2022 ESC Guidelines for CV Assessment of Noncardiac Surgery: Key Points

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This is a summary of new recommendations and expanded topics within the 2022 European Society of Cardiology (ESC) guidelines on cardiovascular (CV) assessment and management of patients undergoing noncardiac surgery (NCS). The following are key points to remember:

Perioperative CV complications dramatically impact overall postoperative prognosis of patients undergoing NCS. Risk is influenced by a) presence and optimization of patient-specific comorbidities, b) complexity of the planned surgical procedure, and c) the clinical urgency of surgery.

1. Patient-specific risk factors should be identified and optimized during preoperative evaluation as time permits.
2. Stratification of surgical risk as low, intermediate, or high along with patient-specific CV risk factors collectively inform the approach to CV testing.
3. When high-risk surgery is planned in patients with high CV risk, less invasive surgical techniques should be considered.

The following is an outline of new sections contained within the ESC guidelines:

Flowchart for general patient assessment before NCS:

1. If NCS is time-sensitive, individualized multidisciplinary decision-making should determine the risk/benefit of cardiac testing and optimization efforts versus going to surgery without delay.
2. If planned NCS is neither emergent nor time-sensitive, the following should be provided to all patients (Class I): a) An accurate history and physical exam, b) standard lab testing, c) smoking cessation counseling, and d) guideline-supported medical optimization.
3. Patients and surgical procedures should be stratified into one of three categories, with the following recommended assessments:
    - <65 years of age, with no CV risk factors:
        - No cardiac testing is recommended before low-risk or intermediate-risk NCS.
        - Electrocardiogram (ECG) and biomarkers are recommended only for high-risk NCS, if age ≥45 (Class IIa).
        - ECG plus transthoracic echocardiography (TTE) are recommended with family history of genetic cardiomyopathy (Class I).
    - ≥65 years of age, or with CV risk factors:
        - No cardiac testing is recommended before low-risk surgery.
        - ECG and biomarkers are recommended for intermediate- and high-risk NCS (Class I).
        - Functional capacity assessment is recommended for intermediate- and high-risk NCS (Class IIa).
    - Unspecified age, with established CV disease (CVD):
        - No cardiac testing is recommended before low-risk surgery.
        - ECG and biomarkers are recommended for intermediate- and high-risk NCS (Class I).
        - Functional capacity assessment is recommended for intermediate- and high-risk NCS (Class IIa).
        - Cardiology consultation plus multidisciplinary discussion are recommended in high-risk surgery.

Preoperative assessment in patients with newly detected conditions:

1. For newly detected murmurs:
    - TTE is recommended: a) if signs or symptoms of CVD are present, before

any NCS (Class I, Level of Evidence [LOE] C), and b) if the murmur suggests clinically significant pathology, before high-risk NCS (Class I, LOE C).
    - TTE may be considered if absent signs or symptoms of CVD, before intermediate-risk NCS (Class IIa, LOE C).
2. For newly detected dyspnea and/or peripheral edema:
    - ECG and natriuretic peptide measurement are recommended unless a non-CV explanation is certain (Class I, LOE C).
    - TTE is recommended before NCS if natriuretic peptic measurement is elevated (Class I, LOE C).
3. For newly detected chest pain suggestive of undetected coronary artery disease:
    - Further CV workup is recommended prior to elective NCS (Class I, LOE C).
    - Multidisciplinary assessment is recommended prior to urgent NCS (Class I, LOE C).
4. From the patient's perspective:
    - Clear, concise written and verbal pre- and postoperative medication instructions should be given to patients prior to NCS (Class I, LOE C).
    - A structured information list should be considered in patients with high CV risk prior to NCS (Class IIa, LOE C).
5. For frailty assessment:
    - Use of a validated frailty assessment tool prior to NCS is recommended in patients ≥70 years old undergoing intermediate- or high-risk surgery (Class IIa, LOE C).
6. For perioperative thromboprophylaxis, thromboprophylaxis decision-making:
    - Should be based on procedural and individual patient-related risk factors (Class I, LOE A).
    - Chosen method should be driven by patient factors and duration of immobility (Class I, LOE A).
    - Treatment may be 14-25 days after hip or knee arthroplasty, if bleeding risk is low (Class IIa, LOE A).
    - Nonvitamin K antagonist oral anticoagulants (NOACs) may be considered vs. low molecular weight heparin (LMWH) after hip or knee arthroplasty (Class IIb, LOE A).
7. For operative blood management:
    - Use of washed cell salvage is recommended for surgery in which anticipated blood loss exceeds 500 mL (Class I, LOE A).

- Use of point-of-care diagnostics is recommended to guide blood product management, when available (Class I, LOE A).
- Administration of tranexamic acid should be immediately considered in patients experiencing major surgical bleeding (Class IIa, LOE A).
- Closed loop blood sampling and application of meticulous hemostasis should be considered routinely (Class IIa, B).

