The timeon and off Anticoagulant, Route, Type & Dose of anticoagulant in Perioperative Management for Patients with Venous Thromboembolism

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폐혈관 school 2023.4.29

CHEST

Perioperative Management of Antithrombotic Therapy

An American College of Chest Physicians Clinical Practice Guideline

22. In patients receiving apixaban who require an elective surgery/procedure, we suggest stopping apixaban for 1 to 2 days before the surgery/procedure over apixaban continuation (Conditional Recommendation, Very Low Certainty of Evidence).

23. In patients receiving dabigatran who require an elective surgery/procedure, we suggest stopping dabigatran for 1 to 4 days before the surgery/procedure over dabigatran continuation (Conditional Recommendation, Very Low Certainty of Evidence).

24. In patients receiving edoxaban who require an elective surgery/procedure, we suggest stopping edoxaban for 1 to 2 days before the surgery/procedure over edoxaban continuation (Conditional Recommendation, Very Low Certainty of Evidence).

25. In patients receiving rivaroxaban who require an elective surgery/procedure, we suggest stopping rivaroxaban for 1 to 2 days before the surgery/procedure over rivaroxaban continuation (Conditional Recommendation, Very Low Certainty of Evidence).

26. In patients who require DOAC interruption for an elective surgery/procedure, we suggest against perioperative heparin bridging (Conditional Recommendation, Very Low Certainty of Evidence).

27. In patients who had DOAC interruption for an elective surgery/procedure, we suggest resuming DOACs > 24 hours after a surgery/procedure over resuming DOACs within 24 hours (Conditional Recommendation, Very Low Certainty of Evidence).

Implications of Strong and Conditional Recommendations

	Strong Recommendation ("We recommend . . .")	Conditional Recommendation ("We suggest . . .")
For patients	The overwhelming majority of individuals in this situation would want the recommended course of action, and only a small minority would not. *(It is the right course of action for >95% of patients.)*	The majority of individuals in this situation would want the suggested course of action, but a sizable minority would not. *(It is the right course of action for >50% of patients.)*
For clinicians	The overwhelming majority of individuals should receive the recommended course of action. Adherence to this recommendation according to the guideline could be used as a quality criterion or performance indicator. Formal decision aids are not likely to be needed to help individuals make decisions consistent with their values and preferences. *(It is reasonable to recommend it strongly to patients and caregivers.)*	Different choices will be appropriate for different patients, and the clinician must help each patient arrive at a management decision consistent with her or his values and preferences. Decision aids may be useful to help individuals make decisions consistent with their values and preferences. Clinicians should expect to spend more time with patients when working toward a decision. *(Slow down, think about it, discuss it with the patient.)*

Am J Respir Crit Care Med. 2020;201(9): e56-e69

Suggested Risk Stratification for Patient-Specific Periprocedural Thromboembolism

Risk Category	Mechanical Heart Valve	Atrial Fibrillation	VTE
High (> 10%/y risk of ATE or > 10%/mo risk of VTE)	Mitral valve with major risk factors for stroke[b] Caged ball or tilting-disc valve in mitral/aortic position Recent (< 3 mo) stroke or TIA or other high-risk stroke situations[c]	CHA_2DS_2VASc score ≥ 7 or $CHADS_2$ score of 5 or 6 Recent (< 3 mo) stroke or TIA Rheumatic valvular heart disease	Recent (< 3 mo and especially 1 mo) VTE Severe thrombophilia (deficiency of protein C, protein S or antithrombin; homozygous factor V Leiden or prothrombin gene G20210A mutation or double heterozygous for each mutation, multiple thrombophilias) Antiphospholipid antibodies Active cancer associated with high VTE risk[a]
Moderate (4%-10%/y risk of ATE or 4%-10%/mo risk of VTE)	Bileaflet AVR *with* major risk factors for stroke[b]	CHA_2DS_2VASc score of 5 or 6 or $CHADS_2$ score of 3 or 4	VTE within past 3-12 mo Recurrent VTE Non-severe thrombophilia (heterozygous factor V Leiden or prothrombin gene G20210A mutation) Active cancer or recent history of cancer[c]
Low (< 4%/y risk of ATE or < 2%/mo risk of VTE)	Bileaflet AVR *without* major risk factors for stroke[b]	CHA_2DS_2VASc score of 1-4 or $CHADS_2$ score of 0-2 (and no prior stroke or TIA)	VTE > 12 mo ago

Douketis, et al. CHEST 2022; 162(5):e207-e243.

Suggested Risk Stratification for Procedural Bleed Risk

High-bleed-risk surgery/procedure[a] (30-d risk of major bleed ≥ 2%)	Major surgery with extensive tissue injury Cancer surgery, especially solid tumor resection (lung, esophagus, gastric, colon, hepatobiliary, pancreatic) Major orthopedic surgery, including shoulder replacement surgery Reconstructive plastic surgery Major thoracic surgery Urologic or GI surgery, especially anastomosis surgery Transurethral prostate resection, bladder resection, or tumor ablation Nephrectomy, kidney biopsy Colonic polyp resection Bowel resection Percutaneous endoscopic gastrostomy placement, endoscopic retrograde cholangiopancreatography Surgery in highly vascular organs (kidneys, liver, spleen) Cardiac, intracranial, or spinal surgery Any major operation (procedure duration > 45 min) Neuraxial anesthesia[b] Epidural injections
Low-to-moderate-bleed-risk surgery/procedure[c] (30-d risk of major bleed 0%-2%)	Arthroscopy Cutaneous/lymph node biopsies Foot/hand surgery Coronary angiography[d] GI endoscopy ± biopsy Colonoscopy ± biopsy Abdominal hysterectomy Laparoscopic cholecystectomy Abdominal hernia repair Hemorrhoidal surgery Bronchoscopy ± biopsy

Douketis, et al. CHEST 2022; 162(5):e207-e243.

Case (61/M)

Chief complain: RUQ pain (onset: 6DA)

Present illness

이전 특이병력 없던 61세 남자 환자

내원 6일전부터 RUQ pain 및 vomiting 증상 발생

내원 2일전 dark urine이 관찰

내원 1일전 연고지 병원에서 abdominal US를 시행
acute cholecystitis with GB stone 진단

이후 본원 진료원해 소화기내과 외래 경유하여 입원

Past medical history

DM(-)
Hepatitis (-)
Malignancy (-)
Previous VTE history (-)
HTN (+)
Tuberculosis (-)
Trauma history (-)

Medication history

Amlodipine/candesartan 5mg/8mg qd

Family history

(-)

Social history

Alcohol: social drinker
Occupation: 회사원
Smoking: never smoker

Physical examination

Vital Signs

BP 107/72 mmHg HR 94/min RR 18/min BT 36.4℃

Body measurements

Height 169.0 cm Weight 60.8 kg BMI : 21.3 kg/m^2

General appearance

Not so ill looking appearance

Mental status: alert, oriented

Physical examination

Thorax

Chest contour : normal
No accessory muscle use
Clear to percussion and auscultation

Heart

Regular rhythm and heart sounds without murmur

Abdomen

Soft and flat
Normo-active bowel sound
Abdominal tenderness/rebound tenderness (**+, RUQ**/-)

Review of system

General

Febrile sense	**(+)**	**Chilling**	**(+)**

Respiratory

Cough	(-)	Sputum	(-)
hemoptysis	(-)	Dyspnea	(-)

Gastrointestinal

Abdominal pain	**(+, RUQ)**	Anorexia	(-)
Nausea/Vomiting	**(+/+)**	Diarrhea	(-)
Hematemesis	(-)	Melena/Hematochezia	(-/-)

Initial laboratory findings

CBC

4500-15.7-**126k**

Coagulation battery

PT(INR) 0.96

aPTT 27.5

D-dimer 2.10ug/mL

Chemical battery

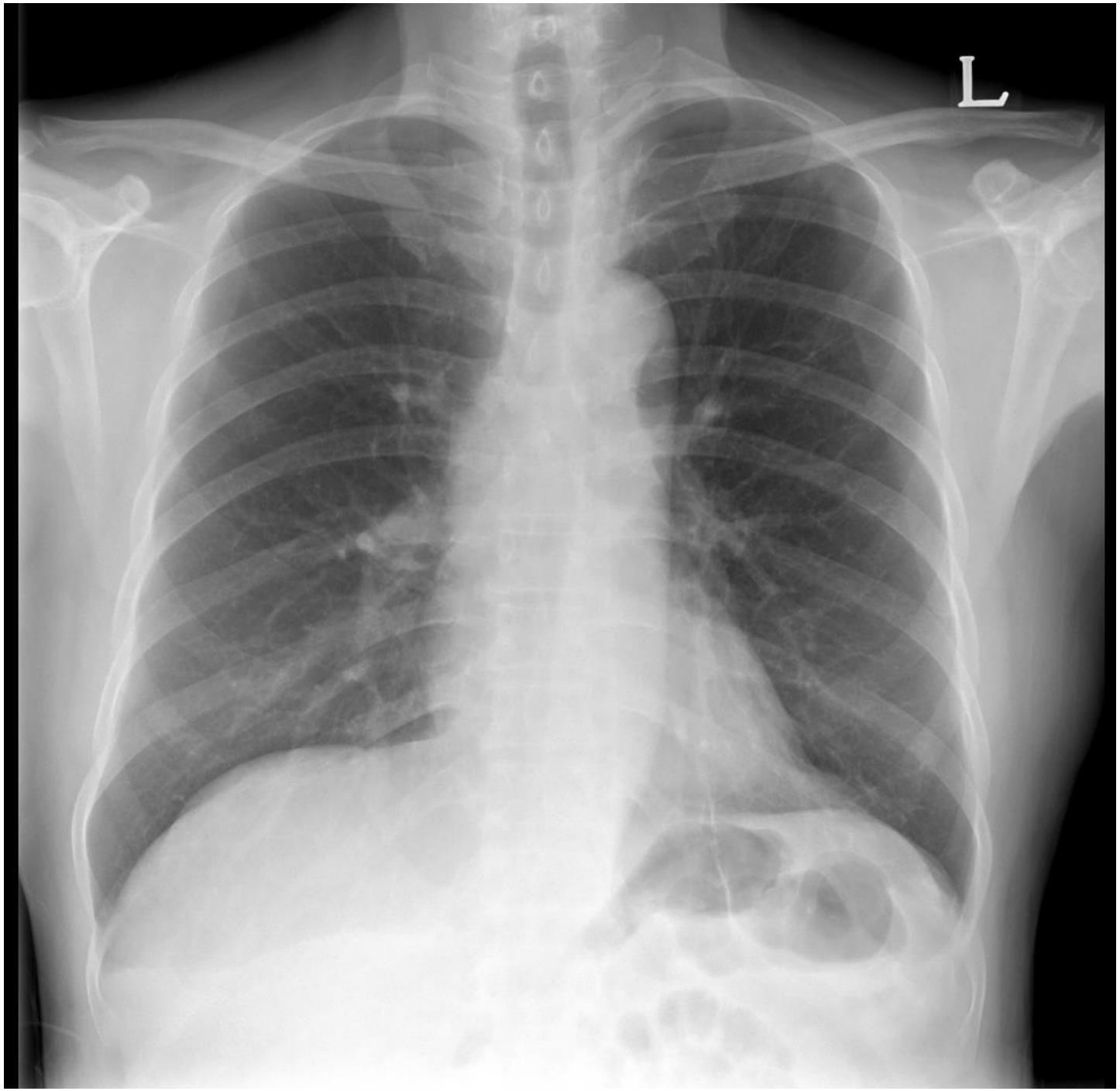
Creatinine/BUN: 0.89/23

Protein/albumin: 6.5/3.3

AST/**ALT**/ALP/total Bil: **45**/**88**/87/1.0

Na/K/Cl: 138/3.9/99

CRP 7.63


L

61 yr
Male

Room:
Loc:119

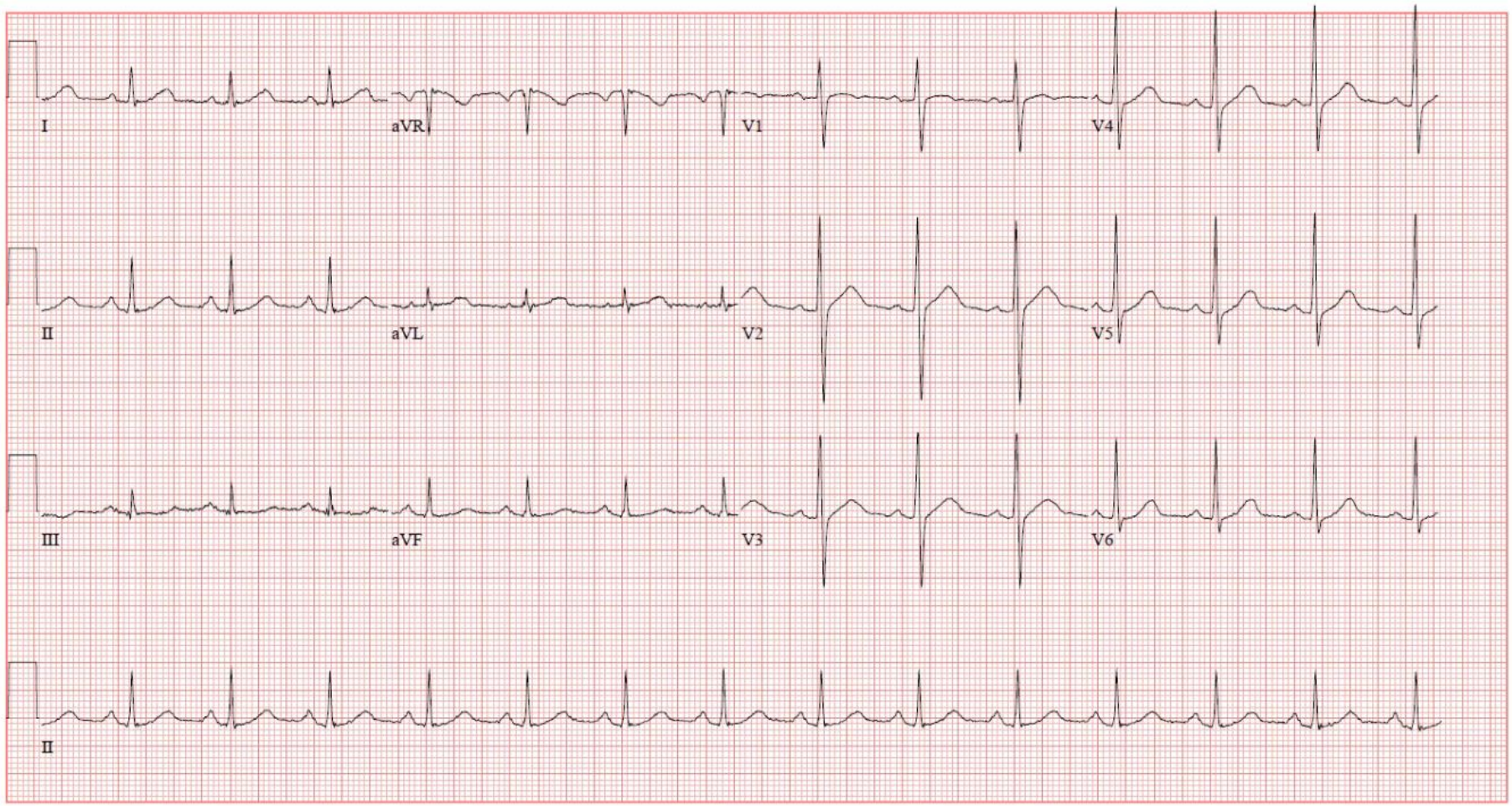
Vent. rate	85	BPM
PR interval	168	ms
QRS duration	88	ms
QT/QTc	388/461	ms
P-R-T axes	59 52	34

Normal sinus rhythm
Normal ECG

Technician: JYC
Test ind:083993

Referred by: 83W

Confirmed By: ROOM EAST



25mm/s 10mm/mV 150Hz 7.1.1 12SL 239 CID: 119

EID:2 EDT: 09:39 20-SEP-2017 ORDER:

Biliary dynamic CT (HD#1)

