-40 kg/m ²], well-controlled diabetes or hypertension, mild lung disease).
ASA grade 3	A patient with severe systemic disease (e.g. poorly controlled diabetes or hypertension, COPD, morbid obesity [BMI ≥40 kg/m ²], active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, end-stage renal disease undergoing regularly scheduled dialysis, history [≥3 months] of myocardial infarction, cerebrovascular attack, transient ischemic attack, or coronary artery disease/stents).
ASA grade 4	A patient with severe systemic disease that is a constant threat to life (e.g. recent [≤ 3 months] myocardial infarction, cerebrovascular attack, transient ischemic attack, or coronary artery disease/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, sepsis, diffuse intravascular coagulation, acute respiratory disease or end-stage renal disease not undergoing regularly scheduled dialysis).
ASA grade 5	A moribund patient who is not expected to survive without the operation (e.g. ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleeding with mass effect, ischemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction).
ASA grade 6	A declared brain-dead patient whose organs are being removed for donor purposes.

In addition we make a distinction based on the complexity of the surgery:

^d source: American Society of Anesthesiologists, <https://www.asahq.org/resources/clinical-information/asa-physical-status-classification-system>, accessed on July 12th 2016

**Table 2 – Surgery grades and examples**

Minor	Intermediate	Major or complex
• Excising skin lesion • Excising Bartholin gland • Draining breast abscess • Carpal tunnel release • Nasal septum deviation repair • Circumcision • Hydrocele repair • Cataract surgery	• Primary repair of inguinal hernia • Excising varicose veins in the leg • Tonsillectomy or aden(otonsill)ectomy • Knee arthroscopy • Resection of submandibular gland • Conisation • Eardrum repair • Caesarean section • Laparoscopic cholecystectomy	• Total abdominal hysterectomy • Mastectomy • Endoscopic resection of prostate • Lumbar discectomy • Thyroidectomy • Total joint replacement • Colonic resection • Radical neck dissection • Nephrectomy • Neurosurgery

1.6. A multidisciplinary, patient-centred approach

In our guideline we focused on the assessment of specific medical tests, without taking into account the organization of care. However, we would like to point out that a multidisciplinary approach should be encouraged in clinical practice. This approach should not only cover the medical but also the psychosocial needs of the patient.

In addition, the choice of an intervention should not only take into account medical aspects but also patient preferences. Each patient should therefore be sufficiently, clearly, timely and even repeatedly informed about all options and their advantages and disadvantages. This was also essential to the patients and their representatives who have been involved in the current report.

1.7. How to read and interpret the recommendations?

For each test we give (a) recommendation(s) mentioning the quality of the evidence (Table 3), according to the GRADE system. The quality reflects the level of confidence of the GDG in the estimation of the effect of the test.

**Table 3 – Levels of evidence according to the GRADE system**

Quality level	Definition	Methodological Quality of Supporting Evidence
High	We are very confident that the true effect lies close to that of the estimate of the effect	RCTs without important limitations or overwhelming evidence from observational studies
Moderate	We are moderately confident in the effect estimate: the true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different	RCTs with important limitations (inconsistent results, methodological flaws, indirect, or imprecise) or exceptionally strong evidence from observational studies
Low	Our confidence in the effect estimate is limited: the true effect may be substantially different from the estimate of the effect	RCTs with very important limitations or observational studies or case series
Very low	We have very little confidence in the effect estimate: the true effect is likely to be substantially different from the estimate of the effect	

Source: Balshem H, Helfand M, Schünemann HJ, Oxman AD, Kunz R, Brozek J, et al. GRADE guidelines: 3. Rating the quality of evidence. *J Clin Epidemiol.* 2011;64(4):401-6.

Furthermore, for each recommendation we provided its strength, also according to the GRADE system. The strength of a recommendation depends on the balance between all desirable and all undesirable effects of an intervention, the quality of the available evidence, the values and preferences of the patients, and the estimated costs (resource utilization). For this guideline, no formal cost-effectiveness study was conducted.

Table 5 explains how patients, clinicians and policy makers should interpret the strength of a recommendation.

