# Preoperative Cardiac Evaluation of Adult Patients Undergoing Noncardiac Surgery in Nepal: Multidisciplinary Consensus Recommendations from a Modified Delphi Study

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#### Abstract

**Background:** Cardiac complications remain a major cause of perioperative morbidity and mortality globally among patients undergoing noncardiac surgery. In Nepal, implementing international guidelines is challenging due to resource constraints, workforce variability, and a high burden of rheumatic heart disease, early-onset coronary artery disease and chronic obstructive pulmonary diseases.

**Objective:** To develop standardized, evidence-based recommendations for preoperative cardiac evaluation for adult patients undergoing noncardiac surgeries focussed on Nepalese context.

Methods: Cardiac Society of Nepal coordinated a three-round modified Delphi process amongst cardiologists, anesthesiologists, and surgeons from healthcare institutions across Nepal. The AGREE II framework guided guideline development, and DELPHISTAR standards ensured transparent reporting. Consensus was defined as ≥70% "Strongly Agree" or ≥80% "Strongly Agree + Agree".

**Results:** Consensus was achieved on 26 key recommendations covering screening, risk stratification, prehabilitation, surgical and institutional considerations. These recommendations adapt international best practices to Nepal's specific challenges, prioritizing low cost tests like ECG, selective use of echocardiography and biomarkers, and addressing modifiable risk factors preoperatively.

**Conclusion:** This multidisciplinary consensus provides a context-appropriate, pragmatic framework for preoperative cardiac evaluation in Nepal. It aims to improve perioperative outcomes, support coordinated perioperative care, and guide national perioperative quality standards and future research.

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#### 1. Introduction

#### 1.1 Background

Preoperative cardiac evaluation plays a critical role in reducing perioperative cardiac morbidity and mortality in noncardiac surgery. In Nepal, the burden of Rheumatic heart disease (RHD), Chronic obstructive pulmonary disease (COPD), and coronary artery disease (CAD) necessitates contextualised approaches.

# 1.2 Rationale: Why a Nepal-Specific Consensus Is Needed

Challenges in Applying Global Guidelines in Nepal

#### 1. Population Differences

*Epidemiologic Profile:* Many global guidelines are based on data from Western populations in which CAD predominates. Nepal faces a high burden of RHD<sup>1,2</sup> and a tendency toward earlier-onset CAD<sup>3,4</sup>, shifting both baseline risk and clinical presentation.

**Demographic and Genetic Variability:** Age distribution, genetic predispositions, environmental exposures, and lifestyle factors<sup>5,6</sup> (e.g., biomass fuel exposure and COPD, high-altitude living, diet, and physical activity patterns) differ in Nepal and may alter the risk profile for perioperative cardiac events and the predictive value of standard tools.

#### 2. Resource Constraints and Infrastructure

*Diagnostic Limitations:* Global guidelines often assume readily available advanced diagnostics (e.g., CT coronary angiography, nuclear perfusion imaging, comprehensive CPET). Such modalities are not uniformly accessible in Nepal, necessitating selective, context-appropriate testing pathways.

*Trained Personnel and Equipment:* Variability in the availability of trained personnel (e.g., cardiac anesthesiologists, echocardiography technicians) and critical equipment affects the feasibility of implementing complex evaluation pathways, particularly outside major urban centers.

# 3. Health System and Economic Factors

Cost and Access: Recommendations built for highincome settings may implicitly assume higher healthcare spending and robust insurance coverage. Out-of-pocket costs and variable reimbursement in Nepal influence test selection, pathway adherence, and equity of access.

Healthcare Delivery Models: Nepal's fragmented and rural dominant health-care system contrasts with the integrated perioperative pathways common in high-income countries. Referral logistics, interfacility coordination, and perioperative follow-up can be challenging, requiring simpler, high-yield protocols.

#### 4. Evidence Base and Local Validation

Lack of Local Data: There are very few published Nepalspecific studies on preoperative cardiac risk evaluation for noncardiac surgery, limiting direct validation of international tools and thresholds (e.g., Metabolic Equivalent of Task cutoffs, biomarker triggers) in our population. Cultural and Social Factors: Patient beliefs, health literacy, and doctor-patient dynamics can influence symptom reporting, timing of presentation, and adherence to recommendations (e.g., smoking cessation, prehabilitation), warranting patient centric counseling strategies and checklists.

Therefore, locally adapted, resource-informed, feasible, usable, and practical recommendations are needed to improve health outcomes in Nepal.

