Perioperative Clearance Guidelines Noncardiac Surgeries

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Disclosures

- No financial conflicts of interest

Objectives

- Identify methods to determine Risk Stratification for noncardiac surgeries and procedures
- Determine when to hold or continue anticoagulation for surgery procedures
- Identify when perioperative medical therapy and testing is necessary

Case 1

- **HPI: S.F. a** 57-year-old patient who presents to you for evaluation prior to a left inguinal hernia repair. She brings you a form asking you to 'clear her for surgery.'
- **PMH:** includes **NSTEMI** at age 50 without permanent physical deficits. She also has a history of non-insulin dependent **diabetes** mellitus and **hypertension**.
- **Soc Hx:** She previously had been active, able to play pickleball three times a week. Recently, she has become more limited due to the inguinal hernia and has had to adjust both her walking and her swing due to bulging area in left inguinal area. Nonsmoker and no ETOH use.
- **Meds:** Her medications include aspirin, metformin, and lisinopril. She also takes Naprosyn three to four days per week prior to playing pickleball.
- **Physical Examination:** reveals a well-appearing woman in no acute distress. Blood pressure is 135/82 with a heart rate of 72. She has a BMI of 33. Otherwise, her physical examination is unrevealing and discomfort associated with the left inguinal hernia is present and the physical examination is otherwise unrevealing.

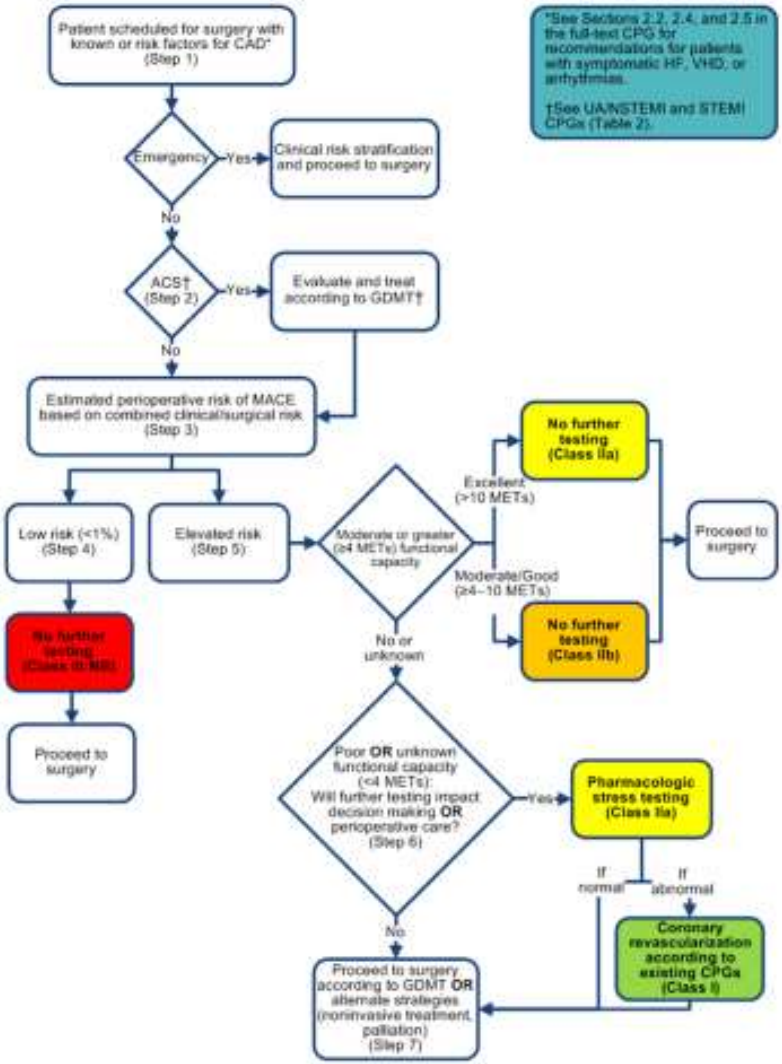
“Cleared for Surgery”

- Hospitalists or Primary Care Physicians are requested by surgery to clear their patients for surgery.
- Truly – we are completing a preoperative risk assessment. In conducting a preoperative risk assessment.
- Perioperative Risk Assessment involves:
  - Assessing risk factors
  - Determining if a patient is at low, intermediate, or high risk for an adverse cardiovascular event
  - Whether they should proceed to surgery without further preoperative risk assessment

Perioperative Cardiac Risk

Perioperative cardiovascular risk -defined as a myocardial infarction or cardiovascular death within 30 days of surgery

- What is the risk of the procedure the patient will be undertaking?
- What are the patients current clinical risk factors?
- Current symptoms putting them at risk, functional capacity?



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ACC/AHA guideline summary: Cardiac risk stratification for noncardiac surgical procedures

High risk (reported risk of cardiac death or nonfatal myocardial infarction [MI] often greater than 5%)
▪ Aortic and other major vascular surgery
▪ Peripheral artery surgery
Intermediate risk (reported risk of cardiac death or nonfatal MI generally 1 to 5%)
▪ Carotid endarterectomy
▪ Head and neck surgery
▪ Intraperitoneal and intrathoracic surgery
▪ Orthopedic surgery
▪ Prostate surgery
Low risk* (reported risk of cardiac death or nonfatal MI generally less than 1%)
▪ Ambulatory surgery¶
▪ Endoscopic procedures
▪ Superficial procedures
▪ Cataract surgery
▪ Breast surgery

* Do not generally require further preoperative cardiac testing.

¶ Ambulatory surgery refers to surgery in patients who are admitted on the day of an operation or procedure, and return home on the same day.

ACC_AHA_CV_risk_noncard_surgery UpToDate. (n.d.).

Role of ECG in perioperative evaluation?

- Our patient has no symptoms of cardiovascular disease

2014 ACC/AHA ECG Recommendation

- Preoperative resting 12-lead electrocardiogram (ECG) is reasonable for patients with known coronary heart disease, significant arrhythmia, peripheral arterial disease, cerebrovascular disease, or other significant structural heart disease, **except** for those undergoing low-risk surgery.137–139 (Level of Evidence: B)

- Routine preoperative resting 12-lead ECG is **not** useful for asymptomatic patients undergoing low-risk surgical procedures.35,141 (Level of Evidence: B)