**Table 5- Interpretation of strong and conditional (weak)* recommendations**

Implications	Strong recommendation	Weak recommendation
For patients	Most individuals in this situation would want the recommended course of action, and only a small proportion would not. Formal decision aids are not likely to be needed to help individuals make decisions consistent with their values and preferences.	The majority of individuals in this situation would want the suggested course of action, but many would not.
For clinicians	Most individuals should receive the intervention. Adherence to this recommendation according to the guideline could be used as a quality criterion or performance indicator.	Recognize that different choices will be appropriate for individual patients and that you must help each patient arrive at a management decision consistent with his or her values and preferences. Decision aids may be useful helping individuals making decisions consistent with their values and preferences.
For policy makers	The recommendation can be adopted as policy in most situations.	Policy-making will require substantial debate and involvement of various stakeholders.

* The terms “conditional” and “weak” can be used synonymously

Source: Andrews JC, Schunemann HJ, Oxman AD, Pottie K, Meerpohl JJ, Coello PA, et al. GRADE guidelines: 15. Going from evidence to recommendation-determinants of a recommendation's direction and strength. *J Clin Epidemiol.* 2013;66(7):726-35.



2. WHICH ROUTINE PREOPERATIVE TESTS ARE (NOT) RECOMMENDED?

2.1. Schedule and app

in adults prior to elective non-cardiothoracic surgery



ARE NOT RECOMMENDED:

- RESTING ECHOCARDIOGRAPHY
- CARDIOPULMONARY EXERCISE TESTING (CPET)
- CHEST X-RAY

- POLYSOMNOGRAPHY
- LUNG FUNCTION TESTS (INCL BLOOD GAS ANALYSIS)

- GLYCATED HAEMOGLOBIN TEST
- LIVER FUNCTION TESTS
- CORONARY CT ANGIOGRAPHY

		OFFER	CONSIDER
ASA GRADE OF PATIENT			
	MINOR SURGERY e.g.: • Draining breast abscess • Excising skin lesion	INTERMEDIATE SURGERY e.g.: • repair of inguinal hernia • excising varicose veins	MAJOR OR COMPLEX SURGERY e.g.: • colonic resection • total joint replacement
1 NORMAL HEALTH	NO ROUTINE TESTS → HAEMOSTASIS TESTS ⁰⁰⁰⁰	→ RESTING ECG ^{****} → HAEMOSTASIS TESTS ⁰⁰⁰⁰	→ FULL BLOOD COUNT TEST ¹ → KIDNEY FUNCTION ² → RESTING ECG ^{****} → URINECULTURE ⁰⁰⁰ → HAEMOSTASIS TESTS ⁰⁰⁰⁰
2 MILD SYSTEMIC DISEASE	→ RESTING ECG [*] → KIDNEY FUNCTION ^{*** 2} → HAEMOSTASIS TESTS ⁰⁰⁰⁰	→ RESTING ECG [*] → NON-INVASIVE CARDIAC STRESS IMAGING ⁰⁰ → KIDNEY FUNCTION ^{*** 2} → HAEMOSTASIS TESTS ⁰⁰⁰⁰	→ FULL BLOOD COUNT TEST ¹ → KIDNEY FUNCTION ² → RESTING ECG [*] → URINECULTURE ⁰⁰⁰ → NON-INVASIVE CARDIAC STRESS IMAGING ⁰⁰ → HAEMOSTASIS TESTS ⁰⁰⁰⁰
3 SEVERE SYSTEMIC DISEASE	→ RESTING ECG [*] → KIDNEY FUNCTION ^{*** 2} → HAEMOSTASIS TESTS ⁰⁰⁰⁰	→ RESTING ECG [*] → NON-INVASIVE CARDIAC STRESS IMAGING ⁰⁰ → KIDNEY FUNCTION ² → HAEMOSTASIS TESTS ⁰	→ FULL BLOOD COUNT TEST ¹ → KIDNEY FUNCTION ² → RESTING ECG [*] → URINECULTURE ⁰⁰⁰ → NON-INVASIVE CARDIAC STRESS IMAGING ⁰⁰ → HAEMOSTASIS TESTS ⁰
4 SEVERE SYSTEMIC DISEASE CONSTANT THREAT TO LIFE	→ RESTING ECG [*] → KIDNEY FUNCTION ^{*** 2} → HAEMOSTASIS TESTS ⁰⁰⁰⁰	→ RESTING ECG [*] → KIDNEY FUNCTION ² → FULL BLOOD COUNT TEST ^{** 1} → HAEMOSTASIS TESTS ⁰	→ FULL BLOOD COUNT TEST ¹ → KIDNEY FUNCTION ² → RESTING ECG [*] → URINECULTURE ⁰⁰⁰ → NON-INVASIVE CARDIAC STRESS IMAGING ⁰⁰ → HAEMOSTASIS TESTS ⁰

