How to create and international thromboprophylaxis guideline?

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KariTikkinen

#clueworkinggroup

#eauguidelines

Lectio Magistralis at the Dipartimento di Scienze Clinico Chirurgiche, Diagnostiche e Pediatiche, Università di Pavia, invited by Professors Richard Naspro, Luca Ansaloni and Gian Luigi Marseglia


Peijas Hospital
Meilahti Hospito

Conflict of Interest Disclosure

I have no financial conflicts of interest

Guideline work (related to this lecture)

EAU *ad hoc* Guideline 2017 on Thromboprophylaxis in Urological Surgery (chair)

American Society of Hematology 2019 Guideline on Prevention of Venous Thromboembolism in Surgical Hospitalized Patients (panel member)

European Society of Anaesthesiology and Intensive Care Task

Introduction

Serious complications of surgery include deep vein thrombosis (DVT) and pulmonary embolism (PE) - together referred to as venous thromboembolism (VTE) - and major bleeding

Substantial practice variation in the use of thromboprophylaxis, both within and between countries

Uro: Violette et al. *Eur Urol Focus* 2020
Gyne: Hopkins et al. *J Obstet Gynaecol*

Can 2012

Gyne: Petch et al. *Thromb Res* 2016
General/Gyne: Pourjamal et al. *BJS Open* 2022

No procedure-specific guidance

No consensus on the use of thromboprophylaxis

No procedure-specific guidance for general abdominal or gynecologic surgery

Risks known to vary between procedures, but magnitude uncertain

The only procedure-specific guideline in any surgery is in urology, EAU

Lavikainen et al. Syst Rev 2021

Table 1 Major guidelines on the use of thromboprophylaxis for abdominal and/or pelvic surgery

Guideline association or guideline group	Year	Type of surgery	Stratification by procedure (Yes/No)	Number (percentage) of procedure specific recommendations for abdominal and/or pelvic surgery[a]
Enhanced Recovery After Surgery Society (ERAS)	2020	Vulvar and vaginal	No	0
American Society of Clinical Oncology (ASCO)	2019	Major cancer	No	0
American Society of Hematology (ASH)	2019	All	Partly[b]	3 (60%)
International Initiative on Thrombosis and Cancer (ITAC-CME)	2019	Cancer	No	0
Enhanced Recovery After Surgery (ERAS) Society	2018	Elective colorectal	No	0
National Institute for Health and Care Excellence (NICE) (of the United Kingdom)	2018	All	No[c]	0
Southern African Society of Thrombosis and Hemostasis	2018	Obstetrics and gynecology	No	0
The American Society of Colon and Rectal Surgeons	2018	Colorectal	No	0
Asian Venous Thrombosis Forum (AVTF) working group	2017	All	No	0
European Association of Urology (EAU)	2017	Urology	Yes	23 (100%)
European Society of Anesthesiology (ESA)	2017	All	No[d]	0
Enhanced Recovery After Surgery Society (ERAS)	2016	Gynecologic oncology	No	0
Enhanced Recovery After Surgery Society (ERAS)	2016	Liver surgery	No	0
Thrombosis Canada	2016	Non-orthopedic	No	0
The Scottish Intercollegiate Guidelines Network (SIGN)	2014	General abdominal Gynecologic Bariatric	No[e]	0
Enhanced Recovery After Surgery Society (ERAS)	2013	Pancreaticoduodenectomy	Yes[f]	1 (100%)
Enhanced Recovery After Surgery Society (ERAS)	2013	Radical cystectomy	Yes[f]	1 (100%)
Enhanced Recovery After Surgery Society (ERAS)	2013	Elective rectal/pelvic	No	0
American College of Chest Physicians (ACCP)	2012	Non-orthopedic	No	0
National Health and Medical Research Council (NHMRC) (of Australia)	2012	All	No[g]	0
American Urological Association (AUA)	2009 (reviewed 2011)	Urologic	No	0
American College of Obstetricians and Gynecologists (ACOG)	2007	Gynecologic	No	0

What should be considered when recommending (or not recommending) thromboprophylaxis?

1. Effect of treatment (prophylaxis)
   - Systematic review and meta-analysis of randomized trials

2. Baseline risk ('natural history') of outcomes
   - 'Best contemporary, observational evidence' including lowest risk of bias (or median value) identified through systematic review

3. Patient-related risk (and protective) factors

Effect of TP: Heparin vs. no prophylaxis

Nonfatal PE

Nonfatal bleeding

Nonfatal PE -50%

Total (95% CI) 7014 6842 100.0% 0.46 [0.34, 0.62]
Total events 58 120
Heterogeneity: Tau² = 0.00; Chi² = 18.22, df = 25 (P = 0.83); I² = 0%
Test for overall effect: Z = 4.96 (P < 0.00001)
Test for subgroup differences: Chi² = 0.12, df = 1 (P = 0.73), I² = 0%

0.01 0.1 1 10 100
Favours experimental Favours control

Nonfatal bleed +50%

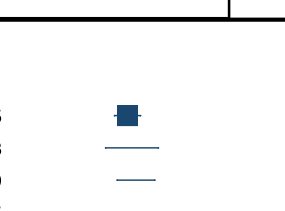
Total (95% CI) 6355 6295 100.0% 1.51 [1.29, 1.76]
Total events 382 232
Heterogeneity: Tau² = 0.00; Chi² = 34.63, df = 35 (P = 0.49); I² = 0%
Test for overall effect: Z = 5.16 (P < 0.00001)
Test for subgroup differences: Chi² = 1.18, df = 1 (P = 0.28), I² = 15.0%

0.01 0.1 1 10 100
Favours experimental Favours control

Effect of TP: Antiplatelets (aspirin) vs. placebo

VTE -20%

Study	Treatment Yes	Treatment No	Control Yes	Control No
PEP-trial, hip fracture-group	87	6,592	122	6,555
PEP-trial, arthroplasty-group	22	2,025	28	2,013
POISE-2-trial	45	4,953	53	4,959
STRATAGEM-trial	1	144	1	145
Overall				



Bleedin +20%

Table 2. Effects of Aspirin on 30-Day Outcomes.*

Outcome	Aspirin (N=4998)	Placebo (N=5012)	Hazard Ratio (95% CI)†	P Value
	no. (%)			
Safety outcomes				
Life-threatening bleeding	87 (1.7)	73 (1.5)	1.19 (0.88–1.63)	0.26
Major bleeding	230 (4.6)	188 (3.8)	1.23 (1.01–1.49)	0.04

1. Devereaux PJ, Mrkobrada M, Sessler DI, et al. Aspirin in patients undergoing noncardiac surgery. *N Engl J Med*. 2014;370(16):1494-1503. doi:10.1056/NEJMoa1401105
2. Prevention of pulmonary embolism and deep vein thrombosis with low dose aspirin: Pulmonary Embolism Prevention (PEP) trial. *Lancet*. 2000;355(9212):1295-1302.
3. Columbo JA, Lambour AJ, Sundling RA, et al. A Meta-analysis of the Impact of Aspirin, Clopidogrel, and Dual Antiplatelet Therapy on Bleeding Complications in Noncardiac Surgery. *Ann Surg*. 2018;267(1):1-10. d

Intervention	Symptomatic VTE	Symptomatic PE	Symptomatic proximal DVT	Symptomatic DVT (any extension)	Major bleeding
Low dose low molecular weight heparin	0.33 (0.16 to 0.67)	0.68 (0.37 to 1.25)	0.43 (0.14 to 1.33)	0.47 (0.26 to 0.85)	2.04 (1.28 to 3.22)*
High dose low molecular weight heparin	0.19 (0.07 to 0.54)	0.63 (0.28 to 1.39)	NA	0.36 (0.11 to 1.20)	3.07 (1.39 to 6.77)
Direct oral anticoagulants	0.17 (0.07 to 0.41)	0.71 (0.34 to 1.43)	0.23 (0.06 to 0.86)	0.33 (0.16 to 0.68)	2.01 (1.08 to 3.73)

RESEARCH

Benefits and harms of direct oral anticoagulation and low molecular weight heparin for thromboprophylaxis in patients undergoing non-cardiac surgery: systematic review and network meta-analysis of randomised trials

Maura Marcucci,[1,2,3] Itziar Etxeandia-Ikobaltzeta,[1] Stephen Yang,[4] Federico Germini,[1,2] Shyla Gupta,[5] Arnav Agarwal,[2,6] Matthew Ventresca,[1] Shaowen Tang,[7] Gian Paolo Morgano,[1] Mengxiao Wang,[8,9] Muhammad Muneeb Ahmed,[2] Ignacio Neumann,[10] Ariel Izcovich,[11] Juan Criniti,[11] Federico Popoff,[11] P J Devereaux,[1,2,3] Philipp Dahm,[12,13] David Anderson,[14] Lauri I Lavikainen,[15] Kari A O Tikkinen,[16,17] Gordon H Guyatt,[1,2] Holger J Schünemann,[1,18] Philippe D Violette[1,19]

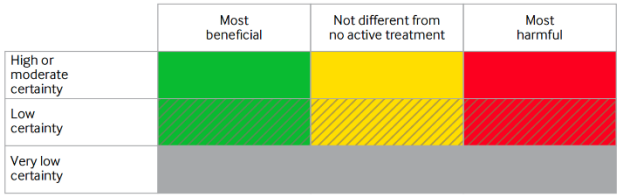


Fig 4 | Network meta-analysis results (network odds ratio (95% confidence interval)) based on GRADE (grading of recommendations, assessment, development, and evaluation) assessment of certainty of evidence, and treatment benefit and harm, with no active treatment as reference. PE=pulmonary embolism; VTE=venous thromboembolism; DVT=deep vein thrombosis; NA=not available. *Based on direct comparison

thebmj | BMJ 2022;376:e066785

ARTS Trial — A Large, Pragmatic, International Trial of Thromboprophylaxis in Intra-abdominal, Gynecologic, and Urologic Surgery