Problem list

#1. Acute calculous cholecystitis with CBD stone

#2. Acute PTE

Problem list

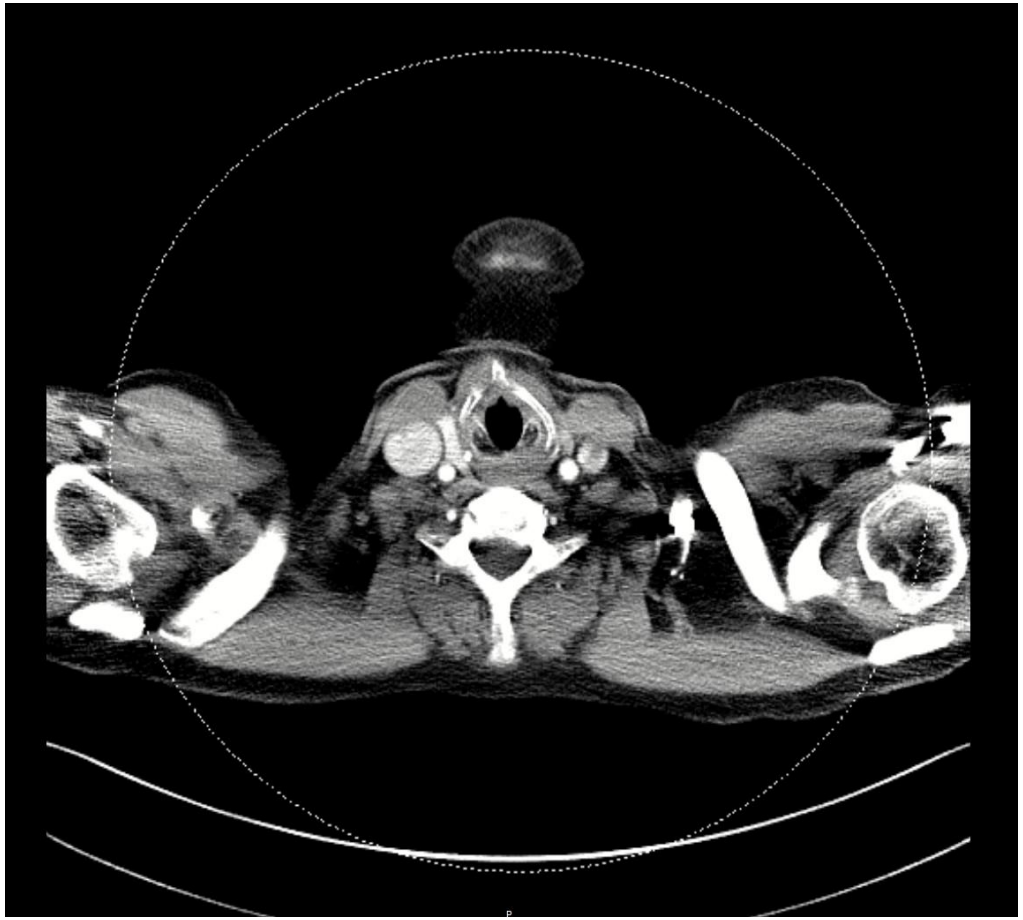
#1. Acute calculous cholecystitis with CBD stone

P> ERCP
Laparoscopic cholecystectomy

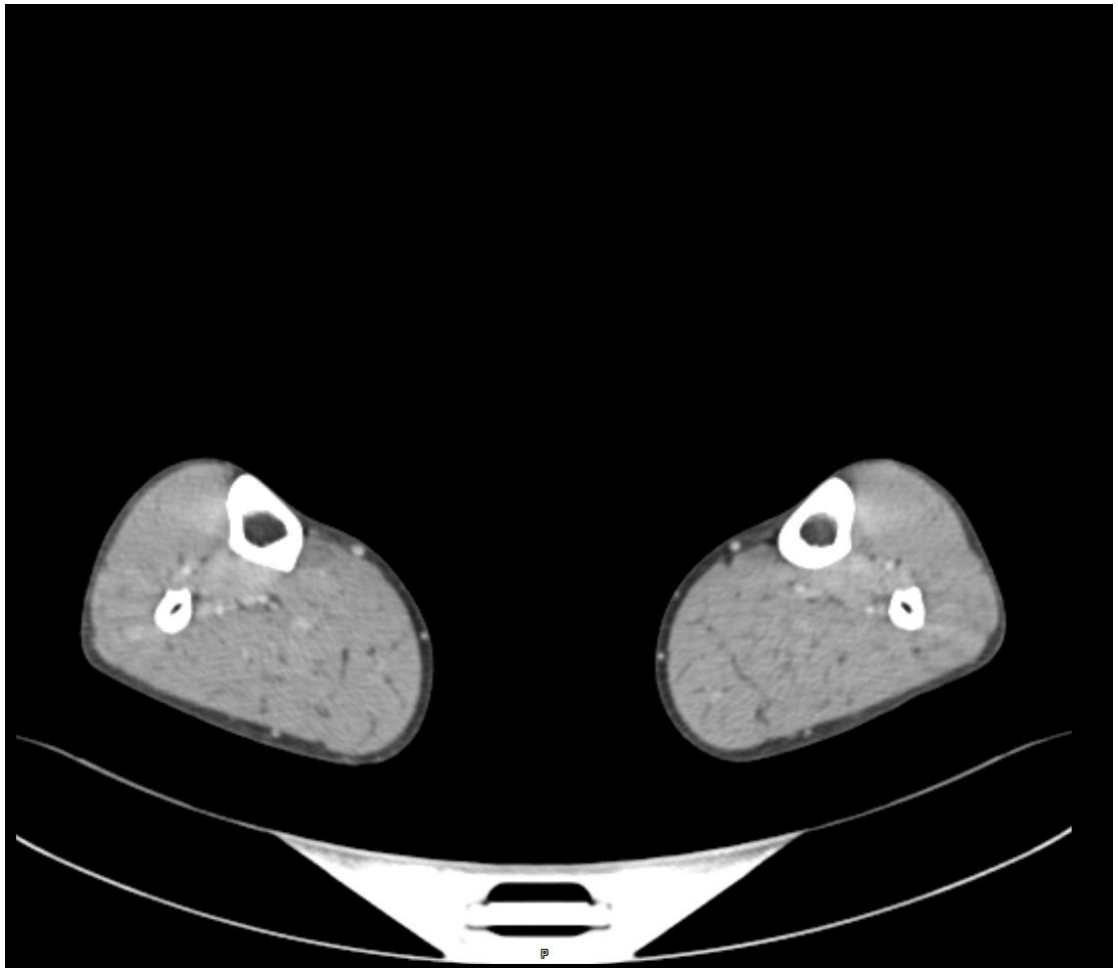
#2. acute PTE

P> Pulmonary embolism CT
Deep vein thrombosis w/u
IV heparinization
PLM consult

Pulmonary embolism CT (HD #2)



Lower extremity CT (HD #2)



Clinical Data

Height	166.8	cm	Weight	66.3	kg	BSA	1.74	m^2	BP	115 / 78	mmHg
HR		bpm	Rhythm	sinus rhythm			Window			poor	

Left Ventricle **Normal LV**

LVIDs	24	mm	LVIDd	40	mm	LA	29	mm	Aorta	34	mm
LVPWs	14	mm	LVPWd	9	mm	ESV	25	ml	EDV	64	ml
IVSs	13	mm	IVSd	8	mm	LV mass	101.8	g	LVEF	61	%
LV mass Index			58.4		g/m²	LA volume index					ml/m²

Right Ventricle **preserved contractility (Tricuspid annulus DTI S velocity=12.4 cm/sec)**

RVOTprox (PLAX)	27	mm	RVOTprox (PSAX)		mm	TV annular S vel		cm/s			
Basal diameter		mm	Mid diameter		mm	TAPSE		mm			

Mitral Valve **Normal**

BC0127	BNP (Qn),Blood	99	0	100	pg/mL
BC0125	Troponin I (Qn),Blood	0.006		1.5	ng/mL
BC0126	CK-MB (Qn),Blood	0.2		5	ng/mL

Aortic Valve **Normal**

AR grade			Peak vel	1.2	m/s	PG	/	mmHg			
AVA(2D/Doppler)	/	cm^2	LVOT vel		m/s	LVOT PG	/	mmHg			
AV TVI		cm	LVOT TVI		cm	LVOT diameter		mm			
Sinus		mm	ST junction		mm	Tubular		mm			

Tricuspid **Normal**

TR grade	tr		TR jet area		cm^2	Peak TR vel	2.1	m/s			
PGsys(RV-RA)	18	mmHg	Peak E vel		cm/s	Peak A Vel		cm/s			

Pulmonic Valve

PR grade			PR peak Vel		m/s	PR ED Vel		m/s			
Peak Vel		m/s	PG(max/mean)	/	mmHg	Pul vein flow S/D	52 / 34	cm/s			

	Original PESI	Simplified PESI
Age	61	0
Male Sex	10	-
Cancer	0	0
Chronic heart failure	0	0
Chronic pulmonary disease	0	0
HR ≥110/min	0	0
SBP <100mmHg	0	0
RR >30/min	0	-
BT <36℃	0	-
Altered mentality	0	-
SaO_2 <90%	0	0
Total	71 **Class II**	0

	VTE-BLEED score
Active cancer	0
Male patients with uncontrolled HTN	0
Anemia	0
History of bleeding	0
Renal dysfunction	0
Age ≥60 years	1.5
Total	1.5 **Low bleeding risk**

Eur Respir J 2016; 48: 1369–1376

PLM consult reply (HD #4)

PE 치료

치료용량 LMWH 1-2일 투여하여 출혈 문제 없으면 apixaban 5mg bid로 변경

Laparoscopic cholecystectomy 시행 Op risk

Acute PE 발생후에 가능하면 1개월은 치료 후 수술 시행하는 것이 안전

조기 수술이 필요하시다면 항응고제 중단하고 수술 전 IVC filter 삽입하고 수술시행

수술 2-3일 후부터 출혈 문제 없으면 항응고제 재투여하시면 되겠습니다.

6.7 Recommendations for acute-phase treatment of intermediate- or low-risk pulmonary embolism

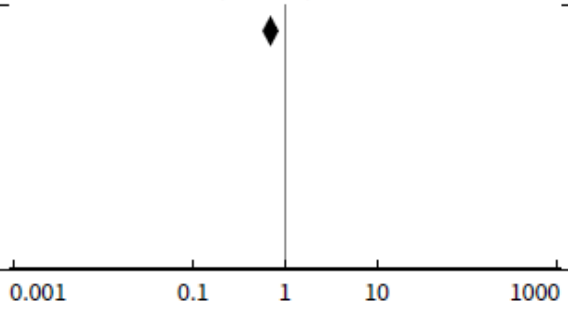
Recommendations	Class[a]	Level[b]
Initiation of anticoagulation		
Initiation of anticoagulation is recommended without delay in patients with high or intermediate clinical probability of PE,[c] while diagnostic workup is in progress.	I	C
If anticoagulation is initiated parenterally, LMWH or fondaparinux is recommended (over UFH) for most patients.[262,309–311]	I	A
When oral anticoagulation is started in a patient with PE who is eligible for a NOAC (apixaban, dabigatran, edoxaban, or rivaroxaban), a NOAC is recommended in preference to a VKA.[260,261,312–314]	I	A
When patients are treated with a VKA, overlapping with parenteral anticoagulation is recommended until an INR of 2.5 (range 2.0–3.0) is reached.[315,316]	I	A
NOACs are not recommended in patients with severe renal impairment,[d] during pregnancy and lactation, and in patients with antiphospholipid antibody syndrome.[260,261,312–314]	III	C

European Heart Journal (2020) 41, 543603

LMWH *vs.* Heparin

Recurrence

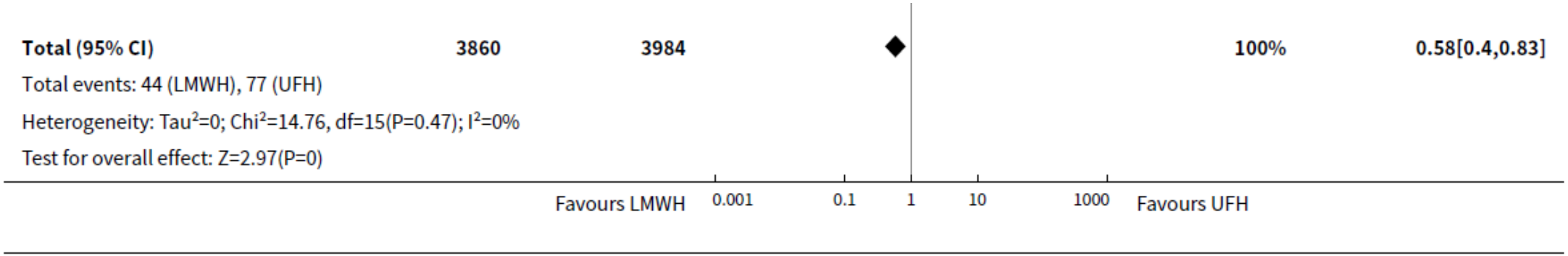
Study or subgroup	LMWH n/N	UFH n/N	Peto Odds Ratio Peto, Fixed, 95% CI	Weight	Peto Odds Ratio Peto, Fixed, 95% CI
Total (95% CI)	**4541**	**4301**	♦	**100%**	**0.7[0.57,0.85]**
Total events: 165 (LMWH), 226 (UFH)					
Heterogeneity: Tau^2=0; Chi^2=19.55, df=18(P=0.36); I^2=7.91%					
Test for overall effect: Z=3.48(P=0)					
Test for subgroup differences: Chi^2=3.26, df=1 (P=0.78), I^2=0%					



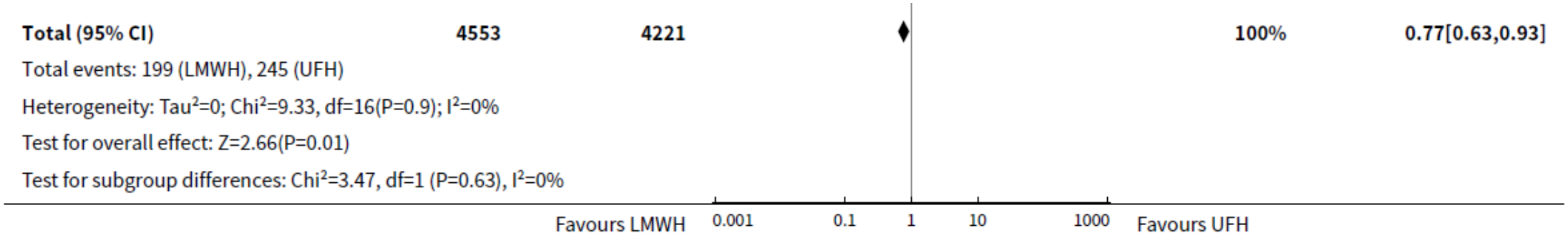
Cochrane Database of Systematic Reviews 2010, Issue 9. Art. No.: CD001100.

LMWH *vs.* Heparin

Major bleeding

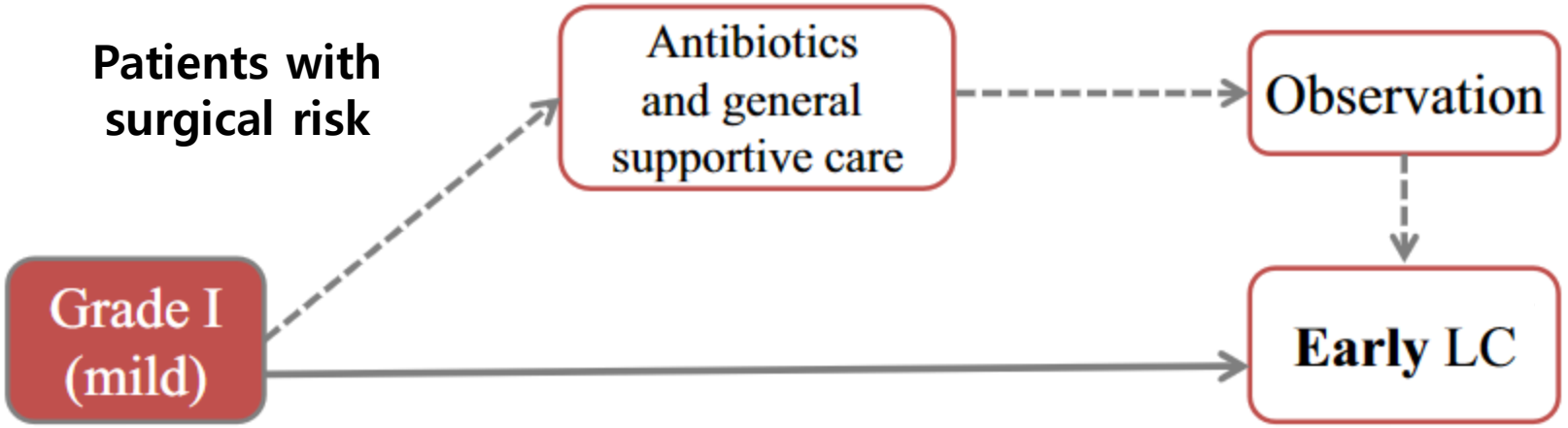


Overall mortality



Cochrane Database of Systematic Reviews 2010, Issue 9. Art. No.: CD001100.