* In case of clinical risk factors according to the cardiac risk index

** In case of cardiovascular or renal disease, if symptoms were not recently examined

*** when renal impairment is suspected

**** if older than 65y

⁰ in case of a chronic liver disease or a history of abnormal bleeding, spontaneous, or after trauma or surgery

⁰⁰ in case of clinical risk factors according to the cardiac risk index and of a poor functional capacity

⁰⁰⁰ in case of urological or prosthesis surgery

⁰⁰⁰⁰ history of abnormal bleeding, spontaneous, or after trauma or surgery

¹ Red blood cells (hemoglobin, hematocrit and count), white blood cells (count and formula) and platelets.

² Creatinine, DFG, sodium and potassium.

Download the free webapp through App store (iOS), Google play (Android) or <http://preop.kce.be>



Federale Kenniscentrum voor de Gezondheidszorg
Centre Fédéral d'Expertise des Soins de Santé
Belgian Health Care Knowledge Centre



To facilitate and encourage the use of this guideline, we have also developed a web app that can be used on most current systems (iOS, Android and Windows). You can download the app at no cost from the App Store (iOS), Google Play (Android), through our website (www.kce.fgov.be) or through the QR code above.

mg/dL or a creatinine clearance of <60 mL/min/1.73 m²), diabetes mellitus requiring insulin therapy.{Kristensen, 2014 #150}

2.2. Preoperative tests recommended for specific patient groups and/or surgical interventions

2.2.1. Resting-electrocardiogram (resting-ECG)

There is no evidence on the effect of a resting ECG on clinical outcome. However, evidence on the prognostic value shows that an abnormal preoperative ECG is associated with an increased risk of perioperative cardiovascular events and mortality (low to very low quality).

Recommendations	Strength of Recommendation	Level of Evidence
• Preoperative ECG is recommended for patients who have risk factor(s)* and are scheduled for elective intermediate- or high-risk non-cardiothoracic surgery.	Strong	Very low
• Preoperative ECG may be considered for patients who have risk factor(s)* and are scheduled for elective low-risk non-cardiothoracic surgery.	Weak	Very low
• Preoperative ECG may be considered for patients who have no risk factors*, are above 65 years of age, and are scheduled for elective intermediate- or high-risk non-cardiothoracic surgery.	Weak	Very low
• Routine preoperative ECG is not recommended for patients who have no risk factors* and are scheduled for elective low-risk non-cardiothoracic surgery.	Strong	Very low

* Clinical risk factors according to revised cardiac risk index: ischaemic heart disease (angina pectoris and/or previous myocardial infarction), heart failure, stroke or transient ischaemic attack, renal dysfunction (serum creatinine >170 µmol/L or 2



Patient information

A resting ECG is used to detect or monitor cardiovascular diseases. For the test, torso and ankles should be uncovered. On the chest, forearms and ankles, stickers are placed to which the electrodes are attached. The electrodes in their turn are connected with wires to the ECG device. This device measures the electrical impulse needed for the contraction of the heart muscle.

Examples:

- Magda is 72 years old and in perfect health. She is planned for excision of a basal cell carcinoma of the nose. A preoperative resting electrocardiogram is not indicated.
- Luc (61j) has well-controlled type 2 diabetes (treated with insulin). He is planned for an inguinal hernia repair. A preoperative resting electrocardiogram is indicated.
- Martine (54j) is in perfect health and is planned for a thyroidectomy because of a multinodular goitre with tracheal compression. A preoperative resting electrocardiogram is not indicated



2.2.2. Full blood count test

There is no evidence on the effect of full blood count tests on the clinical outcome. Evidence of low to very low quality suggests that the absence of anaemia is associated with lower rates of postoperative mortality or complications.

