South African cardiovascular risk stratification guideline for non-cardiac surgery

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Executive summary

The South African (SA) guidelines for cardiac patients for non-cardiac surgery were developed to address the need for cardiac risk assessment and risk stratification for elective non-cardiac surgical patients in SA, and more broadly in Africa.

The guidelines were developed by updating the Canadian Cardiovascular Society Guidelines on Perioperative Cardiac Risk Assessment and Management for Patients Who Undergo Non-cardiac Surgery, with a search of literature from African countries and recent publications. The updated proposed guidelines were then evaluated in a Delphi consensus process by SA anaesthesia and vascular surgical experts.

The recommendations in these guidelines are:

1. We suggest that elective non-cardiac surgical patients who are 45 years and older with either a history of coronary artery disease, congestive cardiac failure, stroke or transient ischaemic attack, or vascular surgical patients 18 years or older with peripheral vascular disease require further preoperative risk stratification as their predicted 30-day major adverse cardiac event (MACE) risk exceeds 5% (conditional recommendation: moderate-quality evidence).
2. We do not recommend routine non-invasive testing for cardiovascular risk stratification prior to elective non-cardiac surgery in adults (strong recommendation: low-to-moderate-quality evidence).
3. We recommend that elective non-cardiac surgical patients who are 45 years and older with a history of coronary artery disease, or stroke or transient ischaemic attack, or congestive cardiac failure or vascular surgical patients 18 years or older with peripheral vascular disease should have preoperative natriuretic peptide (NP) screening (strong recommendation: high-quality evidence).
4. We recommend daily postoperative troponin measurements for 48 - 72 hours for non-cardiac surgical patients who are 45 years and older with a history of coronary artery disease, or stroke or transient ischaemic attack, or congestive cardiac failure or vascular surgical patients 18 years or older with peripheral vascular disease, i.e. (*i*) a baseline risk >5% for MACE 30 days after elective surgery (if no preoperative NP screening), or (*ii*) an elevated B-type natriuretic peptide (BNP)/*N*-terminal-prohormone B-type natriuretic peptide (NT-proBNP) measurement before elective surgery (defined as BNP >99 pg/mL or a NT-proBNP >300 pg/mL) (conditional recommendation: moderate-quality evidence).

Additional recommendations are given for the management of myocardial injury after non-cardiac surgery (MINS) and medications for comorbidities.

Keywords. non-cardiac surgery; preoperative risk stratification; natriuretic peptide testing.

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The population in low- and middle-income countries (LMIC) is five times greater than in high-income (HIC) countries.[3] The focus in LMIC has largely been on communicable diseases; however, increasing urbanisation has led to a greater burden of cardiovascular diseases.[3] Globally, an estimated 200 million adults undergo surgical procedures annually and ~1/20 patients suffer myocardial injury/infarction or cardiac arrest or death within 30 days of major non-cardiac surgery. Perioperative cardiac complications account for one-third of all perioperative deaths.[4,5]

However, despite this burden of disease, there are no evidence-based guidelines for perioperative risk stratification and management of cardiac patients for non-cardiac surgery in LMIC. Developing guidelines for LMIC is challenging due to a lack of resources and funding for essential tests and services.

Recent publications have documented the burden of cardiovascular complications in South African (SA) and African surgical patients. Vascular surgery, in particular, is one of the highest-risk procedures leading to perioperative adverse cardiac events.[6] The risk of vascular surgery patients experiencing myocardial injury after non-cardiac surgery (MINS) is 1 in 5.[7] Furthermore, 7.1% (n=12/68) of vascular patients who are 45 years or older developed in-hospital major adverse cardiac event (MACE) in Africa (African Surgical Outcomes Study (ASOS).[8] The burden of peripheral arterial disease (PAD) is substantial in LMIC.[9]

The objective of this paper was to develop perioperative cardiovascular risk stratification and management practice guidelines for SA cardiac patients presenting for elective non-cardiac surgery.