Acute cholecystitis management

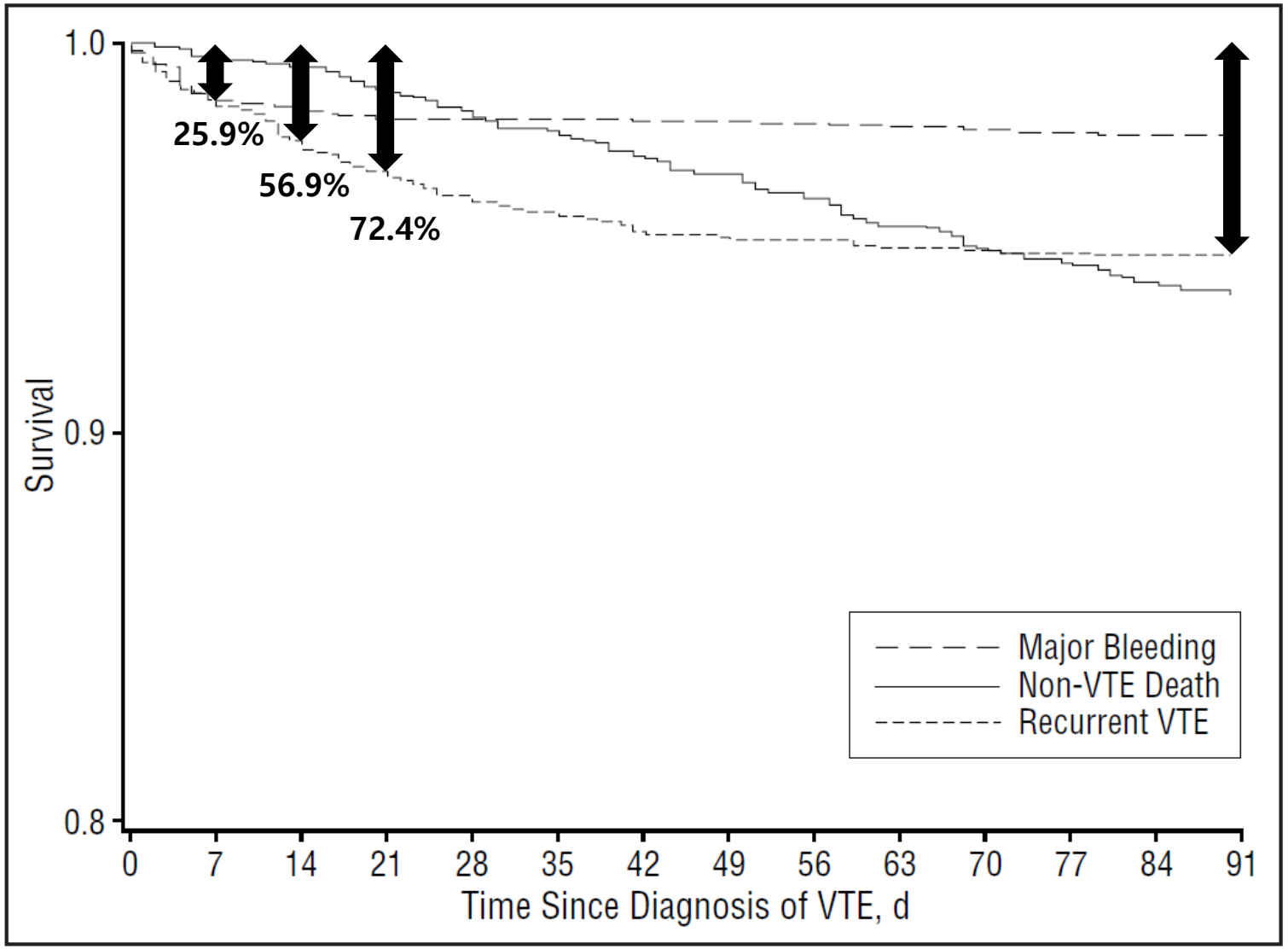


J Hepatobiliary Pancreat Sci (2018) 25:55–72

TABLE 1] Adapted American College of Chest Physicians (CHEST) Suggested Risk Stratification for Patient-Specific Periprocedural Thromboembolism[13,14,25]

Risk Category	Mechanical Heart Valve	Atrial Fibrillation	VTE
High (> 10%/y risk of ATE or > 10%/mo risk of VTE)	Mitral valve with major risk factors for stroke[b] Caged ball or tilting-disc valve in mitral/aortic position Recent (< 3 mo) stroke or TIA or other high-risk stroke situations[c]	CHA_2DS_2VASc score ≥ 7 or $CHADS_2$ score of 5 or 6 Recent (< 3 mo) stroke or TIA Rheumatic valvular heart disease	Recent (< 3 mo and especially 1 mo) VTE Severe thrombophilia (deficiency of protein C, protein S or antithrombin; homozygous factor V Leiden or prothrombin gene G20210A mutation or double heterozygous for each mutation, multiple thrombophilias) Antiphospholipid antibodies Active cancer associated with high VTE risk[a]
Moderate (4%-10%/y risk of ATE or 4%-10%/mo risk of VTE)	Bileaflet AVR *with* major risk factors for stroke[b]	CHA_2DS_2VASc score of 5 or 6 or $CHADS_2$ score of 3 or 4	VTE within past 3-12 mo Recurrent VTE Non-severe thrombophilia (heterozygous factor V Leiden or prothrombin gene G20210A mutation) Active cancer or recent history of cancer[c]
Low (< 4%/y risk of ATE or < 2%/mo risk of VTE)	Bileaflet AVR *without* major risk factors for stroke[b]	CHA_2DS_2VASc score of 1-4 or $CHADS_2$ score of 0-2 (and no prior stroke or TIA)	VTE > 12 mo ago

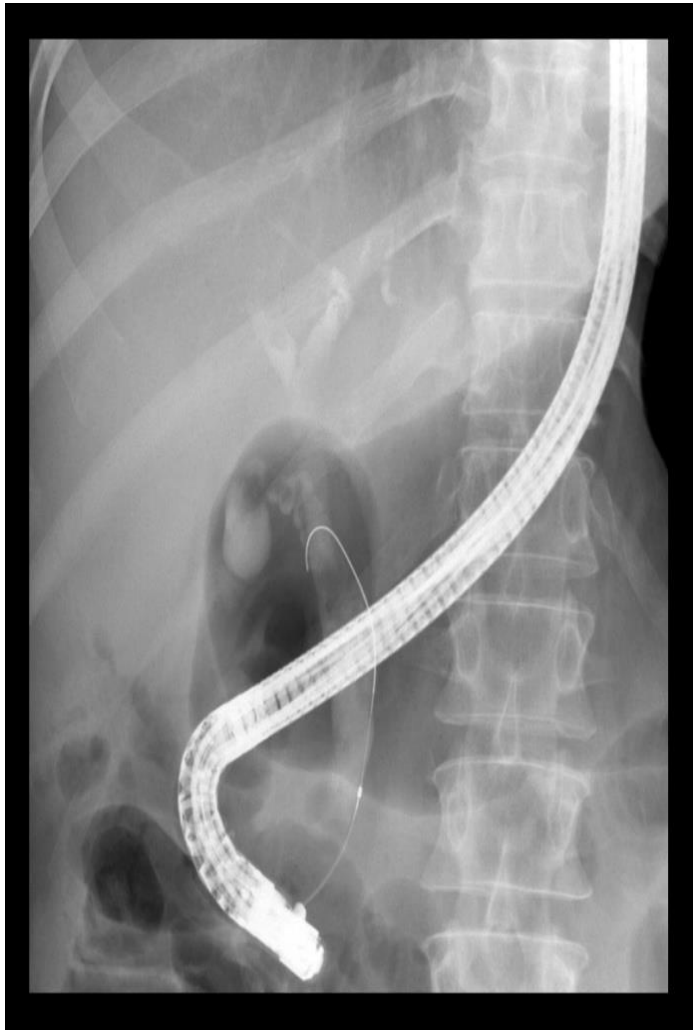
CHEST 2022; 162(5):e207-e243



Time course of recurrent venous thromboembolism (VTE), major bleeding, and non-VTE death.

Arch Intern Med. 2000;160(22):3431-3436

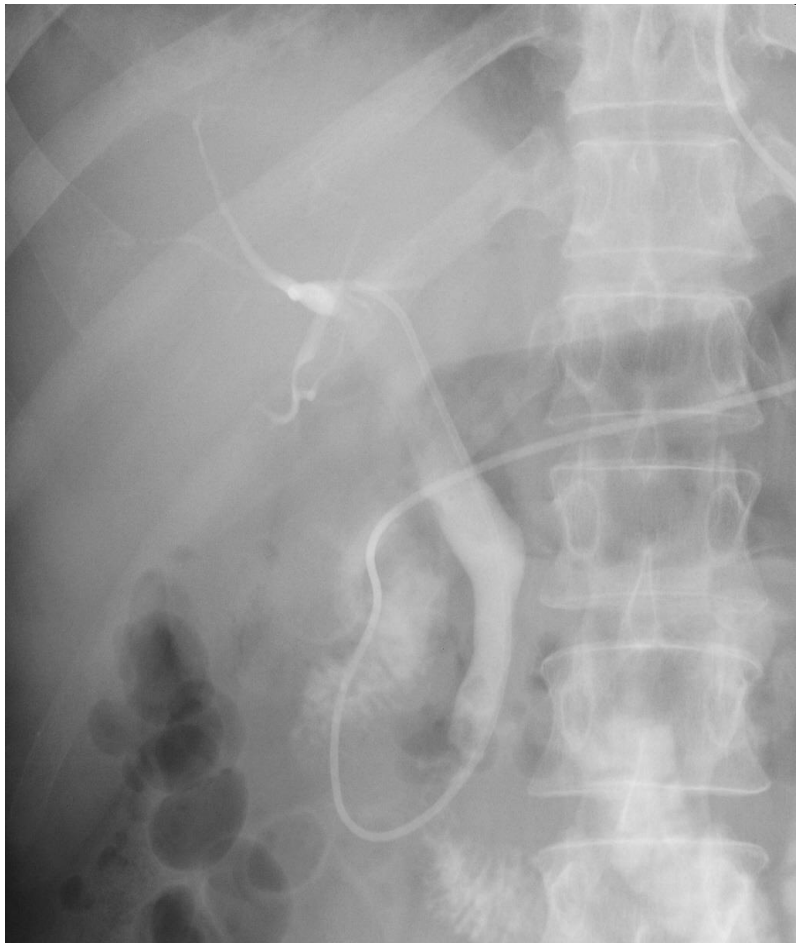
ERCP & EST & stone removal (HD #4)



Cholangitis d/t CBD stone

Enoxaparin 60mg bid
start at next day (HD #5)

Tubogram (HD #6)



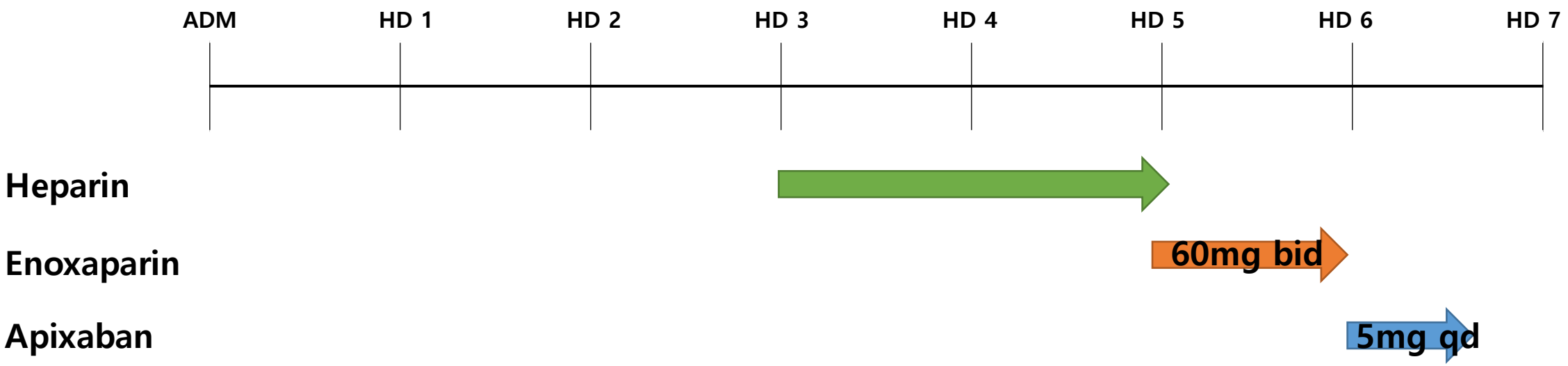
Filling defect d/t CBD stone

Additional ERCP

HD #7

Newly onset Lt. pleuritic pain

aggravated with deep breathing and supine position

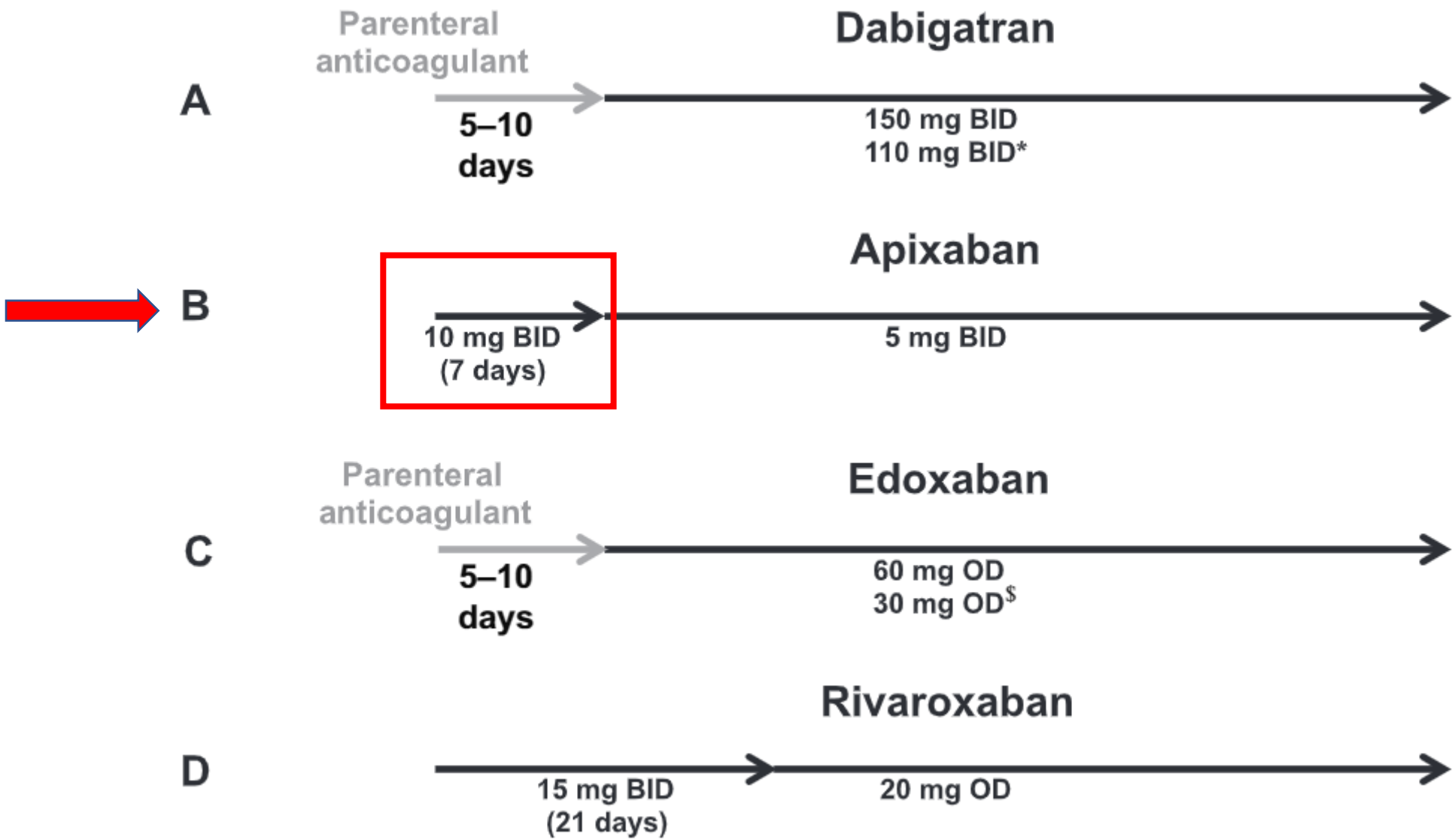


Pulmonary embolism CT (HD #7)

Table 6. Algorithm for Switching Between Anticoagulants

From	To	Action
VKA	DOAC	Stop VKA and start DOAC once INR is <2 or lower INR limit of therapeutic range Measurement of INR before and after DOAC initiation is warranted as DOAC may falsely elevated INRs
Dabigatran	VKA	CrCl >50 mL/min: start VKA and stop dabigatran 3 d later CrCl 31 to 50 mL/min: start VKA and stop dabigatran 2 d later CrCl 15 to 30 mL/min: start VKA and stop dabigatran 1 d later
Rivaroxaban Apixaban	VKA	Start VKA and stop DOAC 3 d later OR for continuous anticoagulation: Stop DOAC and start LMWH and VKA at the time DOAC would have been due, then stop LMWH when INR is within therapeutic range
Edoxaban	VKA	Start VKA and stop DOAC 3 d later OR for continuous anticoagulation: Patients taking 60 mg: reduce edoxaban to 30 mg and start warfarin concomitantly. Stop edoxaban when INR >2 Patients taking 30 mg: reduce edoxaban to 15 mg and start warfarin concomitantly. Stop edoxaban when INR ≥2
Betrixaban	VKA	Start VKA and stop DOAC when INR > lower limit of therapeutic range
DOAC	DOAC	Stop current DOAC regimen and begin the new DOAC agent at the time next dose of DOAC is due
DOAC	Parental anticoagulant*	Stop DOAC and start parenteral anticoagulant at the same time that the next dose of DOAC would have been given
Parenteral anticoagulant*	DOAC	Intravenous: Start DOAC 0 to 2 h after stopping UFH Subcutaneous: Stop LMWH and start DOAC at the same time that the next dose of LMWH would have been given

