Clinical Cases in Inpatient Anticoagulation Management:

Focus on Bridging

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CME Activity: Clinical Cases in Anticoagulation Management

Learning Objectives

1. Discuss current strategies for perioperative antithrombotic management.
2. Compare bleeding and thrombotic event rates between available anticoagulants.
3. Develop anticoagulant treatment plans for complex inpatient scenarios.

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Drs. Sara J. Hyland and David Robinson, faculty for this CPE activity, have no relevant financial relationship(s) with ineligible companies to disclose.

None of the planners for this activity have relevant financial relationships to disclose with ineligible companies.

Learning Objectives

1. Discuss current strategies for perioperative antithrombotic management
2. Compare bleeding and thrombotic event rates between available anticoagulants
3. Develop anticoagulant treatment plans for complex inpatient scenarios

Commonly Used Abbreviations:
AT=antithrombotic medication (includes OACs and antiplatelet agents)
DOAC=direct oral anticoagulant (includes dabigatran, rivaroxaban, apixaban, edoxaban etc)
DVT=deep venous thrombosis
OAC=oral anticoagulant (includes warfarin and DOACs)
PE=pulmonary embolism
TE=thromboembolism; VTE=venous thromboembolism (includes DVT and PE), ATE=arterial thromboembolism

Scope of the Problem

Patients on Oral Anticoagulant (OAC) Medications in U.S.

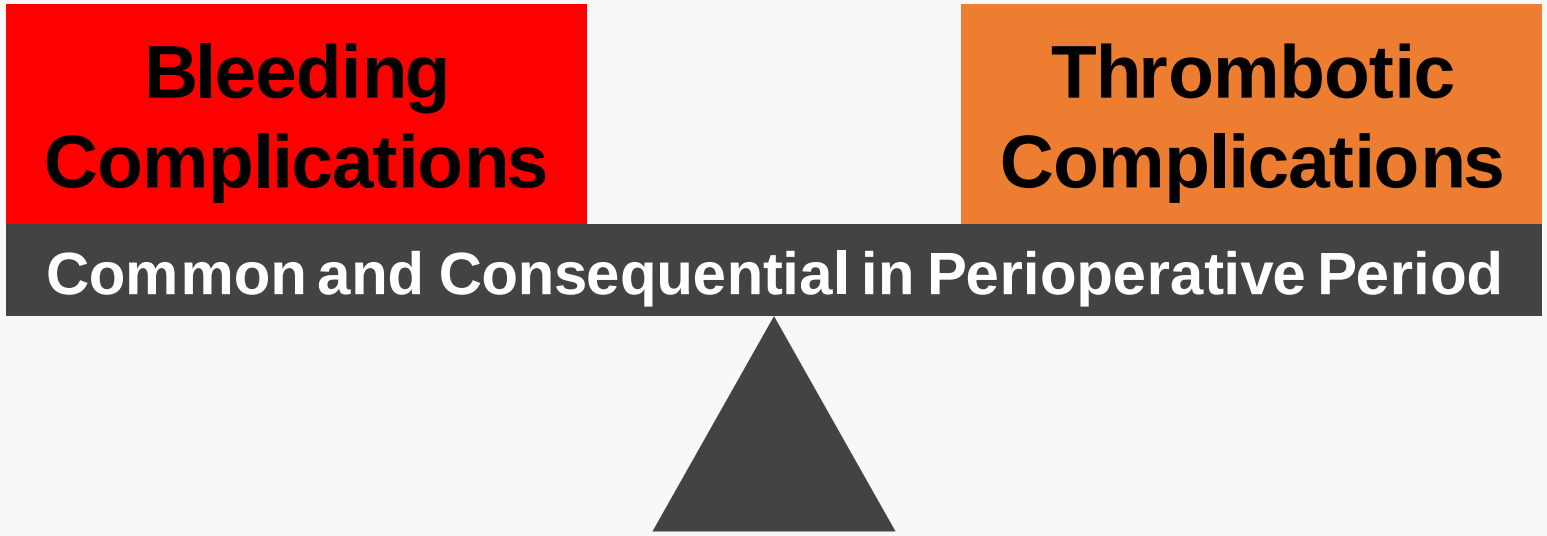
>6M 

Requiring Temporary Interruption of OAC Annually

15-20% 

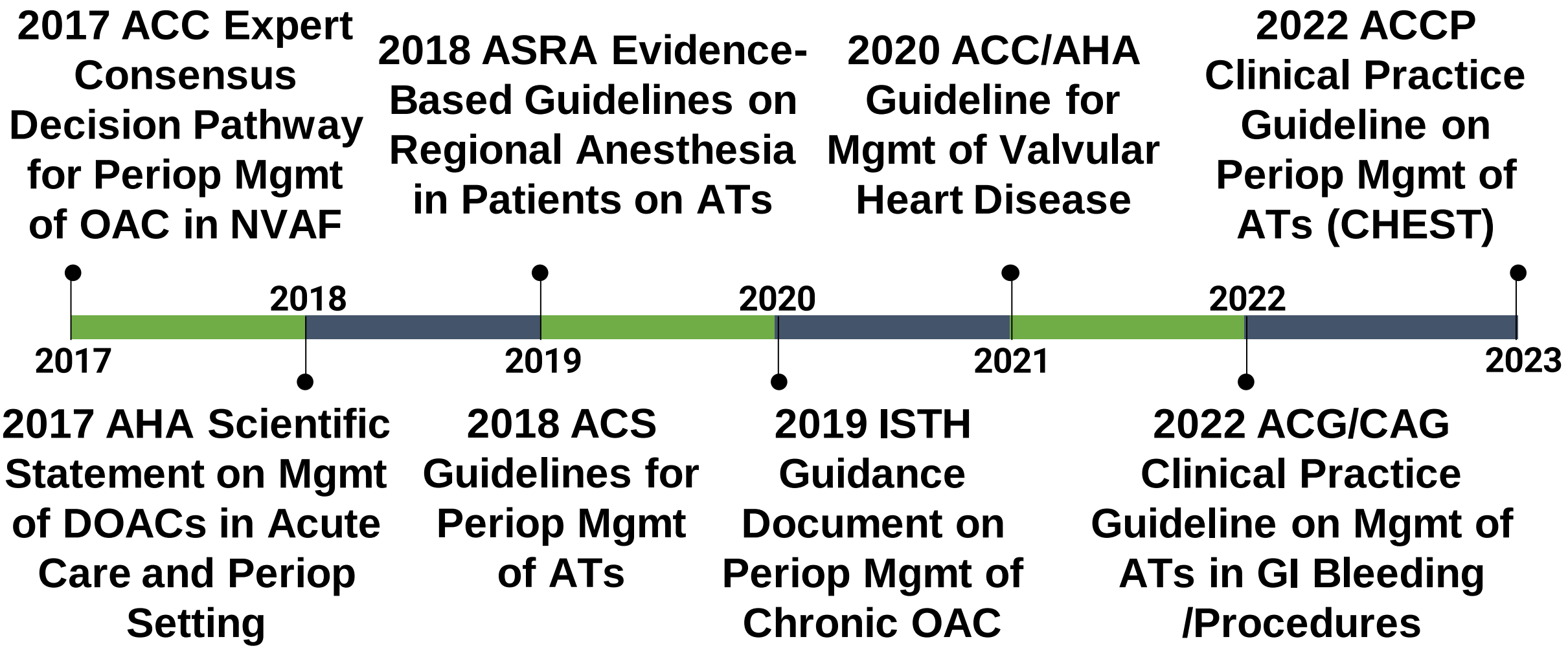
Troy 2021, Douketis 2022

Bridge over Troubled Waters?



Rudd 2023, Douketis 2022, Berry 2022, Dougherty 2017

So Many Guidelines…



Doherty 2017, Raval 2017, Horlocker 2018, Hornor 2018, Spyropoulos 2019, Writing Committee Members/Otto 2021, Abraham 2022, Douketis 2022

Systematic Approach to Developing Inpt/Perioperative Antithrombotic Plans

1. Risk **stratify** patient and procedure
2. Assess **need for interruption** of OAC
3. If interrupting, determine **timing of OAC cessation**
4. If interrupting, assess **need for bridge**
5. If bridging, determine **bridging agent, dose, and timing**
6. If not bridging, assess **need for VTE prophylaxis** during interruption and determine optimal regimen
7. Determine ideal **timing for resumption** of OAC
8. Throughout - **Monitor** closely and **mitigate risk**

Dougherty 2017

Clinical Case #1:
A patient on a DOAC for cancer-associated VTE requires urgent surgery

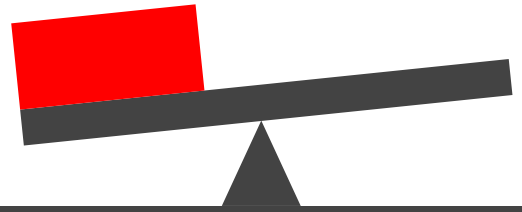
Clinical Case #1: Presentation

- **HPI:** D.J. is a 58yom with advanced lung adenocarcinoma admitted multiple times in recent weeks for worsening malignant pleural effusions
- **PMH**: HTN, multiple DVT/PE (most recent LLE proximal DVT diagnosed 6 weeks ago)
- **Home meds**: lisinopril, apixaban 5 mg BID (held on admission by hospitalist), oxycodone
- Respiratory status tenuous on NIPPV
- Thoracic surgery c/s: plan for VATS with possible open thoracotomy, scheduled for hospital day 4
- You round with the primary team the morning of hospital day 2 – Apixaban has been held since admission over the prior weekend and no antithrombotic is currently ordered

Clinical Case #1: You Decide

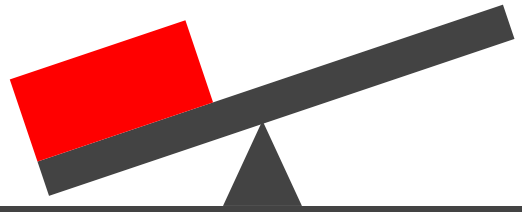
- How would you risk stratify this patient for thrombotic and bleeding complications?
- What anticoagulation strategy do you recommend for this patient at this time?
- Would you bridge this patient with a parenteral anticoagulant preoperatively?
- If so, how? (agent, dose, timing?)
- When and how would you reinitiate anticoagulation postoperatively?