ARTS
Avoiding Risks of Thrombosis and Bleeding in Surgery
A randomized trial by CLUE

STUDY DESIGN AND ELIGIBILITY

- Pragmatic trial of 5,300 patients
- Randomized, open-label
- Adult patients undergoing abdominal or pelvic surgery at similar risk of VTE and bleeding
- Centers able to choose from which eligible procedures they recruit patients

RANDOMIZATION

- Randomization (1:1) to a direct oral anticoagulant (apixaban) or no anticoagulant using online randomization system
- Performed at earliest 12 hours post-surgery or at latest next morning on post-operative day

FOLLOW-UP

- No extraneous data collection
- 30 days follow-up

Comparator Arm

Standard of care

Experimental Arm

Standard of care +

Apixaban 2.5mg orally twice daily for 4 weeks

PRIMARY OUTCOMES

- **Efficacy outcome** Symptomatic VTE, including symptomatic DVT and symptomatic PE
- **Safety outcome** Major bleeding, defined as bleeding leading to a postoperative hemoglobin <70 g/L, transfusion of ≥1 unit of red blood cells, or bleeding that was judged to be the immediate cause of death

CLUE
Clinical Urology and Epidemiology Working Group

Contact: Global Principal Investigator, Professor Kari Tikkinen, email: kari.tikkinen@helsinki.fi

If interested in becoming an ARTS Investigator, please welcome to the ARTS introductory meeting during the Annual Congress of the EAU on Sat 11th March 2023 at 12:30 CET in Meeting Room 6, Amber 3.

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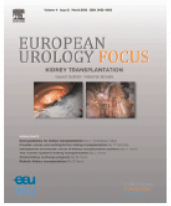
journal homepage: www.europeanurology.com/eufocus



Clinical Studies Update

ARTS: A Large, International Trial of Thromboprophylaxis in Intra-abdominal, Gynecologic, and Urologic Surgery

Philippe D. Violette[a,b], *Rufus Cartwright*[c,d], *P.J. Devereaux*[a,e,f], *Peter L. Gross*[e,g], *Kirsi-Maija Kaukonen*[h,i], *Per Morten Sandset*[j], *Tuomas P. Kilpeläinen*[k], *Lauri I. Lavikainen*[l], *Ville Sallinen*[m,n], *Saana Horstia*[l,o], *Gordon H. Guyatt*[a,e], *Kari A.O. Tikkinen*[k,p,*]

[a] *Department of Health Research Methods, Evidence, and Impact, McMaster University, Hamilton, Canada;* [b] *Department of Surgery, Woodstock General Hospital, Woodstock, Canada;* [c] *Department of Epidemiology and Biostatistics, Imperial College London, London, UK;* [d] *Department of Obstetrics and Gynaecology, LNWH NHS Trust, London, UK;* [e] *Department of Medicine, McMaster University, Hamilton, Canada;* [f] *Population Health Research Institute, Hamilton, Canada;* [g] *Thrombosis and Atherosclerosis Research Institute, Hamilton, Canada;* [h] *Department of Diagnostics and Therapeutics, Anesthesiology and Intensive care, University of Helsinki, Helsinki, Finland;* [i] *Pharmacovigilance Unit, Finnish Medicines Agency, Helsinki, Finland;* [j] *Department of Haematology, University of Oslo and Oslo University Hospital, Oslo, Norway;* [k] *Department of Urology, University of Helsinki and Helsinki University Hospital, Helsinki, Finland;* [l] *Faculty of Medicine, University of Helsinki, Helsinki, Finland;* [m] *Transplantation and Liver Surgery, Helsinki University Hospital and University of Helsinki, Helsinki, Finland;* [n] *Abdominal Surgery, Helsinki University Hospital and University of Helsinki, Helsinki, Finland;* [o] *Abdominal Center, Helsinki University Hospital, Helsinki, Finland;* [p] *Department of Surgery, South Karelian Central Hospital, Lappeenranta, Finland*

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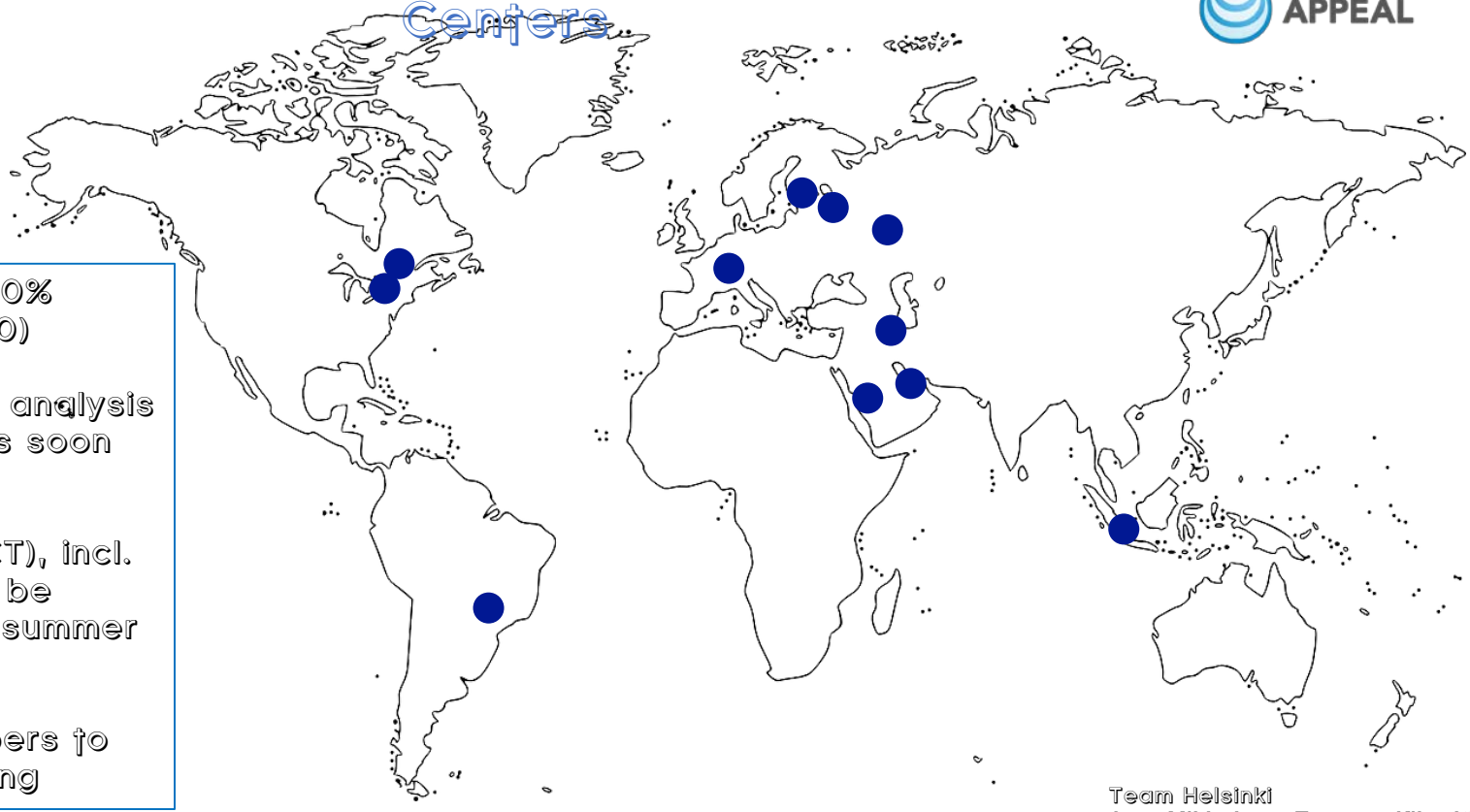
APPEAL Study Centers



1. Recruitment 100% completed (>1,700)

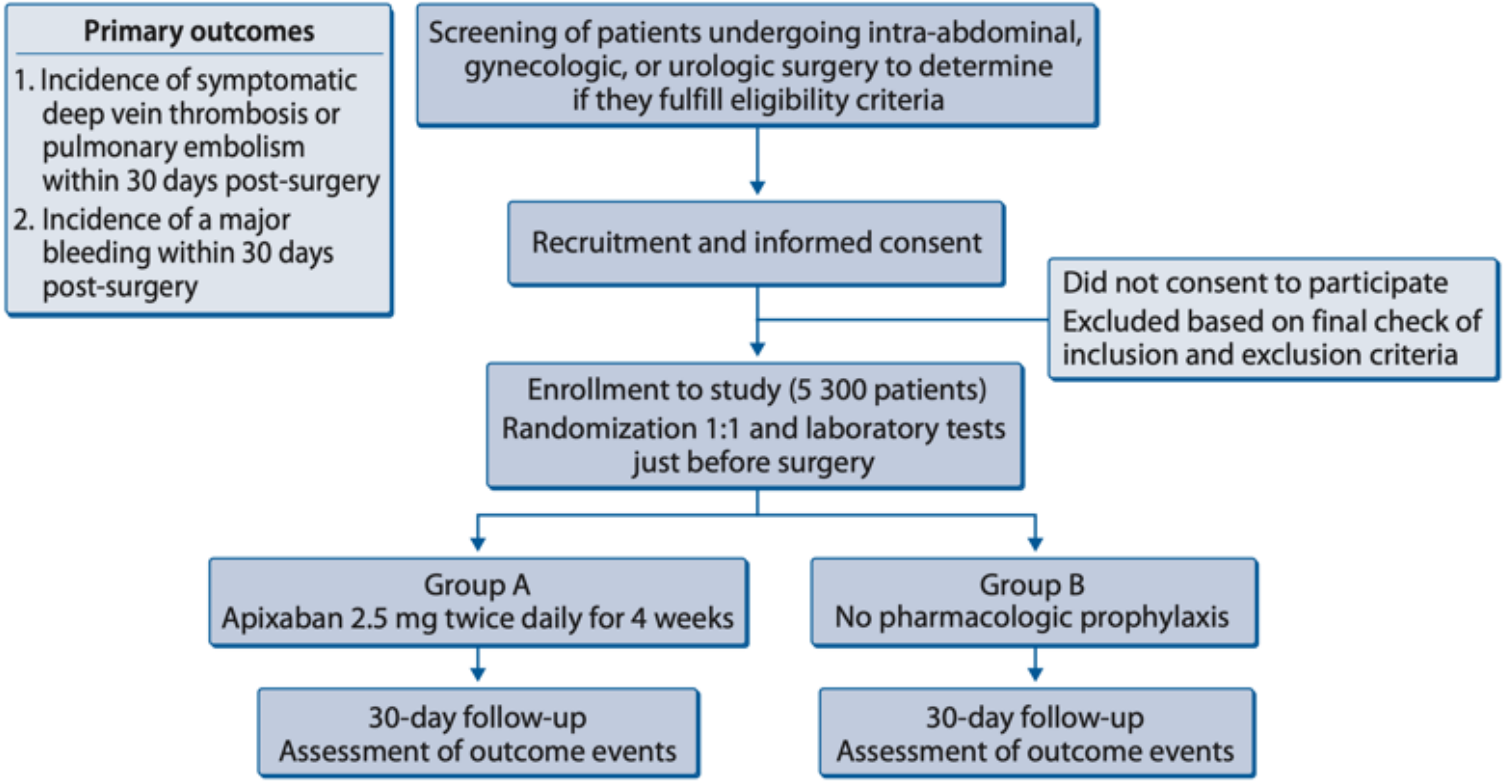
2. Data checking, analysis and meta-analysis soon completed