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Case 1 recommendations

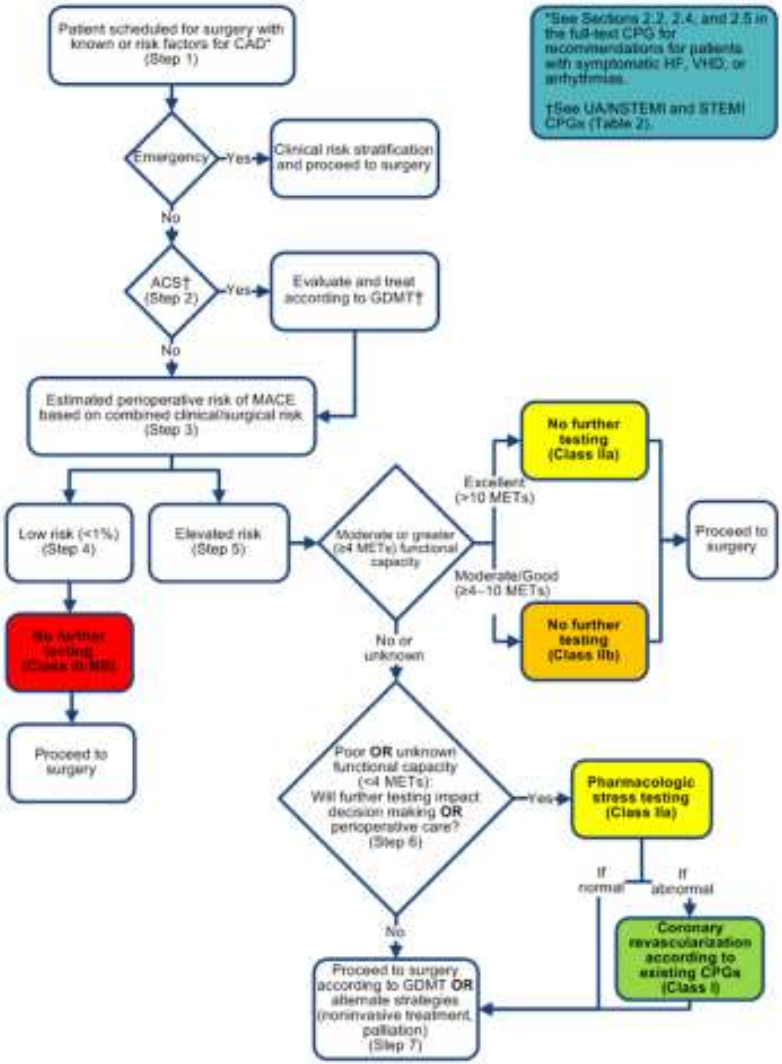
- Inguinal Hernia repair is a low risk procedure
- Patient has a history of Cardiac disease but has no current clinical symptoms
- Report to the surgeon, that this patient would be low risk for cardiovascular complications and no further assessment is needed

Case 2

- **HPI: B.B. a** 60-year-old patient needs a Left Total Knee Replacement (LTKR) Surgery and is seeing his PCP for perioperative risk assessment. Activity is limited due to the knee pain but admits to dyspnea if he climbs more than 2 flights of stairs
.
- **PMH: MI** at age 55, PTCA/DES LAD 7 months prior for Stable angina symptoms and with mild HFpEF in the last 2 years, DM 2 non insulin, HTN and Osteoarthritis.
- **Soc Hx:** Nonsmoker and 1-2 beers per week, retired construction worker
- **Meds:** aspirin, clopidogrel, metformin, lisinopril, furosemide, and diclofenac gel
- **Physical Examination:** reveals a well-appearing man in no acute distress. Blood pressure is 138/84 with a heart rate of 68. BMI of 35. The remainder of his physical examination is unremarkable, with clear lungs and trace lower extremity edema. His most recent laboratory tests reveal normal renal function.

Perioperative Evaluation

- Preoperative risk for Total Knee Replacement
- What risk factor indices are available to assess preoperative risk assessment?
- Considerations for current clinical symptoms?



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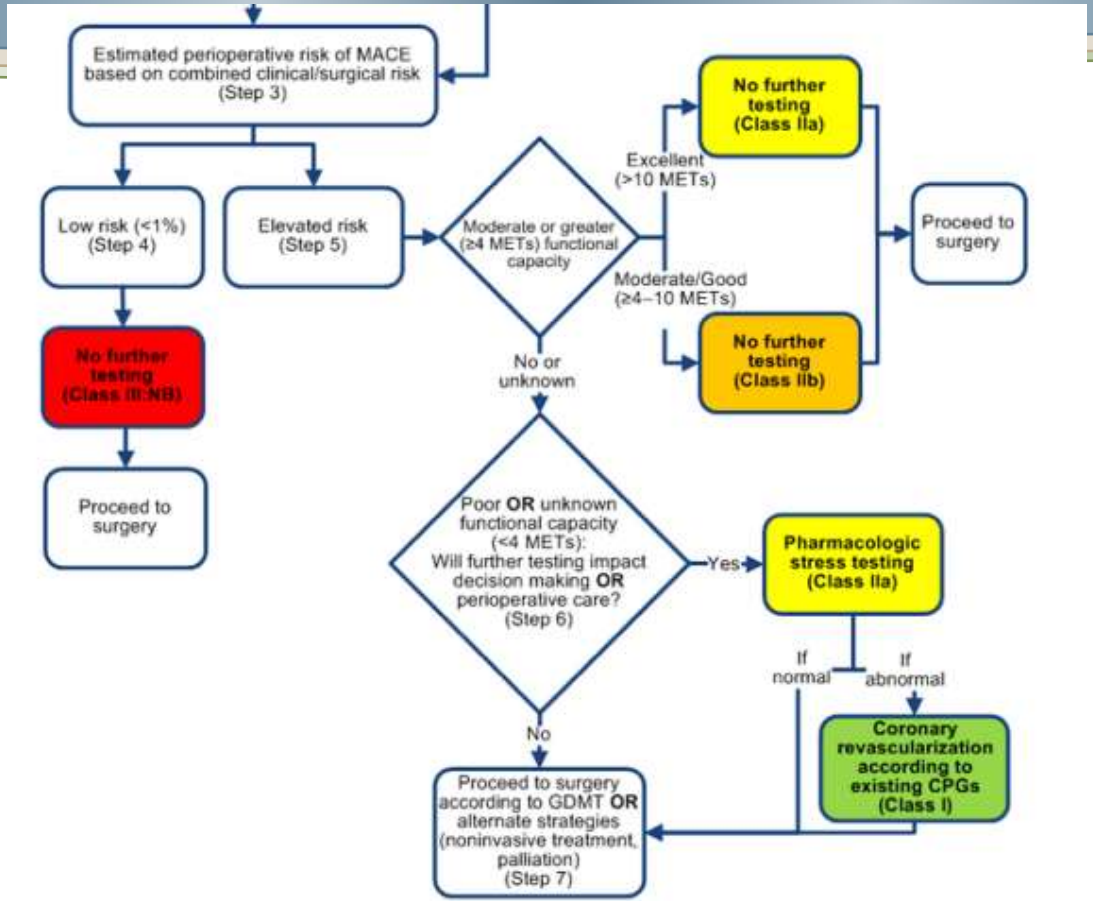
What are the patients current clinical risk factors?

- A recent myocardial infarction/unstable angina
- New heart failure or class IV CHF symptoms
- Symptomatic valvular disease (especially aortic stenosis and mitral stenosis)
- Conductive disease (that would require a pacemaker)



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ACC_AHA_CV_risk_noncard_surgery UpToDate. (n.d.).

What are the patients current risk factors?

- Intermediate risk of major adverse cardiovascular events (MACE)
- Clinical symptoms uncertain due to physical limitations

Comparison of 4 Cardiac Risk Calculators in Predicting Postoperative Cardiac Complications After Noncardiac Operations

Steven L. Cohn, MD[a,b,*], and Nerea Fernandez Ros, MD, PhD[c]

The 2014 American College of Cardiology/American Heart Association Perioperative Guidelines suggest using the Revised Cardiac Risk Index, myocardial infarction or cardiac arrest, or American College of Surgeons—National Surgical Quality Improvement Program calculators for combined patient-surgical risk assessment. There are no published data comparing their performance. This study compared these risk calculators and a reconstructed Revised Cardiac Risk Index in predicting postoperative cardiac complications, both during hospitalization and 30 days after operation, in a patient cohort who underwent select surgical procedures in various risk categories. Cardiac complications occurred in 14 of 663 patients (2.1%), of which 11 occurred during hospitalization. Only 3 of 663 patients (0.45%) had a myocardial infarction or cardiac arrest. Because these calculators used different risk factors, different outcomes, and different durations of observation, a true direct comparison is not possible. We found that all 4 risk calculators performed well in the setting they were originally studied but were less accurate when applied in a different manner. In conclusion, all calculators were useful in defining low-risk patients in whom further cardiac testing was unnecessary, and the myocardial infarction or cardiac arrest may be the most reliable in selecting higher risk patients. **(Am J Cardiol 2018;121:125–130)**