# 1.3 Objective

To provide standardized, Nepal-specific recommendations for cardiac risk assessment in adults undergoing noncardiac surgery.

#### 1.4 Scope

Included: Cardiac risk evaluation, screening criteria, risk stratification tools, prehabilitation measures, surgical and institutional considerations.

Out of Scope: Detailed medication management, intra/post-operative management strategies, and disease-specific perioperative protocols.

# 2. Methodology

# 2.1 Consensus Process

A three-round modified Delphi process was conducted under the leadership of the Cardiac Society of Nepal, in collaboration with the Society of Anesthesiologists of Nepal and the Society of Surgeons of Nepal. The methodology followed the AGREE II framework for guideline development and DelphiStar standards for transparent reporting.

# 2.2 Expert Panel & Participation Requirements

The consensus initiative originated from the Executive Committee of the Cardiac Society of Nepal (2023–2025), which appointed AS (Anesthesiologist) as Chairperson of the Consensus Committee. AS nominated SBP as the process coordinator.

In collaboration with the Society of Anesthesiologists of Nepal and the Society of Surgeons of Nepal, a multidisciplinary consensus document writing committee of 13 senior clinicians was formed. Members included cardiologists, anesthesiologists, and surgeons, each with  $\geq 5$  years of perioperative cardiac or surgical care experience.

All participants were required to:

- Declare any conflicts of interest (COI) prior to participation and again at the start of each Delphi round.
- Commit to full participation in all three Delphi rounds and the final in-person consensus meeting.

# 2.3 Authorship Criteria

Panel members who completed all rounds, participated in the final meeting, and fulfilled COI declarations were listed as coauthors in the final publication. Participants who did not meet these requirements were acknowledged in the Acknowledgements section.

# 2.4 Rounds

 Round 1: Panelists provided open-ended input to identify key evaluation areas for consensus building.

- Round 2: Based on Round 1 responses, 53 draft statements were developed and rated on a 5-point Likert scale ("Strongly Disagree" to "Strongly Agree").
- Round 3: Following analysis of Round 2 feedback,
   10 surgical and institutional considerations were generated and re-rated for consensus.
- During the refinement process, overlapping statements were merged and language was standardized for clarity, resulting in a streamlined and nonredundant set of recommendations.
- Finalization: An in-person meeting with the expert panel reviewed all consensus statements, and a total of 26 final recommendations were endorsed.

Table 1. Evolution of Statements Through the Delphi Consensus Process

Delphi Round	State- ments Dissemi- nated	State- ments Revised/ Merged	State- ments Carried Forward	Final
Round 1 (open-ended)	-	-	53 draft statements	-
Round 2 (rating)	53	30	23	-
Round 3 (surgical/institutional)	10	4	6	-
Final meeting	-	-	-	26

# Consensus Criteria

- Strongly Recommended: ≥70% "Strongly Agree"
- Recommended: if "Strongly Agree" is <70% but ≥80% "Strongly Agree" + "Agree"

All communications, voting, and data analysis were facilitated via **DelphiStar**, and final recommendations were refined in accordance with **AGREE II** domains.

# 3. Recommendations

# 3.1 Preoperative Screening

# **Strongly Recommended**

- Electrocardiogram (ECG) for all intermediate/high-risk surgeries (78.6% strongly agree)
- Echocardiography for symptomatic or active cardiac conditions (unstable coronary syndromes, decompensated heart failure, significant arrhythmia, severe valvular disease) (78.6%), and in patients with abnormal ECG findings (final in-person meeting)
- Echocardiography for high-risk surgeries (e.g., vascular, major abdominal) with multiple risk factors [Revised Cardiac Risk Index (RCRI) ≥3) (78.6%)
- NT-proBNP +- troponin for intermediate/high-risk surgeries with poor functional capacity [<4 Metabolic Equivalents of Task (METs)] (78.6%)

#### Recommended

- Cardiac evaluation if age ≥65 years (92.9%)
- Cardiac evaluation if age 45–64 years with one or more conventional cardiovascular risk factors (92.9%)
- Cardiac evaluation in patients with family history of premature cardiovascular disease or inherited conditions (92.9%)
- Cardiac evaluation in patients with symptoms (chest pain, dyspnea, palpitations) (85.7–100%)
- Cardiac evaluation in patients with stable cardiac conditions (e.g. CAD, RHD, heart failure) and systemic diseases (e.g. diabetes, Chronic Kidney Disease, COPD, hypertension) (92.9–100%)
- Exercise Stress Test for patients able to do so and in patients suspected of myocardial ischemia (85.7%), for those who cannot exercise, the committee recommended pharmacological stress test (final in-person meeting)
- NT-proBNP for heart failure symptoms in intermediate/ high-risk surgery (85.7%)