Bleeding Risk: Procedural – General



Low-to-Moderate
30d major bleed risk 0-2%

Laparoscopic chole, hernia repair
Abdominal hysterectomy
Arthroscopy
Foot/hand surgery
Cardiac cath (+/- PCI)
Pacemaker/defibrillator implantation
Endoscopy/colonoscopy (+/- biopsy)
Bronchoscopy (+/- biopsy)

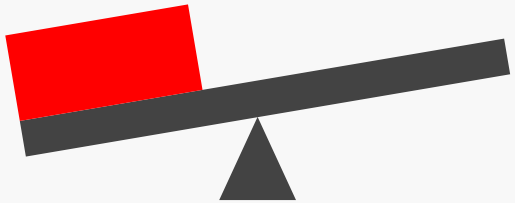


High
30d major bleed risk ≥2%

Major surgery w/ extensive tissue injury
Any major operation lasting > 45 mins
Cancer surgery, major thoracic surgery
Major orthopedic surgery (e.g. TJA)
Reconstructive plastic surgery
Urologic or GI surgery, liver, spleen
Cardiac, intracranial, or spinal surgery
Neuraxial anesthesia or injections
PEG, ERCP, colonic polyp resection

Douketis 2022

Bleeding Risk: Patient Factors

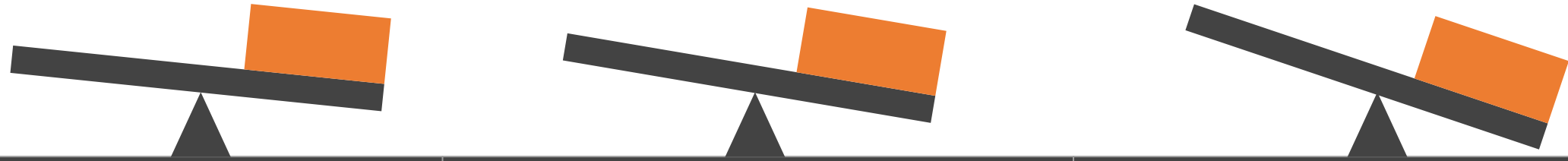


- Prior bleeding events, esp. <3 mo
- Prior bleeding with similar procedure or with bridging
- Platelet dysfunction
- Supratherapeutic or labile INRs

- SBP >160 mmHg
- Renal or hepatic dysfunction
- Prior stroke
- Age >65yo
- Heavy EtOH use
- Anemia

Dougherty 2017

Thrombotic Risk: Indication-Specific



	Low <4%/yr ATE or <2%/mo VTE	Moderate 4-10%/yr ATE or 4-10%/mo VTE	High >10%/yr ATE or >10%/mo VTE
VTE	VTE >12 months ago	VTE 3-12 mo ago Recurrent VTE Non-severe thrombophilia Active or recent cancer (≤5 yrs)	VTE <3 mo ago Severe thrombophilia Prior VTE w/ short-term interruption Active high VTE risk cancers
AFib	CHADS-VASc ≤4 AND NO history of stroke/TIA	CHADS-VASc = 5-6 Prior stroke/TIA/systemic TE ≥3 mo ago	CHADS-VASc ≥7 Prior stroke/TIA <3 mo Prior stroke/TIA with interruption Rheumatic valvular disease
MHV	Bileaflet AVR WITHOUT major stroke risk factors	Newer generation MVR WITHOUT major stroke risk factors Bileaflet AVR WITH risk factors	MVR WITH major stroke risk factors Older generation MVR or AVR Stroke/TIA <3 mo

Douketis 2022 MHV=mechanical heart valve, AVR=aortic valve replacement, MVR=mitral valve replacement

Clinical Case #1: Presentation

- **HPI:** D.J. is a 58yom with advanced lung adenocarcinoma admitted multiple times in recent weeks for worsening malignant pleural effusions
- **PMH**: HTN, multiple DVT/PE (most recent LLE proximal DVT diagnosed 6 weeks ago)
- **Home meds**: lisinopril, apixaban 5 mg BID (held on admission by hospitalist), oxycodone
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Clinical Case #1: Our Approach

- **Risk Stratification**
  - Thrombotic: high (VTE ≤3 months, active cancer)
  - Bleeding: low-moderate (VATS); high (if converted to open procedure)
- **Preoperatively**
  - Anticoagulation has already been held for suboptimal duration
  - OAC may not be a reliable option given respiratory/critical status
  - Enoxaparin 1 mg/kg SC q12h (last dose 10-12 hrs before procedure)
- **Postoperatively**
  - Resume apixaban 24-48 hrs after procedure (can consider enoxaparin 40mg SC qday if resumed POD2)

Clinical Case #2:

A patient on a DOAC for a Hx of AFib is admitted for a critical condition with uncertain procedural plan

Clinical Case #2: Presentation

- **HPI:** N.M. is a 68yof a/w nausea and abdominal pain and found to have a SBO and AKI (eCrCl 30-40mL/min). She is made strict NPO and Surgery is c/s
- **PMH:** HTN, DM2, paroxysmal AFib (CVasc score=4), HLD, PUD (bleed requiring EGD 2 months ago)
- **Home meds**: lisinopril, rivaroxaban 20 mg qDay, metformin, atorvastatin, esomeprazole
- Surgery c/s: monitor with conservative management (IVF, NGT) and consider intervention in the coming days if warranted
- The admitting primary team hospitalist asks you for a recommendation on anticoagulation management while she is strict NPO and interventional plan is TBD

Clinical Case #2: You Decide

- How do you risk stratify this patient?
- What anticoagulation strategy do you recommend for this patient at this time?
- Would you bridge this patient with a parenteral anticoagulant while her DOAC is interrupted?
- If so, how? (agent, dose, timing?)
- When and how would you reinitiate anticoagulation?

Temporary DOAC Interruption in Non-Procedural Circumstances

- No specific RCTs
- Draw from periprocedural setting

CHEST 2022

- Suggest stopping DOAC 1-4 days prior to procedure
- Based on DOAC, bleeding risk of procedure, and patient renal function
- Conditional Rec, Very Low Certainty of Evidence

Douketis 2022, Raval 2017

PAUSE Study Protocol for Periprocedural DOAC Management

DOAC and Procedure Bleed Risk Assessment		Day -3	Day -2	Day -1	DOS	Day +1	Day +2	Day +3	Day +4
Apixaban or Rivaroxaban	High	+	-	-	-	-	+/-	+	+
	Low	+	+	-	-	+	+	+	+

**VTE prophylaxis with parenteral agent allowed postop until DOAC resumption but NO bridging used*
**Resumption assumes operative hemostasis achieved*
**Dabigatran recommendations additionally stratified by CrCl, though patients with significant renal impairment may benefit from longer hold times for the other DOACs as well*

Douketis 2019

PAUSE Study

Adults with AFib and chronically on a full-dose DOAC scheduled for elective procedure

Standardized periop mgmt strategy based on DOAC $t_{1/2}$ n=3007

Outcomes analyzed within each DOAC cohort individually - apixaban, dabigatran, and rivaroxaban

Prospective, single-arm study at 23 medical centers across Canada, U.S., and Europe

0.90-1.85%	**30-day major bleeding** 95%CI 0-2.65%
0.16-0.60%	**30-day arterial TE** 95%CI 0-1.33%
0.24-0.28%	**30-day mortality** 95%CI 0.08-1.31%

- Not an RCT, no suitable comparator
- Did include renally-dosed therapeutic DOACs but excluded patients with significant renal impairment, cognitive impairment or psychiatric illness
- Mean CVasc score 3.3-3.5, mean HAS-BLED 1.8-2.0
- Only ~1/3 of study population underwent high bleed risk procedure
- >90% had minimal/no residual DOAC level

Douketis 2019

Bridging DOACs

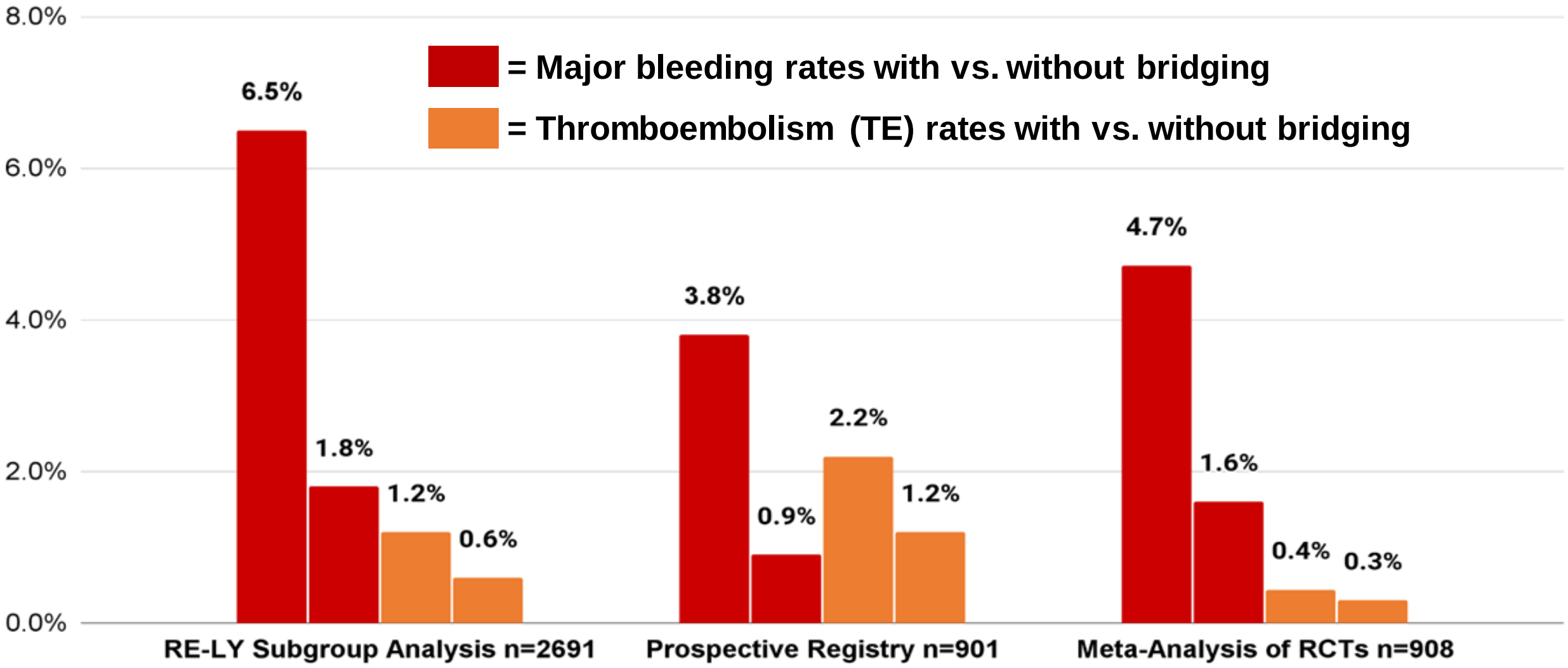
- Half-life obviates need for bridging
- More bleeding, no less thrombotic events