Cardiac Risk Assessments

- Revised Cardiac Risk Index (RCRI)
- Reconstructed – RCRI
- MI Cardiac Arrest Calculator (MACE)
- ACS/NSQIP Surgical Risk Calculator (ACS/SRC)

Table 1
Cardiac risk calculators

Revised Cardiac Risk Index[4] (MI/Cardiac Arrest, complete heart block, pulmonary edema **during admission**)	**MI or Cardiac Arrest Calculator (MICA)**[7] (MI/Cardiac Arrest **within 30 days** after surgery)	**ACS NSQIP Surgical Risk Calculator (ACS-SRC)**[8] (MI/Cardiac Arrest **within 30 days** after surgery)
High-risk surgery (3 categories)	**Type of surgery (21 categories)**	**Surgical procedure (CPT codes)**
Ischemic heart disease	**Age**	**Age group**
Congestive heart failure	**Functional status**	**Functional status**
Cerebrovascular disease	**ASA class**	**ASA class**
Renal insufficiency (Cr > 2 mg/dl)	**Renal insufficiency (Cr > 1.5 mg/dl)**	**Acute renal failure**
Diabetes treated with insulin		**Diabetes on oral meds or insulin**
		Dialysis
Reconstructed-RCRI[5] (MI/Cardiac Arrest, complete heart block, pulmonary edema **during admission**)		**Congestive heart failure** (<30 days)
High-risk surgery (3 categories)		**Dyspnea**
Ischemic heart disease		**Smoker (within past year)**
Congestive heart failure		**Severe COPD**
Cerebrovascular disease		**Ventilator dependent**
Renal insufficiency (GFR < 30 cc/min)		**Sepsis (within 48 hours)**
		Disseminated cancer
		Hypertension requiring meds
		Wound class
		Sex
		Steroid use (chronic)
		Ascites (within 30 days)
		BMI class

ACS-SRC = American College of Surgeons surgical risk calculator; ASA = American Society of Anesthesiology; BMI = body mass index; COPD = chronic obstructive pulmonary disease; GFR = glomerular filtration rate; MI = myocardial infarction; MICA = myocardial infarction or cardiac arrest; RCRI = Revised Cardiac Risk Index; R-RCRI = Reconstructed Revised Cardiac Risk Index.

Table 4
Incidence of cardiac events in low or elevated risk groups as per 2014 ACC/AHA Guidelines

	Overall cohort	RCRI		R-RCRI		MICA		ACS-SRC	
		Low risk	Elevated risk*	Low risk	Elevated risk*	Low risk	Elevated risk	Low risk	Elevated risk
n	663	616	47	626	37	650	13	618	45
All cardiac events 30-day	14	7	7	7	7	11	3	6	8
	(2.1%)	(1.1%)	(14.9%)	(1.1%)	(18.9%)	(1.7%)	(23.1%)	(0.97%)	(17.8%)
All cardiac events in hospital	11	5	6	5	6	8	3	4	7
	(1.65%)	(0.8%)	(12.8%)	(0.8%)	(16.2%)	(1.2%)	(23.1%)	(0.6%)	(15.6%)
Major cardiac events 30-day	3	2	1	2	1	2	1	2	1
	(0.45%)	(0.3%)	(2.1%)	(0.3%)	(2.7%)	(0.3%)	(7.7%)	(0.3%)	(2.2%)

* Considering class 1 as low risk.

ACC/AHA = American College of Cardiology/American Heart Association; ACS-SRC = American College of Surgeons surgical risk calculator; MICA = myocardial infarction or cardiac arrest; RCRI = Revised Cardiac Risk Index; R-RCRI = Reconstructed Revised Cardiac Risk Index.

The Revised Cardiac Risk Index (RCRI)

- **High risk surgery?** – defined as intraperitoneal, intrathoracic, or suprainguinal vascular surgery
- **Ischemic heart disease** – history of myocardial infarction, positive stress test, angina, use of nitroglycerin, or ECG with q waves
- **History of congestive heart failure** – either systolic or diastolic and defined as a known history of congestive heart failure, physical examination with bilateral rales or S3 gallop, or a chest radiograph with evidence of pulmonary edema
- **History of cerebrovascular disease** – history of either stroke or transient ischemic attack
- **Insulin therapy for diabetes**
- **Preoperative creatinine > 2.0 mg/dL**

Case 2

- Rate of major cardiac complication increases with increasing number of risk factors:
  - 0 risk factors - 3.9%
  - 1 risk factor - 6.0%
  - 2 risk factors -10.1%
  - 3+ risk factors - 15%
- Case 2 has two risk factors (prior MI and CHF) for an adverse cardiac event. RCRI criteria, his risk of adverse cardiac event is ~10.1%.

Evaluating Perioperative risk

- Focused history and cardiovascular physical examination.
  - history of ischemic heart disease
  - coronary stents
  - heart failure
  - Arrhythmias
  - valvular heart disease
  - systemic hypertension
  - pulmonary hypertension
  - Cardiovascular disease risk factors, such as chronic kidney disease and diabetes,

Smilowitz, N. R., & Berger, J. S. (2020). Perioperative Cardiovascular Risk Assessment and Management for Noncardiac Surgery: A Review. *JAMA - Journal of the American Medical Association*, *324*(3), 279–290.

Cardiovascular Testing

- Routine cardiac stress testing is **not** indicated for low-risk patients or for high-risk patients who are able to walk up a hill or climb up 2 or more flights of stairs without difficulty.
- ECG would be appropriate in this case
- Stress testing may be considered for patients with unknown or poor functional capacity who may have high cardiovascular risk.
- Patients with established CAD, coronary revascularization prior to surgery did not improve perioperative outcomes in a randomized trial.
- Stress testing should only be considered if the results would change perioperative medical, anesthesia, or surgical approaches.

Smilowitz, N. R., & Berger, J. S. (2020). Perioperative Cardiovascular Risk Assessment and Management for Noncardiac Surgery: A Review. *JAMA - Journal of the American Medical Association*, *324*(3), 279–290.

What about the cardiac stent?

- When is it safe to do surgery after cardiac stents have been placed?

Less than 1 year from placement of drug-eluting stent (DES)

- Cardiology and Surgery consultation
- Based on 2 recent cohort studies, the 2018 European Society of Cardiology DAPT consensus document suggested that when surgical delay is undesired, elective surgery may be considered 1 month after DES implantation for stable angina pectoris (SAP) and 6 months after DES implantation for acute coronary syndrome (ACS).
- Evidence for this recommendation is **limited.** In particular, it is unknown whether noncardiac surgery can be safely performed in patients treated for ACS earlier than 6 months after DES implantation.

Risk of Myocardial Infarction and Death After Noncardiac Surgery Performed Within the First Year After Coronary Drug-Eluting Stent Implantation for Acute Coronary Syndrome or Stable Angina Pectoris

Troels Thim, MD, PhD[a,*], Gro Egholm, MD, PhD[a,b], Steen Dalby Kristensen, MD, DMSc[a], Kevin Kris Warnakula Olesen, MD[a,c], Morten Madsen, MSc[c], Svend Eggert Jensen, MD[d], Lisette Okkels Jensen, MD, PhD, DMSc[b], Henrik Toft Sørensen, MD, DMSc[c], Hans Erik Bøtker, MD, PhD, DMSc[a], and Michael Maeng, MD, PhD[a]

Thim, T., Egholm, G., Kristensen, S. D., Olesen, K. K. W., Madsen, M., Jensen, S. E., Jensen, L. O., Sørensen, H. T., Bøtker, H. E., & Maeng, M. (2021). Risk of Myocardial Infarction and Death After Noncardiac Surgery Performed Within the First Year After Coronary Drug-Eluting Stent Implantation for Acute Coronary Syndrome or Stable Angina Pectoris. *American Journal of Cardiology*, *160*, 14–20.