Recommendations	Strength of Recommendation	Level of Evidence
Preoperative full blood count testing* is not routinely recommended in patients undergoing elective minor non-cardiothoracic surgery.	Strong	Very low
Preoperative full blood count testing* is not routinely recommended in patients undergoing elective intermediate non-cardiothoracic surgery, although it can be considered in patients with ASA 3-4.	Weak	Very low
Preoperative full blood count testing* is recommended in patients undergoing elective major or complex non-cardiothoracic surgery.	Strong	Very low

* Red blood cells (hemoglobin, hematocrit and count), white blood cells (count and formula) and platelets.

Patient information

This test involves an examination and a count of the red and white blood cells and platelets. In this way anemia, bleeding disorders and inherited and acquired hematological disorders etc. can be detected.

Examples:

- Nathalie (43y) is planned for varicose vein stripping. She is in normal health. A preoperative full blood count test is not indicated.
- Eric (55y) has a well-controlled hypertension and is planned for a left hemicolectomy (removal of the left part of the large intestine). In this case, a preoperative full blood count test is indicated.
- François is 55 and suffers from end-stage renal disease. He is planned for repair of an inguinal hernia. He complains about fatigue. A preoperative full blood count test can be considered, if not recently carried out.



2.2.3. Kidney function tests

There is no evidence on the effect of kidney function tests on the clinical outcome. Evidence of low to very low quality suggests that a normal eGFR (>60 ml/minute/1.73m²) is associated with lower rates of post- or perioperative mortality or post-surgical renal failure.

Recommendations	Strength of Recommendation	Level of Evidence
Kidney function tests* are recommended in all patients undergoing elective major or complex non-cardiothoracic surgery and in patients with ASA 3-4 undergoing elective intermediate non-cardiothoracic surgery.	Strong	Very low
Kidney function tests* are not recommended in patients with ASA 1 undergoing elective minor or intermediate non-cardiothoracic surgery.	Strong	Very low
Kidney function tests* can be considered in patients with ASA 2 undergoing elective minor or intermediate non-cardiothoracic surgery and in patients with ASA 3-4 undergoing elective minor non-cardiothoracic surgery, if renal function impairment is suspected.	Weak	Very low

Patient information

Renal function tests are conducted to measure the level of creatinine and electrolytes (sodium and potassium), and sometimes the level of urea in the blood. Often the glomerular filtration rate (eGFR) is also measured, which is the rate at which urine is filtered by the kidneys. In people with normal blood pressure this is about 0.12 liters per minute or about 170 liters per day. The eGFR decreases with age and certain kidney disorders.

Examples:

- Nathalie (43y) is planned for varicose vein stripping. She is in normal health. A preoperative kidney function test is not indicated.
- Jean (68y) has well-controlled hypertension and is treated with an ACE inhibitor. He is planned for a knee arthroscopy. In view of his age and the ACE inhibitor treatment, he has an increased risk of chronic renal function impairment, and a preoperative kidney function test can be considered.



2.2.4. Haemostasis tests

There is no direct evidence that preoperative haemostasis tests have an impact on patient outcomes. Evidence of low to very low quality suggests that an abnormal haemostasis test result is associated with a higher risk for postoperative mortality or major bleeding, but the study results are conflicting.

Recommendations	Strength of Recommendation	Level of Evidence
Haemostasis tests are not routinely recommended before elective non-cardiothoracic surgery.	Strong	Very low
In people with antecedent(s) of abnormal bleeding, either spontaneously or after trauma or surgery, and in people with chronic liver disease having elective intermediate or major or complex non-cardiothoracic surgery, one will consider haemostasis tests.	Weak	Very low

Patient information

Haemostasis tests involve the analysis of blood to detect too much (with risk of thrombosis) or too few coagulation (with risk of hemorrhage) and to examine the effects of anticoagulant drugs that the patient may take.

Examples:

- Maria is 75 years old and has well-controlled diabetes and hypertension. She is planned for cataract surgery. Preoperative haemostasis tests are not indicated.
- Michel is 51 years old and has an alcoholic liver disease. He is planned for a total knee replacement. Preoperative haemostasis tests can be considered.
- Nathalie (43) is in normal health. She is planned for varicose vein stripping. She complains about frequent nose bleeds, prolonged menstrual bleedings and bruises. Preoperative hemostasis tests will certainly need to be considered.
- Jos (72j) takes anticoagulant medication for chronic atrial fibrillation. He has to undergo a resection of a skin injury. Preoperative haemostasis tests should be carried out in order to ascertain whether his anticoagulant medication is dosed correctly.