CHEST 2022

- Suggest against periop bridging
- Conditional Rec, Very Low Certainty of Evidence

Douketis 2022

Bridging DOACs with LMWH Periop



Douketis 2015b, Ferrandis 2020, Nazha 2018

Bleeding Risk: Procedural – GI

Low/Moderate
30d major bleed risk ≤2%

- EGD or colonoscopy without biopsy, polypectomy <1 cm
- ERCP without sphincterotomy
- Enteral stents
- Balloon dilation

High
30d major bleed risk >2%

- Polypectomy >/1 cm
- PEG/PEJ tube placement
- ERCP with sphincterotomy
- Endoscopic hemostasis
- Varices treatment

Abraham 2022

Bleeding Risk: Procedural – Interventional Radiology

Low
warfarin INR goal ≤2.0-3.0, don't hold DOAC

Catheter/tube exchanges
Diagnostic arteriography
Dialysis access interventions
Facet joint injections and medial branch nerve blocks, peripheral nerve blocks, joint injections
Most IVC filter placement and removal
Lumbar puncture
Chest tube placement for pleural effusion
Most venous access/removal (e.g. PICC, ports)
Superficial abscess drainage or biopsy
Thoracentesis, paracentesis

High
warfarin INR goal ≤1.5-1.8, hold DOAC

Ablations
Most arterial interventions
Biliary interventions
Catheter directed thrombolysis (DVT, PE, portal vein)
Deep abscess drainage
Deep nonorgan biopsies, solid organ biopsies
Gastrostomy/gastrojejunostomy placement
Complex IVC filter retrieval
Portal vein interventions
Spine procedures or injections
TIPSS
Urinary tract interventions
Intrathoracic and CNS interventions

Patel 2019

Clinical Case #2: Presentation

- **HPI:** N.M. is a 68yof a/w nausea and abdominal pain and found to have a SBO and AKI (eCrCl 30-40mL/min). She is made strict NPO and Surgery is c/s
- **PMH:** HTN, DM2, paroxysmal AFib (CV score=4), HLD, PUD (bleed requiring EGD 2 months ago)
- **Home meds**: lisinopril, rivaroxaban 20 mg qDay, metformin, atorvastatin, esomeprazole
- Surgery c/s: monitor with conservative management (IVF, NGT) and consider intervention in the coming days if warranted
- The admitting primary team hospitalist asks you for a recommendation on anticoagulation management while she is strict NPO and interventional plan is TBD

Clinical Case #2: Our Approach

- **Risk Stratification**
  - Thrombotic: relatively low (CVasc=4, no prior stroke), though acute illness
  - Bleeding: high (HAS-BLED=3, AKI, PUD with recent bleeding event)
- **Preoperatively**
  - Hold OAC while strict NPO/NGT
  - Maintain VTE prophylaxis with enoxaparin 40 mg SC qDay
    - Start >24 hrs from last rivaroxaban dose
    - Monitor renal function and s/s bleeding closely, hold for 24 hrs preop
- **Postoperatively**
  - Resume VTE prophylaxis DOS PM or POD1 AM if hemostasis assured
  - Resume rivaroxaban ~POD3 AM if cleared for PO, renal adjustment PRN

Clinical Case #3:

A patient on a DOAC for a Hx of VTE sustains a hip fracture requiring urgent total hip arthroplasty (THA)

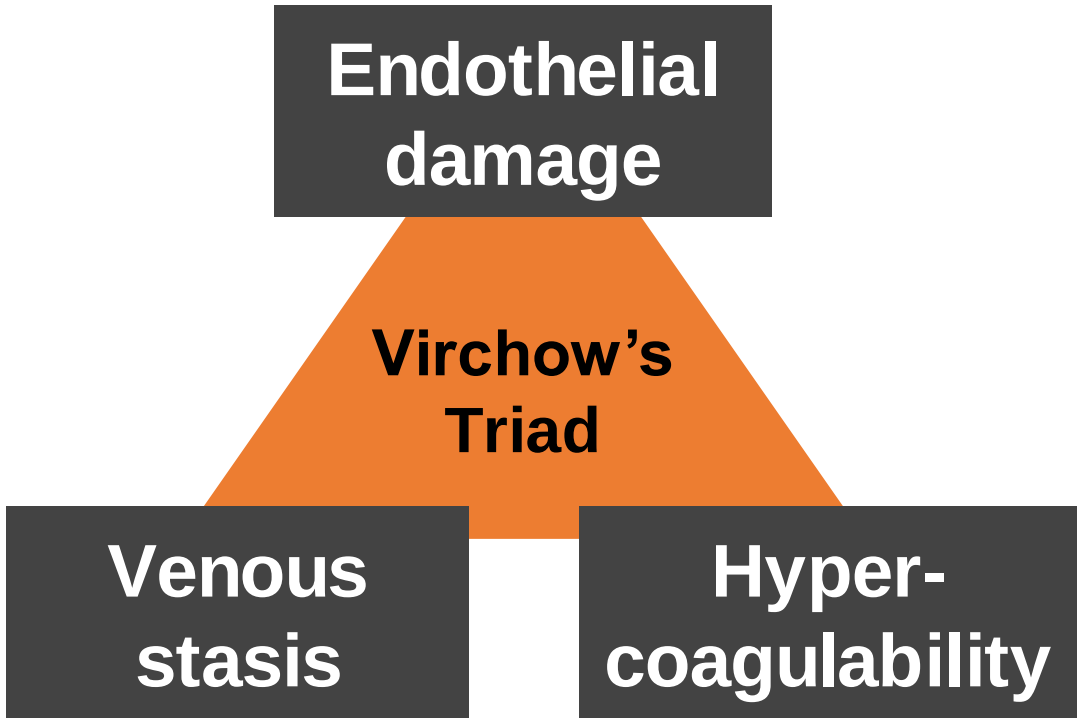
Clinical Case #3: Presentation

- **HPI:** M.M. is a 84yof residing at a nursing home p/w inability to ambulate, found to have fragility hip fracture. Wt=67kg. VS and labs WNL
- **PMH**: osteoporosis, current daily tobacco use with 50pyh, HTN, dementia, Hx of LUE DVT 2 years ago (during hospitalization), COPD
- **Home meds**: vit D/calcium, lisinopril, metoprolol, apixaban 5 mg BID
- The admitting hospitalist holds apixaban on admission (last dose yesterday at 2100) and orders enoxaparin 40 mg SC qDay per the institutional hip fracture admission order set
- Ortho schedules a THA tomorrow at 0800 and usually requests a fascia iliaca block for regional anesthesia and a spinal if feasible
- You will be rounding with the surgical and medical teams and should provide recs for a perioperative antithrombotic plan

Clinical Case #3: You Decide

- How would you risk stratify this patient for thrombotic and bleeding complications?
- Which of these anesthetic strategies would be generally safe in this patient -spinal neuraxial anesthesia and/or a fascia iliaca nerve block?
- What anticoagulation strategy do you recommend for this patient at this time?
- Would you bridge this patient with a parenteral anticoagulant preoperatively?
- If so, how? (agent, dose, timing?)
- When and how would you reinitiate OAC postoperatively?

Thrombotic Risk and VTE Prophylaxis after TJA – Where Are We Now?



ASH 2019 Guidelines

- Suggest **aspirin or anticoagulants** (conditional, very low certainty)
- When anticoagulants used, suggest **DOACS > LMWH** (conditional, modest certainty)
- Suggest **extended (3+ wks) > short-term** (≤2 wks) duration (conditional, very low certainty)