3. Main paper (RCT), incl. meta-analysis, to be submitted before summer 2023

4. Secondary papers to be submitted during 2023:
- LUTS and stone position
- Risk factors of UTI in SWI

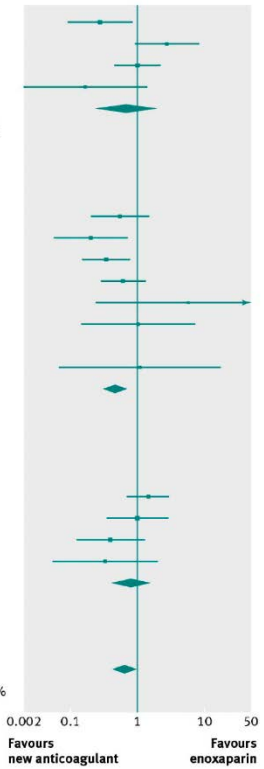
A Multicenter Randomized Trial Assessing the Efficacy of Antimicrobial Prophylaxis (vs Placebo) for Shock Wave Lithotripsy on Reducing Urinary Tract

Team Helsinki
Arto Mikkola Tuomas Kilpeläine
Sanna Myrskysalo
Petrus Järvinen
Petrus JärvinenSara Tornberg
Paulina Kuutti Saana Horstia


Primary outcomes
1. Incidence of symptomatic deep vein thrombosis or pulmonary embolism within 30 days post-surgery
2. Incidence of a major bleeding within 30 days post-surgery
Screening of patients undergoing intra-abdominal, gynecologic, or urologic surgery to determine if they fulfill eligibility criteria
Recruitment and informed consent
Did not consent to participate
Excluded based on final check of inclusion and exclusion criteria
Enrollment to study (5 300 patients)
Randomization 1:1 and laboratory tests just before surgery
Group A
Apixaban 2.5 mg twice daily for 4 weeks
Group B
No pharmacologic prophylaxis
30-day follow-up
Assessment of outcome events
30-day follow-up
Assessment of outcome events

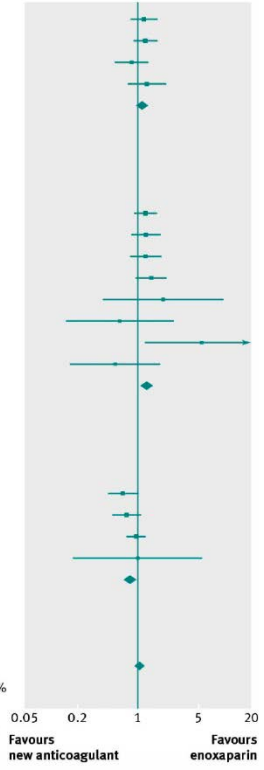
Symptomatic venous thrombosis

Trial	Events/total: New anticoagulant	Events/total: Enoxaparin	Relative risk (95% CI)	Weight (%)	Relative risk (95% CI)
Dabigatran					
RE-MODEL[19]	5/1402	9/699		7.5	0.28 (0.09 to 0.82)
RE-NOVATE[20]	22/2331	4/1162		7.7	2.74 (0.95 to 7.94)
RE-MOBILIZE[21]	20/1739	10/876		10.2	1.01 (0.47 to 2.14)
RE-NOVATE II[22]	1/1036	6/1019		3.1	0.16 (0.02 to 1.36)
Subtotal (95% CI)	48/6508	29/3756		28.5	0.71 (0.23 to 2.12)
Test for heterogeneity: τ^2=0.88, χ^2=11.26, df=3, P=0.01, I^2=73%					
Test for overall effect: Z=0.62, P=0.54					
Rivaroxaban					
RECORD 1[23]	6/2266	11/2275		8.2	0.55 (0.20 to 1.48)
RECORD 2[24]	3/1252	15/1257		6.5	0.20 (0.06 to 0.69)
RECORD 3[25]	8/1254	24/1277		9.8	0.34 (0.15 to 0.75)
RECORD 4[26]	11/1584	18/1564		10.3	0.60 (0.29 to 1.27)
PROOF CONCEPT[27]	1/84	0/162		1.5	5.75 (0.24 to 139.71)
ODIXA KNEE[28]	2/102	2/105		3.5	1.03 (0.15 to 7.17)
ODIXA HIP (twice daily)[29]	0/139	0/136			Not estimable
ODIXA HIP (once daily)[30]	1/147	1/160		2.0	1.09 (0.07 to 17.24)
Subtotal (95% CI)	32/6828	71/6936		41.9	0.48 (0.31 to 0.75)
Test for heterogeneity: τ^2=0.02, χ^2=6.34, df=6, P=0.39, I^2=5%					
Test for overall effect: Z=3.22, P=0.001					
Apixaban					
ADVANCE-1[31]	19/1599	13/1596		10.7	1.46 (0.72 to 2.94)
ADVANCE-2[32]	7/1528	7/1529		7.8	1.00 (0.35 to 2.85)
ADVANCE-3[33]	4/2708	10/2699		7.0	0.40 (0.13 to 1.27)
APROPOS[34]	2/310	3/152		4.0	0.33 (0.06 to 1.94)
Subtotal (95% CI)	32/6145	33/5976		29.6	0.82 (0.41 to 1.64)
Test for heterogeneity: τ^2=0.20, χ^2=4.98, df=3, P=0.17, I^2=40%					
Test for overall effect: Z=0.57, P=0.57					
Total (95% CI)	112/19 481	133/16 668		100.0	0.65 (0.43 to 0.99)
Test for heterogeneity: τ^2=0.29, χ^2=27.48, df=14, P=0.02, I^2=49%					
Test for overall effect: z=2.00, P=0.04					
Test for subgroup differences: χ^2=1.73, df=2, P=0.42, I^2=0%					



Clinically relevant bleeding

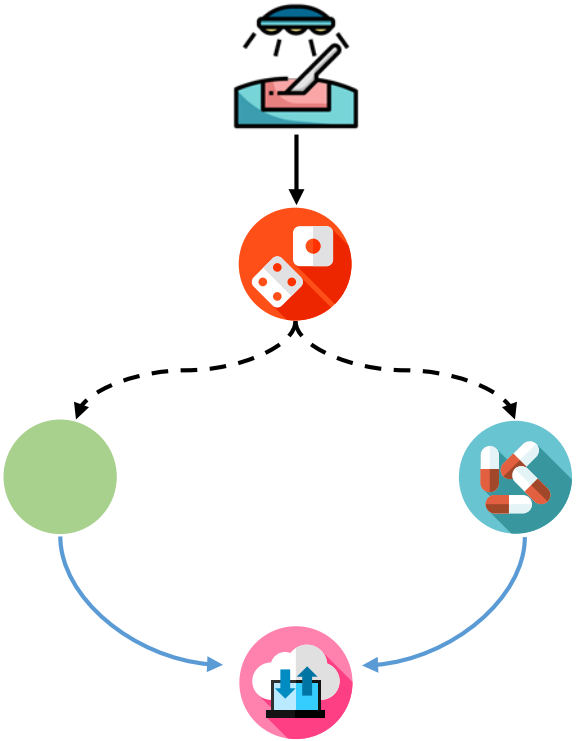
Trial	Events/total: New anticoagulant	Events/total: Enoxaparin	Relative risk (95% CI)	Weight (%)	Relative risk (95% CI)
Dabigatran					
RE-MODEL[19]	107/1402	46/699		9.0	1.16 (0.83 to 1.62)
RE-NOVATE[20]	141/2331	58/1162		10.0	1.21 (0.90 to 1.63)
RE-MOBILIZE[21]	55/1739	33/876		6.9	0.84 (0.55 to 1.28)
RE-NOVATE II[22]	37/1036	29/1019		5.9	1.25 (0.78 to 2.02)
Subtotal (95% CI)	340/6508	166/3756		31.8	1.12 (0.94 to 1.35)
Test for heterogeneity: τ^2=0.00, χ^2=2.30, df=3, P=0.51, I^2=0%					
Test for overall effect: Z=1.26, P=0.21					
Rivaroxaban					
RECORD 1[23]	105/2266	87/2275		10.6	1.21 (0.92 to 1.60)
RECORD 2[24]	63/1252	52/1257		8.3	1.22 (0.85 to 1.74)
RECORD 3[25]	54/1254	45/1277		7.7	1.22 (0.83 to 1.80)
RECORD 4[26]	66/1584	46/1564		8.1	1.42 (0.98 to 2.05)
PROOF CONCEPT[27]	3/84	3/162		0.8	1.93 (0.40 to 9.35)
ODIXA KNEE[28]	3/102	5/105		1.0	0.62 (0.15 to 2.52)
ODIXA HIP (twice daily)[29]	11/139	2/136		0.9	5.38 (1.22 to 23.83)
ODIXA HIP (once daily)[30]	4/147	8/60		1.3	0.54 (0.17 to 1.77)
Subtotal (95% CI)	309/6828	248/6936		38.6	1.25 (1.05 to 1.49)
Test for heterogeneity: τ^2=0.00, χ^2=7.40, df=7, P=0.39, I^2=5%					
Test for overall effect: Z=2.51, P=0.01					
Apixaban					
ADVANCE-1[31]	46/1599	69/1596		8.2	0.67 (0.46 to 0.96)
ADVANCE-2[32]	53/1528	72/1529		8.6	0.74 (0.52 to 1.04)
ADVANCE-3[33]	131/2708	138/2699		12.1	0.95 (0.75 to 1.19)
APROPOS[34]	4/310	2/152		0.7	0.98 (0.18 to 5.29)
Subtotal (95% CI)	234/6145	281/5976		29.5	0.82 (0.69 to 0.98)
Test for heterogeneity: τ^2=0.00, χ^2=3.10, df=3, P=0.38, I^2=3%					
Test for overall effect: Z=2.17, P=0.03					
Total (95% CI)	883/19 481	695/16 668		100.0	1.06 (0.92 to 1.22)
Test for heterogeneity: τ^2=0.03, χ^2=25.27, df=15, P=0.05, I^2=41%					
Test for overall effect: z=0.75, P=0.45					
Test for subgroup differences: χ^2=11.78, df=2, P=0.003, I^2=83%					