# 3.2 Risk Stratification

# **Strongly Recommended**

 Use of validated indices adapted for Nepal. Commonly used indices are American Society of Anesthesiologists Physical Status (ASA-PS), RCRI and in some special cases American College of Surgeons NSQIP Surgical risk assessment calculator have been reported in Nepal. (75 %)

#### Recommended

- ASA PS classification for all; additional tools for ASA PS ≥3 (85.7%).
- Frailty (>65 years) assessment to guide risk discussions (85.7%).
- Coronary angiography in patients with suspected acute coronary syndrome (91.7%).

#### 3.3 Prehabilitation

# **Strongly Recommended**

- Address modifiable risk factors (anemia, frailty, smoking, malnutrition) 4–6 weeks pre-op (78.6%).
- Screen and optimize anemia 4–6 weeks pre-op (100%).

#### Recommended

- Smoking cessation 4–6 weeks pre-op (92.9%).
- Screen for malnutrition (e.g., Nutritional Risk Screening-2002)<sup>7</sup> (85.7%).
- Psychological counseling for stressors or when treating physicians feel necessary (85.7%)

# **3.4 Surgical and Institutional Considerations** Strongly Recommended

- Post-op ICU monitoring for cardiac moderate/high-risk patients (83.3%).
- Invasive hemodynamic monitoring in OT for cardiac/ surgical high risk patients (83.3%).
- Access to interventional cardiology and/or cardiac surgery services in cardiac high risk patients (75.0%).

#### Recommended

 Prefer minimally invasive surgery to reduce hemodynamic stress (91.7%).

- Open surgery for EF <30% or severe diastolic dysfunction if laparoscopy risk is high (91.7%).
- Availability of onsite or on-call cardiologist for cardiac high and intermediate risk patients (91.7%).

# 3.5 Areas Without Consensus

Though we discussed, however, a consensus were not reached for following interventions:

- Routine CT coronary angiography (66.7% agreement).
- Troponin measurement timing
- Short-term smoking cessation (<1 week) protocols.

Table 2 Consensus Recommendations

Table 2 Consensus Recommendations						
Section	Recommendation	Consensus Category	% Agreement			
Preoperative Screening	ECG for all intermediate/high-risk surgeries	Strongly Recommended	78.6% strongly agree			
	Echocardiography for symptomatic or active cardiac conditions (unstable coronary syndromes, decompensated heart failure, significant arrhythmia, severe valvular disease) and in patients with abnormal ECG findings	Strongly Recommended	78.6% strongly agree			
	Echocardiography for high-stress surgeries (e.g., vascular) with multiple risk factors (RCRI ≥3)	Strongly Recommended	78.6% strongly agree			
	NT-proBNP and troponin for intermediate/high-risk surgeries with poor functional capacity (<4 METs)	Strongly Recommended	78.6% strongly agree			
	Cardiac evaluation ≥65 years	Recommended	92.9% agree/strongly agree			
	Cardiac evaluation 45–64 years with risk factors (smoking, obesity)	Recommended	92.9% agree/strongly agree			
	Cardiac evaluation for family history of premature cardiovascular disease or inherited conditions	Recommended	92.9% agree/strongly agree			
	Cardiac evaluation for symptoms (chest pain, dyspnea, palpitations) and poor functional capacity	Recommended	85.7–100% agree/ strongly agree			
	Cardiac evaluation for stable cardiac conditions (CAD, HF) and systemic diseases (diabetes, CKD, COPD, severe HTN)	Recommended	92.9–100% agree/ strongly agree			
	Exercise Stress Test for patients with exercise capacity and suspected ischemia, for those who cannot exercise, the committee recommended pharmacological stress test	Recommended	85.7% agree/strongly agree			
	NT-proBNP for heart failure symptoms in intermediate/high-risk surgery	Recommended	85.7% agree/strongly agree			