Methods

The initial aim of this publication was to create a consensus statement for the perioperative cardiovascular risk stratification and management of PAD in SA. However, we hope that these guidelines may have a broader applicability in Africa.

The most recent evidence-based perioperative cardiovascular risk stratification and management guideline was used as a template based upon the robust methodology used in the generation of these guidelines.[10] These guidelines were critically appraised, and then either endorsed, or updated and revised based on more recent publications, and revised according to SA or African perioperative cardiovascular epidemiological studies.

A Medline search was conducted on 16 July 2019 with search terms: 'perioperative' (or 'postoperative' or 'surgical'), 'outcome/s' (or 'complication/s'), and 'cardiac' (or 'heart') and Africa/n (all African countries) not 'paediatric/s' (English and American spelling). Potentially relevant SA and African publications which described the incidence of cardiovascular complications following surgery were identified by authors CA and BMB. The incidence of MACE and associated patient risk factors were extracted where possible by CA and BMB. Further data describing the incidence of MACE for various patient risk profiles were extracted from the African Surgical Outcomes Study (ASOS)[8] dataset. Where the extracted data only described the in-hospital event rate, the predicted 30-day MACE rate was derived by a factor of 1.416 of the in-hospital incidence.[11] The search was updated on 8 May 2020.

These guidelines were developed using a Delphi technique. CA and BMB produced the first draft of the guidelines, which was then critically evaluated by the lead vascular surgeon and lead anaesthetist for preoperative assessment at each SA university over a two-round consensus process. The main target-users of these guidelines are explicitly anaesthetists and surgeons who perform vascular surgery; however, the group consensus was that these guidelines could be adopted for cardiovascular risk stratification and management of all cardiac patients for non-cardiac surgery (as opposed to only patients with PAD), as the studies on which these recommendations are based are predominantly from mixed non-cardiac surgery studies. The feedback from participants regarding the challenges in implementing these guidelines has been highlighted in context boxes as well as suggestions for future research to investigate strategies to overcome these challenges.

In international guidelines, preoperative cardiovascular risk stratification and management is determined by one demographic risk variable (i.e. age), cardiovascular risk factors (i.e. comorbidities) and a surgical risk variable (i.e. intermediate to high-risk surgery). The interplay of these three variables selects the high-risk population who require further testing, specific monitoring, and intervention.[10]

We have followed these requirements in our analysis of unpublished ASOS data, by only selecting patients who underwent intermediate and high-risk surgery and then analysing the data according to age and comorbidities. Furthermore, we have looked at two vascular cohorts from two SA observational studies due to the powerful signal for cardiovascular complications.[12,13] The event rate is reported as in-hospital MACE and predicted 30-day MACE (Table 1). The ASOS study only reported in-hospital MACE. We calculated the 30-day MACE based on a calculation derived from the VISION study, which showed that 70% of complications occur before discharge and a further 30% occur within 30 days after surgery. Therefore, we have estimated the 30-day event rate by a correction to in-hospital events of 10/7.[4]

All recommendations in these guidelines are based on the GRADE (Grading of Recommendations Assessment, Development and

Table 1. Incidence of cardiac events in African and South African patients undergoing elective intermediate to high-risk surgeries

Clinical risk category	Type of surgery	Outcome	Reported in-hospital events *n/N* (%; 95% CI)	Predicted 30-day events (%)/ Reported 30-day events *n/N* (%; 95% CI)
≥65 years* (ASOS)	All non-cardiac surgery	MACE	15/482 (3.1; 1.6 - 4.7)	4.4
≥45 years with significant CVD* (ASOS)	All non-cardiac surgery	MACE	4/81 (4.9; 0.2 - 9.7)	7.0
Coetzee *et al.*[19]	All non-cardiac surgery	MINS	12/244 (4.9; 2.2 - 7.6)	7.0
Van Zyl *et al.*[25]	Arthroplasty	MINS	68/160 (42; 34.8 - 50.1)	60
RCRI ≥1 (≥45 years* (ASOS))	All non-cardiac surgery	MACE	50/1 543 (3.2; 2.4 - 4.1)	4.5
≥18 years (SA MRC cohort)	Vascular surgery	MINS and death	-	136/749 (18.1; 15.4 - 20.9)
≥18 years (SA cohort, HIV sub-study)[13]	Vascular surgery	MINS and death	-	11/73 (15.1; 6.9 - 23.3)