Patients with drug-eluting stent implantation for ACS (n = 2,291) or SAP (n = 1,804) who underwent noncardiac surgery were compared with a cohort from the general population **without** known coronary artery disease matched on the surgical procedure, hospital contact type, gender, and age.

Results –place in table

- ACS -the 30-day MI risk was **markedly increased** when surgery was performed **within 1 month after stenting** (10% vs 0.8%; adjusted odds ratio(ORadj) 20.1,
- ACS - mortality was comparable (10% vs 8%, Oradj 1.17) when surgery was performed between 1 and 12 months after stenting
- 30-day absolute risk for MI was low but higher than in the comparison cohort (0.6% vs 0.2%, ORadj 2.18)
- SAP - **Mortality risks were similar** (2.0% vs 1.8%, ORadj 1.03) patients with SAP, the 30-day MI risk was low but higher than in the comparison cohort (0.4% vs 0.2%, ORadj 1.90), whereas the mortality risks were similar (2.2% vs 2.1%, ORadj 0.91, 95% CI 0.61 to 1.37).

Case 2 continued

- Intermediate Risk procedure
- ECG recommended
- Revised Cardiac Risk Index =2
- 7 months from stent –Cardiology agrees Clopidogrel can be held, continue ASA
- Functional capacity unclear due to knee pain and some dyspnea with stairs

  Cardiac Stress test or not?

Duke activity status index questionnaire to determine functional capacity[1]

Activity	Weight
Can you...	
1. Take care of yourself, that is, eating, dressing, bathing or using the toilet?	2.75
2. Walk indoors, such as around your house?	1.75
3. Walk a block or 2 on level ground?	2.75
4. Climb a flight of stairs or walk up a hill?	5.50
5. Run a short distance?	8.00
6. Do light work around the house like dusting or washing dishes?	2.70
7. Do moderate work around the house like vacuuming, sweeping floors, or carrying in groceries?	3.50
8. Do heavy work around the house like scrubbing floors, or lifting or moving heavy furniture?	8.00
9. Do yardwork like raking leaves, weeding or pushing a power mower?	4.50
10. Have sexual relations?	5.25
11. Participate in moderate recreational activities like golf, bowling, dancing, doubles tennis, or throwing a baseball or football?	6.00
12. Participate in strenuous sports like swimming, singles tennis, football, basketball or skiing?	7.50

- **Total DASI score: _____**
- **METs [(DASI score × 0.43) + 9.6] / 3.5: _____**

The higher the DASI score, the more physically active the patient is. Patients who can achieve <4 METs have poor functional capacity, 4 to 10 METs suggest moderate functional capacity, and >10 METs suggest excellent functional capacity.

DASI: Duke activity status index; METs: metabolic equivalents.

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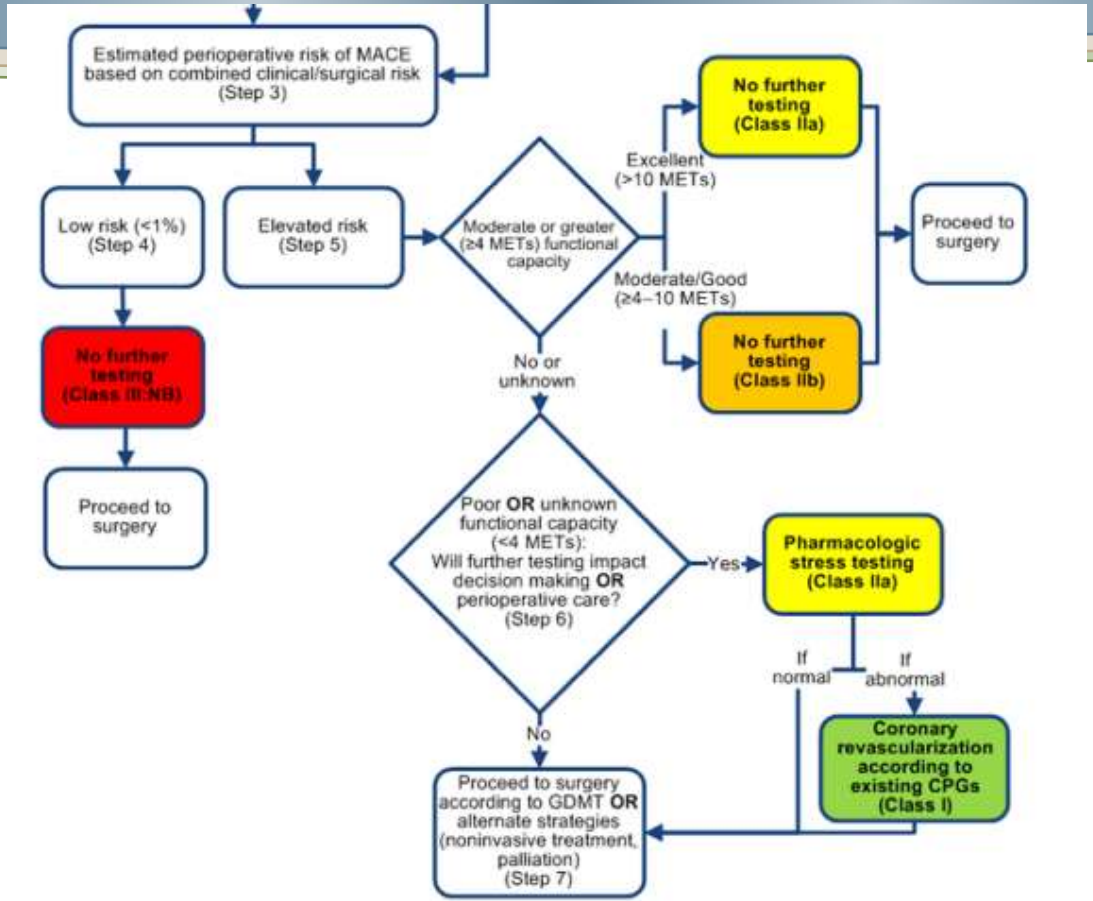


Exercise stress testing for myocardial ischemia and functional capacity		
For patients with elevated risk and excellent functional capacity, it is reasonable to forgo further exercise testing and proceed to surgery	IIa	B
For patients with elevated risk and unknown functional capacity it may be reasonable to perform exercise testing to assess for functional capacity if it will change management	IIb	B
For patients with elevated risk and moderate to good functional capacity, it may be reasonable to forgo further exercise testing and proceed to surgery	IIb	B
For patients with elevated risk and poor or unknown functional capacity it may be reasonable to perform exercise testing with cardiac imaging to assess for myocardial ischemia	IIb	C
Routine screening with noninvasive stress testing is not useful for low-risk noncardiac surgery	III: No Benefit	B

Fleisher, L. A., Fleischmann, et al. (2014). 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery A report of the American College of Cardiology/American Heart Association task force on practice guidelines. In *Circulation* (Vol. 130, Issue 24).

Case 2 – stress test?