J Am Heart Assoc. 2020;9:e017559



Ther Adv Cardiovasc Dis. 2017 Sep;11(9):243-256

Discussion point

Switching from LMWH to DOAC

HD#7

ENBD drainage: old bloody color

PLM consult d/t hemobilia and newly developed PE

Anticoagulants 용량의 적절성
ERCP 가능한 시점
Anticoagulants 변경의 필요성

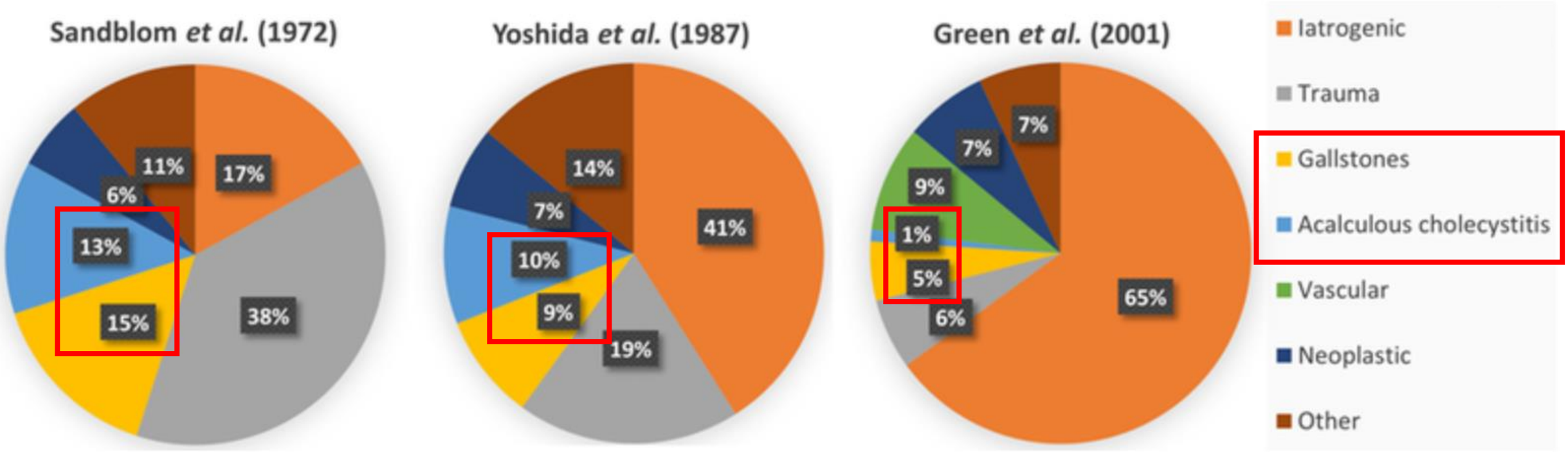
PLM consult (HD #7)

Anticoagulants 용량의 적절성

체중 (60.8kg) 고려시 enoxaparin 용량은 1mg/kg 정도로 적절
Apixaban 5mg bid (?)

Anticoagulation뿐 아니라 CBD stone 및 ENBD의 영향이 함께 있을 것으로 생각되어 가능하면 CBD stone제거하는 것이 좋을 것으로 판단

Cause of hemobilia



Liver Res. 2018 Dec; 2(4): 200–208

PLM consult (HD #7)

ERCP 가능한 시점

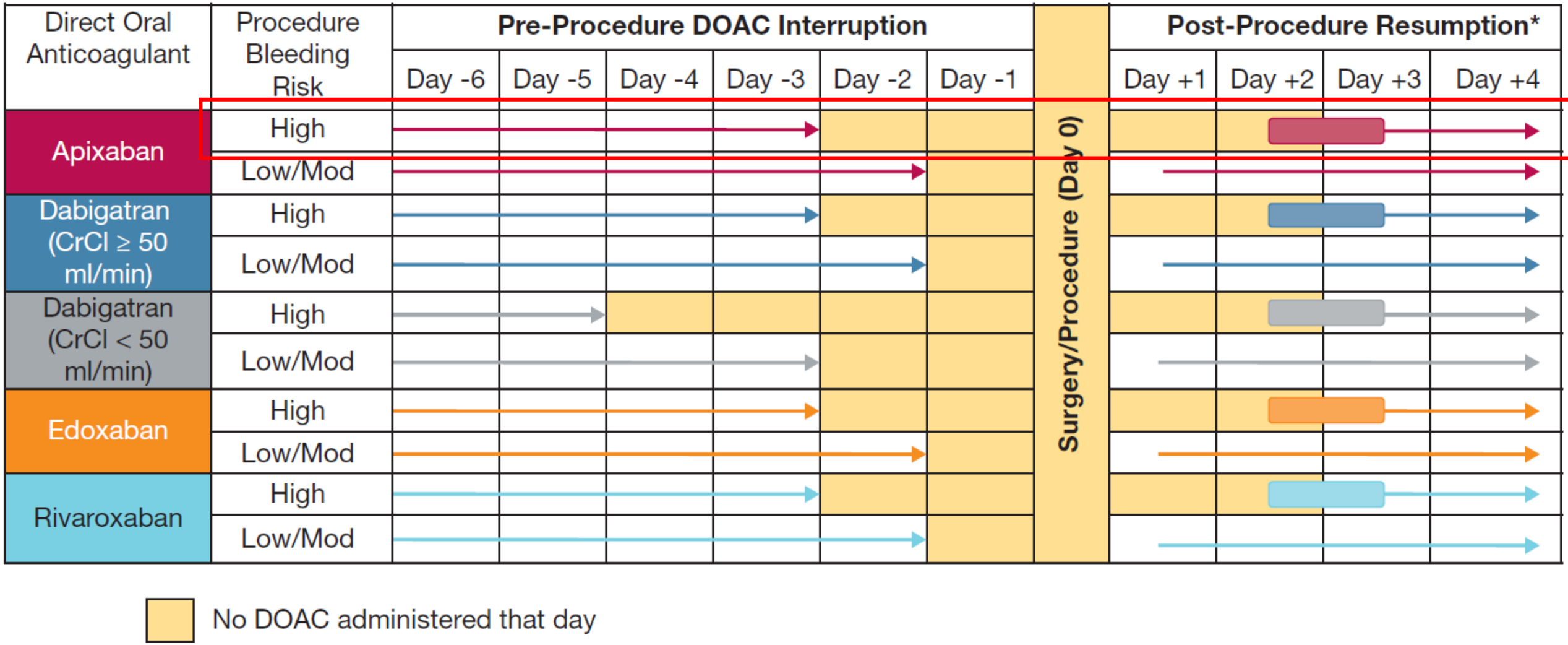
Apixaban 5mg으로 1회 투약 되었으나, 현재 bleeding이 있는 상태로 anticoagulation은 우선 중단

ERCP는 anticoagulation 중단 다음날 가능할 것으로 생각

TABLE 2] Suggested Risk Stratification for Procedural Bleed Risk, Based on ISTH Guidance Statements[25]

High-bleed-risk surgery/procedure[a] (30-d risk of major bleed ≥ 2%)	Major surgery with extensive tissue injury Cancer surgery, especially solid tumor resection (lung, esophagus, gastric, colon, hepatobiliary, pancreatic) Major orthopedic surgery, including shoulder replacement surgery Reconstructive plastic surgery Major thoracic surgery Urologic or GI surgery, especially anastomosis surgery Transurethral prostate resection, bladder resection, or tumor ablation Nephrectomy, kidney biopsy Colonic polyp resection Bowel resection Percutaneous endoscopic gastrostomy placement, endoscopic retrograde cholangiopancreatography Surgery in highly vascular organs (kidneys, liver, spleen) Cardiac, intracranial, or spinal surgery Any major operation (procedure duration > 45 min) Neuraxial anesthesia[b] Epidural injections
Low-to-moderate-bleed-risk surgery/procedure[c] (30-d risk of major bleed 0%-2%)	Arthroscopy Cutaneous/lymph node biopsies Foot/hand surgery Coronary angiography[d] GI endoscopy ± biopsy Colonoscopy ± biopsy Abdominal hysterectomy Laparoscopic cholecystectomy Abdominal hernia repair Hemorrhoidal surgery Bronchoscopy ± biopsy
Minimal-bleed-risk surgery/procedure[e] (30-d risk of major bleed approximately 0%)	Minor dermatologic procedures (excision of basal and squamous cell skin cancers, actinic keratoses, and premalignant or cancerous skin nevi) Ophthalmologic (cataract) procedures Minor dental procedures (dental extractions, restorations, prosthetics, endodontics), dental cleanings, fillings Pacemaker or cardioverter-defibrillator device implantation

CHEST 2022; 162(5):e207-e243



CHEST 2022; 162(5):e207-e243

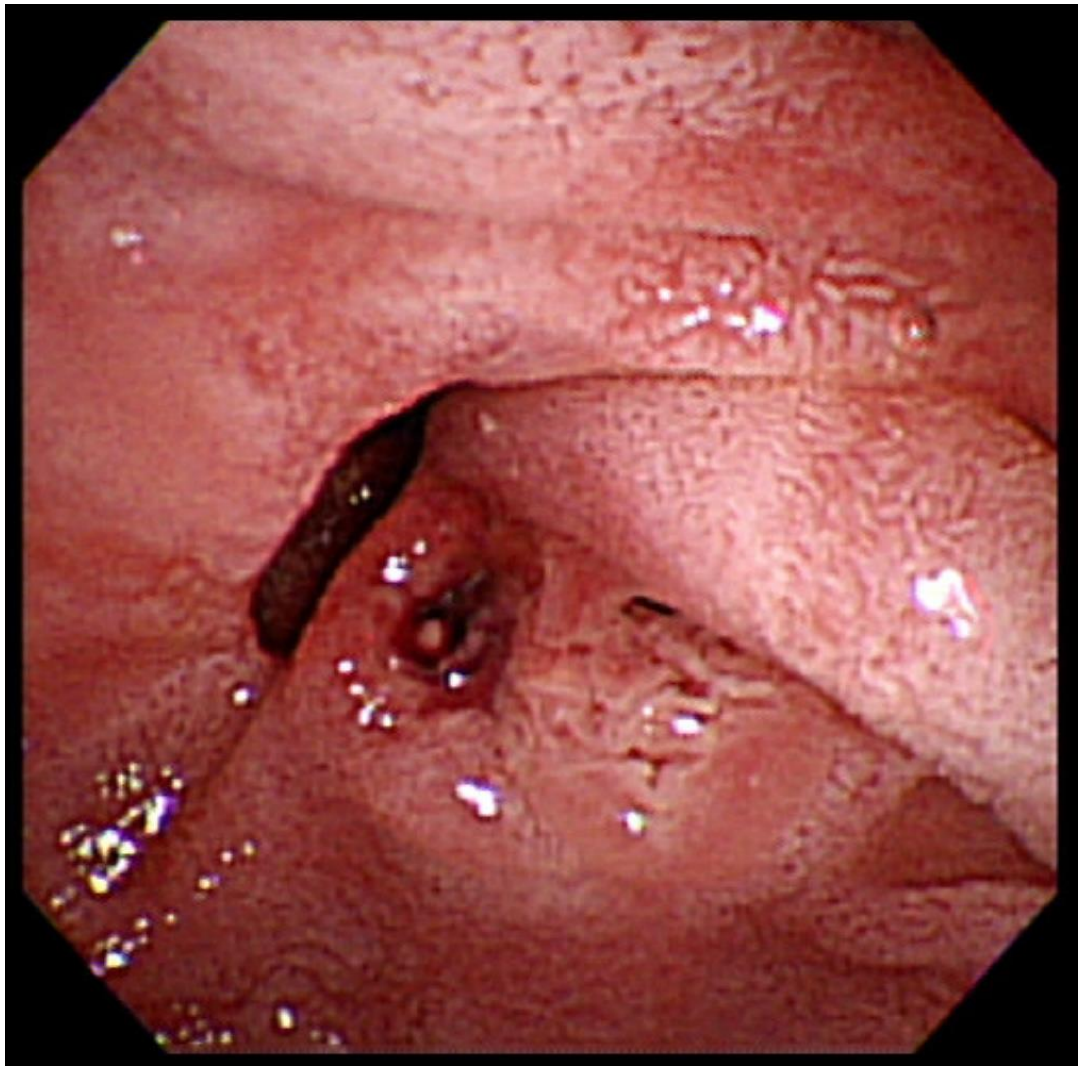
PLM consult (HD #7)

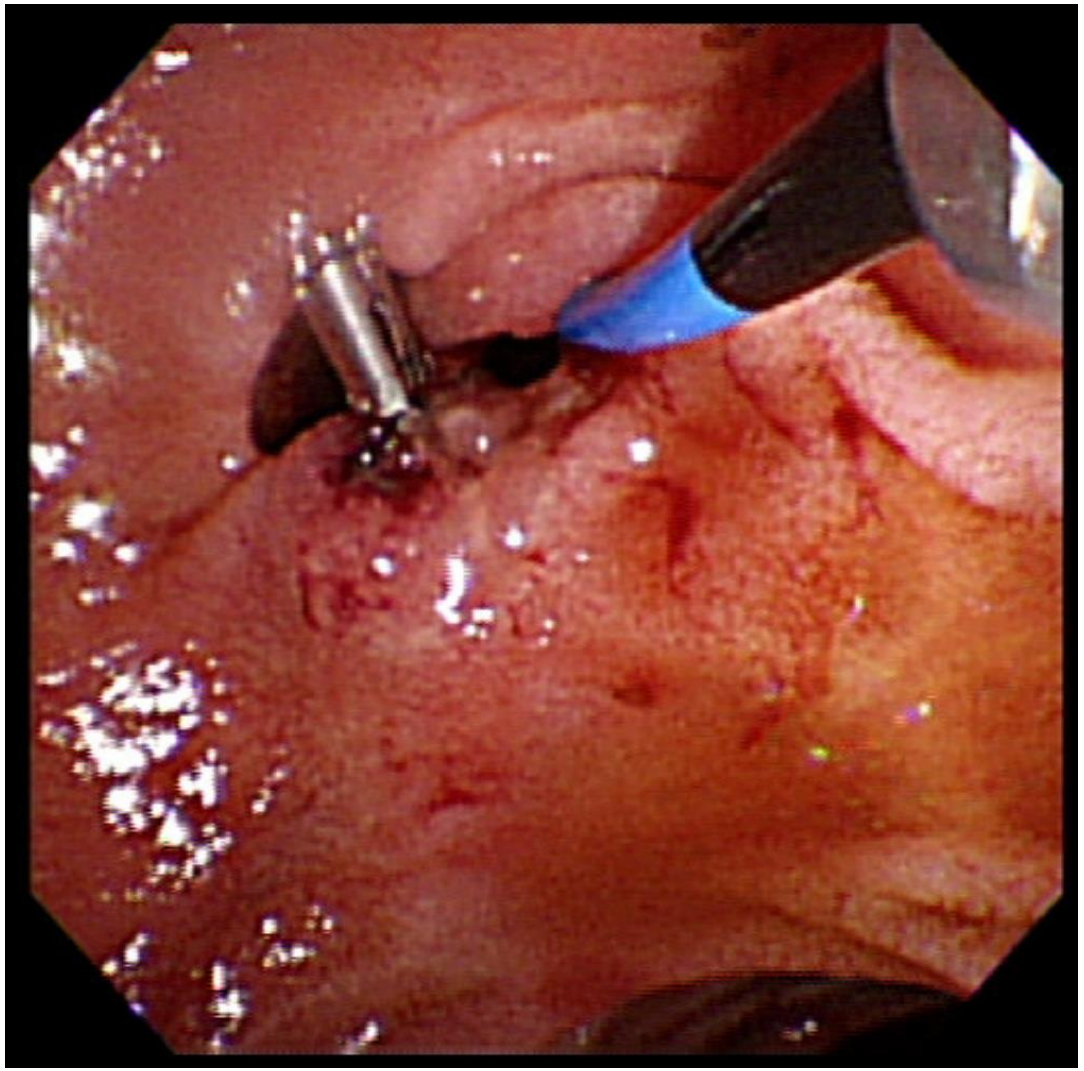
Anticoagulants 변경의 필요성

ERCP 후 bleeding이 없다면 우선 low-dose anticoagulation을 시행

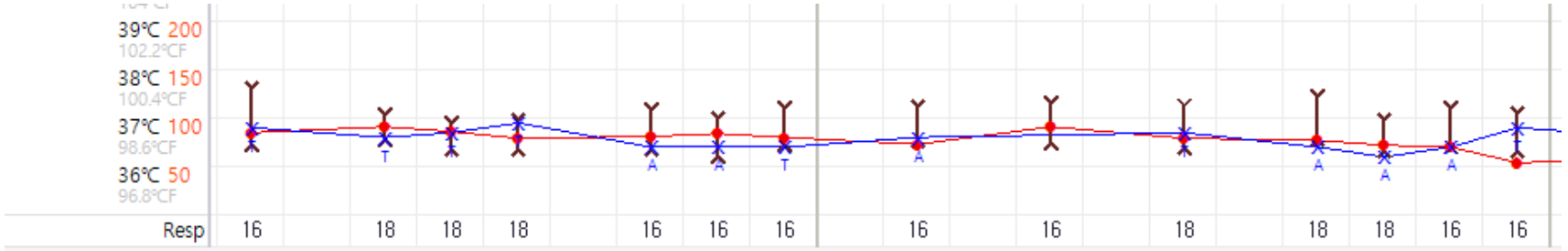
Heparin 5000iu BID로 1~2일 투여
bleeding소견 없을 경우 enoxaparin 40mg QD 투여.