BMJ 2012;344:e3675

Pragmatic trial

- Broad and simple inclusion criteria
- Central randomization
- No extraneous data collection



Simple pragmatic trial
5,300 patients
Apixaban vs no VTE/bleeding post 6p far interested
>100 departments
>80 centers
>20 countries

Drug regulator (Fimea) & Ethics (Tukija) under review

- **Applying for approvals; start during 2023**
  FIN: Helsinki, Tampere, Turku Lappeenranta, Jyväskylä, ...

- **Tentative agreement of participation**
  FIN: Turku, Tampere, Lohja, Hyvinkää, Joensuu, Jyväskylä, Hämeenlinna, Oulu; CAN: Hamilton, Toronto, Sherbrooke, London, Montreal, Saskatoon, Vancouver, Thunder Bay, Calgary, Ottawa, Quebec City; ESP: Malaga, Coruña, Santander, Madrid; USA: Cleveland, Winston-Salem, Philadelphia; AUS: Sydney, Melbourne; NOR: Oslo; SWE: Stockholm; UK: London; IR: Dublin; BE: Leuven; FRA: Tours; IRN: Tabriz, Tehran, Isfahan, Shiraz, Rasht; ISR:

ARTS Study Centers
General, gyne and/or urologic surgery departments

ARTS

CLUE
Clinical Urology and Epidemiology Working Group

Contact:
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Team effort

CLUE
Clinical Urology and Epidemiology Working Group

ARTS

- Great chance to contribute and learn from large, pragmatic trials
- Potentially practice changing
- Thromboprophylaxis policy of your hospitals – several per country!
- Made as easy as possible to be implemented in busy clinical practice
- Flexible inclusion of general abdominal, gynecologic and urologic surgery patients with similar risk of thrombosis and bleeding

Contact:
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What should be considered when recommending (or not recommending) thromboprophylaxis?

1. Effect of treatment (prophylaxis)
   - Systematic review and meta-analysis of randomized trials

2. Baseline risk ('natural history') of outcomes
   - 'Best contemporary, observational evidence' including lowest risk of bias (or median value) identified through systematic review

3. Patient-related risk (and protective) factors

Evidence summaries for baseline risks of VTE and bleeding in urology (ROTBUS)

ROTBUS
Risk of Thrombosis and Bleeding in Urological Surgery
A study by CLUE

EUROPEAN UROLOGY 73 (2018) 242–251

available at www.sciencedirect.com
journal homepage: www.europeanurology.com

European Association of Urology

Platinum Priority – Review – Kidney Cancer

Editorial by Malte Rieken and Alexander Bachmann on pp. 252–253 of this issue

Procedure-specific Risks of Thrombosis and Bleeding in Urological Cancer Surgery: Systematic Review and Meta-analysis

Kari A.O. Tikkinen [a,], Samantha Craigie [b,c], Arnav Agarwal [b,d], Philippe D. Violette [e,f], Giacomo Novara [g], Rufus Cartwright [h,i], Richard Naspro [j], Reed A.C. Siemieniuk [b,k], Bassel Ali [b], Leyla Eryuzlu [b,d], Johanna Geraci [b], Judi Winkup [b], Daniel Yoo [b,d], Michael K. Gould [l], Per Morten Sandset [m,n], Gordon H. Guyatt [b,o]*

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Abstract

Context: Pharmacological thromboprophylaxis involves balancing a lower risk of venous thromboembolism (VTE) against a higher risk of bleeding, a trade-off that critically depends on the risks of VTE and bleeding in the absence of prophylaxis (baseline risk).
Objective: To provide estimates of the baseline risk of symptomatic VTE and bleeding requiring reoperation in urological cancer surgery.
Evidence acquisition: We identified contemporary observational studies reporting symptomatic VTE or bleeding after urological procedures. We used studies with the lowest risk of bias and accounted for use of thromboprophylaxis and length of follow-up to derive best estimates of the baseline risks within 4 wk of surgery. We used the GRADE approach to assess the quality of the evidence.
Evidence synthesis: We included 71 studies reporting on 14 urological cancer procedures. The quality of the evidence was generally moderate for prostatectomy and cystectomy, and low or very low for other procedures. The duration of thromboprophylaxis was highly variable. The risk of VTE in cystectomies was high (2.6–11.6% across risk groups) whereas the risk of bleeding was low (0.3%). The risk of VTE in prostatectomies varied by procedure, from 0.2–0.9% in robotic prostatectomy without pelvic lymph node dissection (PLND) to 3.9–15.7% in open prostatectomy with extended PLND. The risk of bleeding was 0.1–1.0%. The risk of VTE following renal procedures was 0.7–2.9% for low-risk patients and 2.6–11.6% for high-risk patients; the risk of bleeding was 0.1–2.0%.
Conclusions: Extended thromboprophylaxis is warranted in some procedures (eg, open and robotic cystectomy) but not others (eg, robotic prostatectomy without PLND in

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European Association of Urology

Platinum Priority – Review – Kidney Cancer

Editorial by Malte Rieken and Alexander Bachmann on pp. 252–253 of this issue

Procedure-specific Risks of Thrombosis and Bleeding in Urological Non-cancer Surgery: Systematic Review and Meta-analysis

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Abstract

Context: Pharmacological thromboprophylaxis involves a trade-off between a reduction in venous thromboembolism (VTE) and increased bleeding. No guidance specific for procedure and patient factors exists in urology.
Objective: To inform estimates of absolute risk of symptomatic VTE and bleeding requiring reoperation in urological non-cancer surgery.
Evidence acquisition: We searched for contemporary observational studies and estimated the risk of symptomatic VTE or bleeding requiring reoperation in the 4 wk after urological surgery. We used the GRADE approach to assess the quality of the evidence.
Evidence synthesis: The 37 eligible studies reported on 11 urological non-cancer procedures. The duration of prophylaxis varied widely both within and between procedures; for example, the median was 12.3 d (interquartile range [IQR] 3.1–55) for open recipient nephrectomy (kidney transplantation) studies and 1 d (IQR 0–1.3) for percutaneous nephrolithotomy, open prolapse surgery, and reconstructive pelvic surgery studies. Studies of open recipient nephrectomy reported the highest risks of VTE and bleeding (1.8–7.4% depending on patient characteristics and 2.4% for bleeding). The risk of VTE was low for 8/11 procedures (0.2–0.7% for patients with low/medium risk; 0.8–1.4% for high risk) and the risk of bleeding was low for 6/7 procedures (≤0.5%; no bleeding estimates for 4 procedures). The quality of the evidence supporting these estimates was low or very low.
Conclusions: Although inferences are limited owing to low-quality evidence, our results suggest that extended prophylaxis is warranted for some procedures (eg, kidney transplantation procedures in high-risk patients) but not others (transurethral resection of the prostate and reconstructive female pelvic surgery in low-risk patients).