ASOS = African Surgical Outcomes Study; CVD = cardiovascular disease; RCRI = revised cardiac risk index; CI = confidence interval; MACE = major adverse cardiac events (defined as death, non-fatal myocardial infarction, and cardiac arrest); MINS = myocardial injury after non-cardiac surgery; MRC = medical research council.
Significant cardiovascular disease = coronary artery disease, stroke or transient ischaemic attack, congestive cardiac failure, or peripheral arterial disease.
*Recommendations in the CCS guidelines.

Evaluation) rating system with grading as strong or conditional recommendation based on high-, moderate-, low-, or very low-quality evidence.[14]

In these guidelines, we did not survey or reference opinions from the public or patients.

Results

The search results produced 1 071 articles, of which 11 were publications that presented data on risk factors and the incidence of cardiovascular complications following non-cardiac surgery in SA or African patients,[12,13,15-23] and three publications[2,7,24] presented new data which may lead to revision of the Canadian Cardiovascular Society (CCS) guidelines. Thus, we reviewed 14 new or South African/African publications for these guidelines. The updated search yielded one new publication[25] for review, bringing the total to 15 publications. The preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow diagram is shown in Fig. 1.

Clinical cardiac risk assessment

Risk assessment provides a pathway for patient management. Not only does risk assessment provide a context (considering the patient's current physiological state in the presence of comorbidities and the extent of the surgical injury), but it also provides means for communicating the risk to patients and multidisciplinary teams necessary for planning of surgery and anaesthesia.[10]

There are certain tools available to help with risk assessment and stratification.

Risk stratification of patients at significant risk of major adverse cardiac events

The recent CCS Guidelines on Perioperative Cardiac Risk Assessment and Management for Patients Who Undergo Non-cardiac Surgery advocate for risk stratification of patients who have >5% risk of MACE within 30 days of elective surgery.[10]

The incidence of MACE >5% reported in an African cohort of patients includes (*i*) non-cardiac surgical patients 45 years and older with a history of coronary artery disease, or stroke or transient ischaemic attack, or congestive cardiac failure (Table 1);[8] and (*ii*) vascular surgical patients who are 18 years or older with peripheral vascular disease,[10] including HIV-positive patients undergoing vascular surgery.[13] Significant cardiovascular disease is defined as a history of coronary artery disease, or stroke or transient ischaemic attack, or congestive cardiac failure.

In summary, only patients with significant cardiovascular disease and 45 years or older, or patients undergoing vascular surgery (or with established PAD) who are 18 years or older with peripheral vascular disease consistently have a risk for a MACE >5% at 30 days following elective non-cardiac surgery. The use of age and the revised cardiac risk index (RCRI) does not add important additional information in the prediction of MACE risk in the African cohort (Table 1).

Recommendation 1: We suggest that all elective non-cardiac surgical patients 45 years and older with a history of coronary artery disease, or stroke or transient ischaemic attack, or congestive cardiac failure; or patients 18 years or older with peripheral vascular disease undergoing vascular surgery require further preoperative risk stratification as their predicted 30-day MACE risk >5% (conditional recommendation: moderate-quality evidence).

Recommendation in context:
This recommendation is based on observational studies conducted in elective surgery patients requiring at least one-night stay in hospital who were scheduled for intermediate to high-risk surgery. Thus, the need for further risk stratification will only apply to adult patients who fulfill both clinical (history of coronary artery disease, or stroke or transient ischaemic attack, or congestive cardiac failure or peripheral arterial disease) and surgical (intermediate to high-risk surgery) criteria. This recommendation does not apply to patients undergoing low risk surgery, and surgery which does not require overnight hospital admission.