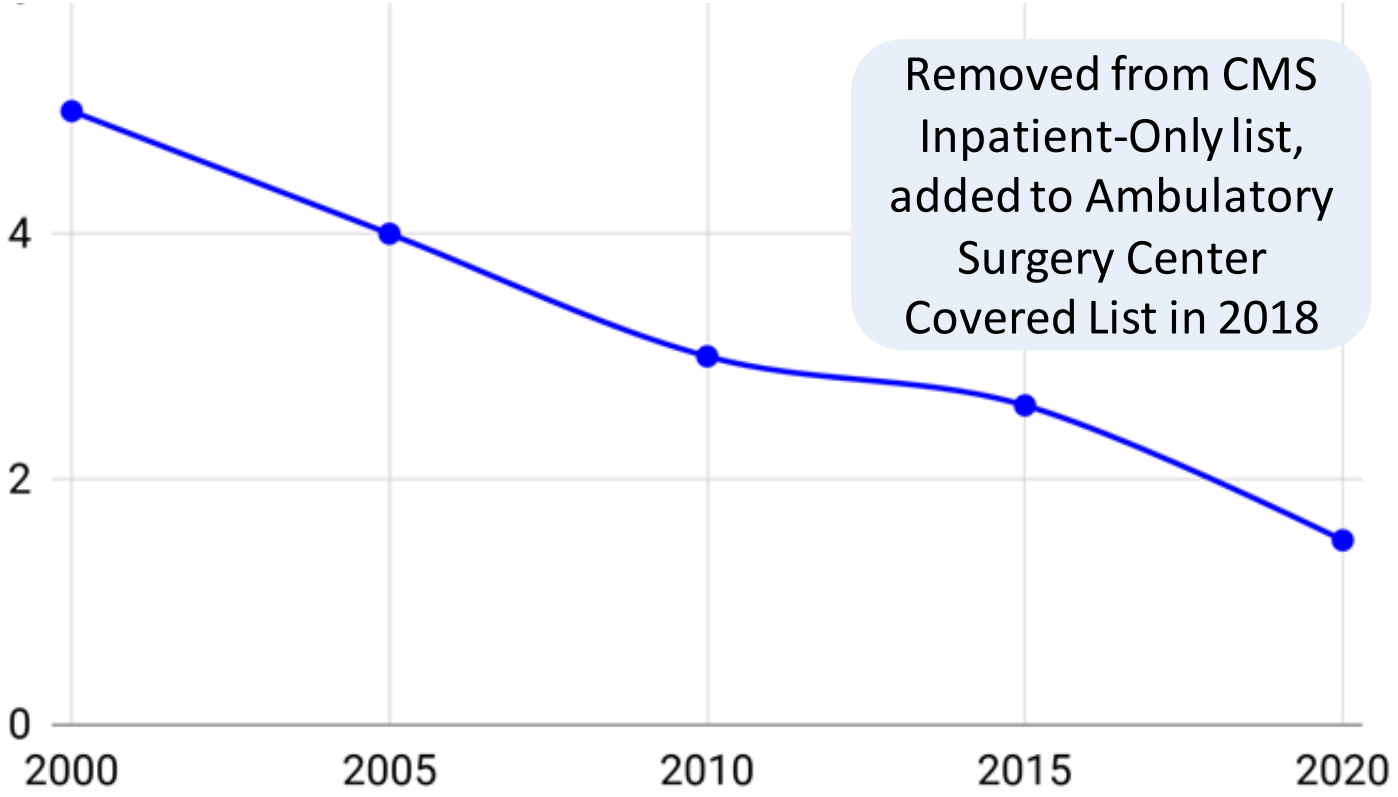
ERAS 2020 Guidelines

- Patients should be mobilized as soon as possible post-surgery and **receive antithrombotic prophylaxis in accordance with local policy** (strong rec, moderate evidence level)
- **Inpatient-only chemoprophylaxis** in select ERAS patients is discussed (ungraded)

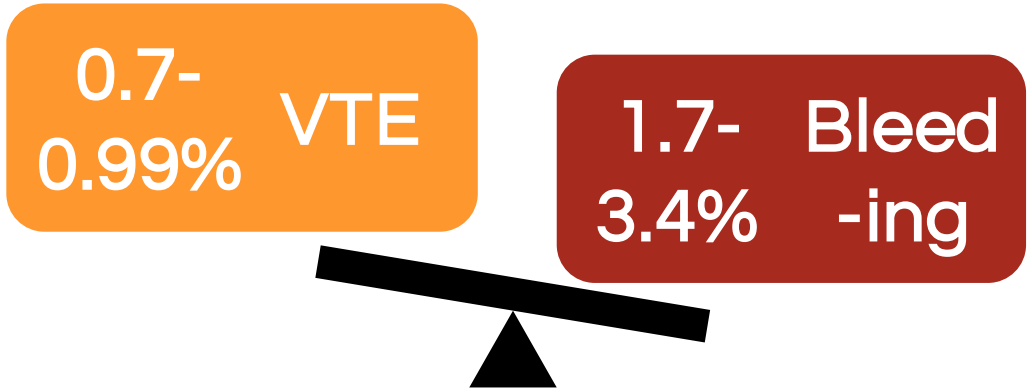
Kushner 2022, Khatkar 2022, Muscatelli 2021, Kahn 2020, Anderson 2019, Wainwright 2020

Thrombotic Risk after TJA has Substantially Decreased

Mean TJA Inpatient LOS (days)

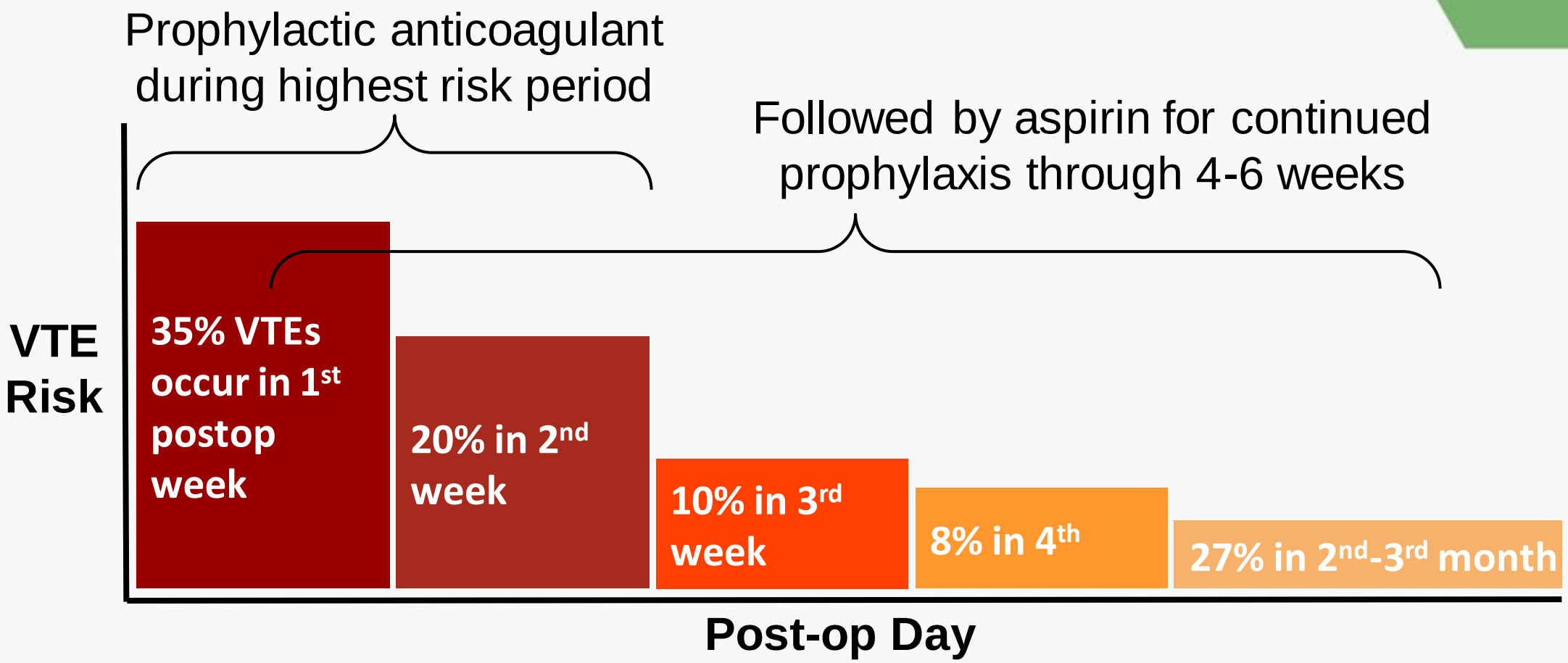


- Enhanced recovery paradigm
- Bleeding complications now predominate



CDC 2015, AJRR 2022, Schloemann 2023, Bemelmans 2022, Jenny 2020, Kahn 2019, Chan 2015

A "Step-Down" Approach to VTE Prophylaxis after TJA



Anderson 2013, Anderson 2018, Krauss 2022, Peng 2021, Petersen 2018, Jørgensen 2013, Pedersen 2019

Current GMC Guidance Document for Risk-Stratified VTE ppx after Elective TJA*

Major Risk Factors:	Non-Major Risk Factors:
• Personal Hx of VTE • Hypercoagulable state • Ongoing use of hormonal agents • Active systemic or metastatic cancer • BMI ≥ 40 kg/m^2 • Prolonged immobility or LOS > 3 d	• BMI 35-39 kg/m^2 • Cardiovascular disease** • Pulmonary disease • Hx of ischemic stroke • Daily tobacco use within 1 mo • Age ≥ 80 years old • Family Hx of VTE

No major risk factors and < 3 non-major risk factors

Routine Risk
Discharge on aspirin
81 mg EC BID x 28 days

≥ 1 major risk factor and/or ≥ 3 non-major risk factors

Moderate Risk
Apixaban 5-10 days then aspirin through 28 days

Hx VTE or thrombophilia

High Risk
Apixaban 10-28 days then aspirin through 28 days

*Assumptions apply. **Does not include HTN, HLD, or DM. GMC=OhioHealth Grant Medical Center.