Risk Stratification	Use of validated indices adapted for Nepal (ASAPS, RCRI, NSQIP surgical risk calculator	Strongly Recommended	≥70% strongly agree
	ASA PS classification for all; additional tools for ASA≥3	Recommended	85.7% agree/strongly agree
	Frailty assessment (>65 years) to guide risk discussions	Recommended	85.7% agree/strongly agree
	Coronary angiography for suspected Acute coronary syndrome	Recommended	91.7% agree/strongly agree
Prehabilitation	Address modifiable risk factors (anemia, frailty, smoking, malnutrition) 4–6 weeks pre-op	Strongly Recommended	78.6% strongly agree
	Screen and optimize anemia 4–6 weeks pre-op	Strongly Recommended	100% strongly agree
	Smoking cessation 4–6 weeks pre-op	Recommended	92.9% agree/strongly agree
	Screen for malnutrition (e.g., Nutritional Risk Screening -2002)	Recommended	85.7% agree/strongly agree
	Psychological counseling for stressors or when physician feel necessary	Recommended	85.7% agree/strongly agree
Surgical & Institutional Considerations	Post-op ICU monitoring for cardiac moderate/high-risk patients	Strongly Recommended	83.3% strongly agree
	Invasive hemodynamic monitoring intraoperatively for cardiac/surgical high-risk patients	Strongly Recommended	83.3% strongly agree
	Access to interventional cardiology and/or cardiac surgery for high-risk patients	Strongly Recommended	75.0% strongly agree
	Prefer minimally invasive surgery to reduce hemodynamic stress	Recommended	91.7% agree/strongly agree
	Open surgery preferred over laparoscopy if EF <30% or severe diastolic dysfunction	Recommended	91.7% agree/strongly agree
	Onsite or on-call cardiologist availability for intermediate-risk patients	Recommended	91.7% agree/strongly agree
Areas Without Consensus	Routine CT coronary angiography for unstable angina/nonspecific symptoms	No Consensus	66.7%
	Optimal timing of troponin measurement	No Consensus	<70%
	Short-term smoking cessation protocols (<1 week)	No Consensus	<70%

# 4. Decision-Making Algorithm (Overview)

- 1. Initial screening (age, symptoms, history).
- 2. Functional capacity assessment.
- 3. Risk stratification (RCRI, ASA PS or ACS NSQIP risk calculator, consider frailty).
- 4. Targeted investigations per recommendations.
- 5. Prehabilitation if time allows.
- 6. Surgical and institutional planning and postoperative monitoring.

Flowchart:

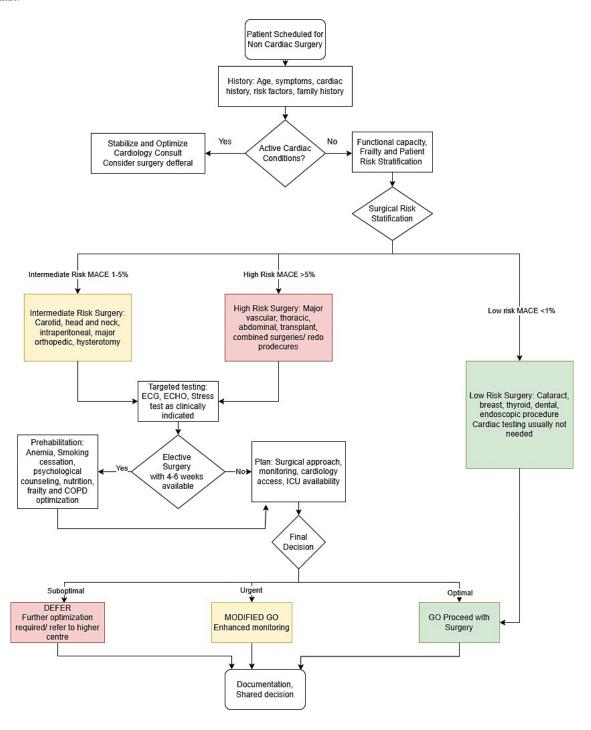


Figure 1: Algorithm for Preoperative Cardiac Risk Evaluation.

This flowchart outlines the stepwise assessment of patients undergoing noncardiac surgery, integrating screening, functional capacity assessment, risk stratification, and targeted investigations to guide perioperative decision-making.

#### 5. Limitations and Challenges

- There still is a large published evidence gap for the Nepalese population in terms of cardiac disease and its evaluation in perioperative period.
- There is still uneven access to advanced diagnostics and care facilities across Nepal<sup>8,9</sup>.
- The expert panel size was relatively small and may not fully represent the geographic and clinical diversity across Nepal.
- Recommendations largely extrapolate international evidence due to limited Nepal-specific data, potentially affecting precision.
- Patient and public perspectives were not integrated, limiting patient-centeredness.
- Significant variations in resource availability and personnel expertise exist across Nepal, which may impact guideline feasibility.
- No formal implementation, monitoring, or audit strategy is included to ensure uptake and evaluate impact.