2.2.5. Urinalysis and urine culture

No evidence was found on the clinical benefit of urinalysis. In patients undergoing urogenital surgery, the prognostic evidence on the association between a positive preoperative urine culture and postoperative infections was conflicting.

In patients undergoing hip or knee arthroplasty, preoperative asymptomatic leucocyturia was not a predictive factor of early prosthetic joint infections, although asymptomatic bacteruria was. Preoperative antibiotic treatment of asymptomatic bacteriuria did not affect the occurrence of prosthetic joint infection.

Recommendations	Strength of Recommendation	Level of Evidence
Routine preoperative urinalysis and urine culture is not recommended before elective non-cardiothoracic surgery.	Strong	Very low
Preoperative urine culture can be considered in patients undergoing elective urinary tract or prosthetic joint surgery.	Weak	Very low

Patient information

Through a urinalysis, kidney, bladder and urinary tract diseases can be detected.

More specifically the following is examined:

- Blood in the urine (hematuria). This may occur in case of an infection of the kidney(s), bladder or urinary tract, but it may also be an indication of kidney or bladder cancer.
- Protein in the urine (proteinuria). This may be transient, e.g. caused by fever, infections, sports efforts, heart diseases or high blood pressure (hypertension). If the proteinuria persists, or if there are also red blood cells present in the urine, other causes are possible: kidney damage caused by diabetes or other (kidney) diseases.
- White blood cells (leucocyturie) in the urine can denote an infection of the urinary tract (kidney, bladder or prostate in men).
- Glucose in the urine (glucosuria)

In addition, a urine culture can be carried out, whereby urine is applied on a small dish in the laboratory. This dish is placed in an incubator (at 37 ° C), to cause a multiplication of the bacteria that are possibly present. In this way infections of the urinary tract can be detected.

Examples:

- Marc (57y) is a smoker and is planned for a transurethral resection of the prostate (TURP). A preoperative urinalysis can be considered.
- Michel (51y) has an alcoholic liver disease and is planned for a total knee replacement. A preoperative urinalysis can also be considered.
- Eric (55y) has well-controlled hypertension and is planned for a left hemicolectomy. A preoperative urinalysis is not indicated.



2.2.6. Non-invasive cardiac stress imaging

2.2.6.1. Stress echocardiography

Since the available evidence is of very low quality, a firm conclusion about the effect of preoperative dobutamine stress echocardiography on postoperative outcome cannot be drawn.

The available prognostic studies reported a wide range of estimates of prognostic accuracy, rendering a conclusion very difficult.

Patient information

For a stress echocardiography, the patient's heart has to beat faster, to make the heart muscle use more oxygen. Therefore, a patient is asked to do physical exercise (walking, cycling) or is given a special medication (dobutamine, dipyridamole). If the blood vessels of the heart are narrowed, there is a shortage of oxygen with a reduced contraction of the heart muscle as a result, which can be detected by the ultrasound. In this way, abnormalities of the heart valve and ischemia (inadequate blood flow) can be diagnosed.

2.2.6.2. Myocardial scintigraphy

There is no evidence for the clinical benefit of preoperative myocardial scintigraphy. Meta-analysis suggests that the prognostic value is inferior to those of a stress echocardiography (see above), but the quality of the evidence is low.

Patient information

A slightly radioactive "tracer" is injected into the bloodstream. When this substance enters the heart muscle, its radiation is picked up by the scanner, so that an image of the blood flow into the heart is shown. In this way the blood flow into the heart at rest and after a physical exercise (or after the administration of medication that mimics certain effects of a strain on the heart) can be compared.

Recommendations	Strength of Recommendation	Level of Evidence
Non-invasive stress imaging can be considered for patients at elevated risk* with a poor functional capacity§ before elective non-cardiothoracic surgery, if this would change clinical management.	Weak	Very low
Routine noninvasive stress imaging is not recommended before elective low-risk non-cardiothoracic surgery, regardless of the patient's clinical risk.	Strong	Very low

* Clinical risk factors according to revised cardiac risk index: ischaemic heart disease (angina pectoris and/or previous myocardial infarction), heart failure, stroke or transient ischaemic attack, renal dysfunction (serum creatinine $>170 \mu\text{mol/L}$ or 2 mg/dL or a creatinine clearance of $<60 \text{ mL/min/1.73 m}^2$), diabetes mellitus requiring insulin therapy. {Kristensen, 2014 #150}