- Evidence is not clear on benefits of stress test to reduce risk
- Patient in Case 2 screened for new or worsening cardiac symptoms , if no new symptoms then functional capacity is important to determine - ?exercise greater than four mets?, if he can then there would be no benefit in ordering a stress test regardless of the pending surgery.
  - Activities that equate to four mets are walking up a flight of stairs or walking two blocks on level ground without stopping.
- If unable to determine a patient's exercise capacity due to physical limitations and if the surgery is entirely elective, it is not unreasonable to order a stress test to assess for high-risk conditions, but patient would need to agree to the interventions required if abnormalities were determined

Risk Mitigation

- Maximize patients chronic health conditions such as Heart Failure, Diabetes and Hypertension

Heart Failure and Biomarkers – BNP

Journal of the American College of Cardiology
© 2014 by the American College of Cardiology Foundation
Published by Elsevier Inc.

Vol. 63, No. 2, 2014
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2013.08.1630

CME

The Prognostic Value of Pre-Operative and Post-Operative B-Type Natriuretic Peptides in Patients Undergoing Noncardiac Surgery

B-Type Natriuretic Peptide and N-Terminal Fragment of Pro-B-Type Natriuretic Peptide: A Systematic Review and Individual Patient Data Meta-Analysis

Reitze N. Rodseth, MBChB, MMed, PhD,*†‡ Bruce M. Biccard, MBChB, MMedSc, PhD,*

ORIGINAL RESEARCH

Annals of Internal Medicine

Preoperative *N*-Terminal Pro–B-Type Natriuretic Peptide and Cardiovascular Events After Noncardiac Surgery

A Cohort Study

Emmanuelle Duceppe, MD; Ameen Patel, MD; Matthew T.V. Chan, MBBS, PhD; Otavio Berwanger, MD, PhD;

- Evidence is increasing that a pro-BNP used in addition to the RCRI model, may improve clinical risk stratification.
- Substudy within the prospective VISION cohort study, 10,402 patients having inpatient noncardiac surgery had NT-proBNP measured before surgery
- In multivariable analyses, increasing NT-proBNP values were associated with an independent and incremental risk of vascular death and myocardial injury or infarction within 30 days of surgery.

Duceppe, E., Patel, A., Chan, M. T. V., Berwanger, et al. (2020). Preoperative n-terminal pro-b-type natriuretic peptide and cardiovascular events after noncardiac surgery: A cohort study. *Annals of Internal Medicine*, *172*(2), 96–104.

Beta Blockers

- **The only class I recommendation from the ACC/AHA perioperative guidelines is to continue beta-blockers for those who have been on beta blockers chronically.**

- Perioperative use of β-blockers confers some theoretical advantages in reducing mismatch in myocardial oxygen supply and demand. However, high-dose extended-release metoprolol succinate (100 mg/d) initiated immediately prior to surgery is associated with increased perioperative stroke and mortality in randomized trials. JAMA July 21, 2020 Volume 324, Number 3

Effects of extended-release metoprolol succinate in patients undergoing non-cardiac surgery (POISE trial): a randomised controlled trial

POISE Study Group*

Summary

Background Trials of β blockers in patients undergoing non-cardiac surgery have reported conflicting results. This randomised controlled trial, done in 190 hospitals in 23 countries, was designed to investigate the effects of perioperative β blockers.

Devereaux, P. J., Yang, H., Yusuf, S., Guyatt, G et al. (2008). Effects of extended-release metoprolol succinate in patients undergoing non-cardiac surgery (POISE trial): A randomised controlled trial. *The Lancet*, *371*(9627)

POISE Trial

- A large RCT, POISE, was designed to answer the question of addition of beta blocker to reduce risk.
- POISE was a RCT of greater than 8,000 intermediate risk patients undergoing intermediate or high-risk surgeries.
  - Inclusion criteria were established CAD or PVD or 3 (of 7) risk factors for vascular disease. None of the patients could be on a beta blocker prior to randomization

- Statistically significant **reduction** in combined cardiac endpoints (ARR 1.1%) and myocardial infarction (ARR 1.5%)
- Statistically **significant increase** in both overall mortality (risk increase from 2.3% to 3.1%) and stroke (risk increase from 0.5% to 1%) in the beta blocker arm.
- The major criticism of this study is the high dose of metoprolol XL in the protocol, as beta blocker naïve patients were started on 100 mg daily, with a quick titration to 200 mg daily for 30 days. There was also a statistically significant increase in hypotension and bradycardia in the metoprolol arm, which likely contributed to the risk of stroke.

Beta Blockers - recommendation

- Continue beta blocker therapy for those already on it and have indications for benefit from use.
- Do not start as a prophylaxis if no indications based on POISE trial
- For long term therapy of beta blocker when indicated, Start more than 4 weeks ahead of surgery, if there is a clinical indication to be on a beta blocker therapy.
- Consider waiting to initiate after the surgery if can't wait 30 days prior to the procedure. Close monitoring needed

Diabetes

Preoperative medications should be adjusted preoperatively to prevent hypoglycemia or excessive hyperglycemia while fasting in preparation for surgery

Effect of A1C and Glucose on Postoperative Mortality in Noncardiac and Cardiac Surgeries

Willem van den Boom,[1] Rebecca A. Schroeder,[2] Michael W. Manning,[2] Tracy L. Setji,[3] Gic-Owens Fiestan,[4] and David B. Dunson[1]

Diabetes Care 2018;41:782–788 | https://doi.org/10.2337/dc17-2232

- Retrospective analysis on 431,480 surgeries within the Duke University Health System determined the association of preoperative A1C with perioperative glucose (averaged over the first 3 postoperative days) and 30-day mortality among 6,684 noncardiac and 6,393 cardiac surgeries with A1C and glucose measurements.

- Glucose and mortality were positively associated for noncardiac cases:
  - 1.0% mortality at mean glucose of 100 mg/dL and 1.6% at mean glucose of 200 mg/dL.
- For cardiac procedures, there was a striking U-shaped relationship between glucose and mortality, ranging from 4.5% at 100 mg/dL to a nadir of 1.5% at 140 mg/dL and rising again to 6.9% at 200 mg/dL.
- A1C and 30-day mortality were not associated when controlling for glucose in noncardiac or cardiac procedures.

Boom, W. Vanden, Schroeder, R. A., Manning, M. W., Setji, T. L., Fiestan, G. O., & Dunson, D. B. (2018). Effect of A1c and glucose on postoperative mortality in noncardiac and cardiac surgeries. *Diabetes Care*, *41*(4), 782–788.

Diabetic Medications

GLP-1 receptor agonists and oral diabetes medications other than SGLT2 inhibitors can be continued until the morning of surgery.

- **Metformin** is contraindicated in conditions that increase the risk of renal hypoperfusion, lactate accumulation, and tissue hypoxia.
- **Sulfonylureas** and **meglitinides** can cause hypoglycemia.
- **Thiazolidinediones** may worsen fluid retention and peripheral edema and could precipitate congestive heart failure.
- **Dipeptidyl peptidase 4 (DPP-4) inhibitors** and **GLP-1 receptor agonists** could alter gastrointestinal motility and worsen the postoperative state.

Diabetic Medications cont.

SGLT2 inhibitors should be stopped three to four days before surgery.

- These agents increase the risk of urinary tract infections and hypovolemia.
- Reports of acute kidney injury and euglycemic diabetic ketoacidosis in patients with type 2 diabetes taking SGLT2 inhibitors

Milder, D. A., Milder, T. Y., & Kam, P. C. A. (2018). Sodium-glucose co-transporter type-2 inhibitors: pharmacology and peri-operative considerations. *Anaesthesia*, *73*(8), 1008–1018.