ERCP (HD #8)



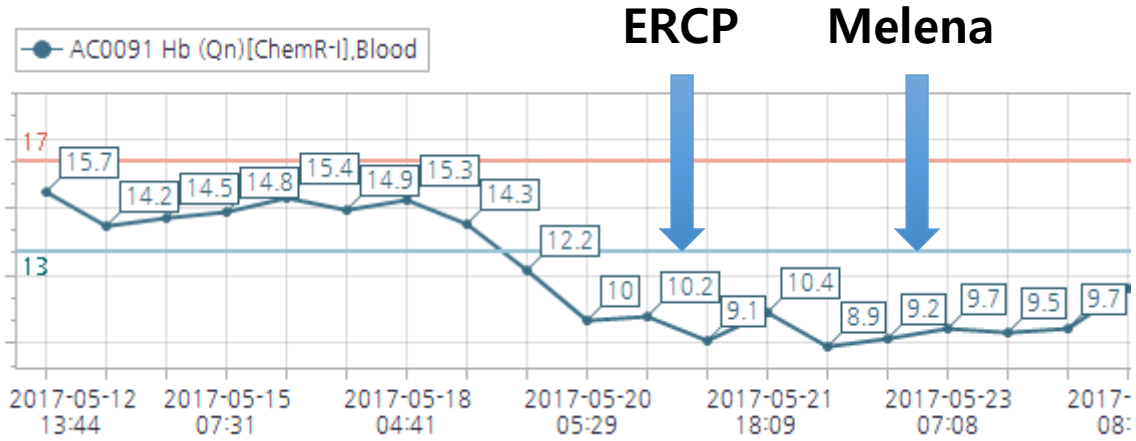


Melena (HD #10)



	04:00	07:00	08:00	10:00	11:00	12:00	16:00	20:00	23:00	00:00	03:00	04:00	06:10	07:00	08:00	12:00	13:00	16:00	20:00	23:00
미측정 사유																				
SBP	131		104	95	98		109	100	111		112		116		113		123	98	111	105
DBP	72		77	68	68		68	60	72		76		74		69		78	66	70	66
MBP	92		86	77	78		82	73	85		88		88		84		93	77	84	79
PR	85		91	86	79		81	84	80		73		91		79		77	72	70	54
BT 측정구분	T		T	T	T		A	A	T		A		T		T		A	A	A	T
BT	36.8		36.6	36.7	36.9		36.4	36.4	36.4		36.6				36.7		36.4	36.2	36.4	36.8
RR	16		18	18	18		16	16	16		16		16		18		18	18	16	16

Melena (HD #10)


AC0091 Hb (Qn)[ChemR-I],Blood
ERCP
Melena
17
13
15.7
14.2
14.5
14.8
15.4
14.9
15.3
14.3
12.2
10
10.2
9.1
10.4
8.9
9.2
9.7
9.5
9.7
2017-05-12 13:44
2017-05-15 07:31
2017-05-18 04:41
2017-05-20 05:29
2017-05-21 18:09
2017-05-23 07:08
2017-

f/u EGD (HD #10)

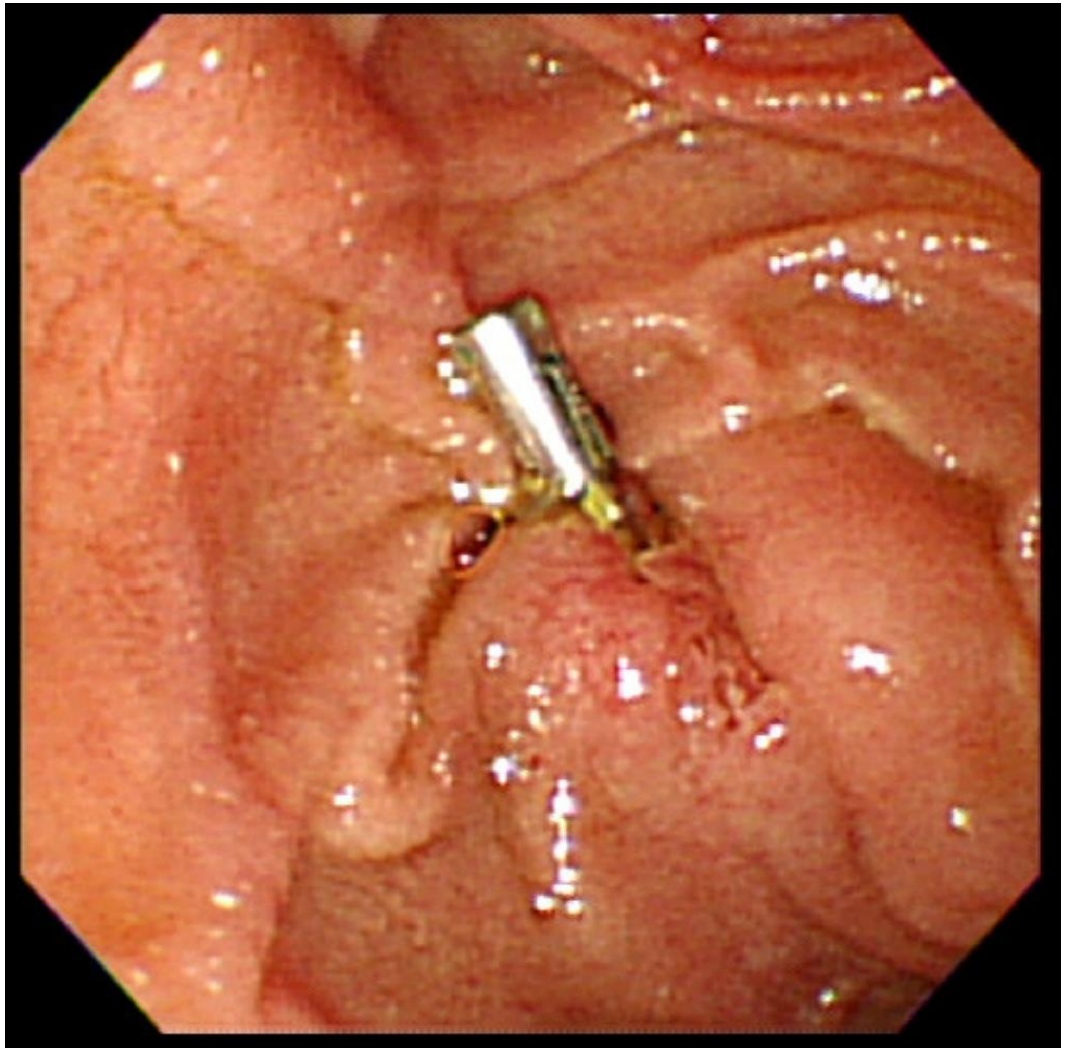


Table 1. Outcomes after anticoagulation-related gastrointestinal tract bleeding in patients who do and do not resume anticoagulation therapy

Study	Indication for anticoagulation	Anticoagulant	Follow-up period	Adjusted HR-TE (95% CI)	Adjusted HR-recurrent GIB (95% CI)	Adjusted HR all-cause mortality (95% CI)
Witt 2012, N = 442[6]	AF, VTE, MVR, Other	Warfarin	90 d	0.05 (0.01-0.58)	1.32 (0.50-3.57)	0.31 (0.15-0.62)
Qureshi 2014, N = 1329[5]	AF	Warfarin	1-y (TE) 90-d (GIB) 2-y (ACM)	0.71 (0.54-0.93)	1.18 (0.94-1.10)	0.67 (0.56-0.81)
Staerk 2015, N = 3409[7]	AF	Single OAC*	5-y	0.41 (0.31-0.54)	1.22 (0.84-1.77)	0.39 (0.34-0.46)
		Single antiplatelet†		0.76 (0.61-0.95)	1.19 (0.82-1.74)	0.76 (0.68-0.86)
		OAC + antiplatelet*		0.54 (0.36-0.82)	1.34 (0.79-2.28)	0.41 (0.32-0.52)
		Dual antiplatelet‡		0.79 (0.34-1.84)	0.58 (0.08-4.30)	0.88 (0.57-1.36)
Sengupta 2015, N = 197[8]	Various	Warfarin	90 d	0.12 (0.006-0.81)	2.17 (0.86-6.67)	0.63 (0.22-1.89)

Hematology Am Soc Hematol Educ Program. 2016 Dec 2;2016(1):620-624

Timing of initiation

- Conditions wit y reinitiation of anticoagulatio nd the patient is clinically sta

TABLE 6 Original Indications for Anticoagulation With High Thrombotic Risk

Indication	Patient Characteristics That May Further Increase Thrombotic Risk
Mechanical valve prosthesis with or without AF*	• Mechanical valve (mitral > aortic) + additional thrombotic considerations: AF, HF, prior stroke/TIA • Caged ball or tilting disc valve prosthesis • Stroke/TIA within 6 months
Nonvalvular AF†	• AF with CHA_2DS_2-VASc score of ≥4 (84)‡ • Ischemic stroke/TIA within 3 months • Stroke risk ≥10% per year
Valvular AF (with moderate or greater mitral stenosis or a mechanical valve prosthesis)*	
VTE†	• VTE within 3 months • History of unprovoked or recurrent VTE • Active cancer and history of cancer-associated VTE
Prior thromboembolism with interruption of anticoagulation	
Left ventricular thrombus§	• >3 months post-MI, if recovery of LV function
Left atrial thrombus	
Left ventricular assist device§	

J Am Coll Cardiol 2020;76:594-622

Table 3. Clinical characteristics arguing for or against resuming anticoagulation after major bleeding

Clinical characteristic	For	Against
Bleed-related characteristics		
Known, correctable source	+++	
Known, uncorrectable source	+	
Unknown source		+
Deep ICH location, blood pressure–controlled	++	
Lobar ICH location, MRI evidence of microbleeding		+
Indication for anticoagulation		
Mechanical heart valve	+++	
Idiopathic or recurrent VTE	+++	
Provoked VTE, completed 3 mo of therapy		+++
VTE + protein C/S or antithrombin deficiency or APLA syndrome	++	
Atrial fibrillation, prior history of stroke or higher $CHADS_2$ or CHA_2DS_2-VASc score	+++	
Atrial fibrillation, lower $CHADS_2$, or CHA_2DS_2-VASc score	+	
Atrial fibrillation, no additional stroke risk factors		+++
Other characteristics		
History of anticoagulation therapy nonadherence		+
Previously unstable INR control despite adequate adherence		+
Renal failure		+
Poor prognosis, limited life expectancy		+

Timing of Anticoagulation Reinitiation

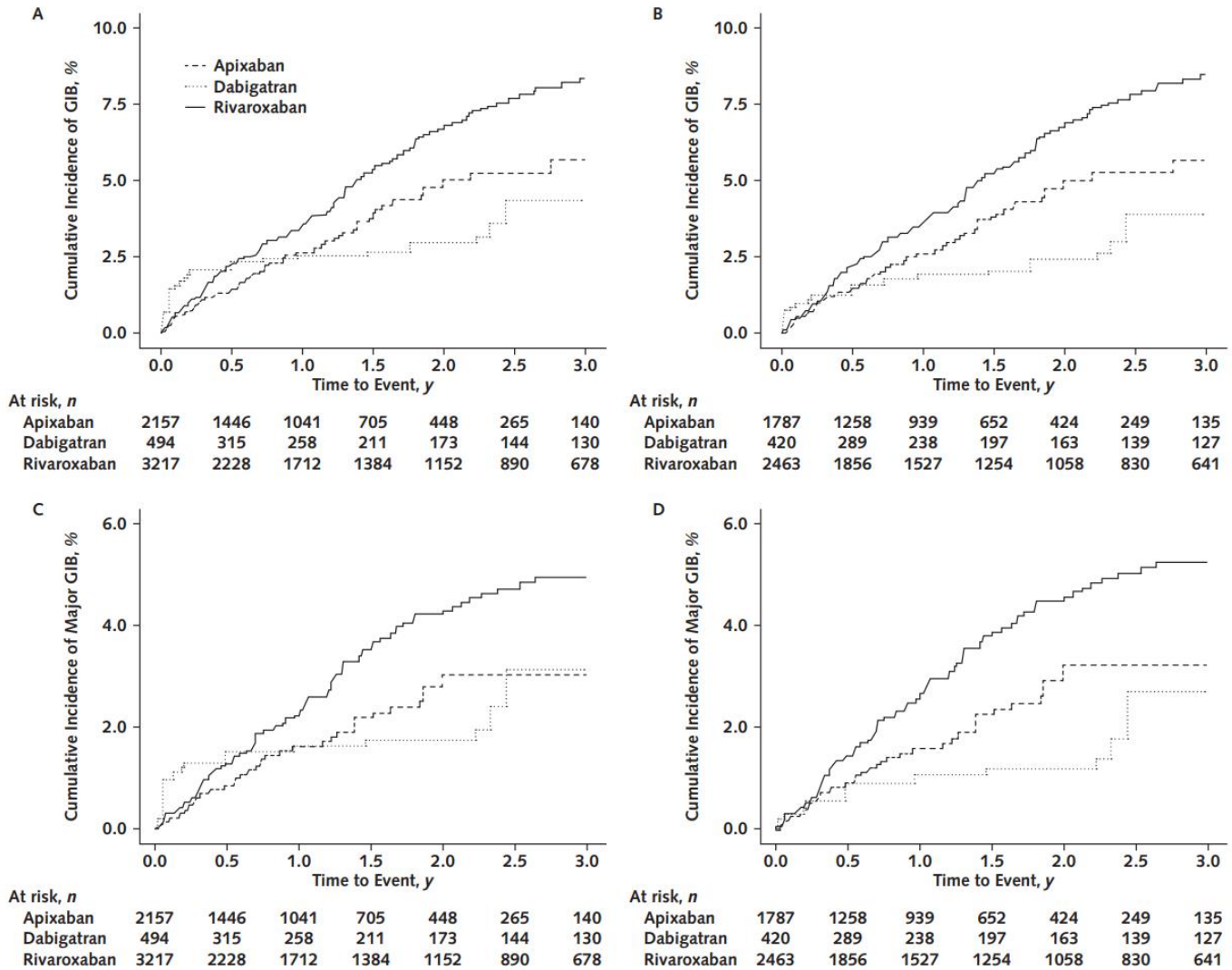
- For patients at high rebleeding risk for whom the thrombotic risk is unacceptably high and therapeutic anticoagulation is deemed necessary, it is suggested that **unfractionated heparin be administered by intravenous infusion owing to its short half-life and the availability of a reversal agent** (protamine sulfate)

- **Temporary use of prophylactic doses with close clinical monitoring** is a reasonable strategy to balance bleeding and thrombotic risk in this setting.

J Am Coll Cardiol 2020;76:594-622

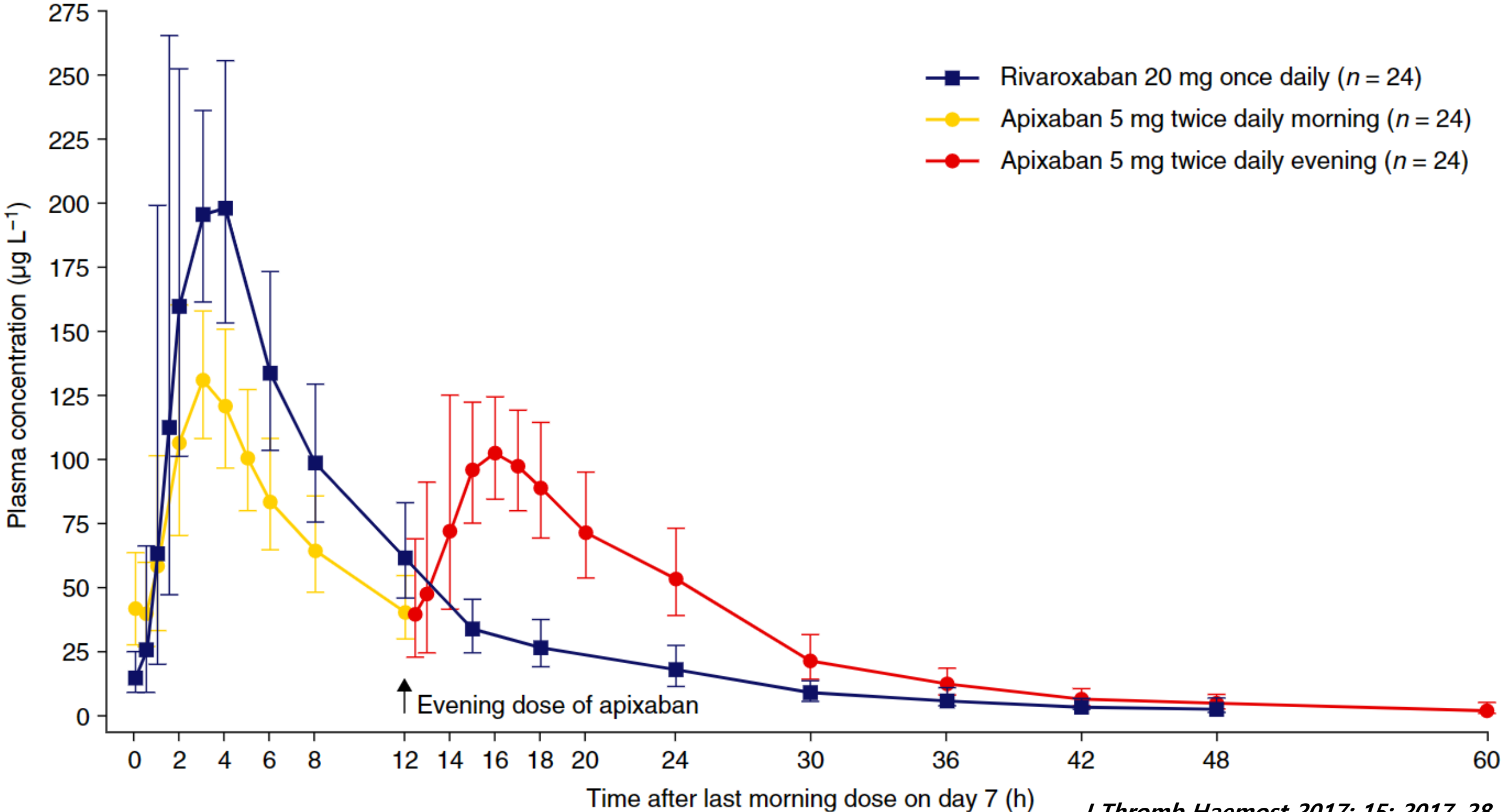
2 Direct oral anticoagulants (edoxaban, rivaroxaban, or apixaban) are recommended for patients with cancer when creatinine clearance is ≥30 mL/min in the absence of strong drug–drug interactions or gastrointestinal absorption impairment (grade 1A). Use caution in patients with gastrointestinal tract malignancies, especially upper gastrointestinal tract malignancies, as the available data show increased risk of gastrointestinal tract bleeding with edoxaban and rivaroxaban.