Future areas for research: The available data in SA is dominated by research focusing on high-risk patients who are presenting for vascular surgery. There is a paucity of data in the greater cohort of non-cardiac surgery patients from LMIC and this requires urgent attention. This recommendation can be strengthened through research focused on perioperative cardiovascular outcomes in non-cardiac surgical patients in developing countries, particularly in Africa.

The role of non-invasive testing in risk stratification

We have endorsed the recommendations of the CCS Guidelines regarding non-invasive testing.[10] The non-invasive tests discussed below do not add any further incremental value to risk stratification of elective non-cardiac surgical patients. Our

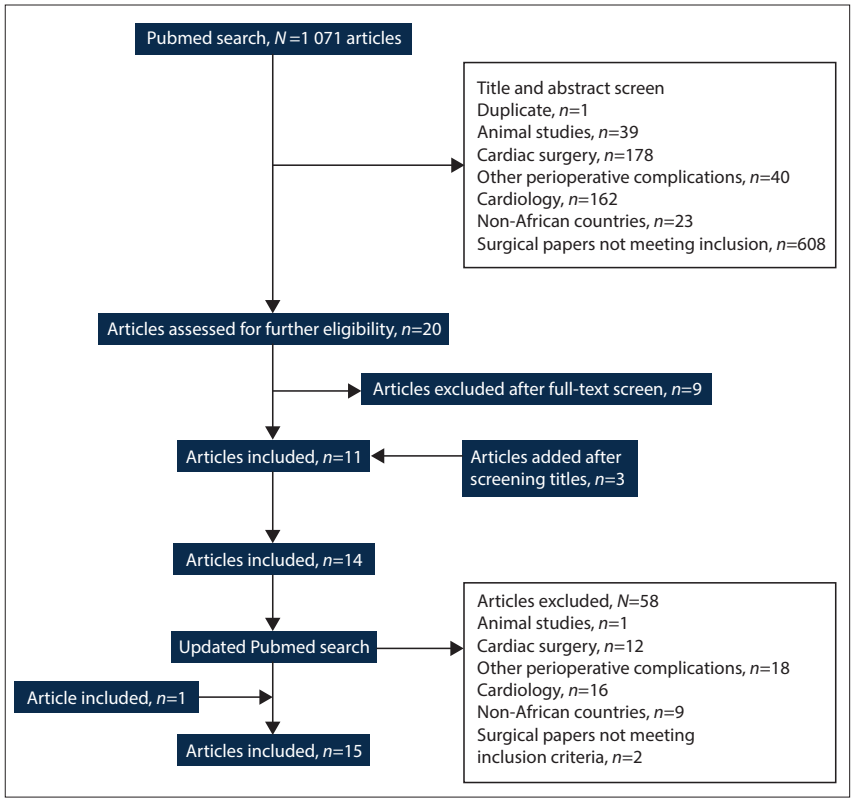

Fig. 1. PRISMA flow diagram.

search did not identify any further evidence which would change these recommendations.

Self-reported functional capacity

Patient-reported ability to exercise is an inaccurate and biased measure of physical fitness. This was shown in systematic reviews and confirmed in a recent, large prospective observational study (strong recommendation: moderate-quality evidence, Grade 1B).[2,26]

Resting echocardiography, coronary computed tomographic angiography, pharmacological stress echocardiography and radionuclide imaging

The above investigations are not recommended as a means of cardiovascular risk assessment. Resting echocardiography is an inferior risk-assessment tool compared with cardiac biomarkers (strong recommendation: low-quality evidence).[27] Resting echocardiography is not recommended unless there is a clinical suspicion of intracardiac lesion (mitral or aortic stenosis or hypertrophic obstructive cardiomyopathy) or severe pulmonary hypertension.