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0302-2838/

EAU Guidelines on
Thromboprophylaxis in Urological Surgery

K.A.O. Tikkinen (Chair), R. Cartwright, M.K. Gould, R. Naspro, G. Novara, P.M. Sandset, P.D. Violette, G.H. Guyatt

European Association of Urology

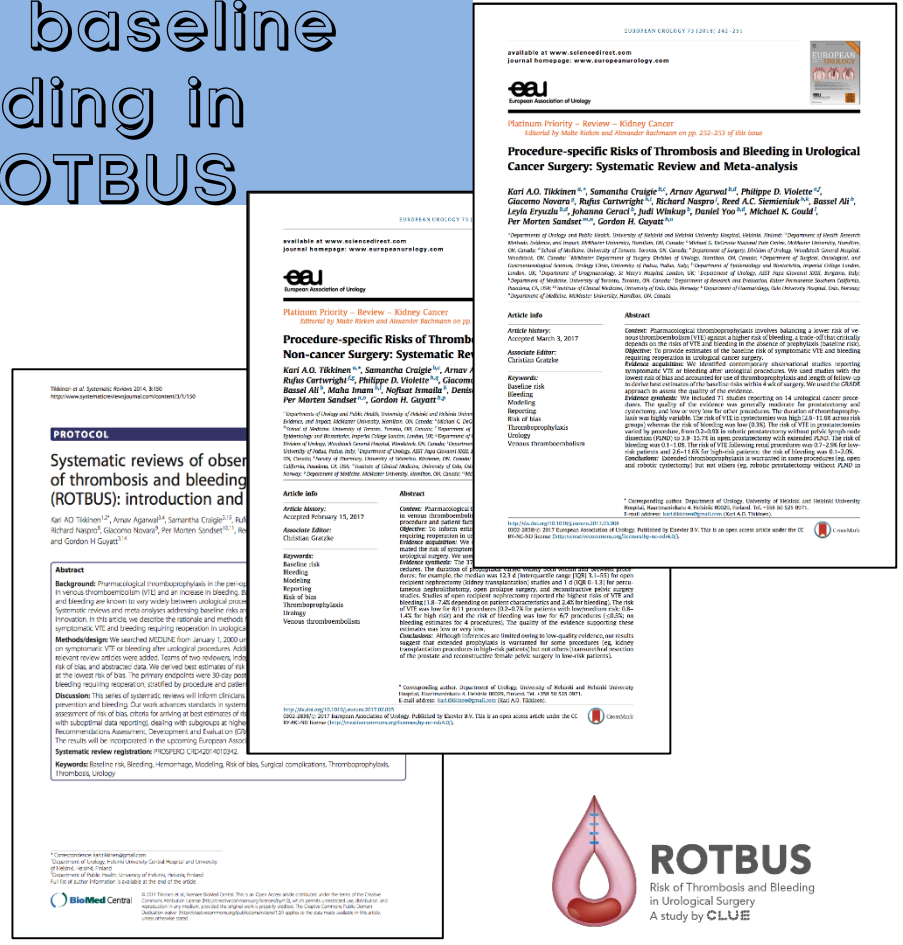
Evidence summaries for baseline risks of VTE and bleeding in urology available - ROTBUS

14 different types of urological cancer procedures based on 71 studies

11 uro(gyneco)logical noncancer procedures based on 38 studies

Much of the evidence regarding baseline risk is (very) low quality

- Old search was until 01 Jan



Eur Urol 2017

Big variation in the risk of symptomatic VTE between the procedures

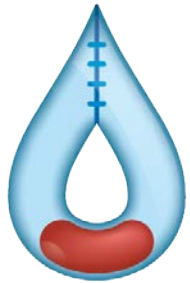
Procedure	Risk of VTE (low-high patient strata), %	Risk of bleeding, %
Open radical cystectomy	2.9-11.6	0.3
Robotic radical cystectomy	2.6-10.3	0.3
RALP without PLND	0.2-0.9	0.4
RALP with extended PLND	0.9-3.7	0.8
Open radical prostatectomy without PLND	1.0-3.9	0.1
Open radical prostatectomy with ext'd PLND	3.9-15.7	0.2
Artificial urinary sphincter	0.3-1.0	
TURP or equivalent	0.2-0.8	
Urethroplasty	0.3-1.1	
Prolapse surgery (open)	0.2-0.7	0.4
Reconstructive pelvic surgery (including female SUI and vaginal prolapse)	0.1-0.5	0.3

Evidence summaries for baseline risks of VTE and bleeding soon available for general abdominal and gynecologic surgeries

- General abdominal: 25,000 T&A and 2,600 full texts screened
- Gynecologic: 7,500 T&A and 1,600 full texts screened
- 581 studies included (282+299)

- >100 general abdominal surgery procedures
- >80 gynecologic surgery procedures

- Series of 5 articles to be published in 2023
  - General Abdominal, Colorectal, HPB & Upper GI
  - Cancer and Non-Cancer Gynecology



ROTBIGGS

Risk of Thrombosis and Bleeding in General and Gynecologic Surgery

A study by CLUE

Protocol OpenAccess from PubMed or from https://systematicreviewsjournal.biomedcentral.com/articles/10.1186/s1

Evidence summaries for baseline risks of VTE and bleeding in urology (ROTBUS) as well as general abdominal and gynecologic surgeries (ROTBIGGS)

ROTBIGGS
Risk of Thrombosis and Bleeding in General and Gynecologic Surgery
A study by CLUE

General abdominal surgery procedures: Symptomatic VTE and major bleeding

Under review

Gynecologic non-cancer procedures: Symptomatic VTE and major bleeding

Am J Obstet Gynecol (submission 03/2023)

Gynecol
procedur
Symptor
and majo

Am J Obstet Gynecol (submission 03/2023)

Colorect
procedur
Symptor
and majo

Under review

HPB and
surgery
Symptor
and majo

Under review

VTE Timing

Practice variation

Protocol

EAU Guidelines on Thromboprophylaxis in Urological Surgery

K.A.O. Tikkinen (Chair), R. Cartwright, M.K. Gould, R. Naspro, G. Novara, P.M. Sandset, P.D. Violette, G.H. Guyatt

Eur Urol 201

ROTBUS
Risk of Thrombosis and Bleeding in Urological Surgery
A study by CLUE

How long? "Extended" (4 weeks) thromboprophylaxis?

When to start? Beginning next morning after surgery?

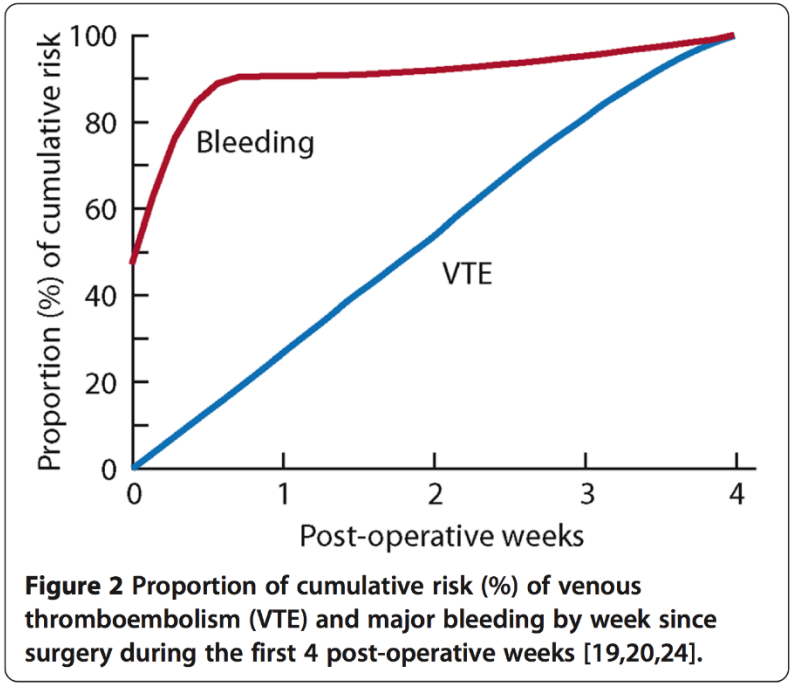
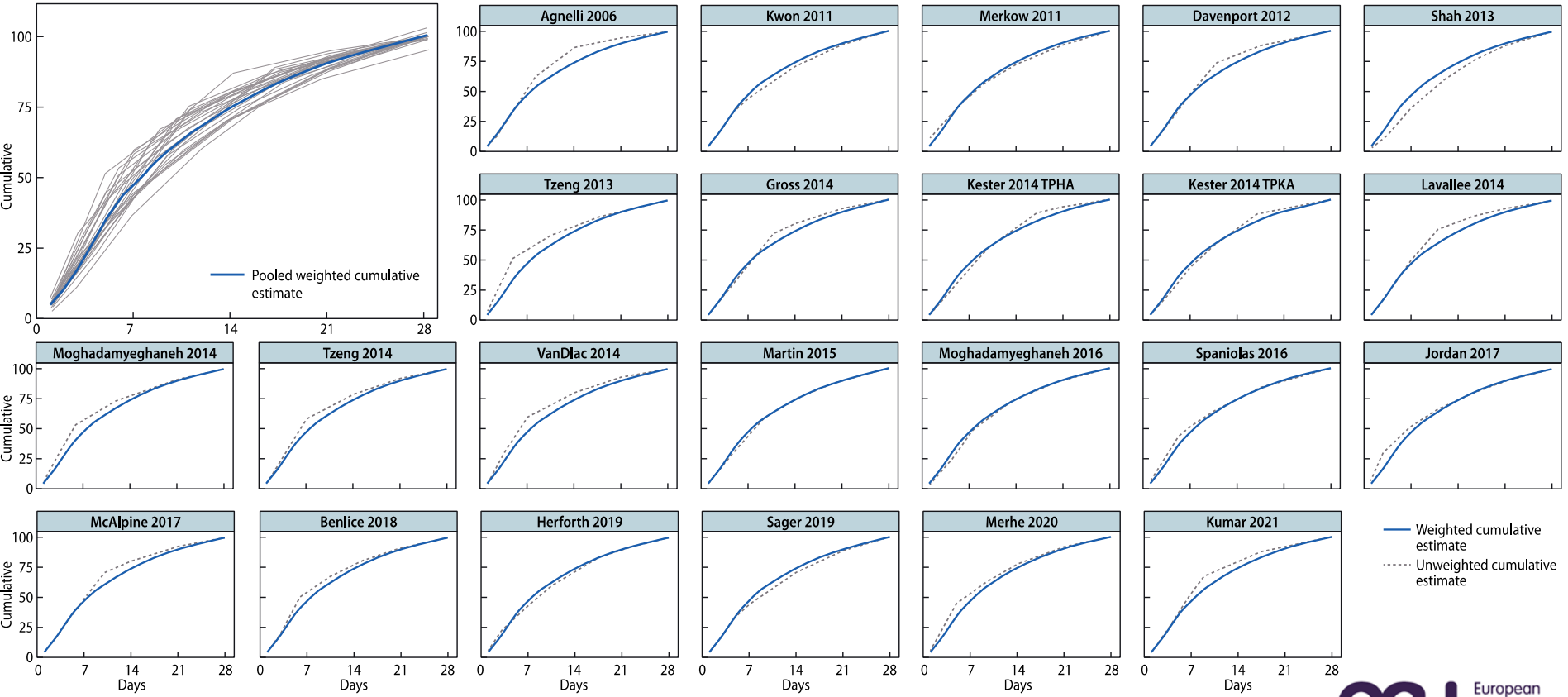


Figure 2 Proportion of cumulative risk (%) of venous thromboembolism (VTE) and major bleeding by week since surgery during the first 4 post-operative weeks [19,20,24].