Insulin

- type 1 diabetes and some insulin-treated patients with type 2 diabetes are insulin deficient.
  - Higher risk of diabetic ketoacidosis and must have basal insulin supplied at all times.
  - It is necessary to prevent ketoacidosis and limit protein loss during reduced caloric intake and perioperative stress.

Guidelines for Anticoagulation

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
© 2017 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER

VOL. 69, NO. 7, 2017
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2016.11.024

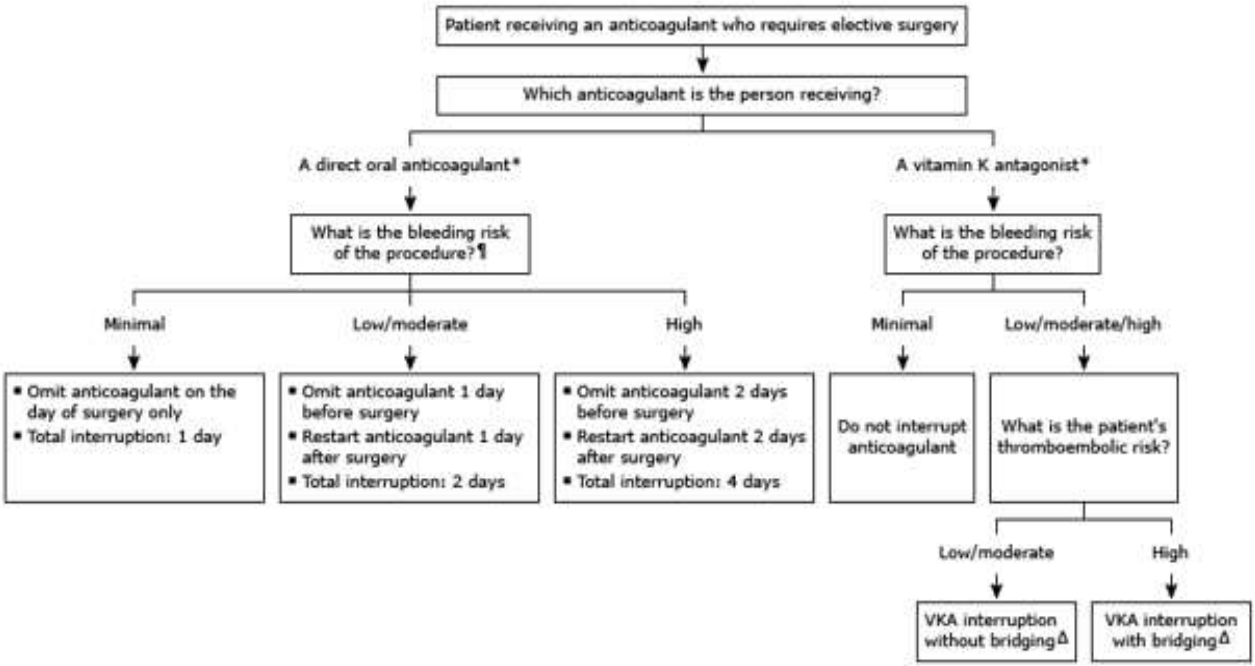
EXPERT CONSENSUS DECISION PATHWAY

2017 ACC Expert Consensus Decision Pathway for Periprocedural Management of Anticoagulation in Patients With Nonvalvular Atrial Fibrillation

A Report of the American College of Cardiology Clinical Expert Consensus Document Task Force