Hyland 2022, Kahn 2020, Krauss 2022, Salomon 2021, Bala 2021, Parvizi 2016

Regional Anesthesia in Patients on Antithrombotic Medications

	Minimum Interval Before Neuraxial Procedure*	Minimum Interval Before Resumption After Neuraxial injection**	Management Before/After Low-Risk Nerve Blocks
Apixaban 5 mg PO BID	72 hours	6 hours	Does not need interrupted
Enoxaparin 40 mg SC qDay	12 hours	4 hours	Does not need interrupted

*Longer in renal dysfunction, consider pre-procedure coagulation laboratory testing
**Longer after bloody tap

Horlocker 2018, Kietaibl 2022

Periprocedural DOAC Interruption

- Half-life obviates need for bridging
- More bleeding, no less thrombotic events

CHEST 2022

- Suggest against periop bridging
- Conditional Rec, Very Low Certainty of Evidence

Douketis 2022

Anticoagulation Transitions are Risky

- Higher rates of both bleeding and thrombotic events
- Explicit transition plans may mitigate these risks
- Some experts still consider bridging in select circumstances

AHA 2017

- Careful consideration to strategies that **minimize prolonged durations of both sub- therapeutic and excessive anticoagulation** during transition periods
- Consideration should be given to **managing temporary interruptions without bridging**

Raval 2017, Douketis 2022, Berry 2022

Clinical Case #3: Presentation

- **HPI:** M.M. is a 84yof residing at a nursing home p/w inability to ambulate, found to have fragility hip fracture. Wt=67kg. VS and labs WNL
- **PMH**: osteoporosis, current daily tobacco use with 50pyh, HTN, dementia, Hx of LUE DVT 2 years ago (during hospitalization), COPD
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- The admitting hospitalist holds apixaban on admission (last dose yesterday at 2100) and orders enoxaparin 40 mg SC qDay per the institutional hip fracture admission order set
- Ortho schedules a THA tomorrow at 0800 and usually requests a fascia iliaca block for regional anesthesia and a spinal if feasible
- You will be rounding with the surgical and medical teams and should provide recs for a perioperative antithrombotic plan

Clinical Case #3: Our Approach

- **Risk Stratification**
  - Thrombotic:
    Indication-specific: low - single VTE event >12 mo ago, no clear indication for chronic OAC
    Procedural: high - TJA, fracture, Hx VTE, advanced age, COPD, heavy tobacco use
  - Bleeding: high - fracture and major ortho surgery, advanced age, recent DOAC dose
- **Preoperatively**
  - Continue to hold PTA apixaban
  - Recommend against enoxaparin ppx during ~36 hr preop interruption of DOAC
  - Neuraxial anesthesia is contraindicated, fascia iliaca block should be safe to pursue
- **Postoperatively**
  - Start apixaban 2.5 mg PO BID at PM DOS if surgical hemostasis assured
  - Continue for a least 4 weeks and reevaluate need for chronic OAC thereafter

Clinical Case #4:

A patient on warfarin for mechanical heart valve (MHV) develops an intra-cranial hemorrhage (ICH)

Clinical Case #4: Presentation

- **HPI:** T.F. is a 72yom that fell off a ladder while working on his roof. He sustained an SAH and multiple rib fractures
- **PMH**: mAVR (bileaflet), HTN, Afib, HLD
- **Home meds**: aspirin, atorvastatin, metoprolol, losartan, warfarin
- Initial INR was 2.7. He received 2000 units of 4F-PCC + 10 mg vitamin K IVPB in the trauma bay. He was intubated for airway protection and transferred to the ICU for close observation
- Neurosurgery c/s recommended non-operative management and serial neuro checks/imaging. Repeat head CT the following day demonstrated stable SAH and no midline shift
- The trauma team is asking if bridging is required and when to resume full anticoagulation

Clinical Case #4: You Decide

- What anticoagulation strategy do you recommend for this patient at this time?
- Would you bridge this patient with a parenteral anticoagulant while OAC interrupted?
- If so, how? (agent, dose, timing?)
- When and how would you reinitiate anticoagulation?
- How would your plan change if he had a mechanical MVR?

Periprocedural Warfarin Interruption

- Long half-life → prolonged hold time or reversal indicated pre-op
- Heparin bridging may reduce period of subtherapeutic anticoagulation but is poorly studied

CHEST 2022

- Suggest **against** periop heparin bridging in patients on warfarin for MHV (Conditional Rec, Very Low Certainty) except in select high VTE risk patients
- Suggest resume warfarin within 24 hours at patient's usual dose

Douketis 2022

PERIOP-2 Trial – MHV Subgroup

Adults with Afib +/- MHV on warfarin scheduled for an elective procedure

Randomized, double blind, placebo controlled trial at 10 centers across Canada and India

Post procedure: No bridging placebo n=154

Post procedure: WB dalteparin (low bleed risk) Ppx dalteparin (high bleed risk) until INR ≥2.0 n=150

Major TE: 0% vs. 0.7% *p*=0.49

Major bleeding: 2% vs. 0.7% *p*=0.62

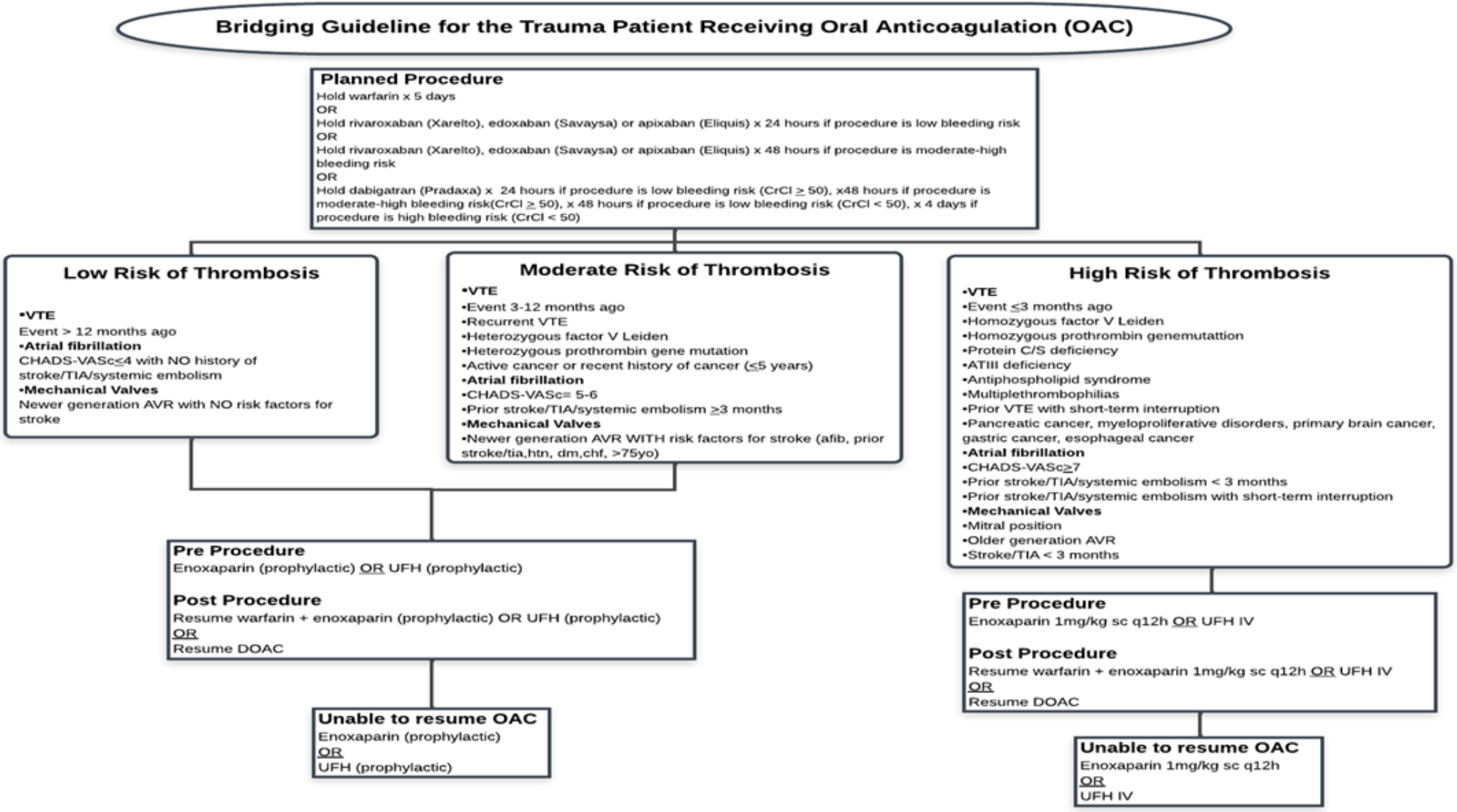
Death: 1.3% vs 0.7% *p*=1.00

- Of MHV patients, roughly even split between MVR and AVR
- All patients received pre-op bridging with WB LMWH
- Did not achieve full sample size and number of MHV patients was low
- Did not compare between WB dalteparin and proph dalteparin groups