#### **Future Recommendations**

Future work should focus on prospective validation of these recommendations through multicenter studies to assess their impact on perioperative outcomes. Development of Nepal-specific risk prediction tools, structured implementation pathways, and regular audit mechanisms will be essential to ensure effectiveness and sustainability. Capacity building, equity-focused resource allocation, and patient-centered communication strategies should be prioritized to support nationwide adoption. Collaboration with professional societies and health authorities may enable integration into national perioperative standards and quality improvement initiatives. Areas without consensus reveal uncertainties warranting further research and guideline updates.

#### 6. Conclusion

This consensus provides a practical, resource-sensitive framework for preoperative cardiac evaluation in patients undergoing noncardiac surgery in Nepal. It reflects a collaborative effort across cardiology, anesthesia, and surgery to align global evidence with local realities. Implementation of these recommendations can support improved perioperative outcomes, standardize care pathways, and guide future research and policy.

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# **Conflict of interests:**

All participants declared, in every round, that they had no conflicts of interest.

# **Language Editing Disclosure:**

The authors used ChatGPT-4.0 (OpenAI, San Francisco, CA, USA) to improve the clarity and grammar of the English language in this manuscript. The authors reviewed and approved all AI-assisted edits and have taken full responsibility for the content.

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# मुटुका बिरामीका लागि शल्यक्रियाअघि आवश्यक जानकारी

# (Important Information Before Surgery for Heart Patients)







यो जानकारी-पर्चा शल्यक्रिया गर्नुपर्ने मुटुका समस्या भएका बिरामीहरूका लागि तयार गरिएको हो।

यस पर्चामा मुटु सम्बन्धी समस्या भएका बिरामीहरूले शल्यिक्रयाअघि र पिछ थाहा पाउनुपर्ने मुख्य कुराहरू समे टिएका छन्।

मुदुका बिरामीको लागि शल्यिऋया अधिको परामर्श

हजुरलाई मुटु सम्बन्धी समस्या छ र हजुरलाई अन्य शल्यिक्रया गर्नुपर्छ। यस पर्चामा हजुरले थाहा पाउनुपर्ने मुख्य कुरा समे टिएको छ।

# शल्यक्रियाअघि के गर्ने?

- सबै औषधि (मुटु, मधुमेह, रक्तचाप आदि) बारे डाक्टर लाई देखाउने।
- धूम्रपान तुरून्तै छोड्ने (कम्तीमा ४ हप्ता अघि छोड्दा अभ राम्रो)।
- पोषिलो खाना खाने, रक्तअल्पता (Anaemia) भए उपचार गर्ने।
- रक्तचाप, सुगर, बोसो नियन्त्रणमा राख्ने।
- आवश्यक परेमा ECG, इको वा रगत परीक्षण गर्ने।

# औषधि सम्बन्धी सन्देश

 औषधि आफेंले कहिल्यै नरोक्ने ⇒ रोक्ने/खान सुरू गर्ने समय डाक्टरले भन्छन्।

# शल्यक्रियाको बेला र पछि

- मुटु, रक्तचाप, अक्सिजन निरन्तर निगरानी हुन्छ।
- दुखाइ नियन्त्रणको योजना हुन्छ।
- उच्च जोखिम भए क्ष्ऋग् वा ज्म्ग मा राख्न सिकन्छ।
- केही नियमित औषि अपरेशनपिछ पुनः सुरू गरिन्छ।

# सम्भावित जोखिम

- छाती दुख्ने, हृदयघात, मुटु फेल, अनियमित धड्कन
- लामो अस्पताल बसाइँ
- धेरै उच्च जोखिममा मृत्यु पनि सम्भव
- यी जोखिम घटाउन हजुरको **नियमित औषधि, जीवनशैली र डाक्टरको सल्लाह** महत्त्वपूर्ण हुन्छ।

# अपरेशनपछि घर फर्केपछि खबर गर्नुपर्ने लक्षण

- छाती दुखाइ
- सास फेर्न गाह्रो
- चक्कर लाग्ने वा चेत हराउने
- खुट्टा वा शरीर सुन्निने

# मुख्य सन्देश

- सबै कुरा डाक्टरसँग खुलेर सोध्नुहोस्।
- शल्यिक्रियाको जोखिम र फाइदा बुक्तेर मात्र सहमित दिनुहोस्।
- हजुर र डाक्टर मिलेर सही निर्णय लिनु सबैभन्दा महत्त् वपूर्ण छ।