Coronary computed tomographic angiography leads to overestimation of risk and unnecessary cardiac intervention (strong recommendation: moderate-quality evidence).[28] Both stress echocardiography (strong recommendation: low-quality evidence) and radionuclide imaging (strong recommendation: moderate-quality evidence) have been studied in small cohorts of patients and there is little evidence on the utility of these preoperative tests.[10]

Exercise stress testing and cardiopulmonary exercise testing

Current evidence does not support the use of the above tests for cardiovascular risk assessment (strong recommendation: moderate-quality evidence, Grade 1B).[2,10]

Recommendation 2: We do not recommend routine non-invasive testing for cardiovascular risk stratification prior to elective adult non-cardiac surgery (strong recommendation: low- and moderate-quality evidence).

Recommendation in context: Current evidence does not support large-scale, non-invasive testing for cardiac risk stratification. This recommendation does recognise the clinician's autonomy to conduct further testing based on clinical findings, where these investigations may guide subsequent management.

Future areas for research: To establish robust evidence on the utility of non-invasive testing in a low-resource environment, we must be cognisant of the clinical experience and the context in which care is delivered. The lack of resources for adequate quality care for surgical patients was highlighted by the ASOS I study, which found high mortality and morbidity in young healthy patients.

Currently, there are limited data on the outcomes for high-risk patients presenting for non-cardiac surgery in Africa. Outcomes data are urgently needed before one can adequately further evaluate the role of non-invasive testing in this environment.

The role of natriuretic peptide testing in risk stratification

Natriuretic peptide (NP) testing has been shown to be a good predictor of perioperative adverse cardiac events,[29,30] and is significantly better than the RCRI (Table 2). This has also been confirmed in SA vascular surgical patients. A prospective cohort study of 788 patients found that B-type natriuretic peptide (BNP) significantly improved risk prediction of patients who did and did not develop postoperative cardiac complications.[15]

Based on recommendation 1, the SA Practice Guidelines for cardiac patients for elective non-cardiac surgery recommends the following patients for NP screening: all patients 45 years and older with a history of coronary artery disease, or stroke or transient ischaemic attack, or congestive cardiac failure; or patients who are 18 years or older with peripheral vascular disease undergoing vascular surgery require further preoperative risk stratification using preoperative NP screening.

The incidence of MACE and utility of various NP thresholds is shown in Table 3. A BNP level above 99 pg/mL and *N*-terminal prohormone B-type natriuretic peptide (NT-proBNP) above 300 pg/mL are predictive of >5% risk of developing MACE.[30,31]

Recommendation 3: We recommend that all elective non-cardiac surgical patients who are 45 years and older with a history of coronary artery disease, or stroke or transient ischaemic attack, or congestive cardiac failure, or patients who are 18 years or older with peripheral vascular disease undergoing vascular surgery should have preoperative NP screening (strong recommendation: high-quality evidence).

Recommendation in context: We recognise that resource constraints could limit the ability to conduct preoperative NP testing in some hospitals. This recommendation is aspirational in resource-limited settings. Patients with raised NP present with a spectrum of symptoms (from asymptomatic to overt symptoms and signs of cardiovascular pathology). The presence of raised NP has prognostic utility in the preoperative period. Failure to identify these patients may have serious implications on postoperative outcomes.

There are currently few data to guide a cheap alternative to NP testing in a resource-limited environment. The current data would support the Duke Activity Status Index[2] as a potential candidate, but this would require further research with NP screening used as the 'gold standard'.

Future areas for research: The increase in cardiovascular disease due to chronic comorbid conditions in SA and Africa as a whole, places a great deal of strain on already under-resourced healthcare systems. It follows then, that if there is a lack of evidence for non-invasive testing, resources could be allocated for a potentially robust test such as a NP test. Research is needed to determine whether the availability of NP testing informs the management of high-risk patients for non-cardiac surgery, improves the quality of care and patient outcomes in developing countries.