Tikkinen et al. Syst Rev 2014 Sweetland et al. BMJ 2009 Amin et al. J Tromb Haemost 2007
Devereaux et al. NEJM 2014

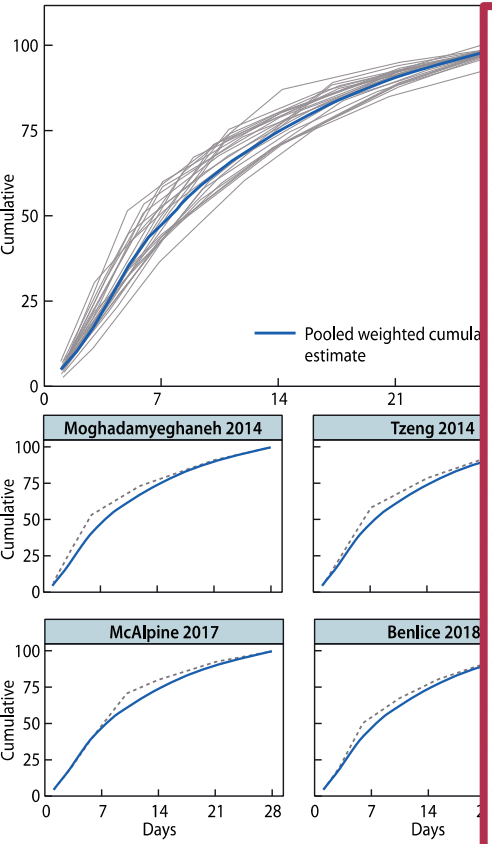
EAU23 - A1009: Singh et al. Timing of symptomatic venous thromboembolism after surgery: A systematic review and meta-analysis



EAU23 | MILAN, ITALY 10-13 March 2023

EAU23 - A1009: Singh et al. Timing of symptomatic venous thromboembolism after surgery: A systematic review and meta-analysis

Published today in the BJS!



www.eau23.org

OXFORD

BJS, 2023, 1–9
https://doi.org/10.1093/bjs/znad035
Systematic Review

Timing of symptomatic venous thromboembolism after surgery: meta-analysis

Tino Singh[1,2], Lauri I. Lavikainen[1], Alex L. E. Halme[1], Riikka Aaltonen[3], Arnav Agarwal[4,5], Marco H. Blanker[6], Kostiantyn Bolsunovskyi[1,7], Rufus Cartwright[8,9], Herney García-Perdomo[10], Rachel Gutschon[5,11], Yung Lee[12], Negar Pourjamal[1], Robin W. M. Vernooij[13,14], Philippe D. Violette[5,11], Jari Haukka[1], Gordon H. Guyatt[5,15] and Kari A. O. Tikkinen[1,16,17,*]

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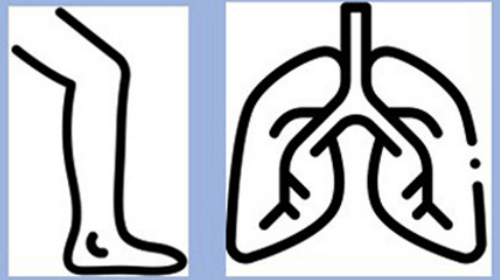
Timing of Perioperative Pharmacological Thromboprophylaxis Initiation and Its Effect on Venous Thromboembolism and Bleeding Outcomes: A Systematic Review and Meta-Analysis

22 randomized trials (n=17,124)

Starting thromboprophylaxis before surgery compared to after surgery may decrease any VTE



5.1% before vs. 6.6% after

Number Needed to Treat = 67

Starting thromboprophylaxis before surgery compared to after surgery may increase bleeding

31% before vs. 26% after

Number Needed to Harm = 20

RCTs needed for thromboprophylaxis timing on VTE and bleeding risk in non-orthopedic surgery

No statistically significant differences

McAlpine et al. J Am Coll Surg, November 2021

JACS

Prolonged thromboprophylaxis with low molecular weight heparin for abdominal or pelvic surgery (Review)

2019

Cochrane Library

Cochrane Database of Systematic Reviews

Felder S, Rasmussen MS, King R, Sklow B, Kwaan M, Madoff R, Jensen C

- Seven RCTs (1728 participants) were identified evaluating extended prophylaxis with LMWH for ≥14 days vs in-hospital period only after abdominal or pelvic surgery

- Any VTE: 5.3% in the extended vs. 13.2% in the hospital only (OR 0.38, 95% CI 0.26-0.54; I^2=28%; moderate-quality)
- Sympt. VTE: 0.1% in the extended vs. 1.0% the hospital only (OR 0.30, 95% CI 0.1-1.1; I^2=0%; moderate-quality)

What should be considered when recommending (or not recommending) thromboprophylaxis?

1. Effect of treatment (prophylaxis)
   - Systematic review and meta-analysis of randomized trials

2. Baseline risk ('natural history') of outcomes
   - 'Best contemporary, observational evidence' including lowest risk of bias (or median value) identified through systematic review

3. Patient-related risk (and protective) factors

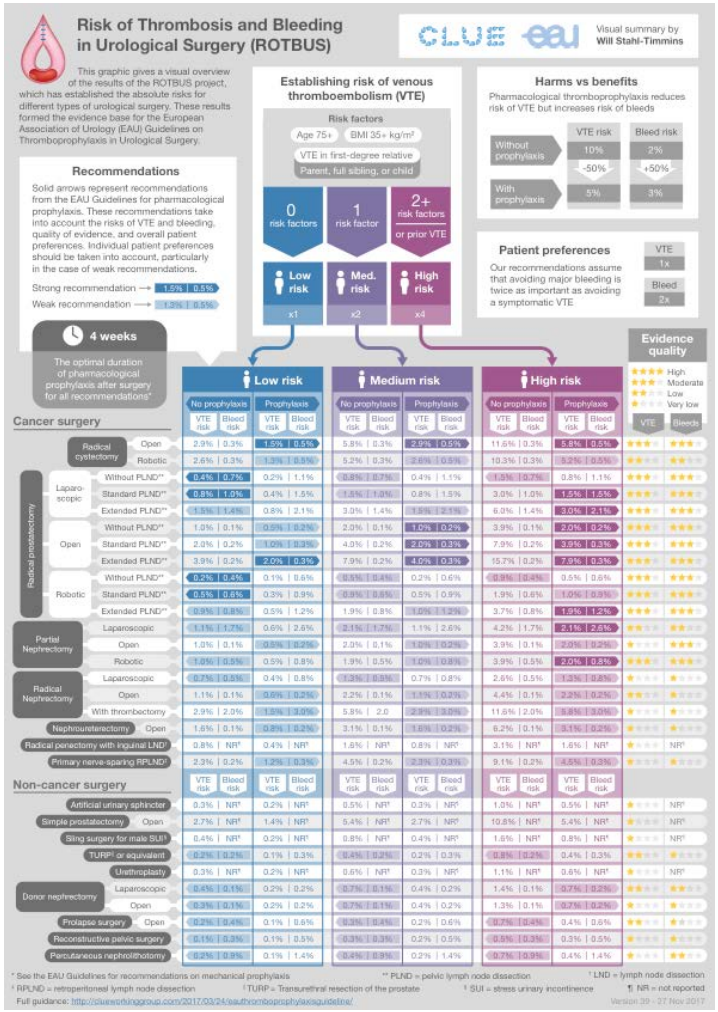
Stratifying the risk of VTE according to patient risk factors

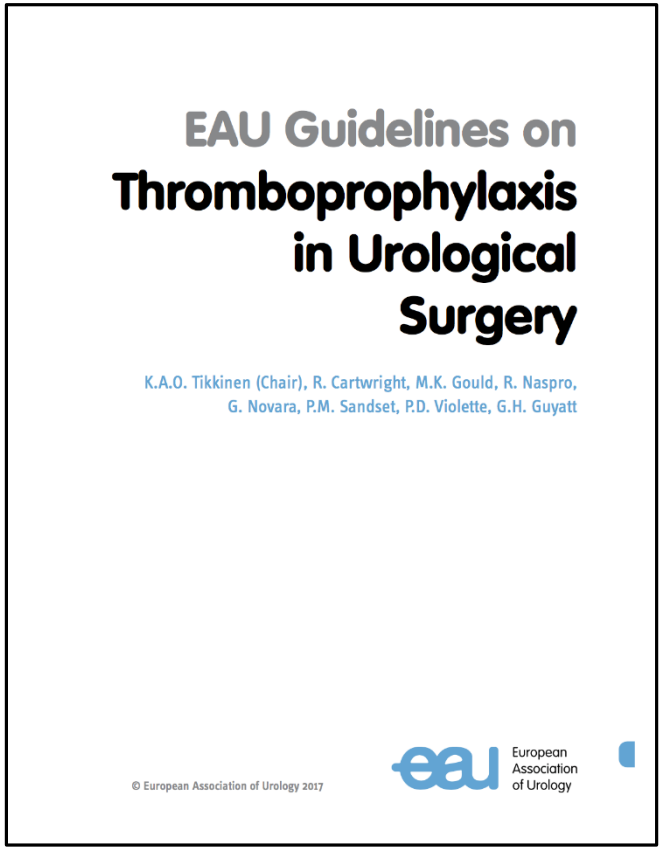
Based on literature search, we developed a very simple model for risk of VTE but not for risk of bleeding (inconsistent evidence)

VTE risk		Risk
Low	No risk factors	1x
Medium	Any one of the following:	2x
	Age 75 years or more	
	Body mass index 35 or more	
	VTE in 1st degree relative (parent, full sibling, or child)	
High	Prior VTE	4x
	Patients with any combination of two or more risk factors	

What should be considered when recommending (or not) thromboprophylaxis?