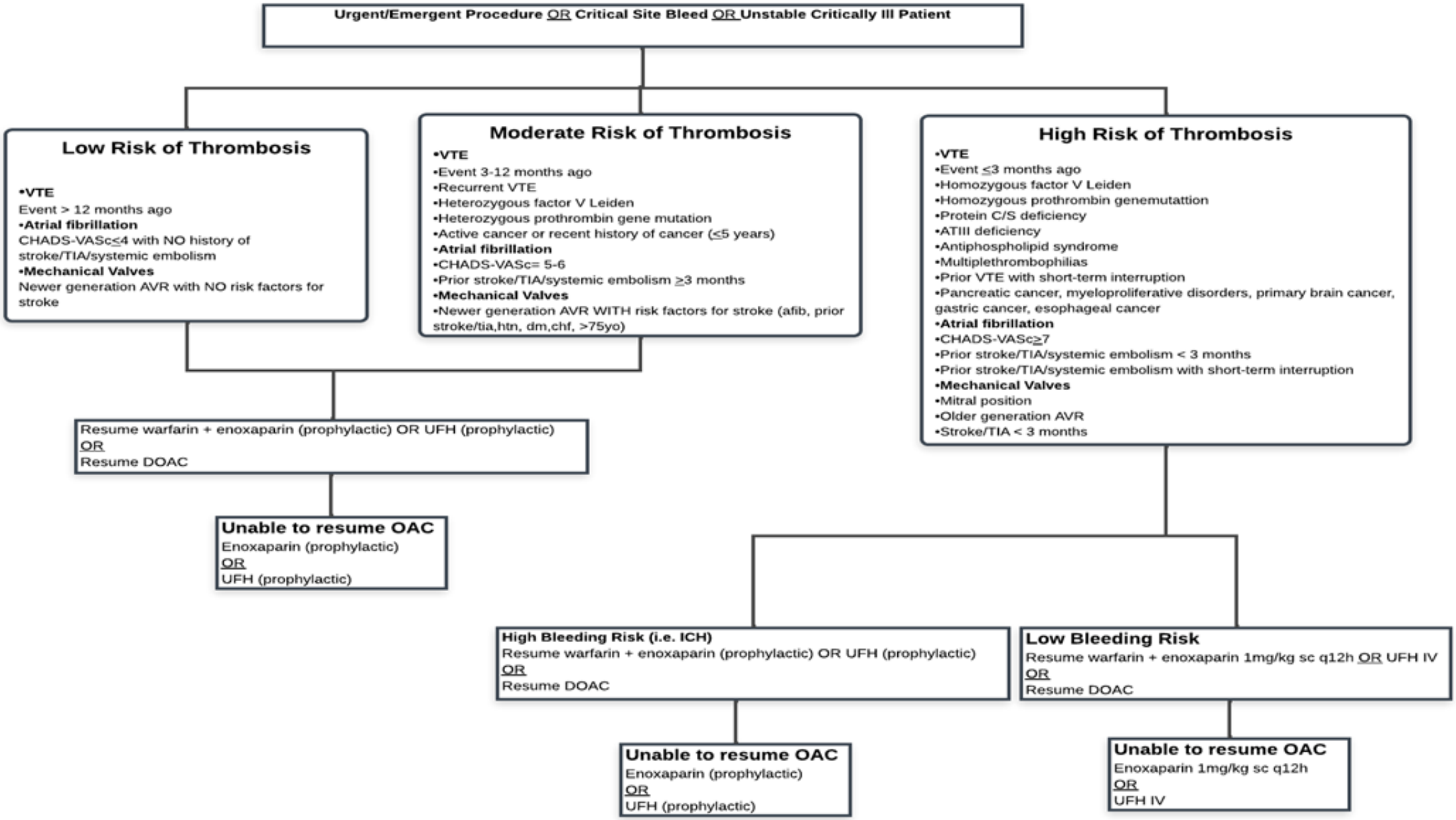
Kovacs 2021

MHV=mechanical heart valve, TE=thromboembolism, WB=weight-based dosing

GMC Trauma Bridging Protocol



GMC Trauma Bridging Protocol



Anticoagulation Resumption after ICH

≥1 week	American Heart Association/American Stroke Association 2014
14 days	European Stroke Organization 2014
4 weeks	American College of Cardiology (low risk) 2020
90 days	American Society of Hematology 2018

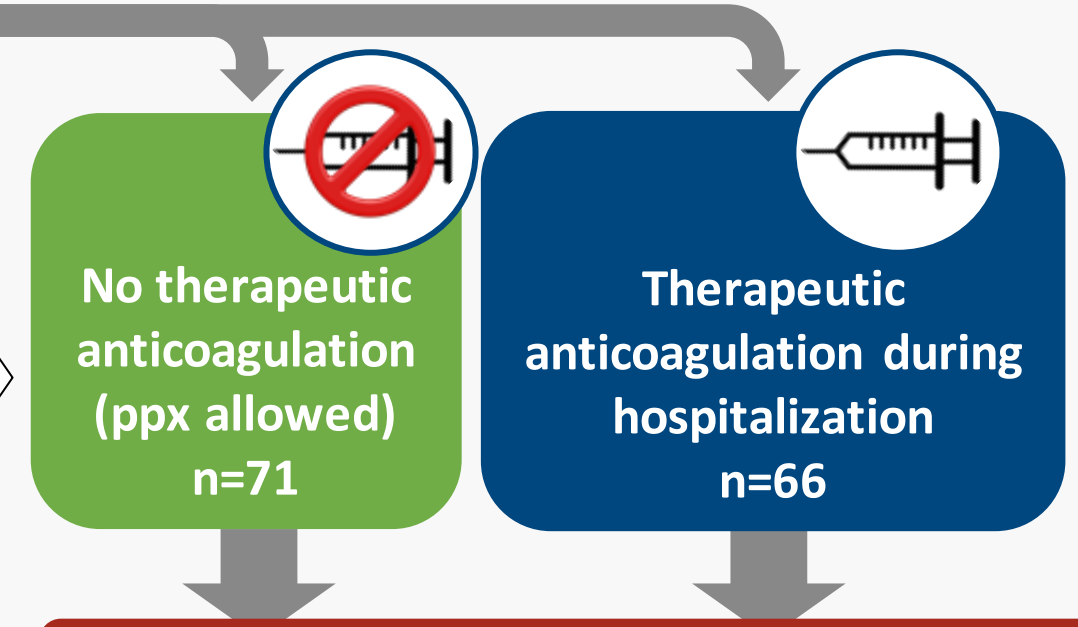
Whit 2018

Risk of Hemorrhage vs. TE After ICH

Design	Author Year	Timing of OAC	ICH with OAC resumption vs. no resumption	TE with OAC resumption vs. no resumption	Death with OAC resumption vs. no resumption
Retrospective cohort n=160	Witt 2015	**14** days	7.6% vs. **3.7%**	**3.7%** vs. 12.3%	**18.5%** vs. 31.1%
Nationwide cohort n=1752	Nielson 2015	**34** days	8.0% vs. 8.6%	**5.3%** vs. 10.4%	**9.7%** vs. 19.1%
Nationwide cohort n=2415	Nielson 2017	**31** days	5.8% vs. 5.3%	**3.3%** vs. 8.9%	**19.6%** vs. 35.5%

Li 2018

RETRACE Study Post-hoc Analysis

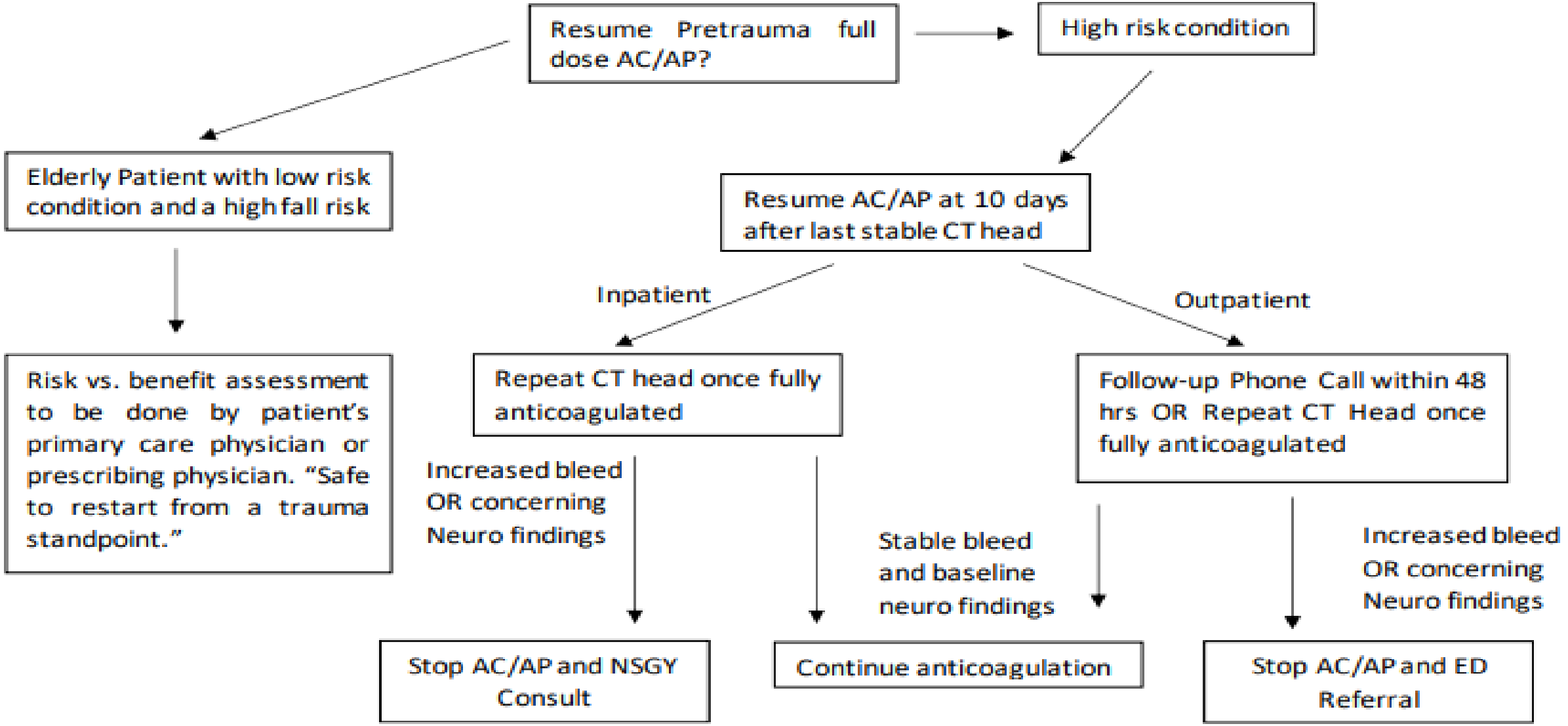


Retrospective cohort nested within a nation-wide observational cohort study in Germany

- About ⅔ AVR and ⅓ MVR
- Re-initiation of therapeutic AC associated with increased HR for hemorrhagic complications until 13 days after ICH (HR 7.06, 95% CI 2.33-21.37; p<0.01)
- Re-initiation of therapeutic AC >14 days after ICH no longer significantly related to hemorrhagic complications: HR 1.50, 95% CI 0.17-13.32; p=0.71

Kuramatsu 2018

GMC Trauma AT Resumption Protocol



AT=antithrombotic, includes anticoagulants (AC) and antiplatelets (AP)

Clinical Case #4: Presentation

- **HPI:** T.F. is a 72yom that fell off a ladder while working on his roof. He sustained an SAH and multiple rib fractures
- **PMH**: mAVR (bileaflet), HTN, Afib, HLD
- **Home meds**: aspirin, atorvastatin, metoprolol, losartan, warfarin
- Initial INR was 2.7. He received 2000 units of 4F-PCC + 10 mg vitamin K IVPB in the trauma bay. He was intubated for airway protection and transferred to the ICU for close observation
- Neurosurgery c/s recommended non-operative management and serial neuro checks/imaging. Repeat head CT the following day demonstrated stable SAH and no midline shift
- The trauma team is asking if bridging is required and when to resume full anticoagulation