The role of postoperative troponin screening

Myocardial injury after non-cardiac surgery (MINS) is defined as a postoperative troponin elevation with no evidence of a non-ischaemic aetiology of troponin elevation. The classic signs and symptoms of MI are often absent, with no chest pain or absent or minor electrocardiogram changes. It commonly occurs within the first 48 hours after surgery and can usually only be detected through daily troponin screening.[32] The diagnostic definition of MINS with 5th generation high-sensitivity troponin T (hsTnT) is an absolute change of at least 5 ng/L, if the level is between 20 to <65 ng/L, or a hsTnT level of at least 65 ng/L.[33]

The VISION (Vascular events In non-cardiac Surgery patIents cOhort evaluatioN) prospective observational study of 15 000

Table 2. AUC for BNP and RCRI in predicting perioperative outcomes (*N*=632)[29]

Outcome	BNP, AUC (%); 95% CI	RCRI, AUC (%); 95% CI
MACE	80.5; 75.1 - 85.8	64.5; 56.6 -72.3
Cardiac death	80.0; 71.5 - 88.6	67.1; 53.8 - 80.5
Non-fatal MI	78.6; 72.2 - 85.5	62.3; 52.8 - 71.7
All-cause mortality	71.4; 60.7 - 82.2	63.8; 53.2 - 74.3

AUC = area under the curve receiver operating characteristics; BNP = B-type natriuretic peptide; RCRI = revised cardiac risk index; CI = confidence interval; MACE = major adverse cardiac events (defined as death, non-fatal myocardial infarction, and cardiac arrest); MI = myocardial infarction.

Table 3. Preoperative NP thresholds for predicting the composite outcome of 30-day mortality and non-fatal myocardial infarction

Type of surgery	Type of NP	NP level (pg/mL)	MACE, % (95% CI)	Likelihood ratio
Mixed non-cardiac surgery[30]	BNP	0 - 99	5.3 (3.2 - 7.2)	0.58
		100 - 250	11.6 (4.3 - 18.8)	1.38
		≥250	26.9 (17.1 - 35.5)	3.88
	NT-proBNP	0 - 300	5.2 (4 - 6.8)	0.42
		301 - 900	16.1 (12 - 20.2)	1.46
		901 - 3 000	26 (18.3 - 33.7)	2.68
		>3 000	39.5 (26.3 - 52.6)	4.97

NP = natriuretic peptides; BNP = B-type natriuretic peptide; CI = confidence interval; NT-proBNP = *N*-terminal pro-brain natriuretic peptide; MACE = major adverse cardiac events.

patients who were 45 years or older showed that ~1:20 patients suffer myocardial injury/infarction or cardiac arrest or death within 30 days of major non-cardiac surgery. Perioperative cardiac complications accounted for one-third of all perioperative deaths.[4,32]

In the vascular cohort of patients from the VISION study, the incidence (95% confidence interval (CI)) of MINS was 19.1% (15.7 - 22.6). The 30-day mortality was higher in patients with MINS (12.5%; 95% CI 7.3 - 20.6) compared with patients without MINS (1.5%; 95% CI 0.7 - 3.2; p <0.001). MINS was independently associated with 30-day mortality (odds ratio 9.48; 95% CI 3.46 - 25.96). The proportion of vascular surgery patients who suffered MINS without overt evidence of myocardial ischaemia was 74.1% (95% CI 63.6 - 82.4).[7] The reported incidence of MINS in SA vascular surgical patients was similar to the VISION study (17.3%; 95% CI 14.6 - 19.9).[12]

In a SA cohort of patients aged ≥45 years presenting for elective elevated-risk non-cardiac surgery (defined as all intra-abdominal, non-cardiac thoracic, joint replacement, major orthopaedic and vascular surgery) had an incidence of in-hospital MINS of 4.9% (95% CI 2.8 - 8.5).[19]

Recommendation 4: We recommend daily postoperative troponin measurements for 48 - 72 hours for all non-cardiac surgical patients 45 years and older with: (*i*) a history of coronary artery disease, stroke or transient ischaemic attack, congestive cardiac failure, or patients who are 18 years and older with peripheral vascular disease undergoing vascular surgery, i.e. a baseline risk >5% for major adverse cardiac events at 30 days after surgery (if no preoperative NP screening); or (*ii*) an elevated NT-pro BNP/BNP measurement before surgery (defined as BNP >99 pg/mL or a NT-proBNP >300 pg/mL) (conditional recommendation; moderate quality evidence).