4. Quality of evidence / certainty in estimates
5. Relative value of different (good and bad) outcomes
6. Burden and other effects of treatment (prophylaxis)
7. Patients' values and preferences
8. Costs



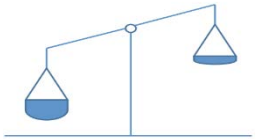


Available at:
https://twitter.com/KariTikkinen/status/936532034817847
http://clueworkinggroup.com/2017/12/01/thromboprophyl

Strength of recommendation

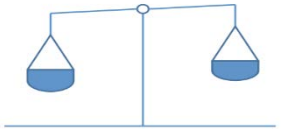
Strong recommendation

- benefits clearly outweigh risks/hassle/cost
- risk/hassle/cost clearly outweighs benefit



What can downgrade strength?

- low confidence in estimates
- close balance between upsides and downsides



Relative value of different outcomes

- We considered DVT and PE as equally problematic and assigned them a single weighting: “any symptomatic VTE”

- We defined “major bleeding” as bleeding requiring re-operation/re-exploration (including angio-embolization)

  - Also transfusion rates to be provided in ROTBIGGS

- We assigned twice the weight for major bleeding as

Take home messages

VTE and bleeding risks unknown, ROTBIGGS publications available next year

In some procedures, VTE risk high, bleeding low → clearly prophylaxis

In some, VTE risk is low, bleeding high → clearly no prophylaxis

Most not so clear because of close call and because of uncertainty in both VTE and bleeding

ROTBIGGS
Risk of Thrombosis and Bleeding in General and Gynecologic Surgery
A study by CLUE

ARTS

The NEW ENGLAND JOURNAL of MEDICINE

2022

ORIGINAL ARTICLE

Tranexamic Acid in Patients Undergoing Noncardiac Surgery

P.J. Devereaux, M. Marcucci, T.W. Painter, D. Conen, V. Lomivorotov, D.I. Sessler, M.T.V. Chan, F.K. Borges, M.J. Martínez-Zapata, C.-Y. Wang, D. Xavier, S.N. Ofori, M.K. Wang, S. Efremov, G. Landoni, Y.V. Kleinlugtenbelt, W. Szczeklik, D. Schmartz, A.X. Garg, T.G. Short, M. Wittmann, C.S. Meyhoff, M. Amir, D. Torres, A. Patel, E. Duceppe, K. Ruetzler, J.L. Parlow, V. Tandon, E. Fleischmann, C.A. Polanczyk, A. Lamy, S.V. Astrakov, M. Rao, W.K.K. Wu, K. Bhatt, M. de Nadal, V.V. Likhvantsev, P. Paniagua, H.J. Aguado, R.P. Whitlock, M.H. McGillion, M. Prystajecky, J. Vincent, J. Eikelboom, I. Copland, K. Balasubramanian, A. Turan, S.I. Bangdiwala, D. Stillo, P.L. Gross, T. Cafaro, P. Alfonsi, P.S. Roshanov, E.P. Belley-Côté, J. Spence, T. Richards, T. VanHelder, W. McIntyre, G. Guyatt, S. Yusuf, and K. Leslie, for the POISE-3 Investigators*

Patients

- Recruited patients 06/2018 – 07/2021 at 114 hospitals in 22 countries
- Inclusion
  - 45 years of age or older
  - Inpatient noncardiac surgery
  - At risk for bleeding & cardiovascular complications
- Exclusion
  - Cardiac surgery or intracranial neurosurgery
  - If a physician planned to administer systemic tranexamic acid during surgery
  - Creatinine clearance of <30 ml/minute or long-term dialysis

Characteristics	Tranexamic Acid (N=4757)	Placebo (N=4778)
Surgery — no./total no. (%)		
Any procedure	4729/4757 (99.4)	4740/4778 (99.2)
General‡	1769/4729 (37.4)	1773/4740 (37.4)
Orthopedic	1083/4729 (22.9)	1063/4740 (22.4)
Vascular	699/4729 (14.8)	700/4740 (14.8)
Urologic	598/4729 (12.6)	624/4740 (13.2)
Spinal	237/4729 (5.0)	206/4740 (4.3)
Gynecologic	162/4729 (3.4)	171/4740 (3.6)
Thoracic	127/4729 (2.7)	146/4740 (3.1)
Low-risk	39/4729 (0.8)	34/4740 (0.7)
Plastic	14/4729 (0.3)	23/4740 (0.5)
Data missing on type of procedure performed	1/4729 (<0.1)	0/4740
No procedure performed	27/4757 (0.6)	35/4778 (0.7)
Data missing on whether patient underwent surgery	1/4757 (<0.1)	3/4778 (0.1)
Medication taken within 24 hr before surgery — no. (%)		
Therapeutic-dose thrombin or factor Xa inhibitor	22 (0.5)	28 (0.6)
Therapeutic-dose vitamin K antagonist	6 (0.1)	8 (0.2)
Therapeutic-dose intravenous or subcutaneous antithrombotic agent	58 (1.2)	44 (0.9)
Prophylactic-dose anticoagulant	753 (15.8)	757 (15.8)

Interventions and Outcomes

Patients assigned in a 1:1 ratio to receive tranexamic acid (1-g intravenous bolus) or placebo at the start and end of surgery and, in a 1:1 ratio with the use of a partial factorial design, to a hypotension-avoidance strategy or a hypertension-avoidance strategy

The primary efficacy outcome (at 30 days)

A composite of life-threatening bleeding, major bleeding, and bleeding into a critical organ

The primary safety outcome (at 30 days)

A composite of myocardial injury (i.e., myocardial infarction or isolated ischemic troponin elevation), nonhemorrhagic stroke, peripheral arterial thrombosis, and symptomatic proximal venous thromboembolism

Table 2. Effects of Tranexamic Acid on 30-Day Outcomes.*

Outcome	Tranexamic Acid (N=4757)	Placebo (N=4778)	Hazard Ratio (95% CI)†	P Value
Primary efficacy outcome: composite bleeding outcome — no. (%)‡	433 (9.1)	561 (11.7)	0.76 (0.67–0.87)	<0.001§
Individual components of composite bleeding outcome — no. (%)				
Life-threatening bleeding¶	78 (1.6)	79 (1.7)	0.99 (0.73–1.36)	
Major bleeding¶	363 (7.6)	496 (10.4)	0.72 (0.63–0.83)	
Bleeding into a critical organ¶	12 (0.3)	21 (0.4)	0.57 (0.28–1.16)	
Primary safety outcome: composite cardiovascular outcome — no./total no. (%)‖	649/4581 (14.2)	639/4601 (13.9)	1.02 (0.92–1.14)	0.04**
Individual components of composite cardiovascular outcome — no. (%)				
MINS¶	608 (12.8)	602 (12.6)	1.02 (0.91–1.14)	
Nonhemorrhagic stroke††	24 (0.5)	16 (0.3)	1.51 (0.80–2.84)	
Peripheral arterial thrombosis††	22 (0.5)	23 (0.5)	0.96 (0.53–1.72)	
Symptomatic proximal venous thromboembolism††	32 (0.7)	28 (0.6)	1.15 (0.69–1.91)	
Other secondary outcomes — no. (%)				
Bleeding independently associated with death after noncardiac surgery	416 (8.7)	541 (11.3)	0.76 (0.67–0.87)	
MINS not fulfilling the universal definition of myocardial infarction	549 (11.5)	549 (11.5)	1.01 (0.89–1.13)	
Myocardial infarction	67 (1.4)	53 (1.1)	1.27 (0.89–1.82)	
Net risk–benefit outcome‡‡	983 (20.7)	1046 (21.9)	0.94 (0.86–1.02)	

§ Shown is the two-sided P value for superiority.

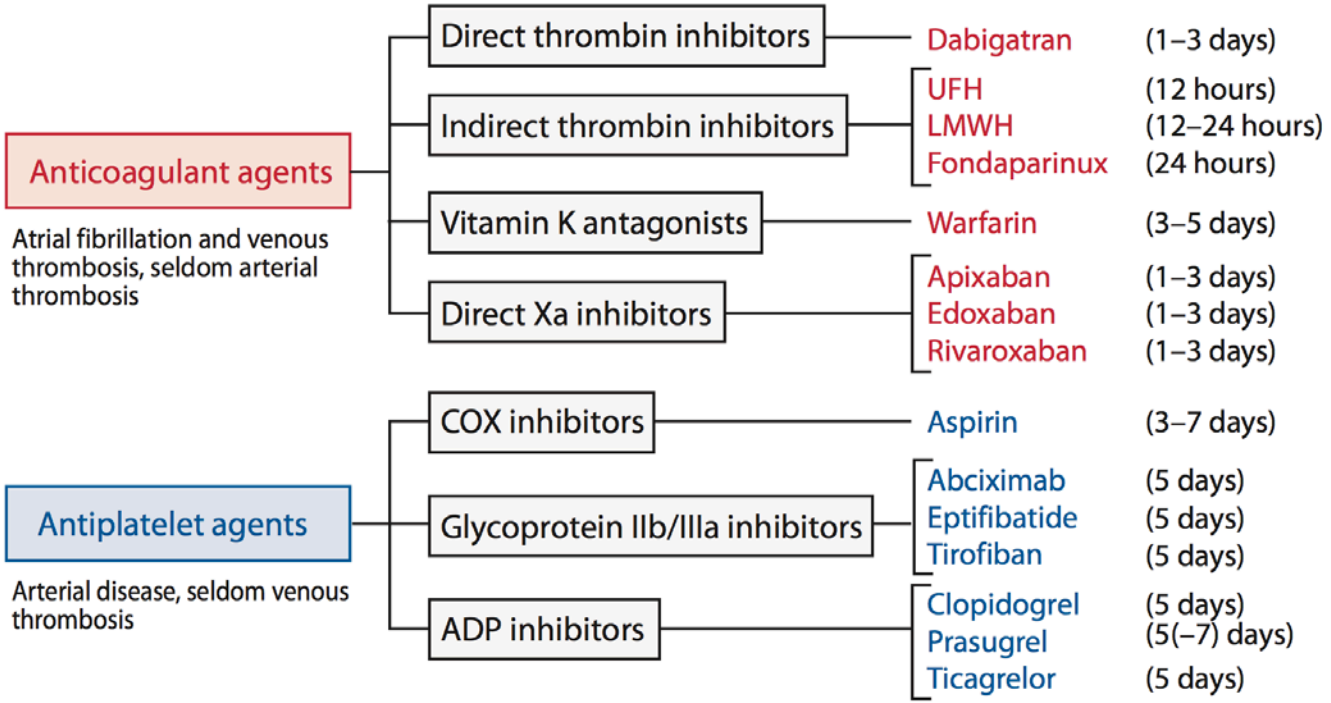
** Shown is the one-sided P value for noninferiority. To show statistical significance, this P value had to be less than 0.025.