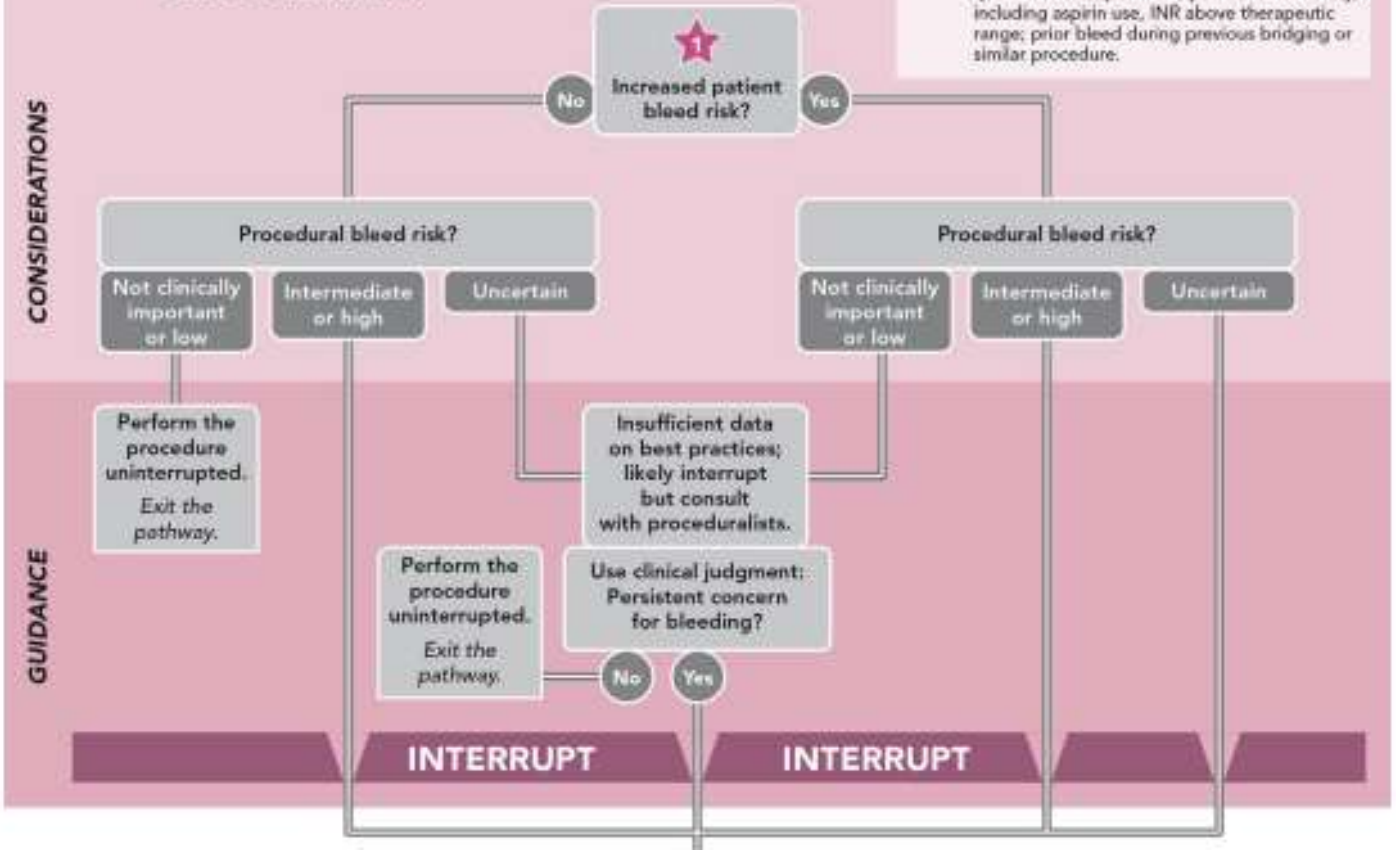
Case 3 –Anticoagulation

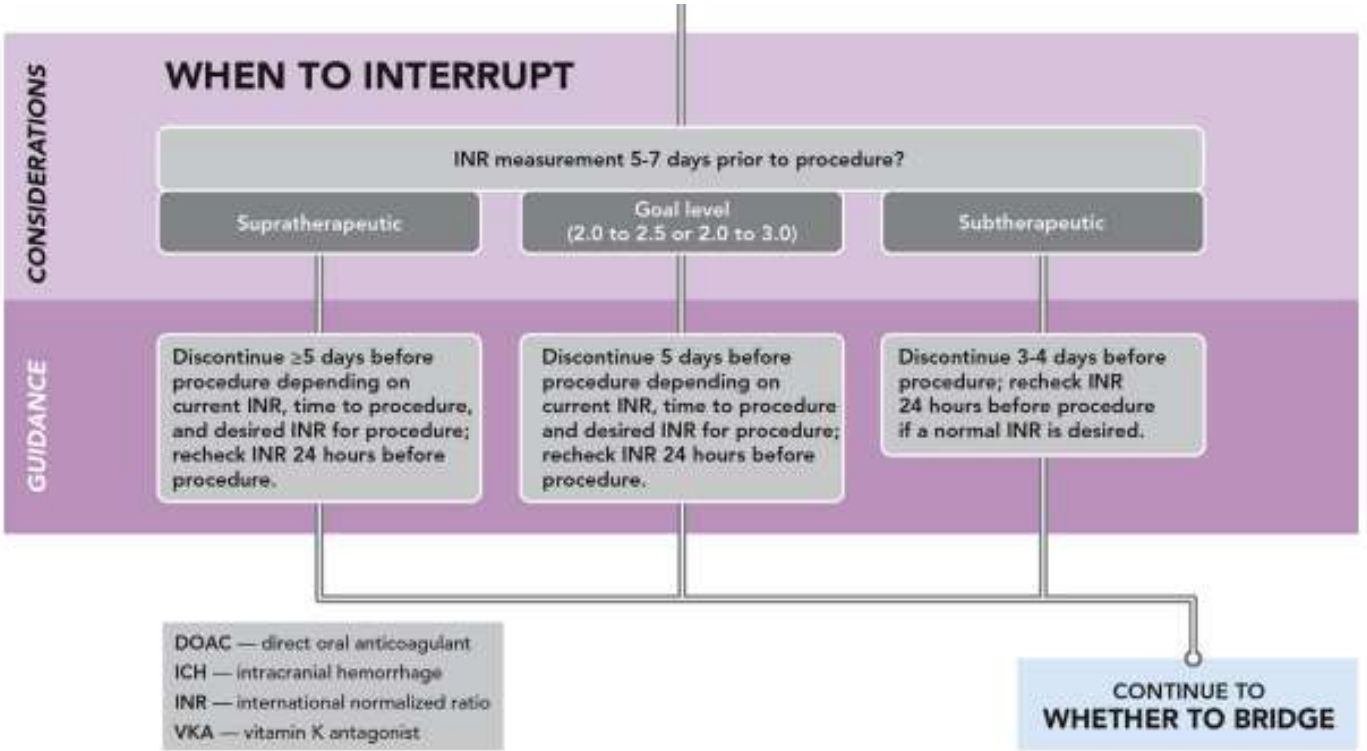
Algorithm for anticoagulant discontinuation in individuals undergoing elective surgery