Lancet Oncol 2022; 23: e334–47



Ann Intern Med. 2021;174:1493-1502.

Indication	Dabigatran	Rivaroxaban	Apixaban	Edoxaban
VTE Treatment	CrCl > 30 mL/min: 150 mg twice daily	15 mg twice daily for 21 days, followed by 20 mg daily with food	10 mg twice daily for 7 days, followed by 5 mg twice daily	60 mg daily CrCl 15-50 mL/min: 30 mg daily
VTE Prophylaxis ***Total hip or knee arthroplasty***	CrCl > 30 mL/min: 110 mg on day one, then 220 mg daily	10 mg daily with or without food	2.5 mg twice daily	Not approved
Stroke/Systemic Embolism Prophylaxis in NVAF	CrCl > 30 mL/min: 150 mg twice daily CrCl 15-30 mL/min: 75 mg twice daily	CrCl > 50 mL/min: 20 mg daily with evening meal CrCl 15-50 mL/min: 15 mg daily with evening meal	5 mg twice daily; reduce to 2.5 mg twice daily if at least two of the following: body weight ≤ 60 kg, age ≥ 80 years, serum creatinine ≥ 1.5 mg/dL	CrCl > 95 mL/min: avoid use CrCl 50-95 mL/min: 60 mg daily CrCl 15-50 mL/min: 30 mg daily



J Thromb Haemost 2017; 15: 2017–28

Hospital course

HD #11

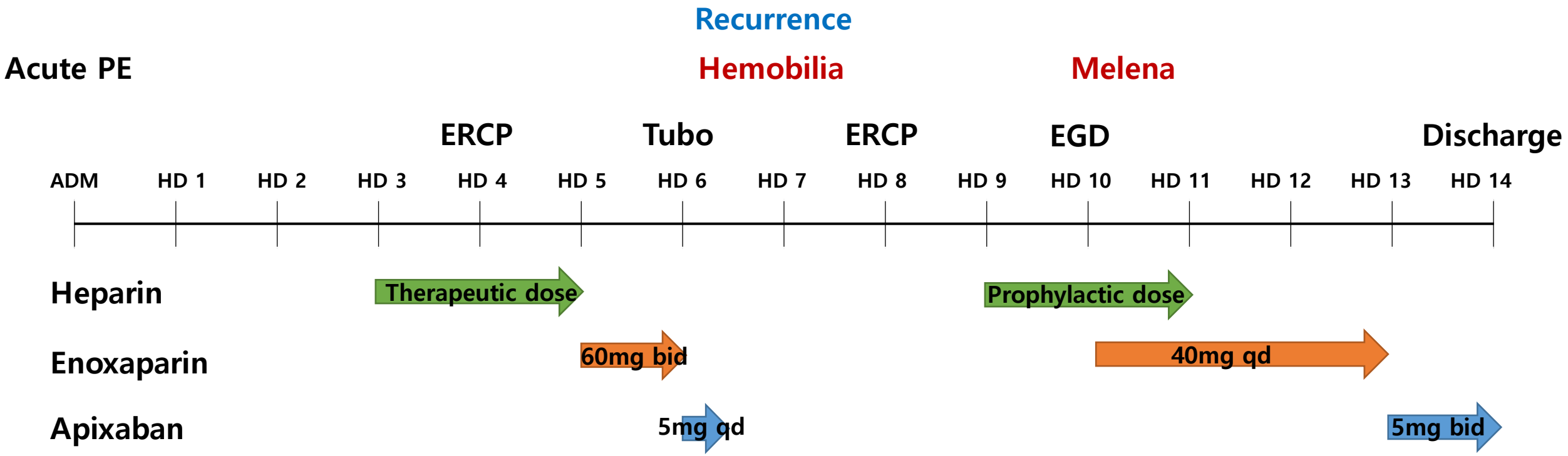
Melena 지속되나 그 양 증가하지 않아 enoxaparin 40mg qd start

HD #12

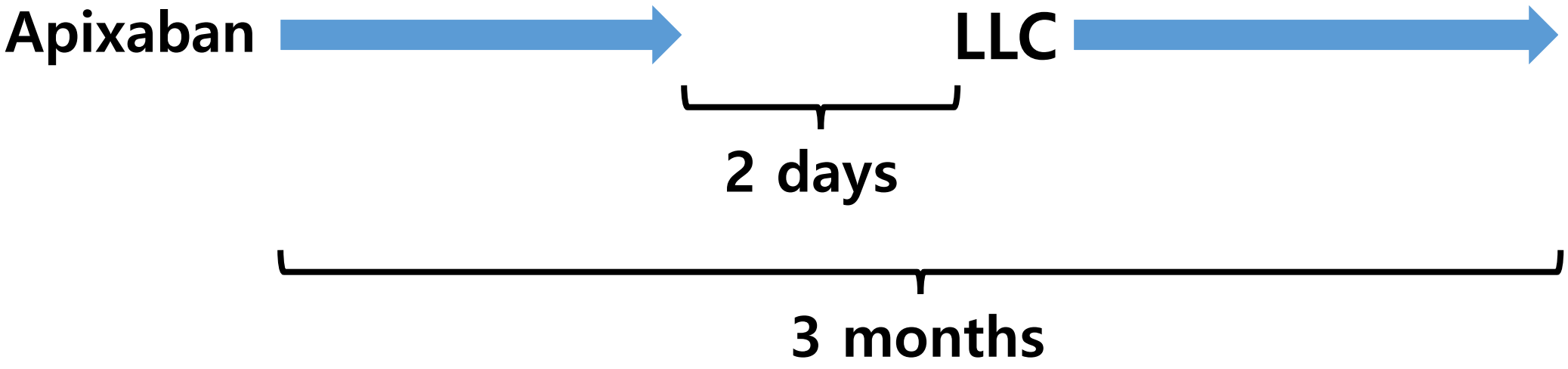
일반 변 보기 시작하여 오전 enoxaparin 60mg qd 투약 후 오후부터 apixaban 5mg qd 투약

HD #13-14

Apixaban 5mg bid로 투약하기로 하고 퇴원


Recurrence
Acute PE
Hemobilia
Melena
ERCP
Tubo
ERCP
EGD
Discharge
ADM
HD 1
HD 2
HD 3
HD 4
HD 5
HD 6
HD 7
HD 8
HD 9
HD 10
HD 11
HD 12
HD 13
HD 14
Heparin
Therapeutic dose
Prophylactic dose
Enoxaparin
60mg bid
40mg qd
Apixaban
5mg qd
5mg bid

Disease course



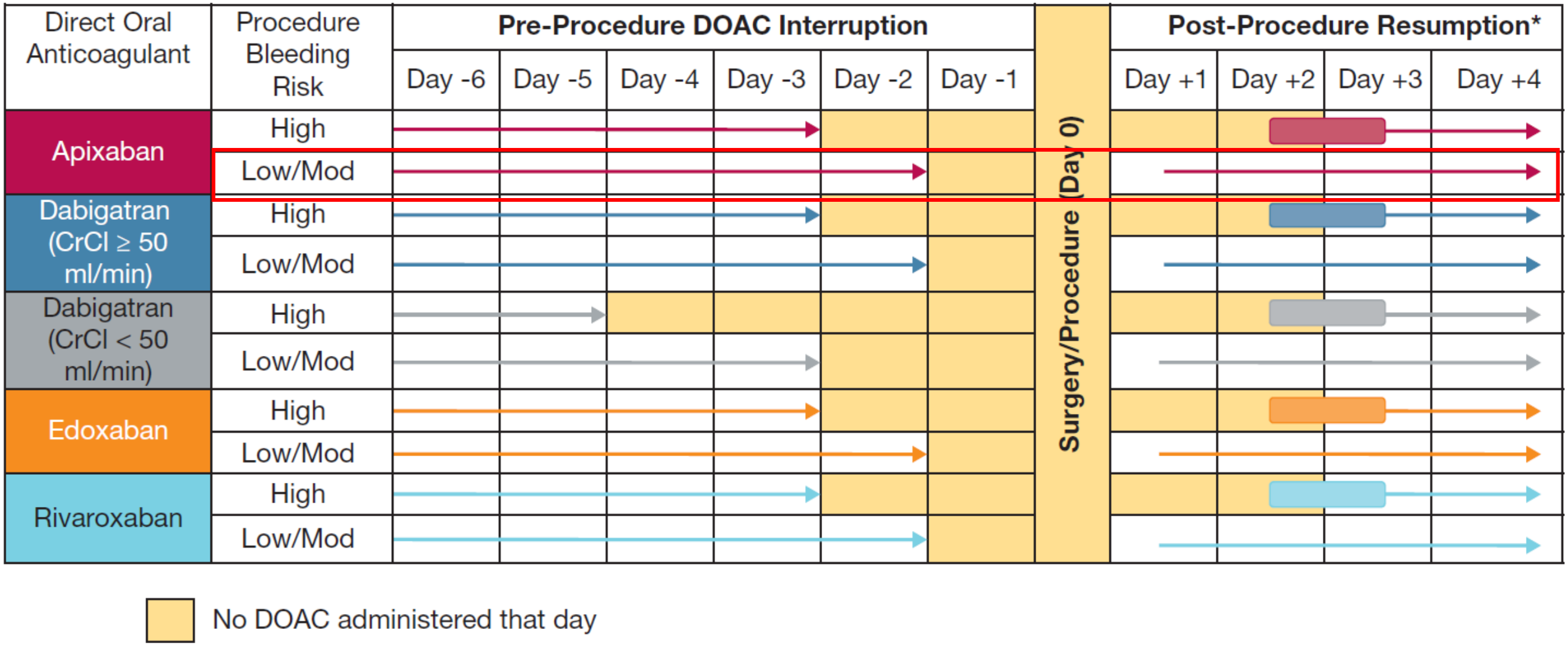
22. In patients receiving apixaban who require an elective surgery/procedure, we suggest stopping apixaban for 1 to 2 days before the surgery/procedure over apixaban continuation (Conditional Recommendation, Very Low Certainty of Evidence).

CHEST 2022; 162(5):e207-e243

TABLE 2] Suggested Risk Stratification for Procedural Bleed Risk, Based on ISTH Guidance Statements[25]

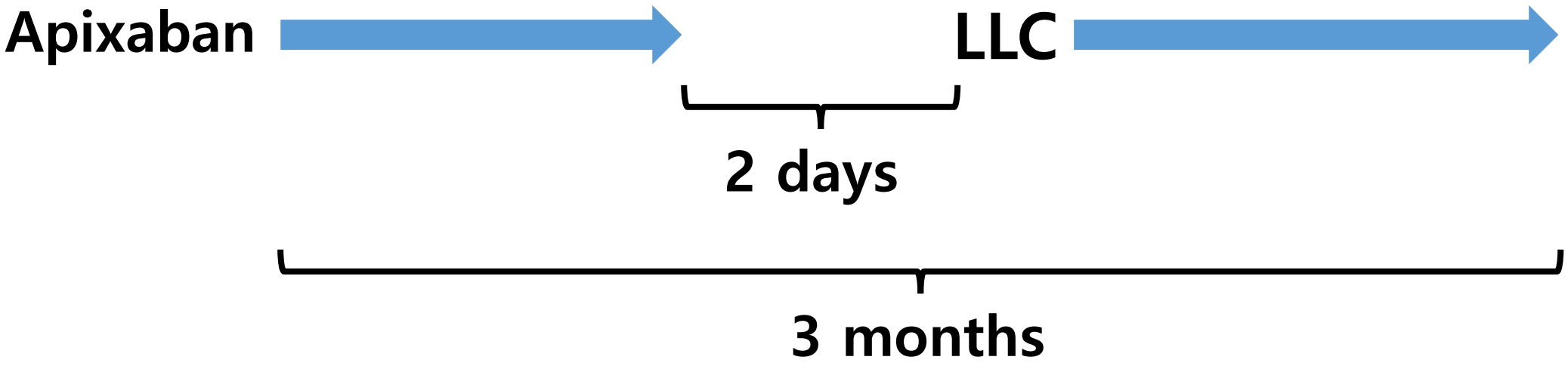
High-bleed-risk surgery/procedure[a] (30-d risk of major bleed ≥ 2%)	Major surgery with extensive tissue injury Cancer surgery, especially solid tumor resection (lung, esophagus, gastric, colon, hepatobiliary, pancreatic) Major orthopedic surgery, including shoulder replacement surgery Reconstructive plastic surgery Major thoracic surgery Urologic or GI surgery, especially anastomosis surgery Transurethral prostate resection, bladder resection, or tumor ablation Nephrectomy, kidney biopsy Colonic polyp resection Bowel resection Percutaneous endoscopic gastrostomy placement, endoscopic retrograde cholangiopancreatography Surgery in highly vascular organs (kidneys, liver, spleen) Cardiac, intracranial, or spinal surgery Any major operation (procedure duration > 45 min) Neuraxial anesthesia[b] Epidural injections
Low-to-moderate-bleed-risk surgery/procedure[c] (30-d risk of major bleed 0%-2%)	Arthroscopy Cutaneous/lymph node biopsies Foot/hand surgery Coronary angiography[d] GI endoscopy ± biopsy Colonoscopy ± biopsy Abdominal hysterectomy Laparoscopic cholecystectomy Abdominal hernia repair Hemorrhoidal surgery Bronchoscopy ± biopsy
Minimal-bleed-risk surgery/procedure[e] (30-d risk of major bleed approximately 0%)	Minor dermatologic procedures (excision of basal and squamous cell skin cancers, actinic keratoses, and premalignant or cancerous skin nevi) Ophthalmologic (cataract) procedures Minor dental procedures (dental extractions, restorations, prosthetics, endodontics), dental cleanings, fillings Pacemaker or cardioverter-defibrillator device implantation

CHEST 2022; 162(5):e207-e243



CHEST 2022; 162(5):e207-e243

Disease course



Bleeding event (-)

VTE event (-)

Discussion point

Interruption duration of DOACs before procedure

Case (57/F)

Chief complain: Fall down (onset: 1DA)