§ Poor functional capacity is defined as < 4 metabolic equivalents (METs), i.e. the inability to climb two flights of stairs or run a short distance (100 m on level ground at 3-5 km/h). {Kristensen, 2014 #150}

**Examples:**

- Martine is 54 years old and in perfect health. She is planned for a thyroidectomy because of a multinodular goitre with tracheal compression. Preoperative non-invasive stress imaging is not indicated.
- Luc (61y) has well-controlled type 2 diabetes treated with insulin. He is planned for an inguinal hernia repair. He walks daily for one hour. Preoperative non-invasive stress imaging is not indicated.
- Two years ago, Frans (61y) had a myocardial infarction. Now he is planned for a knee arthroscopy. During the preoperative clinical assessment he complains about worsening dyspnoea and peripheral oedema. He is unable to climb stairs. Preoperative non-invasive stress imaging can be considered.

2.3. Preoperative tests that are not routinely recommended

2.3.1. *Resting echocardiography*

Evidence of very low quality suggests that a routine resting echocardiography has no clinical benefit.

Recommendations	Strength of Recommendation	Level of Evidence
• Resting echocardiography is not routinely recommended before elective non-cardiothoracic surgery.	Strong	Very low

Patient information

A resting echocardiography makes live images of the heart using ultrasound. The test is similar to the ultrasound on a pregnant woman, to examine the unborn child.

Examples:

- Michel is 68 years old. He has an implanted pacemaker and has no symptoms of heart failure. He is planned for a total hip replacement. A preoperative resting echocardiography is not indicated.
- Two years ago, Frans (61y) had a myocardial infarction. Now he is planned for a knee arthroscopy. During the preoperative clinical assessment he complains about worsening dyspnoea and peripheral oedema. A resting echocardiography is indicated, not as a routine preoperative test, but as part of the diagnostic work-up of heart failure.



2.3.2. Cardiopulmonary exercise testing

The clinical benefit of CPET in patients undergoing Abdominal Aortic Aneurysm (AAA) surgery is unclear, because the only retrieved study showed a decrease in length of inpatient stay, but inconsistent results for 30-day mortality when different surgical techniques were considered.

Based on the available evidence, the prognostic value of CPET is unclear because conflicting results were found for mortality, survival, and cardiovascular and pulmonary complications. Heterogeneity was also noticed according to the type of elective surgery.

Recommendations	Strength of Recommendation	Level of Evidence
Routine cardiopulmonary exercise testing is not recommended before elective non-cardiothoracic surgery.	Strong	Very low

Patient information

Cardiopulmonary exercise testing (CPET) is used to assess the patient's functional capacity and the tolerance to physiological stress.

The patient needs to cycle on an exercise bike or walk on a treadmill. During this physical exercise, his heart rate, respiration, blood pressure and electrical activity in the heart are measured.

Example:

- Sofie is 52 years old and has severe COPD. She is planned for a total abdominal hysterectomy. Preoperative cardiopulmonary exercise testing is not indicated.

2.3.3. Chest X-ray

Since chest X-ray involves exposure to harmful radiation, it is doubtful that routinely performing this test offers more advantages than disadvantages, especially in patients who have no specific complaints. Furthermore, there is no evidence that a chest X-ray before surgery has a positive impact on clinical outcomes. Chest X-ray findings are also poor predictors of postoperative complications.

Recommendations	Strength of Recommendation	Level of Evidence
Chest X-ray before elective non-cardiothoracic surgery without clinical indication is not recommended.	Strong	Low

Patient information

A chest X-ray can detect diseases of the lungs, pleura, heart, major vasculature, mediastinum, chest wall and diaphragm. However, the patient is exposed to harmful radiation. Chronic obstructive pulmonary disease (COPD), heart failure, tuberculosis and lung cancers are frequently detected by this test.

Examples:

- Sofie (52y) suffers from severe COPD. She is planned for a total abdominal hysterectomy. A preoperative chest X-ray may be indicated, but only for clinical reasons (monitoring of her COPD).
- Marc is 57 years old. He is a smoker and is planned for a transurethral resection of the prostate. He has no cardiopulmonary symptoms. A preoperative chest X-ray is not indicated.