8. In patients with heart failure (HF) undergoing NCS:
   - Regular assessment of volume status and organ perfusion adequacy are recommended (Class I).
   - For patients with HF receiving mechanical circulatory support, involvement of a multidisciplinary team including ventricular assist device (VAD) specialists is recommended (Class I).
9. For patients with valvular heart disease:
   - In severe aortic valve regurgitation (AVR), if left ventricular end-systolic dimension (LVESD) >50 mm, LVESD index >25 mm/m^2, or LV ejection fraction (LVEF) <50%, valve surgery is recommended prior to intermediate- or high-risk NCS (Class I).
   - In moderate-to-severe rheumatic mitral stenosis plus symptoms or systolic pulmonary artery pressure >50 mm Hg, valve intervention is recommended prior to intermediate- or high-risk surgery (Class I).
   - In asymptomatic patients with severe aortic stenosis planning elective NCS, aortic valve replacement (AVR: surgical AVR [SAVR] or transcatheter aortic valve implantation [TAVI]) should be considered before NCS after discussion with the Heart Team (Class IIa).
   - In patients with severe primary mitral regurgitation [MR] with LV dysfunction (LVESD ≥40 mm and/or LVEF <60%), valve intervention (surgical or transcatheter) should be considered before intermediate- or high-risk NCS if time permits (Class IIa).
   - In patients with severe secondary MR who remain symptomatic despite guideline-directed medical therapy (GDMT), including cardiac resynchronization therapy (CRT), valve intervention (surgical or transcatheter) should be considered before NCS (Class IIa).
   - In patients with severe, symptomatic aortic stenosis needing time-sensitive NCS and/or in whom valve treatment (SAVR or TAVI) is unfeasible, bicuspid aortic valve may be considered before NCS as a bridge to definitive aortic valve repair (Class IIb).
10. For patients with arrhythmia:

- In patients with atrial fibrillation plus acutely deteriorating hemodynamic stability undergoing NCS, emergent electrical cardioversion is recommended (Class I).
- In patients with symptomatic, sustained monomorphic ventricular tachycardia (VT) from myocardial scar, recurring despite antiarrhythmic therapy, arrhythmia ablation before elective NCS is recommended (Class I).
- In patients with cardiac implantable electronic devices (CIEDs) undergoing reprogramming prior to surgery, recheck and reinstatement of prior function immediately after surgery are recommended (Class I).
- If indications for pacing are present according to ESC guidelines on pacing and resynchronization therapy, NCS should be deferred and permanent CIED implantation should be considered (Class IIa).
- In symptomatic patients with recurrent or persistent supraventricular VT despite medical therapy needing high-risk, nonurgent NCS, ablation should be considered (Class IIa).
- In patients with implantable cardioverter-defibrillators or pacing dependency undergoing NCS above the umbilicus, preoperative CIED evaluation and possible reprogramming should be considered immediately prior to surgery (Class IIa).

Revised, expanded sections in the ESC Guidelines are listed below:

1. Perioperative use of biomarkers in NCS:
   - High-sensitivity cardiac troponin T (hs-cTnT) or hs-cTnI before and 24 + 48 hours after intermediate- or high-risk NCS should be measured in patients with known CVD or CV risk factors including age ≥65 years (Class I, LOE B).
   - B-type natriuretic peptide (BNP) or NT-proBNP before intermediate- or high-risk NCS should be measured in patients with known CVD or CV risk factors including age ≥65 years (Class IIa, LOE B).
   - Routine biomarker measurement, before or after NCS is not recommended in low-risk patients undergoing low- or intermediate-risk NCS (Class III, LOE B).
2. Perioperative antiplatelet medication management:
   - Elective NCS after elective percutaneous coronary intervention (PCI) or acute coronary syndrome (ACS) should be delayed 6 months after elective PCI and 12 months after ACS (Class I, LOE A).
   - Time-sensitive NCS after elective PCI should be delayed until a minimum of 1 month of dual antiplatelet therapy (DAPT) has been given (Class I, Level of

Evidence B).
- For NCS patients who have undergone recent PCI, perioperative antiplatelet management should be discussed between the cardiologist, surgeon, and anesthesiologist (Class I, LOE C).
- For patients receiving recent PCI treatment for ACS, who require time-sensitive NCS, uninterrupted DAPT for at least 3 months should be considered (Class IIa, LOE C).
- Time interval for P2Y12 inhibitor discontinuation, if necessary for surgery should be 3-5 days for ticagrelor, 5 days for clopidogrel, and 7 days for prasugrel (Class I, LOE B).
- Time interval for discontinuation of aspirin should be 7 days in planned high bleeding risk procedures (intracranial, spinal surgery) (Class I, LOE C).
- In patients taking aspirin without any prior history of PCI, aspirin can be discontinued at least 3 days if bleeding risk outweighs ischemic risk (Class IIb, LOE B).
- In patients whose antiplatelet medication was interrupted prior to surgery, the medication should be restarted within 48 hours, or as soon as it is safe to do so from the standpoint of surgical hemostasis (Class I, LOE C).