Brief history

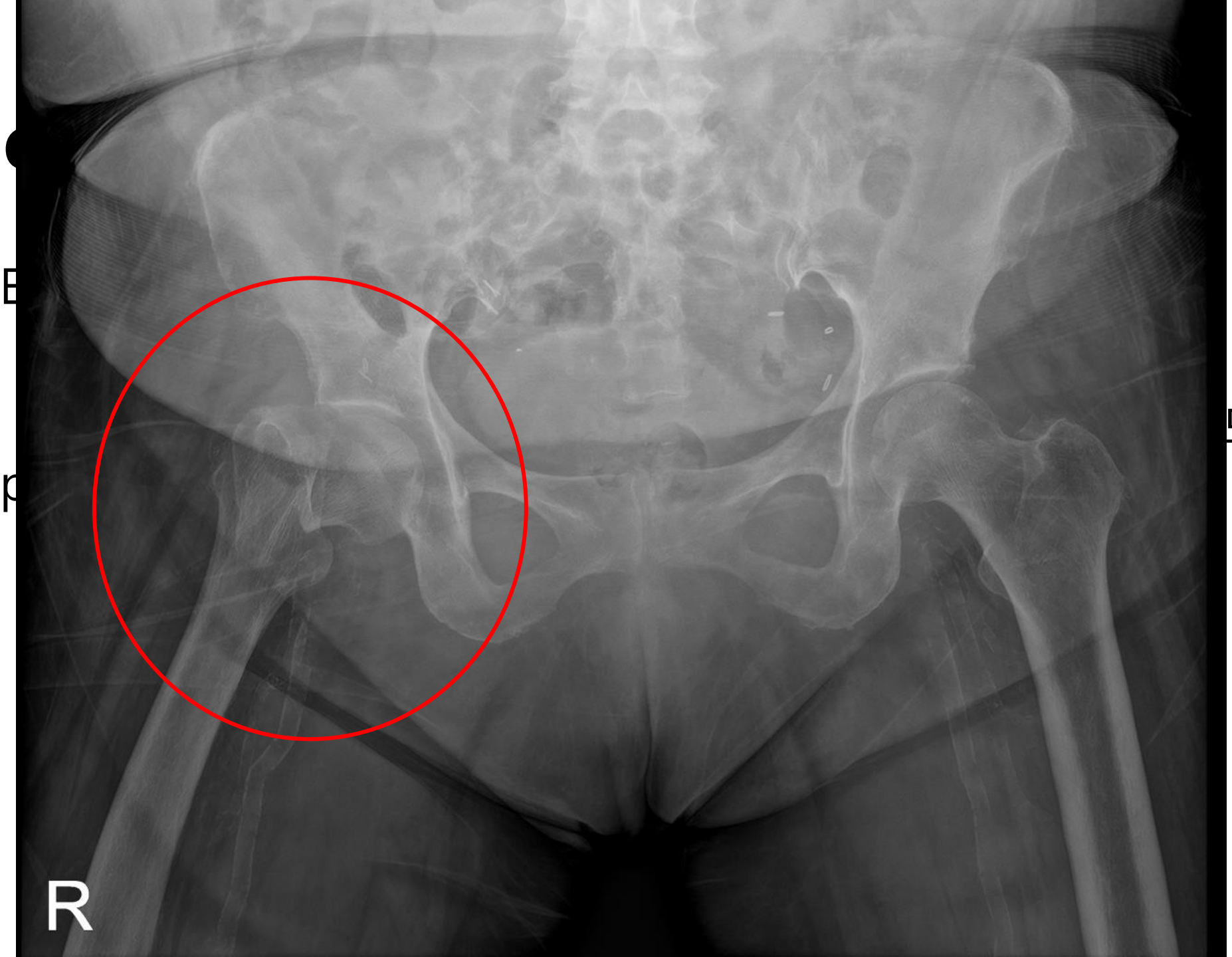
DM ESRD로 혈액투석 받는 57세 여환

내원 1일전 화장실에서 나오던 중 미끄러져 낙상. 이후 지속되는 Rt.hip pain을 주소로 ER 내원

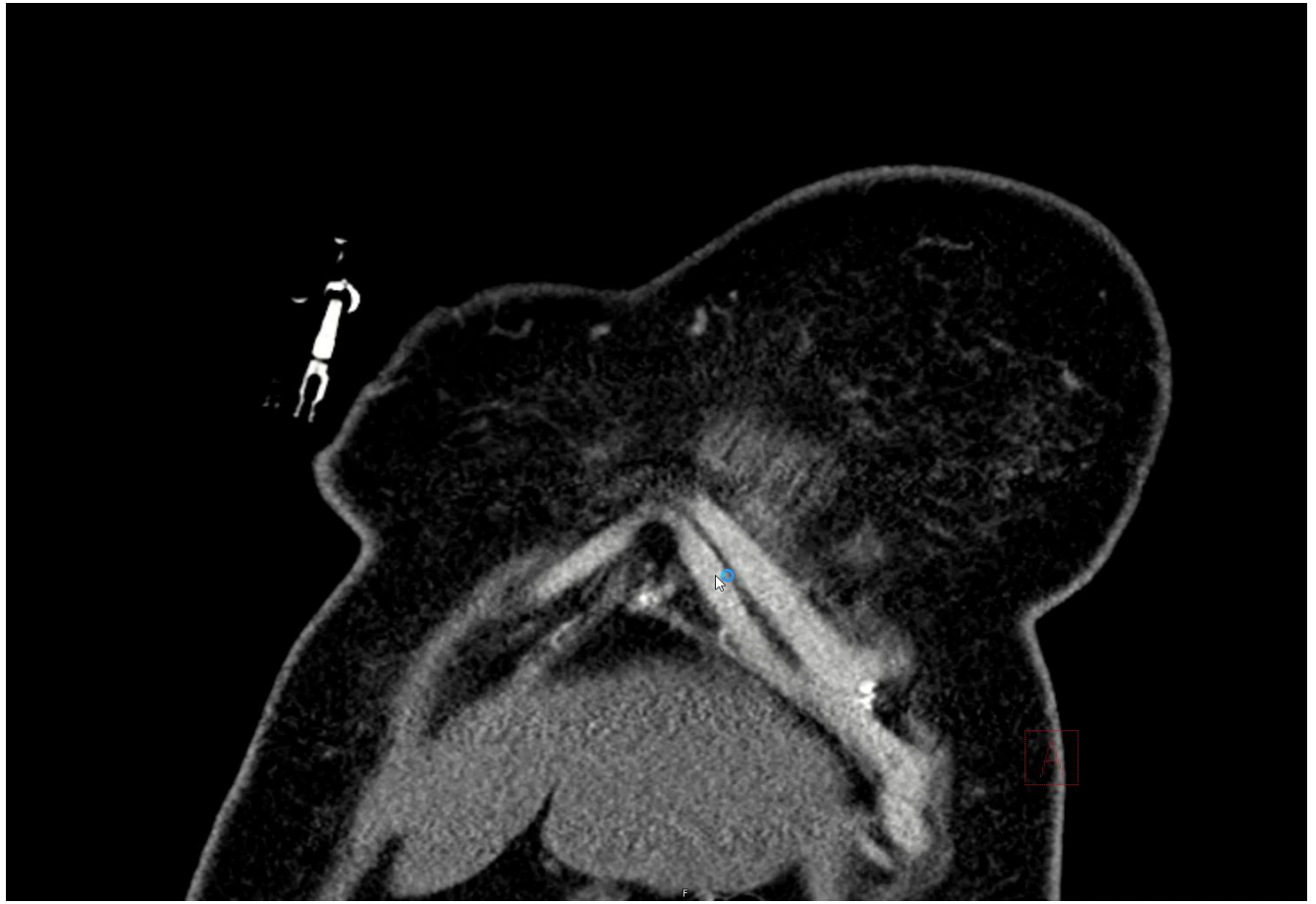
Bri

DM E

내원 되는
Rt.hip



Pulmonary embolism CT



Lower extremity CT

Clincal information: r/o DVT

Findings:
1. No evidence of DVT in bilateral lower extremities.

2. Rt. femoral neck fracture.

3. Fatty liver.

4. No evidence of abnormal enlarged LNs in the retroperitoneum.

[결 론]

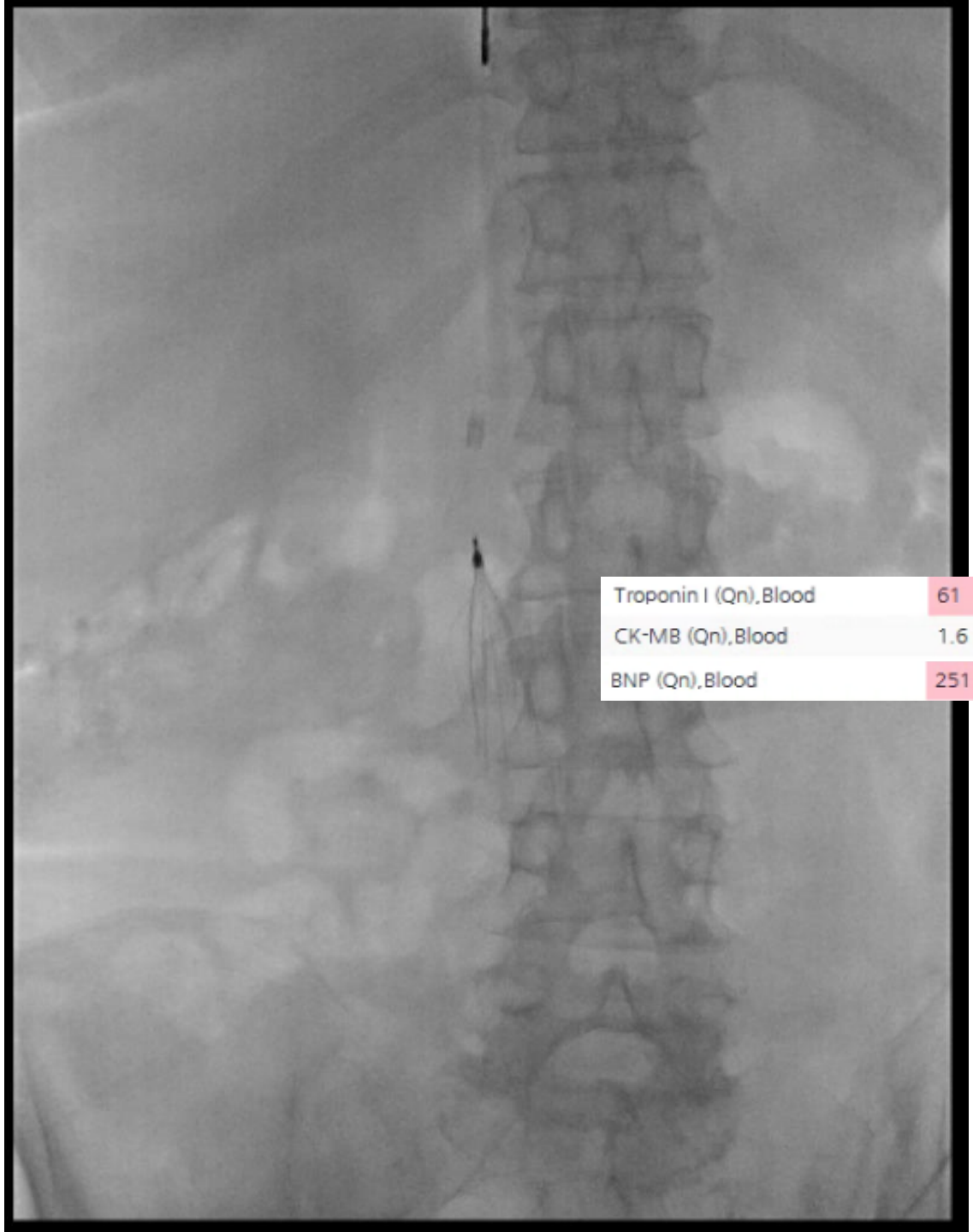
No evidence of DVT in bilateral lower extremities.

PLM ER note

PreOp risk evaluation related to pulmonary embolism

- TTE
- Cardiac enzyme

IVC filter insertion



Troponin I (Qn),Blood	61	▲ 60	pg/mL
CK-MB (Qn),Blood	1.6	5	ng/mL
BNP (Qn),Blood	251	▲ 76	pg/mL

Left Ventricle **normal LV**

LVIDs	29 mm	LVIDd	47 mm	LA	40 mm	Aorta	29 mm
LVPWs	18 mm	LVPWd	11 mm	ESV	42 ml	EDV	110 ml
IVSs	15 mm	IVSd	12 mm	LV mass	199.6 g	LVEF	62 %
LV mass Index		110.9 g/m²		LA volume index			ml/m²

Right Ventricle **preserved RV contractility**

RVOTprox (PLAX)	mm	RVOTprox (PSAX)	mm	TV annular S vel	cm/s
Basal diameter	mm	Mid diameter	mm	TAPSE	mm

Mitral Valve **posterior annular calcification**

Peak E vel	56 cm/s	Peak A vel	104 cm/s	Dec Time	ms
DTI S/E'A' (septal)	9 / 10.1 / 14.5 cm/s	E/A ratio	0.54	E/E' ratio	6
DTI S/E'/A' (lateral)	6 / 8.8 / 7 cm/s	MR grade		MR jet area	cm²
			mmHg	PISA	mm

AR grade		Peak vel	1.3 m/s	PG	/ mmHg
AVA(2D/Doppler)	/ cm²	LVOT vel	m/s	LVOT PG	/ mmHg
AV TVI	cm	LVOT TVI	cm	LVOT diameter	19.2 mm
Sinus	mm	ST junction	mm	Tubular	mm

Tricuspid **normal morphology**

TR grade		TR jet area	cm²	Peak TR vel	m/s
PGsys(RV-RA)	mmHg	Peak E vel	cm/s	Peak A Vel	cm/s

Pulmonic Valve

PR grade		PR peak Vel	m/s	PR ED Vel	m/s
Peak Vel	m/s	PG(max/mean)	/ mmHg	Pul vein flow S/D	/ cm/s

	Original PESI	Simplified PESI
Age	57	0
Male Sex	0	-
Cancer	0	0
Chronic heart failure	0	0
Chronic pulmonary disease	0	0
HR ≥110/min	0	0
SBP <100mmHg	0	0
RR >30/min	0	-
BT <36℃	0	-
Altered mentality	0	-
SaO_2 <90%	0	0
Total	57 **Class I**	0

	VTE-BLEED score
Active cancer	0
Male patients with uncontrolled HTN	0
Anemia	0
History of bleeding	0
Renal dysfunction	1.5
Age ≥60 years	0
Total	1.5 **Low bleeding risk**

Eur Respir J 2016; 48: 1369–1376

TIMING OF SURGICAL INTERVENTION

Although the timing of surgery in patients with hip fracture is ultimately determined by the surgeon, it is often influenced by the findings of the preoperative medical evaluation. Furthermore, timing of surgical intervention may have an important impact upon patient outcomes [41]. We advise:

- In patients who are medically stable and without significant comorbid illness, surgery should be performed within 24 hours.

  Delay in surgical repair will result in postponement of full weightbearing status, leading to delayed functional recovery. In addition, prolonged bed rest may increase the risk of medical complications, including deep vein thrombosis, pneumonia, urinary tract infection, and skin breakdown.

- In patients with comorbid medical illness, such as congestive heart failure, active infection (eg, pneumonia), unstable angina, or severe chronic obstructive pulmonary disease, surgery should also be performed as soon as feasible. However, such individuals may require more extensive preoperative evaluation with medical management and optimization of these conditions prior to repair of their fracture. Failure to stabilize coexisting medical conditions prior to surgery may increase the risk of postoperative complications [44]. (See "Evaluation of perioperative pulmonary risk" and "Management of cardiac risk for noncardiac surgery", section on 'For urgent or emergency surgery' and "Evaluation of cardiac risk prior to noncardiac surgery", section on 'Management based on risk'.)

- For all patients, avoid delaying surgery beyond 72 hours.

- Unless contraindicated, thromboembolic prophylaxis should be instituted in patients who are awaiting surgery. (See 'Thromboembolic prophylaxis' below.)

- Aggressive pressure ulcer prevention measures should be employed in patients in whom surgery is delayed beyond 24 to 48 hours. (See 'Prevention of pressure ulcers' below.)