2.3.4. Polysomnography

The clinical benefit and prognostic value of a preoperative polysomnography are not demonstrated.

Recommendations	Strength of Recommendation	Level of Evidence
Polysomnography before elective non-cardiothoracic surgery, including bariatric surgery, is not routinely recommended.	Strong	Very low

Patient information

A polysomnography is used to detect obstructive sleep apnoea (OSA) and other sleeping disorders. The test is conducted in a hospital setting. While the patient sleeps, the pulse oximetry (level of oxygen in the blood), respiration and the electrical activity in the brain (EEG), in the heart (ECG), in the eyes (EOG) and in the muscles (EMG) are measured. The test is non-invasive and safe. The only complication is skin irritation from the electrodes that are stuck onto the body.

Example:

- Alain is 45-years old and has a BMI of 42 kg/m² and symptoms of obstructive sleep apnoea. To lose weight, he is planned for a laparoscopic gastric bypass. Since he has symptoms of a sleeping disorder, a polysomnography is indicated on clinical grounds, but the test does not need to be carried out before the operation.

2.3.5. Lung function tests (including arterial blood gas analysis)

There is no evidence on the effect of lung function tests on the clinical outcome. The evidence on the prognostic value is limited and inconsistent.

Recommendations	Strength of Recommendation	Level of Evidence
Lung function tests (including arterial blood gas analysis) are not routinely recommended before elective non-cardiothoracic surgery.	Strong	Very low

Patient information

During the *pulmonary function tests* the patient breathes through a mouthpiece in the lung function device, while the nose is held closed with a clamp. The test measures the volume, the capacity, the air flows, the gas exchange of the lungs, etc. With the test, respiratory diseases can be detected and monitored.

A *blood gas analysis* measures i.a. the amount of oxygen in the blood. The results of the test provide information on the functioning of the lungs.

Example:

- Marc is 57-years old and a smoker. He is planned for a transurethral resection of the prostate (TURP). He has no cardiopulmonary symptoms. Preoperative lung function tests are not indicated.



2.3.6. Glycated haemoglobin test (HbA1c)

2.3.6.1. People with diabetes

There is no evidence on the effect of a preoperative HbA1c on the clinical outcome of patients with diabetes. There is inconsistent evidence on the prognostic value of HbA1c.

Recommendations	Strength of Recommendation	Level of Evidence
People with diabetes who are being referred by primary care for elective non-cardiothoracic surgery should have their most recent HbA1c test results included in their referral information.	Weak	Low
HbA1c testing is recommended in people with diabetes having elective non-cardiothoracic surgery if they have not been tested in the last 3 months.	Weak	Low

Example:

- Christiane (71y) recently had a myocardial infarction (<3 months) and she has a well-controlled diabetes. She is now planned for a mastectomy. HbA1c was tested during the hospitalisation for her myocardial infarction. Preoperative HbA1c testing is therefore not indicated.

2.3.6.2. People without diabetes

There is no evidence on the effect of HbA1c on the clinical outcome of patients without diabetes. On the prognostic value of HbA1c there is only limited evidence.

Recommendations	Strength of Recommendation	Level of Evidence
HbA1c testing is not recommended before elective non-cardiothoracic surgery in people without diabetes.	Strong	Low

Patient information

The glycated haemoglobin (HbA1c) test is a blood test to detect diabetes mellitus and to check to which extent the disease is under control in patients with diabetes.

Example:

- Nicole (71y) has a well-controlled hypertension. Recently (<3 months), she had a myocardial infarction. Now she is planned for a mastectomy. She does not have a history of diabetes. Preoperative HbA1c testing is not indicated.



2.3.7. Liver function tests

There is insufficient evidence to recommend the routine use of preoperative liver tests in asymptomatic patients.

Recommendations	Strength of Recommendation	Level of Evidence
Routine preoperative liver function testing without clinical indication is not recommended before elective non-cardiothoracic surgery.	Strong	Very low

Patient information

The number of liver enzymes, proteins, and bilirubin (bile pigments) are measured in the blood.

Examples

- Nathalie, 43 years old, is in normal health and is planned for varicose vein stripping. Preoperative liver function testing is not indicated.
- Christiane, a 71-year old woman with a recent myocardial infarction (<3 months) and well-controlled diabetes, is planned for a mastectomy. A preoperative liver function test is not indicated.
- Jean-Pierre (65y) is planned for resection of a solitary colorectal liver metastasis. Preoperative liver function tests may be indicated, but only for technical (surgical) reasons.