3. Perioperative oral anticoagulant (OAC) management:
   - If urgent surgery is needed, NOAC medications should be immediately interrupted (Class I, LOE C).
   - For patients taking dabigatran needing urgent intermediate or high bleeding risk surgery, idarucizumab should be considered (Class IIa, LOE B).
   - For NOAC interruption prior to nonminor bleeding risk surgery, timing of interruption should depend on the specific drug compound, drug half-life, the patient's renal function, and estimated bleeding risk of the planned surgery (Class I, LOE B).
   - For high bleeding risk procedures including spinal or epidural anesthesia, NOAC should be interrupted for 5 drug half-lives, and resumed no less than 24 hours after completion of the procedure and/or removal of epidural catheter (Class IIa, LOE C).
   - If specific NOAC reversal agents are not available prior to urgent surgery, Prothrombin complex concentrate (PCC) or activated PCC can be considered to reverse the NOAC effect (Class IIa, LOE C).
   - If urgent surgery is needed, specific NOAC plasma levels or coagulation studies may be considered (Class IIa, LOE C).
   - If planned surgery involves minor bleeding risk that can be easily controlled,

performing surgery without OAC interruption is recommended (Class I, LOE B).
- For patients with mechanical heart valves and high surgical risk, LMWH is recommended for bridging as an alternative to IV unfractionated heparin (Class I, LOE B).
- For patients using NOACs, performance of surgery at trough levels (12- to 24-hour interruption) is recommended for procedures involving minor bleeding risk (Class I, LOE C).
- Bridging anticoagulation with unfractionated heparin or LWMH for patients with mechanical heart valves taking OAC should be considered for a) AVR with any thrombotic risk factor, b) old-generation AVR, or c) mechanical mitral valve or tricuspid valve replacement (Class IIa, LOE C).
- For patients undergoing NCS with low/moderate thrombotic risk, bridging AC is not recommended (Class III, LOE B).
- If resumption of full-dose anticoagulation in the postoperative period imposes bleeding risk that outweighs the risk of thromboembolic events, resumption of full anticoagulation after 48-72 hours may be considered, with interim thromboprophylaxis until full anticoagulation is felt to be safe (Class IIb, LOE C).
- To attenuate risk of postoperative bleeding, use of reduced-dose NOAC is not recommended (Class III, LOE C).

Other topics addressed for the first time in the ESC 2022 guideline document:

1. CV risk in patients with cancer undergoing NCS:
   - Special attention to the cancer patient population is warranted due to increased prevalence of comorbidities related to cancer and cancer treatment. There is an increased risk of thrombosis due to malignancy, and cardiotoxic neoadjuvant chemotherapy (anthracycline, trastuzumab, and immune checkpoint inhibitor medications) and chest radiation treatment impose increased CV risk.
2. NCS in patients with COVID-19 infection:
   - Registry data show an increase in morbidity and mortality if NCS takes place <7 weeks from the time of COVID-19 diagnosis. However, these data were collected from unvaccinated patients, and the relationship to recent COVID-19 diagnosis and postoperative outcome among vaccinated patients is currently uncertain. Persistent symptoms of dyspnea, chest pain, or fatigue are cited as factors increasing risk of postoperative mortality,

regardless of timing or relationship to COVID-19 infection.

Clinical Topics: Acute Coronary Syndromes, Anticoagulation Management, Arrhythmias and Clinical EP, Cardiac Surgery, Cardio-Oncology, Cardiovascular Care Team, COVID-19 Hub, Heart Failure and Cardiomyopathies, Invasive Cardiovascular Angiography and Intervention, Noninvasive Imaging, Prevention, Valvular Heart Disease, ACS and Cardiac Biomarkers, Anticoagulation Management and ACS, Implantable Devices, SCD/Ventricular Arrhythmias, Atrial Fibrillation/Supraventricular Arrhythmias, Aortic Surgery, Cardiac Surgery and Arrhythmias, Cardiac Surgery and Heart Failure, Cardiac Surgery and VHD, Acute Heart Failure, Heart Failure and Cardiac Biomarkers, Interventions and ACS, Interventions and Imaging, Interventions and Structural Heart Disease, Mitral Regurgitation

Keywords: *Acute Coronary Syndrome, Anticoagulants, Arrhythmias, Cardiac, Arthroplasty, Aspirin, Biomarkers, Cardiac Surgical Procedures, Cardiotoxicity, Catheter Ablation, Chest Pain, COVID-19, Defibrillators, Implantable, Diagnostic Imaging, Diagnostic Tests, Routine, Dyspnea, Electrocardiography, ESC22, ESC Congress, Frailty, General Surgery, Heart Failure, Heart Valve Diseases, Hemorrhage, Hemostasis, Heparin, Mitral Valve Insufficiency, Natriuretic Peptide, Brain, Neoplasms, Pacemaker, Artificial, Percutaneous Coronary Intervention, Perioperative Care, Physical Examination, Platelet Aggregation Inhibitors, Risk Assessment, Secondary Prevention, Tachycardia, Ventricular*