N Engl J Med 2017;377:2053-62

https://www.uptodate.com/contents/hip-fracture-in-adults-epidemiology-and-medical-management/abstract/41

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N Engl J Med 2017;377:2053-62

https://www.uptodate.com/contents/hip-fracture-in-adults-epidemiology-and-medical-management/abstract/41

6.9 Recommendations for inferior vena cava filters

Recommendations	Class[a]	Level[b]
IVC filters should be considered in patients with acute PE and absolute contraindications to anticoagulation.	IIa	C
IVC filters should be considered in cases of PE recurrence despite therapeutic anticoagulation.	IIa	C
Routine use of IVC filters is not recommended.[302–304]	III	A

European Heart Journal (2019) 00, 161

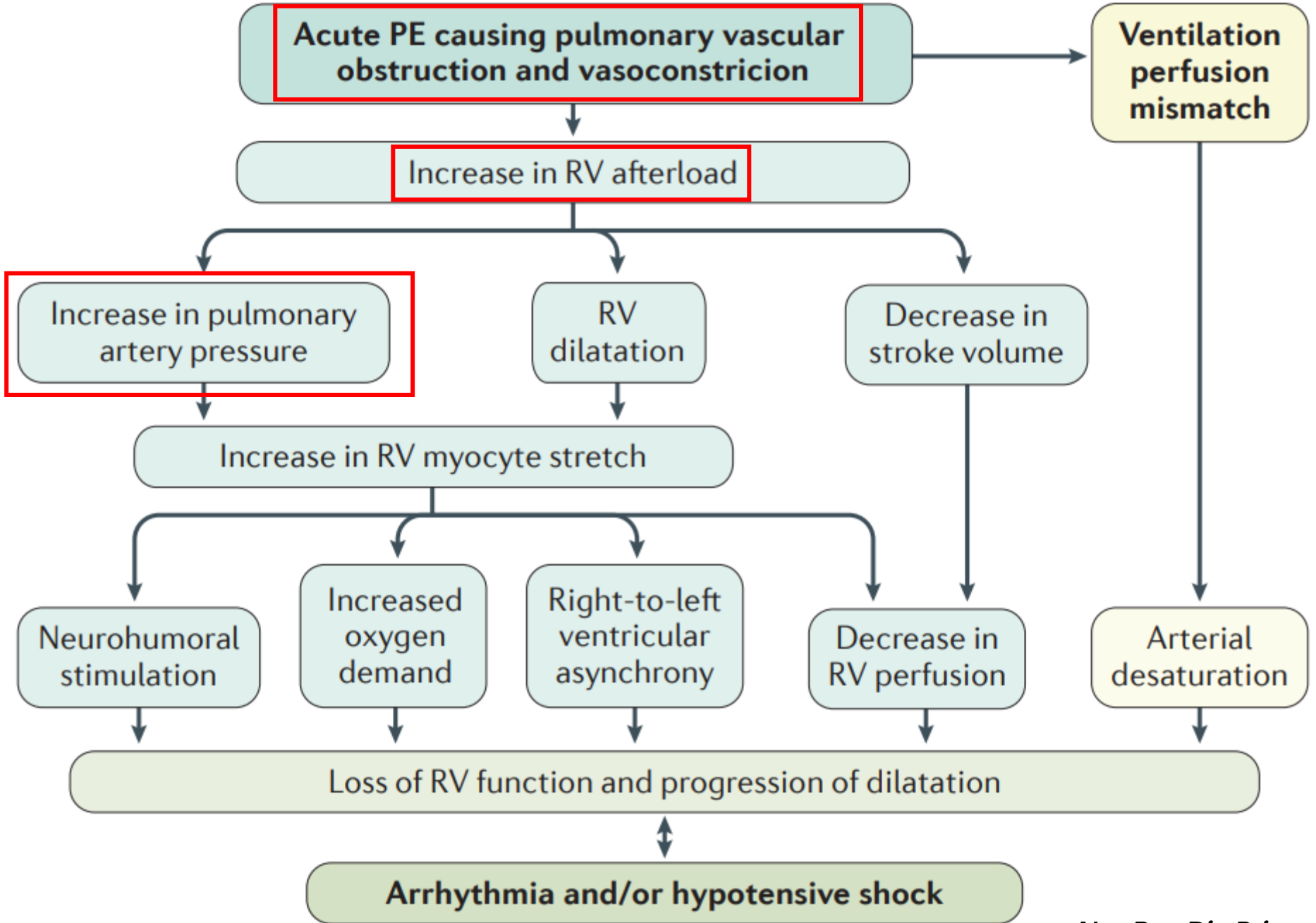
PLM consult

PostOp anticoagulation

출혈 위험 평가 후에 anticoagulation 가능한 시점에 heparinization 시작

Heparinization 후 출혈 없이 안정적이라면 warfarin 복용 시작.
이때 bridging 후 INR target 2-3 도달시 heparin 중단

항응고제 투여 후 문제 없으면 가능하면 퇴원 1-2일 전에 IVC filter 제거



Nat Rev Dis Primers 4, 18028 (2018)

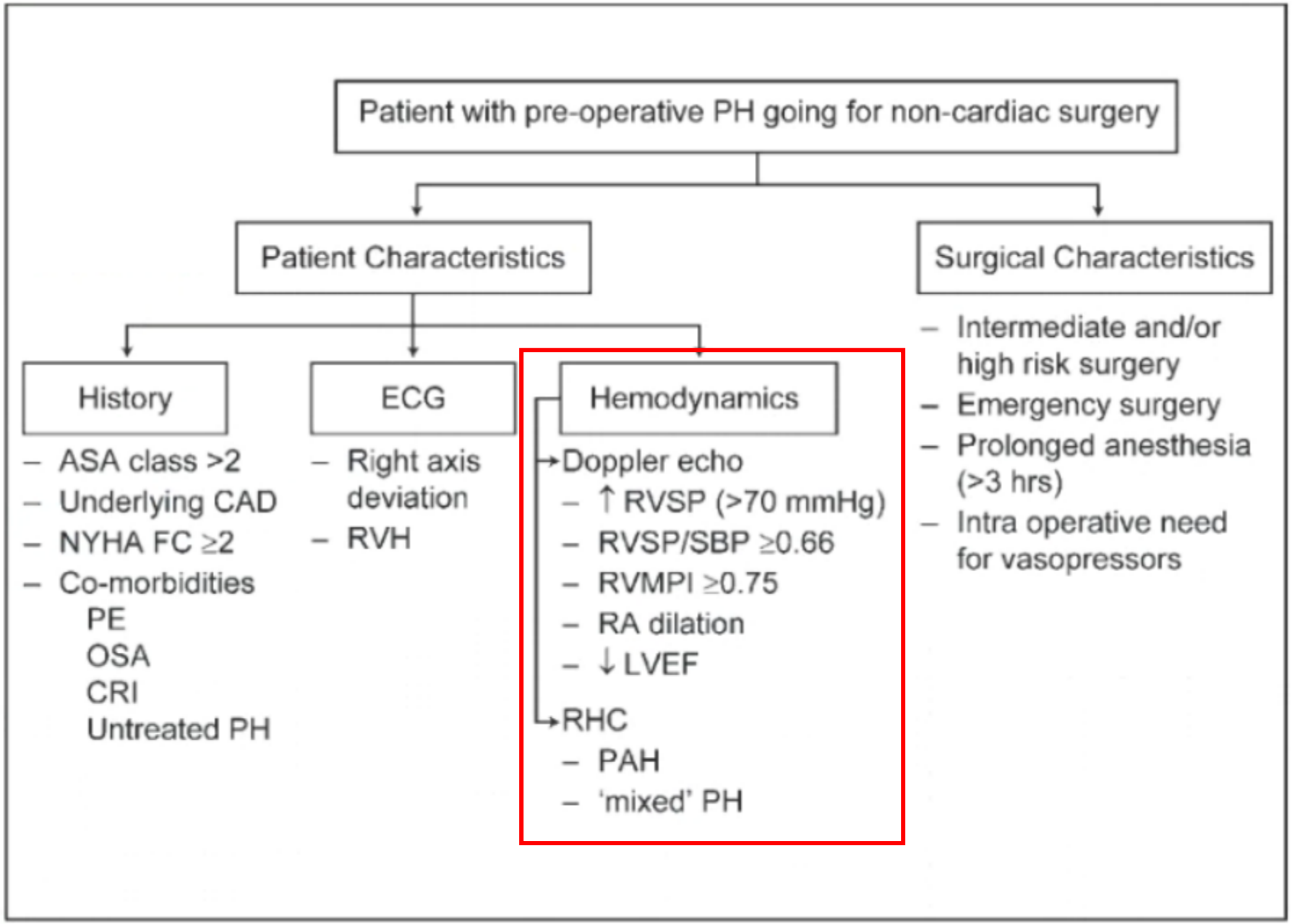
Preoperative risk assessment

After elective non-cardiac surgery,

Patients with PH face high rates of fatal complications,

and even higher for urgent surgery.

British Journal of Anaesthesia, 126 (4): 774e790 (2021)



CHEST 2013; 144(1):329–340

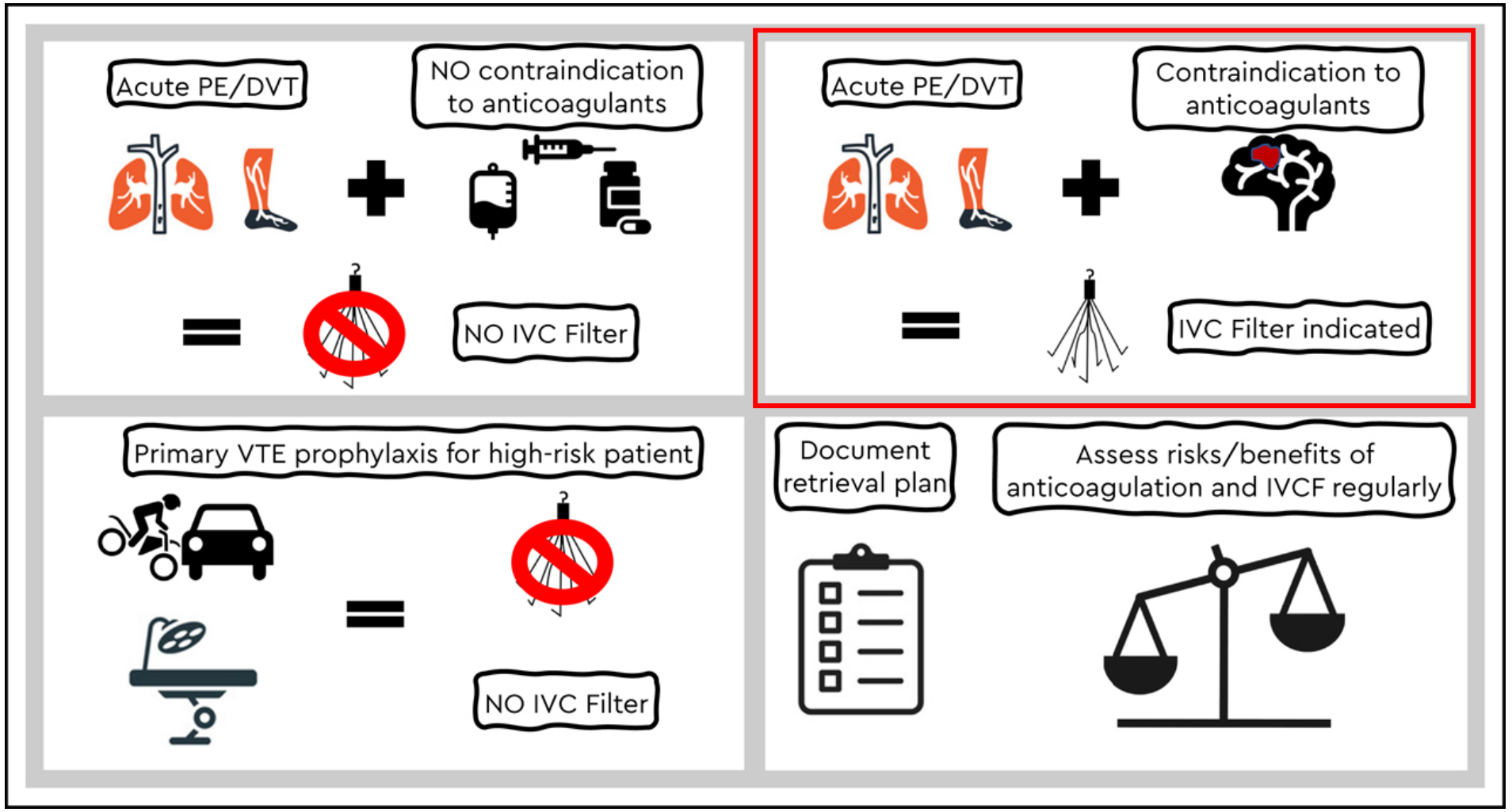
Table 2 Variables used to predict mortality in pulmonary arterial hypertension and intensify treatment accordingly. This can be adapted to perioperative risk assessment to target preoperative PAH therapeutic optimisation to the 'low risk' column. RA, right atrial; RV, right ventricular; LV, left ventricular; F RV, ejection fraction; RVESVi, RV end-systolic volume index; LVEDVi, left ventricular end diastolic volume index; $RVESvO_2$, mixed venous oxygen saturations; CPET, cardiopulmonary exercise test; CI, cardiac index; RAP, right atrial pressure; 6MWD, 6 min walk distance; VO_2, oxygen uptake; BNP, brain natriuretic peptide; NT-proBNP, N-terminal BNP.

	Risk		
	Low	**Intermediate**	**High**
Clinical assessment			
Right heart failure	None	None	Present
Progression of symptoms	None	Slow	Rapid
Syncope	None	Occasional	Recurrent
Chest pain	None	Occasional	Recurrent
Arrhythmia	None	Occasional	Recurrent
WHO functional class	I/II	III	IV
Imaging and haemodynamics			
Echocardiographic	Preserved RV function. RA area <18 cm^2 No pericardial effusion	Impaired RV function. RA area 18–26 cm^2 No or minimal pericardial effusion	Impaired RV function. RA area >26 cm^2 Pericardial effusion present
Cardiac magnetic resonance	High RVEF (>54%) Normal RVESVi Normal LVEDVi	Reduced RVEF (37–54%) Increased RVESVi Decreased LVEDVi	Reduced RVEF (<37%) Increased RVESVi Decreased LVEDVi
Right heart catheterisation	RAP <8 mm Hg CI >2.5 L min^{-1} m^{-2} SvO_2 >65%	RAP 8–14 mm Hg CI 2.0–2.4 L min^{-1} m^{-2} SvO_2 60–65%	RAP >14 mm Hg CI <2.0 L min^{-1} m^{-2} SvO_2 <60%
Exercise capacity			
6MWD	> 440 m	165–440 m	< 165 m
CPET	Peak VO_2 >15 ml min^{-1} kg^{-1} (>65% predicted) VE/VCO_2 slope <36.0	Peak VO_2 11–15 ml min^{-1} kg^{-1} (35–65% predicted) VE/VCO_2 slope 36.0–44.9	Peak VO_2 <11 ml min^{-1} kg^{-1} (<35% predicted) VE/VCO_2 slope >45.0
Biomarkers			
BNP	< 50 ng L^{-1}	50–300 ng L^{-1}	>300 ng L^{-1}
NT-pro BNP	<300 ng L^{-1}	300–1400 ng L^{-1}	>1400 ng L^{-1}

6.7 Recommendations for acute-phase treatment of intermediate- or low-risk pulmonary embolism

Recommendations	Class[a]	Level[b]
Initiation of anticoagulation		
Initiation of anticoagulation is recommended without delay in patients with high or intermediate clinical probability of PE,[c] while diagnostic workup is in progress.	I	C
If anticoagulation is initiated parenterally, LMWH or fondaparinux is recommended (over UFH) for most patients.[262,309–311]	I	A
When oral anticoagulation is started in a patient with PE who is eligible for a NOAC (apixaban, dabigatran, edoxaban, or rivaroxaban), a NOAC is recommended in preference to a VKA.[260,261,312–314]	I	A
When patients are treated with a VKA, overlapping with parenteral anticoagulation is recommended until an INR of 2.5 (range 2.0–3.0) is reached.[315,316]	I	A
NOACs are not recommended in patients with severe renal impairment,[d] during pregnancy and lactation, and in patients with antiphospholipid antibody syndrome.[260,261,312–314]	III	C

European Heart Journal (2020) 41, 543603



Hematology Am Soc Hematol Educ Program (2020) 2020 (1): 619–628.

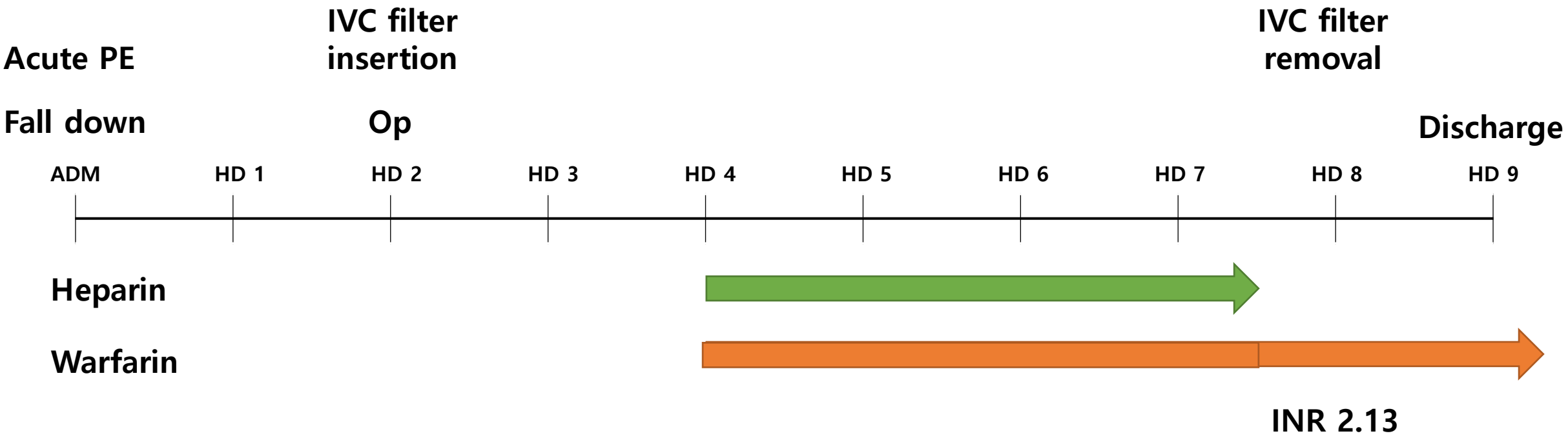
Table 3 Main complications of inferior vena cava filters

Complication	Rate (%)
Complications from insertion	4–11
Filter migration	3–69
IVC perforation	9–24
Post-thrombotic syndrome	5–70

Remove IVC filter as soon as PE risk subsides and/or anticoagulants can be resumed safely

J Thromb Thrombolysis. 2012 Apr;33(3):258-66

Hematology Am Soc Hematol Educ Program (2020) 2020 (1): 619–628.


Acute PE
Fall down
IVC filter insertion
Op
IVC filter removal
Discharge
ADM
HD 1
HD 2
HD 3
HD 4
HD 5
HD 6
HD 7
HD 8
HD 9
Heparin
Warfarin
INR 2.13


Thank you for your attention