Recommendation in context: The diagnosis of MINS has prognostic implications. Current evidence suggests that simple supportive strategies may be associated with improved outcomes, which can be easily managed by surgical teams. However, ~3 out of 4 patients requiring these interventions will not be identified without troponin screening. The cost implications of troponin screening have not been studied in SA. A cost-consequence study based on the VISION study shows favourable cost implications for patients at high risk of MINS.[1]

Management by a multidisciplinary team would only be required for select patients. This is an area which requires much research in both acute management of MINS, the timing and role of multidisciplinary teams, and the place of subsequent cardiovascular risk modification at the primary healthcare level.

The South African Practice Guidelines for non-cardiac surgery algorithm in cardiac patients is shown in Fig. 2.

Additional recommendations: Management of MINS

The management of patients with MINS is supportive. Adequate treatment of tachycardia, hypotension, hypoxia, and bleeding (anaemia) is needed. An electrocardiogram should be done and a cardiologist should be notified if there is ST elevation, new left-bundle branch block (LBBB) or anterior ischaemic changes, as these clinical signs significantly increase mortality.[32] Statin and aspirin therapy should be started or continued[34] and beta-blockers should be continued if the patient is haemodynamically stable.[35]

The MANAGE (Management of myocardial injury After Non-cArdiac surGEry) study showed that anticoagulation, in this case dabigatran for up to 2 years after surgery, was protective against death, non-fatal MI and thrombotic complications. Dabigatran should be considered for patients who have had MINS. The suggested recommendation is that for patients who have had MINS but are stable and have no risk of subsequent surgical bleeding, anticoagulation should be started within 30 days of the MINS event (strong recommendation: high-quality evidence).[24] Arterial components of the primary composite outcome (MI, non-haemorrhagic stroke, peripheral arterial thrombosis, amputation, and vascular death of unknown origin) and per-protocol analysis censoring 7 days after discontinuation of therapy both support the intervention as indicated by the hazard ratio of 0.73 (95% CI 0.55 - 0.96) and (0.57; 95% CI 0.41 - 0.79), respectively.

Recommendation in context: The management of MINS encompasses many interventions that are already part of good postoperative surgical care. The infrastructure and follow-up plan to safely anticoagulate patients who have had MINS might not be available at all centres. However, the high-quality evidence demonstrating that anticoagulation is protective for MINS in the long-term cannot be ignored. The implementation of anticoagulation for these patients requires further collaborative work. Currently, dabigatran is of limited availability in the public sector. Although other anticoagulants may offer protection against MINS, there is currently no evidence from clinical trials to support this.