Clinical Case #4: Our Approach

- **Risk Stratification**
  - Thrombotic: moderate (mAVR + Afib)
  - Bleeding: high (ICH)
- **Anticoagulation Plan**
  - Enoxaparin 30 mg SC q12h (24hrs after stable head CT per protocol)
  - Resume warfarin 10 days after stable head CT
  - Continue prophylactic enoxaparin + warfarin until INR ≥2
  - Repeat head CT when INR therapeutic per protocol
  - Hold aspirin indefinitely if able
- **Plan if mMVR?**

Closing Remarks

Institutional Anticoagulation Stewardship and Protocols

Clinical Decision Support Systems

+

Effective Communication incl. EMR Integration

→

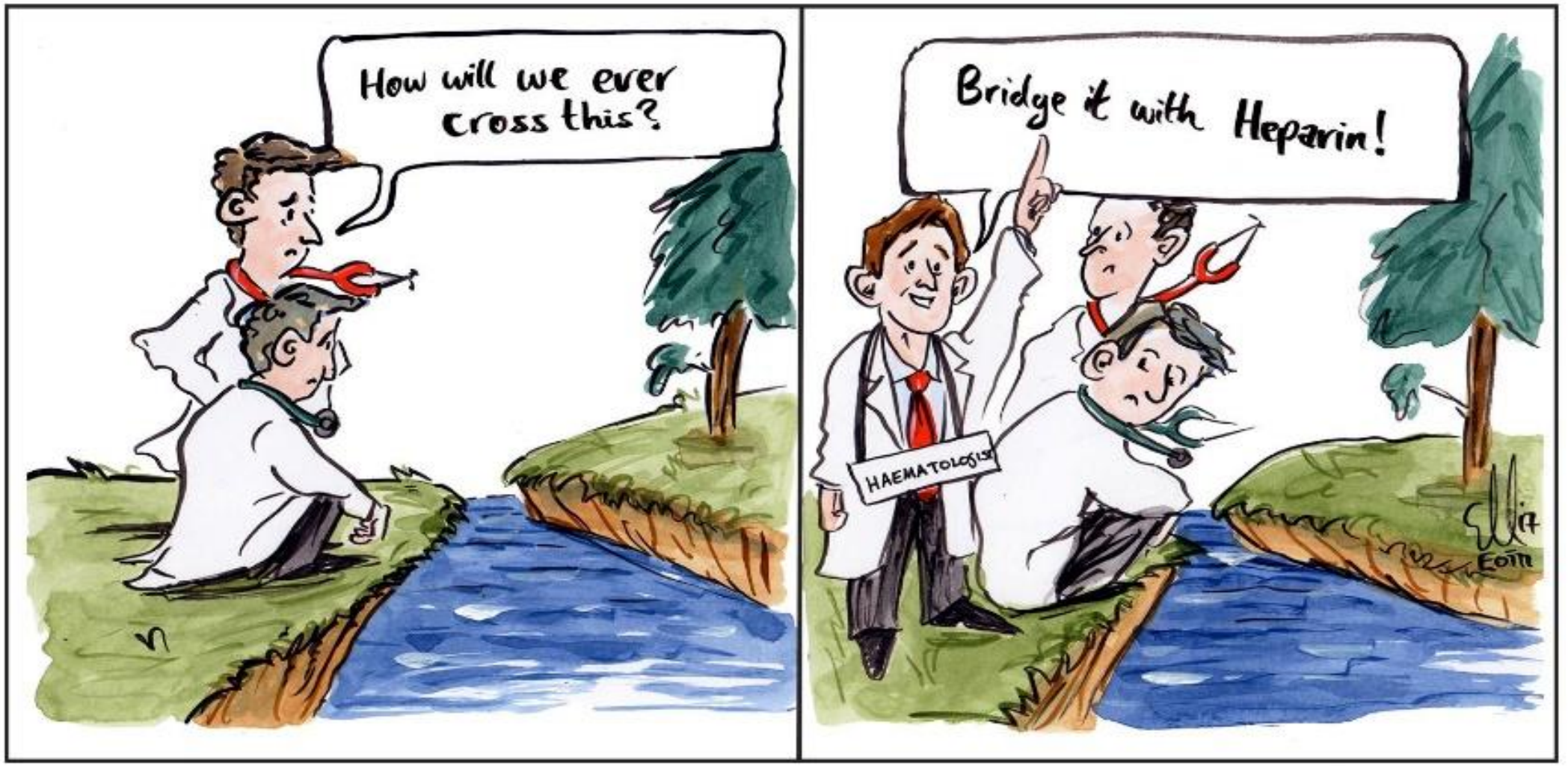
Sustainable, High-Quality Care to Optimize Patient Outcomes

Rudd 2023

Tools

- ACC ManageAnticoag App
- Anticoagulation Forum
- Thrombosis Canada

Key Takeaways



http://eoinkelleher.com/ - public domain post

Key Takeaways

http://eoinkelleher.com/ - public domain post

Key Takeaways

- Anticoagulants are high risk medications, and acute care and/or perioperative settings further heighten bleeding and thrombotic risks
- Evaluate patient-specific bleeding risk and thrombotic risk carefully and collaboratively, and monitor frequently
- Oral anticoagulants rarely need to be resumed immediately after a major procedure or bleed
- Therapeutic bridging likely causes more harm than good for most (if not all) patients
- Pharmacists should be prepared to lead on developing antithrombotic management plans in acute care and perioperative settings

Full Citations List (1 of 2)

- Abraham NS, Barkun AN, Sauer BG, Douketis J, Laine L, Noseworthy PA, et al. American College of Gastroenterology-Canadian Association of Gastroenterology Clinical Practice Guideline: Management of Anticoagulants and Antiplatelets During Acute Gastrointestinal Bleeding and the Periendoscopic Period. J Can Assoc Gastroenterol. 2022;5: 100–101.
- AJRR Annual Report, AAOS 2022. Available: Download the AJRR 2022 Annual Report (registryapps.net)
- Anderson DR, et al. Aspirin versus low-molecular-weight heparin for extended venous thromboembolism prophylaxis after total hip arthroplasty: a randomized trial. Ann Intern Med. 2013;158: 800–806.
- Anderson DR, et al. Aspirin or Rivaroxaban for VTE Prophylaxis after Hip or Knee Arthroplasty. N Engl J Med. 2018;378: 699–707.
- Anderson DR, et al. American Society of Hematology 2019 guidelines for management of venous thromboembolism: prevention of venous thromboembolism in surgical hospitalized patients. Blood Adv 2019; 3 (23): 3898–3944.
- Bala A, Oladeji K, Amanatullah DF. Effect of Comorbidity Burden on the Risk of Venous Thromboembolic Events After Total Knee Arthroplasty. Geriatr Orthop Surg Rehabil. 2021;12: 21514593211043998.
- Bemelmans YFL, et al. Safety and efficacy of outpatient hip and knee arthroplasty: a systematic review with meta-analysis. Arch Orthop Trauma Surg. 2022 Aug;142(8):1775-1791.
- Caldeira D, et al. Thromboprophylaxis With Apixaban in Patients Undergoing Major Orthopedic Surgery: Meta-Analysis and Trial-Sequential Analysis. Clin Med Insights Blood Disord. 2017 May 8;10:1179545X17704660.
- Berry J, Patell R, Zwicker JI. The bridging conundrum: perioperative management of direct oral anticoagulants for venous thromboembolism. J Thromb Haemost. 2023 Apr;21(4):780-786.
- CDC/Wolford ML, Palso K, Bercovitz A. Hospitalization for total hip replacement among inpatients aged 45 and over: United States, 2000–2010. NCHS data brief, no 186. Hyattsville, MD: National Center for Health Statistics. 2015.
- Chan NC, et al. A systematic review of contemporary trials of anticoagulants in orthopaedic thromboprophylaxis: suggestions for a radical reappraisal. J Thromb Thrombolysis. 2015 Aug;40(2):231-9.
- Doherty John U., Gluckman Ty J., Hucker William J., Januzzi James L., Ortel Thomas L., Saxonhouse Sherry J., et al. 2017 ACC Expert Consensus Decision Pathway for Periprocedural Management of Anticoagulation in Patients With Nonvalvular Atrial Fibrillation. J Am Coll Cardiol. 2017;69: 871–898.
- Douketis JD, Spyropoulos AC, Kaatz S, Becker RC, Caprini JA, Dunn AS, et al. Perioperative Bridging Anticoagulation in Patients with Atrial Fibrillation. N Engl J Med. 2015;373: 823–833.
- Douketis JD, Healey JS, Brueckmann M, Eikelboom JW, Ezekowitz MD, Fraessdorf M, Noack H, Oldgren J, Reilly P, Spyropoulos AC, Wallentin L, Connolly SJ. Perioperative bridging anticoagulation during dabigatran or warfarin interruption among patients who had an elective surgery or procedure. Substudy of the RE-LY trial. Thromb Haemost. 2015 Mar;113(3):625-32.
- Douketis JD, Spyropoulos AC, Duncan J, Carrier M, Le Gal G, Tafur AJ, Vanassche T, Verhamme P, Shivakumar S, Gross PL, Lee AYY, Yeo E, Solymoss S, Kassis J, Le Templier G, Kowalski S, Blostein M, Shah V, MacKay E, Wu C, Clark NP, Bates SM, Spencer FA, Arnaoutoglou E, Coppens M, Arnold DM, Caprini JA, Li N, Moffat KA, Syed S, Schulman S. Perioperative Management of Patients With Atrial Fibrillation Receiving a Direct Oral Anticoagulant. JAMA Intern Med. 2019 Nov 1;179(11):1469-1478.
- Douketis JD, Spyropoulos AC, Murad MH, Arcelus JI, Dager WE, Dunn AS, et al. Perioperative Management of Antithrombotic Therapy: An American College of Chest Physicians Clinical Practice Guideline. Chest. 2022;162: e207–e243.
- Douketis James D., Spyropoulos Alex C. Perioperative Management of Anticoagulant and Antiplatelet Therapy. NEJM Evidence. 2023;2: EVIDra2200322.
- Ferrandis R, Llau JV, Sanz JF, Cassinello CM, González-Larrocha Ó, Matoses SM, Suárez V, Guilabert P, Torres LM, Fernández-Bañuls E, García-Cebrián C, Sierra P, Barquero M, Montón N, Martínez-Escribano C, Llácer M, Gómez-Luque A, Martín J, Hidalgo F, Yanes G, Rodríguez R, Castaño B, Duro E, Tapia B, Pérez A, Villanueva ÁM, Álvarez JC, Sabaté S; RA-ACOD investigators. Periprocedural Direct Oral Anticoagulant Management: The RA-ACOD Prospective, Multicenter Real-World Registry. TH Open. 2020 Jun 26;4(2):e127-e137.
- Horlocker TT, Vandermeuelen E, Kopp SL, Gogarten W, Leffert LR, Benzon HT. Regional Anesthesia in the Patient Receiving Antithrombotic or Thrombolytic Therapy: American Society of Regional Anesthesia and Pain Medicine Evidence-Based Guidelines (Fourth Edition). Reg Anesth Pain Med. 2018;43: 263–309.
- Hornor MA, Duane TM, Ehlers AP, Jensen EH, Brown PS Jr, Pohl D, et al. American College of Surgeons' Guidelines for the Perioperative Management of Antithrombotic Medication. J Am Coll Surg. 2018;227: 521–536.e1.
- Hyland SJ, et al. Optimal duration of anticoagulant before de-escalation to aspirin monotherapy for chemoprophylaxis of venous thromboembolism after total joint arthroplasty. Poster at 2022 ACCP Global Conference on Clinical Pharmacy. Abstract available: https://www.accp.com/docs/meetings/abstracts/2022_global.pdf. [publication manuscript in process 2023]
- Jenny J-Y, et al. Bleeding and thromboembolism risk of standard antithrombotic prophylaxis after hip or knee replacement within an enhanced recovery program. Orthop Traumatol Surg Res. 2020;106: 1533–1538
- Jørgensen CC, et al. Thromboprophylaxis only during hospitalisation in fast-track hip and knee arthroplasty, a prospective cohort study. BMJ Open. 2013;3: e003965.
- Kahn SR, Shivakumar S. What's new in VTE risk and prevention in orthopedic surgery. Res Pract Thromb Haemost. 2020;4: 366–376.
- Khatkar H, et al. Preventing Venous Thromboembolism after elective total hip arthroplasty surgery - are the current guidelines appropriate? Venous thromboembolism prophylaxis in elective total hip arthroplasty surgery. J Clin Orthop Trauma. 2022 Jan 25;26:101782.
- Kietaibl S, Ferrandis R, Godier A, Llau J, Lobo C, Macfarlane AJ, Schlimp CJ, Vandermeulen E, Volk T, von Heymann C, Wolmarans M, Afshari A. Regional anaesthesia in patients on antithrombotic drugs: Joint ESAIC/ESRA guidelines. Eur J Anaesthesiol. 2022 Feb 1;39(2):100-132.