2.3.8. Coronary CT angiography

There is no evidence on the clinical benefit of coronary CT in patients undergoing elective non-cardiothoracic surgery, whereas the patient is exposed to harmful radiation. The evidence on the prognostic value of coronary CT is limited.

Recommendations	Strength of Recommendation	Level of Evidence
Preoperative coronary CT is not routinely recommended in patients undergoing elective non-cardiothoracic surgery.	Strong	Very low

Patient information

A coronary CT angiography is performed in order to detect possible narrowings of coronary arteries. A contrast fluid is injected into the blood stream. The CT scanner then makes computer images of the coronary arteries, the surrounding structures, the heart valves and the heart muscle.

Example:

- Christiane is 71 years old and has well-controlled diabetes. Recently she had a myocardial infarction (<3 months) and now she is planned for a mastectomy. Preoperative coronary CT is not indicated



3. IMPLEMENTATION AND UPDATING OF THE GUIDELINE

3.1. Implementation

3.1.1. *Barriers and facilitators for the implementation of this guideline*

During the stakeholders meeting (for participants, see colophon), the potential barriers and facilitators were discussed. Clinical inertia is probably the most important barrier for the implementation. For many years, a large battery of lab tests, ECG and chest X-ray were the minimum for a preoperative assessment, and many practitioners still adhere to these habits. Unavailability of tests and/or expertise was not considered to be a barrier, since all recommended tests are available in all Belgian hospitals.

More information on the identification of barriers and facilitators in the implementation of guidelines can be found in KCE-report 212 (2013)^e.

3.1.2. *Who will implement this guideline?*

To facilitate and encourage the implementation of this guideline, a free web app was developed. The app can be used on most current systems (iOS, Android, Windows). Also patients can consult the app and verify whether the recommended tests are offered to them. In addition, this guideline should be disseminated by scientific and professional organisations, through their website or continuous education (LOK/GLEM).

3.2. Monitoring the quality of care

This guideline should be considered as a starting point to develop quality improvement programs that target all caregivers concerned.

It can thus be used as a tool to increase caregivers' awareness and to improve their practice, or for the development (or revision) of sets of process and outcome indicators. The NRKP/CNPQ can again seize the publication of this guideline to provide feedback to every Belgian hospital on its use of preoperative tests.

3.3. Guideline update

In view of the rapidly evolving evidence, this guideline should be updated every 5 years. If, in the meantime, important new evidence should become available, this also has to be taken into consideration.

Therefore, the KCE processes foresee that the relevance of an update will be assessed annually by the authors for each published guideline. Their decisions are made on the basis of new scientific publications on a specific topic (e.g. Cochrane reviews, RCTs on medications or interventions). Potential interest for groups of health practitioners is also considered in this process.

Based on these criteria a decision is taken on whether to (partially) update a guideline or not, to ensure that our recommendations stay in line with the latest scientific developments.

^e <https://kce.fgov.be/publication/report/dissemination-and-implementation-of-clinical-practice-guidelines-in-belgium>



■ RECOMMENDATIONS^f

To EBMPPracticeNet

- In addition to the traditional dissemination of this guideline through the EBMPPracticeNet platform, a link to the accompanying app should be provided.

To the National Council for Quality Promotion (NRKP/CNPQ)

- Based on the recommendations in this guideline, the National Council for Quality Promotion can again provide feedback to the Belgian hospitals about their use of preoperative tests.

To the professional associations of the concerned caregivers

- This guideline should be disseminated through various channels, such as websites or programs for continuing education.

^f The KCE has sole responsibility for the recommendations.



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COLOPHON

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Other possible interests that could lead to a potential or actual conflict of interest: Ian Smith (As a contributor to the NICE guidelines, obviously passionate about their recommendations)

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- **The external experts were consulted about a (preliminary) version of the scientific report. Their comments were discussed during meetings. They did not co-author the scientific report and did not necessarily agree with its content.**
- **Subsequently, a (final) version was submitted to the validators. The validation of the report results from a consensus or a voting process between the validators. The validators did not co-author the scientific report and did not necessarily all three agree with its content.**
- **Finally, this report has been approved by common assent by the Executive Board.**
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