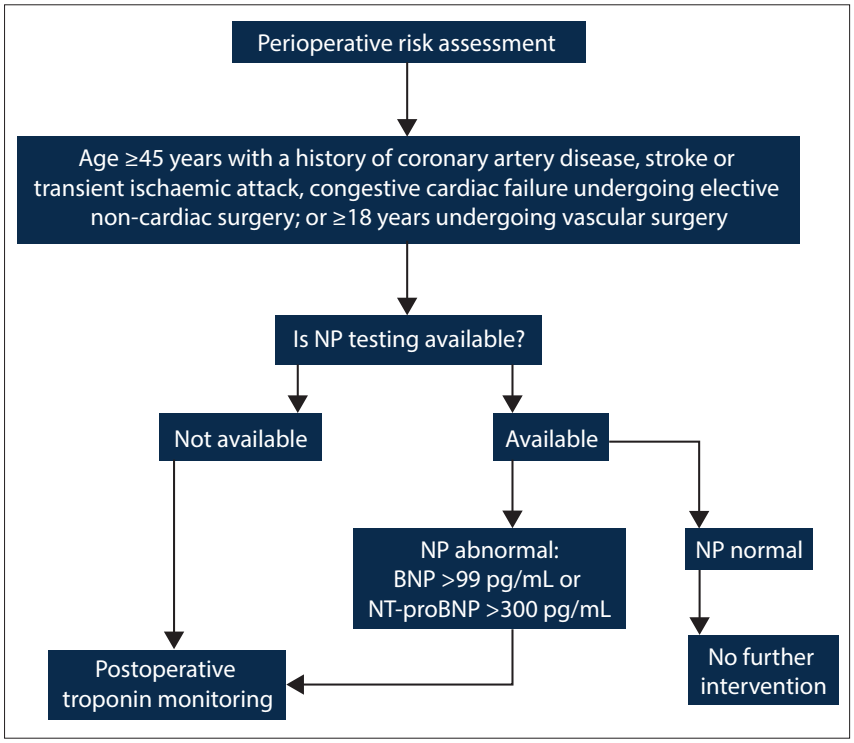

Fig. 2. South African Cardiac patient for non-cardiac surgery practice guidelines algorithm. (NP = natriuretic peptide; BNP = B-type natriuretic peptide; NT-proBNP = N-terminal prohormone B-type natriuretic peptide).

Additional recommendations: chronic medication

Acetylsalicylic acid

There is no evidence of primary prevention of cardiovascular events in the perioperative period. Acetylsalicylic acid (ASA) should be stopped at least 3 days before surgery, and ASA can be restarted when there is minimal risk of surgical bleeding (strong recommendation: high-quality evidence).[36] Perioperative withdrawal of chronic ASA therapy does not increase cardiac or other arterial thrombotic events.[36] There are limited data in vascular surgical patients, although the findings of the vascular sub-study are consistent with the main trial, that ASA should be stopped in the perioperative period.[37]

This recommendation does not apply to patients who have had recent coronary stents, bare-metal stents within 3 months or drug-eluting stents within 1 year, and patients who are going for carotid endarterectomy. Continuation of ASA is recommended in these patients (strong recommendation: moderate-quality evidence).[38]

Beta-blockade

It is recommended that chronic beta-blocker medication is continued throughout the perioperative period (conditional recommendation: low-quality evidence).[39] Beta-blocker therapy should not be started immediately before surgery (strong recommendation: high-quality evidence).[40]

Alpha-agonist

There is no recommendation to start this medication in the immediate preoperative period (strong recommendation: high-quality evidence).[41]

Calcium channel blocker

There is no recommendation to start this medication in the immediate preoperative period although chronic medication can be continued (conditional recommendation: low-quality evidence).[10]

Angiotensin-converting enzyme inhibitor/ angiotensin II receptor blocker

It is recommended that the above medication is stopped 24 hours before surgery and restarted when risk of hypotension has passed (strong recommendation: low-quality evidence).[10,42,43] The POISE-3 trial (NCT03505723) may provide high-quality evidence on how to manage antihypertensive agents in the perioperative period.

Statins

It is recommended that statins are continued in the perioperative period (strong recommendation: moderate-quality evidence).[44,45]

Conclusion

These cardiovascular risk stratification guidelines have been developed to provide context for risk stratification in elective non-cardiac surgery in SA. Future guidelines will need to include a broader group of participants from different surgical and medical disciplines, as well as input from patients. These guidelines would need to be updated when sufficient evidence has been generated in LMIC. Future work will also need to include assessment of guidelines implementation, adherence to recommendations, and associated patient outcomes.

Declaration. None.

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Conflicts of interest. None.

Supplementary material. Supporting material is available at http://samj.org.za/public/sup/15874.pdf.

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