Management of antithrombotic agents during perioperative period

In principle there are four options:

1. to defer surgery until antithrombotic agents are not anymore needed
2. stop antithrombotic agents prior to surgery and restart some time after surgery
3. continue through the surgery
4. “bridge” antithrombotic agents

5 days appropriate time to stop antiplatelet agents
before surgery while the optimal time to stop varies across anticoagulants



Earlier major guidelines preceded major studies

- A large, rigorous randomized trial comparing aspirin to placebo showed that aspirin increases post-operative bleeding without reducing arterial thrombotic events Devereaux et al. NEJM 2014
  - Indirect evidence for antiplatelet agents other than aspirin
  - However, perioperative aspirin may be beneficial for patients with prior percutaneous coronary intervention (PCI) Graham et al. Ann Intern Med 2017

- Evidence has also demonstrated that bridging with LMWH increases bleeding without preventing

EAU Thromboprophlaxis guideline principles for peri-operative management of antithrombotic agents in urology

1. Discontinue antithrombotic therapy for the period around surgery

or

2. In those with a temporary very high risk of thrombosis, delay surgery until that risk decreases. If it is not possible to delay, continuing antithrombotic therapy or bridging through surgery may be advisable

Peri-operative management of antithrombotic agents: 7 recommendations out of 9 strong

In patients receiving antiplatelet agents, we recommend stopping antiplatelet agents before surgery and not initiating any alternative antithrombotic therapy

In patients in whom antiplatelet agents have been stopped before surgery, we recommend restarting when bleeding is no longer a serious risk - typically four days post-surgery - rather than longer periods of withholding

In patients with very high risk of thrombosis receiving antiplatelet agents in whom surgery can be delayed, we recommend delaying surgery

- drug-eluting stent placement within 6 months

JAMA Internal Medicine | Original Investigation

Perioperative Management of Patients With Atrial Fibrillation Receiving a Direct Oral Anticoagulant

PAUSE prospective cohort study
Douketis et al. JAMA Int Med 20

Conducted at 23 clinical centers in Canada, USt, and Europe (08/2014 - 07/2018)

3,007 participants with AF; long-term DOAC users; scheduled for elective surgery

DOAC omitted 1d before a low-; and 2d before a high-bleeding-risk procedure

	Major bleeding at 30 days	Arterial thromboembolism at 30 days
Apixaban	1.35% (0%-2.00%)	0.16% (0%-0.48%)
Dabigatran	0.90% (0%-1.73%)	0.60% (0%-1.33%)
Rivaroxa	1.85% (0%-2.65%)	0.37% (0%-0.82%)

Peri-operative management of antithrombotic agents: 7 recommendations out of 9 strong

In patients receiving anticoagulant agents, except those with very high risk of thrombosis, we recommend stopping drugs before surgery and not initiating any alternative antithrombotic therapy

In patients with a new VTE, we recommend that surgery is delayed for at least 1 month, and if possible 3 months, to permit discontinuation of anticoagulation pre-operatively, rather than operating within 1 month of thrombosis

In patients receiving any anticoagulant with a severe thrombophilia, such as antithrombin deficiency and

Exclusion criteria

- Active bleeding or major hemorrhage during the last 6 months
- Contraindication to anticoagulant prophylaxis
- Requiring ongoing anticoagulant/antiplatelet during previous 7 days preceding surgery or within 30 days post-surgery
- Known thrombophilia
- Known bleeding disorder
- Substantial liver impairment (for instance, INR 1.4 or more during last 60 days)
- Creatinine clearance <30ml/min
- Platelet count <50,000 × 10^9/L
- Hb <70 g/L (= <7 g/dL)
- Known allergy to apixaban
- Taking strong inhibitors or inductors of both CYP 3A4 and P-glycoprotein, such as anti-seizure medications (e.g. phenytoin, fosphenytoin, carbamazepine), azole-antimycotics (e.g. ketoconazole, itraconazole), HIV-protease inhibitors (e.g. ritonavir, indinavir) and rifampicin
- Concomitant procedures with high risk of VTE/bleeding
- Emergency operation that needs to be performed within 24 hours
- Pregnant or breast-feeding women
- Previous randomization in this trial
- Any reason why, in the opinion of the investigator(s), the patient should not participate

General Abdominal Surgery: Potential procedures to be included after careful consideration of patient's personal VTE and bleeding risk factors

General abdominal surgery
- Cholecystectomy, open
- Cholecystectomy, open, emergency
- Groin hernia repair, open, emergency
- Ventral hernia repair, open
- Ventral hernia repair, laparoscopic, emergency
- Ventral hernia repair, open, emergency
- Small bowel resection, laparoscopic
- Small bowel resection, laparoscopic, benign
- Small bowel resection, laparoscopic, malignant
- Small bowel resection, laparoscopic, IBD
- Splenectomy, laparoscopic, elective
- Splenectomy, open, elective

General colorectal surgery
- Abdominoperineal resection, laparoscopic
- Anterior resection, minimally-invasive
- Anterior resection, robotic
- Anterior resection, open
- Anterior resection, laparoscopic, emergency
- Anterior resection, open, benign
- Anterior resection, open, malignant
- Anterior resection, open, IBD
- Colectomy, minimally-invasive
- Colectomy, laparoscopic
- Colectomy, robotic
- Colectomy, laparoscopic, malignant
- Colectomy, laparoscopic, IBD
- Colectomy, open, benign
- Colectomy, laparoscopic, left
- Colectomy, laparoscopic, right
- Colectomy, open, left
- Colectomy, open, right

General hepatobiliary and upper gastrointestinal surgery
- Distal pancreatectomy, minimally-invasive
- Distal pancreatectomy, laparoscopic
- Distal pancreatectomy, laparoscopic, benign
- Distal pancreatectomy, open, benign
- Liver resection, minimally-invasive, minor
- Liver resection, robotic
- Liver resection, open
- Liver resection, laparoscopic, minor
- Liver resection, open, minor
- Liver resection, open, major
- Gastrectomy, robotic
- Gastric bypass, robotic
- Gastric bypass, open
- Sleeve gastrectomy, robotic

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Gynecologic Surgery: Potential procedures to be included after careful consideration of patient's personal VTE and bleeding risk factors

Gynecologic cancer surgery

Trachelectomy, radical, with laparoscopic pelvic lymphadenectomy, vaginal
Trachelectomy, radical, with pelvic lymphadenectomy, open
Surgery for ovarian cancer, any, minimally-invasive
Vulvectomy, any
Hysterectomy, any, vaginal
Hysterectomy, any, open
Supracervical hysterectomy, malign, laparoscopic
Supracervical hysterectomy, malign, open
Total hysterectomy, with or without lymphadenectomy, robotic
Total hysterectomy, with or without lymphadenectomy, vaginal
Total hysterectomy, with or without lymphadenectomy, open
Total hysterectomy, with lymphadenectomy, minimally-invasive
Total hysterectomy, with lymphadenectomy, laparoscopic
Total hysterectomy, with lymphadenectomy, robotic
Total hysterectomy, with lymphadenectomy, open
Radical hysterectomy, with lymphadenectomy, minimally-invasive
Radical hysterectomy, with lymphadenectomy, laparoscopic
Radical hysterectomy, with lymphadenectomy, open

Gynecologic non-cancer surgery

Deep endometriosis surgery, with bowel surgery, open
Oophorectomy, robotic
Sacrocolpopexy, robotic
Sacrocolpopexy, open
Sacrocolpopexy, with hysterectomy, minimally-invasive
Sacrocolpopexy, with hysterectomy, open
Sacrocolpopexy, without hysterectomy, minimally-invasive
Sacrocolpopexy, without hysterectomy, open
Uterosacral ligament suspension, laparoscopic
Vaginal obliterative POP surgery (colpocleisis)
Hysterectomy, any, open
Supracervical hysterectomy, benign, open
Total hysterectomy, benign, open

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Urologic Surgery: Potential procedures to be included after careful consideration of patient's personal VTE and bleeding risk factors

Urologic cancer surgery

Laparoscopic radical prostatectomy without lymph node dissection
Laparoscopic radical prostatectomy with standard lymph node dissection
Laparoscopic radical prostatectomy with extended lymph node dissection
Open radical prostatectomy without lymph node dissection
Robotic radical prostatectomy with standard lymph node dissection
Robotic radical prostatectomy with extended lymph node dissection
Laparoscopic partial nephrectomy
Open partial nephrectomy
Robotic partial nephrectomy
Laparoscopic radical nephrectomy
Open radical nephrectomy
Open nephroureterectomy
Radical penectomy with inguinal lymph node dissection

Urologic non-cancer surgery

Sling surgery for male stress urinary incontinence
Recipient nephrectomy, open

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