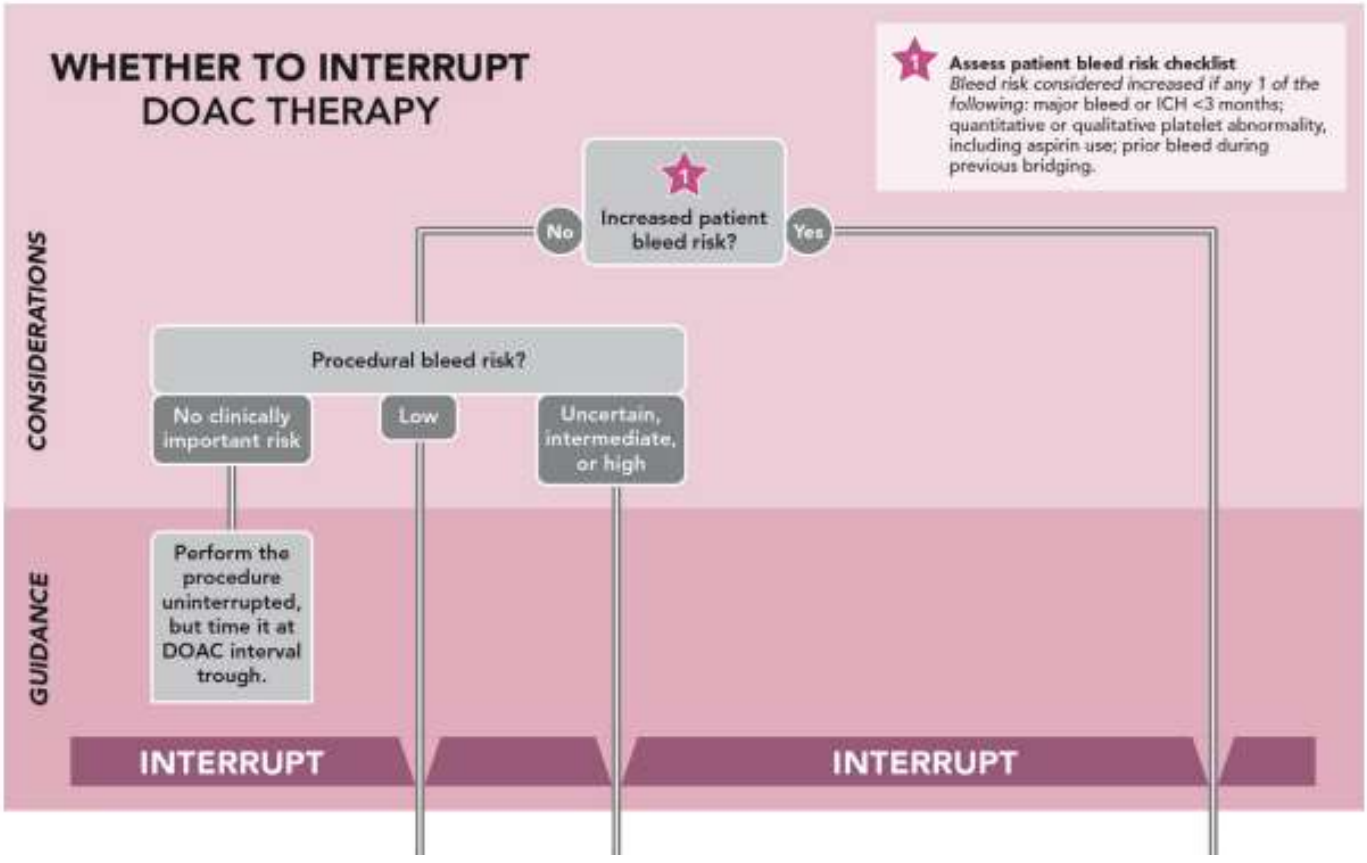


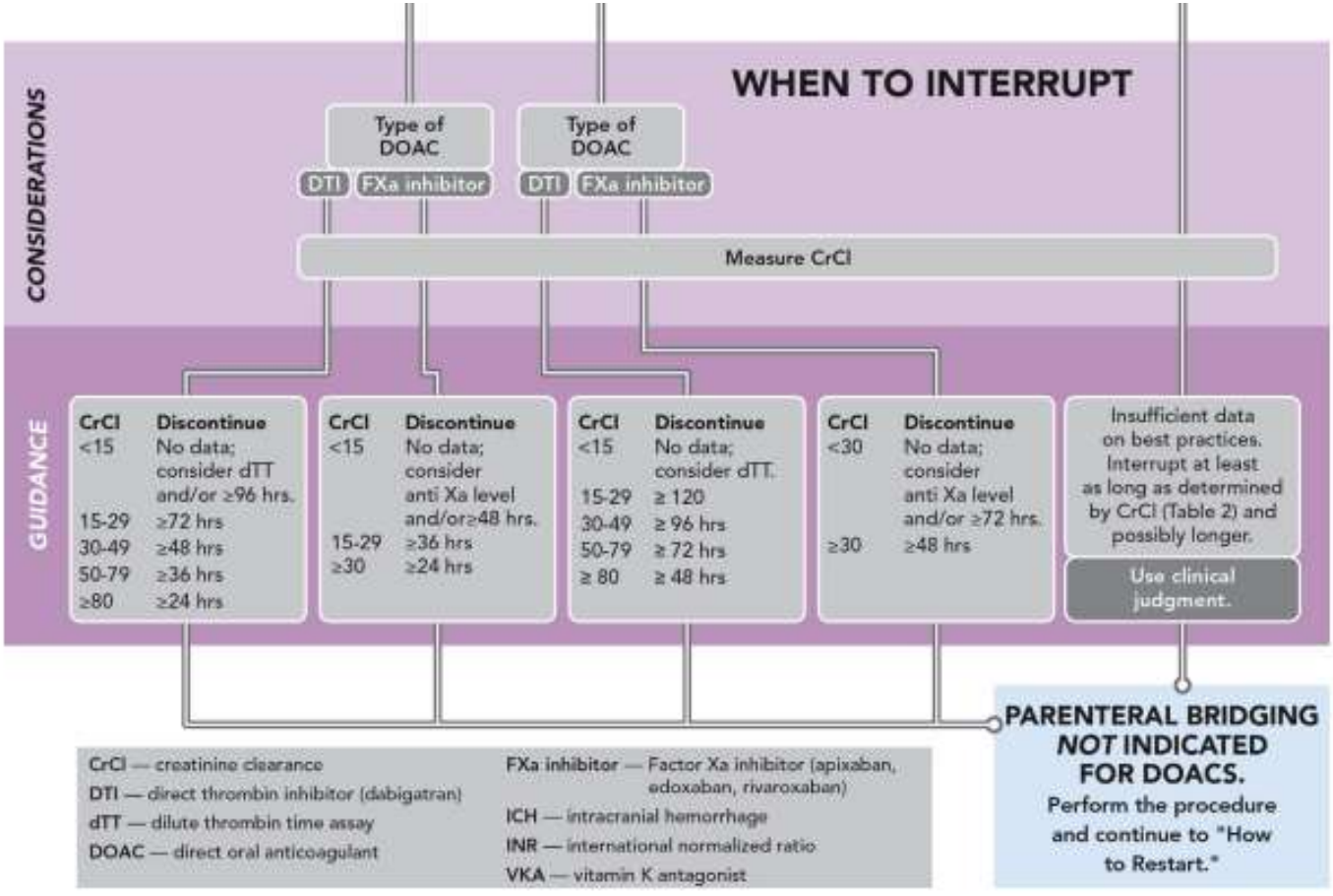
WHETHER TO INTERRUPT VKA THERAPY

1 Assess patient bleed risk checklist
Bleed risk considered increased if any 1 of the following: major bleed or ICH <3 months; quantitative or qualitative platelet abnormality, including aspirin use; INR above therapeutic range; prior bleed during previous bridging or similar procedure.




CONSIDERATIONS
WHEN TO INTERRUPT
INR measurement 5-7 days prior to procedure?
Supratherapeutic
Goal level
(2.0 to 2.5 or 2.0 to 3.0)
Subtherapeutic
GUIDANCE
Discontinue ≥5 days before procedure depending on current INR, time to procedure, and desired INR for procedure; recheck INR 24 hours before procedure.
Discontinue 5 days before procedure depending on current INR, time to procedure and desired INR for procedure; recheck INR 24 hours before procedure.
Discontinue 3-4 days before procedure; recheck INR 24 hours before procedure if a normal INR is desired.
DOAC — direct oral anticoagulant
ICH — intracranial hemorrhage
INR — international normalized ratio
VKA — vitamin K antagonist
CONTINUE TO
WHETHER TO BRIDGE


WHETHER TO INTERRUPT DOAC THERAPY
1
Assess patient bleed risk checklist
Bleed risk considered increased if any 1 of the following: major bleed or ICH <3 months; quantitative or qualitative platelet abnormality, including aspirin use; prior bleed during previous bridging.
CONSIDERATIONS
GUIDANCE
1
Increased patient bleed risk?
No
Yes
Procedural bleed risk?
No clinically important risk
Low
Uncertain, intermediate, or high
Perform the procedure uninterrupted, but time it at DOAC interval trough.
INTERRUPT
INTERRUPT


CONSIDERATIONS
WHEN TO INTERRUPT
Type of DOAC
DTI
FXa inhibitor
Type of DOAC
DTI
FXa inhibitor
Measure CrCl
GUIDANCE
CrCl Discontinue
<15 No data; consider dTT and/or ≥96 hrs.
15-29 ≥72 hrs
30-49 ≥48 hrs
50-79 ≥36 hrs
≥80 ≥24 hrs
CrCl Discontinue
<15 No data; consider anti Xa level and/or≥48 hrs.
15-29 ≥36 hrs
≥30 ≥24 hrs
CrCl Discontinue
<15 No data; consider dTT.
15-29 ≥ 120
30-49 ≥ 96 hrs
50-79 ≥ 72 hrs
≥ 80 ≥ 48 hrs
CrCl Discontinue
<30 No data; consider anti Xa level and/or ≥72 hrs.
≥30 ≥48 hrs
Insufficient data on best practices. Interrupt at least as long as determined by CrCl (Table 2) and possibly longer.
Use clinical judgment.
PARENTERAL BRIDGING NOT INDICATED FOR DOACS.
Perform the procedure and continue to "How to Restart."
CrCl — creatinine clearance
DTI — direct thrombin inhibitor (dabigatran)
dTT — dilute thrombin time assay
DOAC — direct oral anticoagulant
FXa inhibitor — Factor Xa inhibitor (apixaban, edoxaban, rivaroxaban)
ICH — intracranial hemorrhage
INR — international normalized ratio
VKA — vitamin K antagonist

When to bridge anticoagulation

For patients who are at low risk for thromboembolism (<5%/year) – CHA2Ds2-VASc score </= 4 and no prior history of ischemic stroke, TIA, or Systemic Embolism, discontinue the Vitamin K Antagonist (VKA) prior to the procedure and resume, without bridging.

Bridging with moderate risk thromboembolism

- Moderate risk for thromboembolism (5% to 10%/year) with a CHA2DS2-VASc score of 5 to 6 or history of prior ischemic stroke, TIA, or peripheral arterial embolism (3 or months previously).
- Determine the patient's bleed risk to determine the appropriateness of bridging therapy.
  - If increased risk of bleeding, interruption of the VKA without bridging is recommended.
  - If no significant bleed risk:
    - a. In patients with prior stroke, TIA, or SE, consider use of a parenteral anticoagulant for periprocedural bridging (use clinical judgment, likely bridge)
    - b. In patients with no prior stroke, TIA, or SE, the use of a parenteral anticoagulant for periprocedural bridging is not advised (use clinical judgment, likely do not bridge.).

Bridging with high risk of thromboembolism

For patients who are at high risk of stroke or systemic embolism (>10% per year) with a CHA2DS2-VASc score of 7 to 9 or recent (within 3 months) ischemic stroke, TIA, or SE, parenteral bridging anticoagulation should be considered

Summary Slide

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Questions

Thank you

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