Full Citations List (2 of 2)

- Kovacs MJ, Wells PS, Anderson DR, Lazo-Langner A, Kearon C, Bates SM, et al. Postoperative low molecular weight heparin bridgingtreatment for patients at high risk of arterial thromboembolism (PERIOP2): double blind randomised controlled trial. BMJ. 2021;373: n1205.
- Krauss ES, Segal A, Dengler N, Cronin M, Pettigrew J, Simonson BG. Utilization of the Caprini Score for Risk Stratification of the Arthroplasty Patient in the Prevention of Postoperative Venous Thrombosis. Semin Thromb Hemost. 2022;48: 407–412.
- Kuramatsu JB, Sembill JA, Gerner ST, Sprügel MI, Hagen M, Roeder SS, Endres M, Haeusler KG, Sobesky J, Schurig J, Zweynert S, Bauer M, Vajkoczy P, Ringleb PA, Purrucker J, Rizos T, Volkmann J, Müllges W, Kraft P, Schubert AL, Erbguth F, Nueckel M, Schellinger PD, Glahn J, Knappe UJ, Fink GR, Dohmen C, Stetefeld H, Fisse AL, Minnerup J, Hagemann G, Rakers F, Reichmann H, Schneider H, Wöpking S, Ludolph AC, Stösser S, Neugebauer H, Röther J, Michels P, Schwarz M, Reimann G, Bäzner H, Schwert H, Claßen J, Michalski D, Grau A, Palm F, Urbanek C, Wöhrle JC, Alshammari F, Horn M, Bahner D, Witte OW, Günther A, Hamann GF, Lücking H, Dörfler A, Achenbach S, Schwab S, Huttner HB. Management of therapeutic anticoagulation in patients with intracerebral haemorrhage and mechanical heart valves. Eur Heart J. 2018 May 14;39(19):1709-1723.
- Kushner A, West WP, Khan Suheb MZ, et al. Virchow Triad. [Updated 2022 Dec 10]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK539697/
- Li YG, Lip GYH. Anticoagulation Resumption After Intracerebral Hemorrhage. Curr Atheroscler Rep. 2018 May 21;20(7):32.
- Nazha B, Pandya B, Cohen J, Zhang M, Lopes RD, Garcia DA, Sherwood MW, Spyropoulos AC. Periprocedural Outcomes of Direct Oral Anticoagulants Versus Warfarin in Nonvalvular Atrial Fibrillation. Circulation. 2018 Oct 2;138(14):1402-1411. doi: 10.1161/CIRCULATIONAHA.117.031457. PMID: 29794081.
- Patel IJ, Rahim S, Davidson JC, Hanks SE, Tam AL, Walker TG, Wilkins LR, Sarode R, Weinberg I. Society of Interventional Radiology Consensus Guidelines for the Periprocedural Management of Thrombotic and Bleeding Risk in Patients Undergoing Percutaneous Image-Guided Interventions-Part II: Recommendations: Endorsed by the Canadian Association for Interventional Radiology and the Cardiovascular and Interventional Radiological Society of Europe. J Vasc Interv Radiol. 2019 Aug;30(8):1168-1184.e1.
- Parvizi J, Huang R, Rezapoor M, Bagheri B, Maltenfort MG. Individualized Risk Model for Venous Thromboembolism After Total Joint Arthroplasty. J Arthroplasty. 2016;31: 180–186.
- Pedersen AB, et al. Optimal duration of anticoagulant thromboprophylaxis in total hip arthroplasty: new evidence in 55,540 patients with osteoarthritis from the Nordic Arthroplasty Register Association (NARA) group. Acta Orthop. 2019 Aug;90(4):298-305.
- Peng H-M, et al. Risk-Stratified Venous Thromboembolism Prophylaxis after Total Joint Arthroplasty: Low Molecular Weight Heparins and Sequential Aspirin vs Aggressive Chemoprophylaxis. Orthop Surg. 2021;13: 260–266.
- Petersen PB, et al. Safety of In-Hospital Only Thromboprophylaxis after Fast-Track Total Hip and Knee Arthroplasty: A Prospective Follow-Up Study in 17,582 Procedures. Thromb Haemost. 2018;118: 2152–2161
- Raval AN, Cigarroa JE, Chung MK, Diaz-Sandoval LJ, Diercks D, Piccini JP, et al. Management of Patients on Non-Vitamin K Antagonist Oral Anticoagulants in the Acute Care and Periprocedural Setting: A Scientific Statement From the American Heart Association. Circulation. 2017;135: e604–e633.
- Rudd K, Winans A, Triller D. Standardizing periprocedural anticoagulation management: a stewardship initiative. J Thromb Thrombolysis. 2023 Oct;56(3):361-367.
- Salomon B, Dasa V, Krause PC, Hall L, Chapple AG. Hospital Length of Stay Is Associated With Increased Likelihood for Venous Thromboembolism After Total Joint Arthroplasty. Arthroplast Today. 2021;8: 254–257.e1.
- Schloemann DT, Sajda T, Ricciardi BF, Thirukumaran CP. Association of Total Knee Replacement Removal From the Inpatient-Only List With Outpatient Surgery Utilization and Outcomes in Medicare Patients. JAMA Netw Open. 2023;6(6):e2316769.
- Spyropoulos AC, Brohi K, Caprini J, Samama CM, Siegal D, Tafur A, et al. Scientific and Standardization Committee Communication: Guidance document on the periprocedural management of patients on chronic oral anticoagulant therapy: Recommendations for standardized reporting of procedural/surgical bleed risk and patient-specific thromboembolic risk. J Thromb Haemost. 2019;17: 1966–1972.
- Troy A, Anderson TS. National Trends in Use of and Spending on Oral Anticoagulants Among US Medicare Beneficiaries From 2011 to 2019. JAMA Health Forum. 2021 Jul 23;2(7):e211693.
- Wainwright MG, et al. Consensus statement for perioperative care in total hip replacement and total knee replacement surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations, Acta Orthopaedica, 2020 91:1, 3-19.
- Writing Committee Members; Otto CM, Nishimura RA, Bonow RO, Carabello BA, Erwin JP 3rd, Gentile F, Jneid H, Krieger EV, Mack M, McLeod C, O'Gara PT, Rigolin VH, Sundt TM 3rd, Thompson A, Toly C. 2020 ACC/AHA Guideline for the Management of Patients With Valvular Heart Disease: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. J Am Coll Cardiol. 2021 Feb 2;77(4):e25-e197.
- Witt DM, Nieuwlaat R, Clark NP, Ansell J, Holbrook A, Skov J, Shehab N, Mock J, Myers T, Dentali F, Crowther MA, Agarwal A, Bhatt M, Khatib R, Riva JJ, Zhang Y, Guyatt G. American Society of Hematology 2018 guidelines for management of venous thromboembolism: optimal management of anticoagulation therapy. Blood Adv. 2018 Nov 27;2(22):3257-3291. doi: 10.1182/bloodadvances.2018024893. PMID: 30482765; PMCID: PMC6258922.

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