Diagnosis & Management of Heparin-Induced Thrombocytopenia

An Educational Slide Set

American Society of Hematology 2018 Guidelines for Management of Venous Thromboembolism

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Clinical Guidelines

American Society of Hematology 2018 guidelines for management of venous thromboembolism: heparin-induced thrombocytopenia

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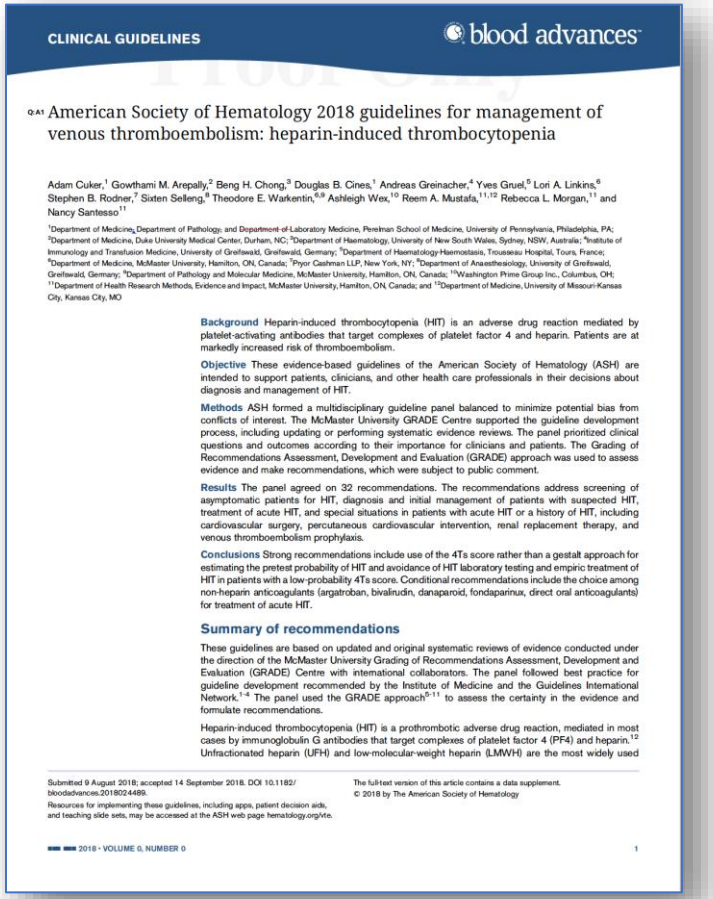

CLINICAL GUIDELINES

blood advances

American Society of Hematology 2018 guidelines for management of venous thromboembolism: heparin-induced thrombocytopenia

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Background Heparin-induced thrombocytopenia (HIT) is an adverse drug reaction mediated by platelet-activating antibodies that target complexes of platelet factor 4 and heparin. Patients are at markedly increased risk of thromboembolism.

Objective These evidence-based guidelines of the American Society of Hematology (ASH) are intended to support patients, clinicians, and other health care professionals in their decisions about diagnosis and management of HIT.

Methods ASH formed a multidisciplinary guideline panel balanced to minimize potential bias from conflicts of interest. The McMaster University GRADE Centre supported the guideline development process, including updating or performing systematic evidence reviews. The panel prioritized clinical questions and outcomes according to their importance for clinicians and patients. The Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach was used to assess evidence and make recommendations, which were subject to public comment.

Results The panel agreed on 32 recommendations. The recommendations address screening of asymptomatic patients for HIT, diagnosis and initial management of patients with suspected HIT, treatment of acute HIT, and special situations in patients with acute HIT or a history of HIT, including cardiovascular surgery, percutaneous cardiovascular intervention, renal replacement therapy, and venous thromboembolism prophylaxis.

Conclusions Strong recommendations include use of the 4Ts score rather than a gestalt approach for estimating the pretest probability of HIT and avoidance of HIT laboratory testing and empiric treatment of HIT in patients with a low-probability 4Ts score. Conditional recommendations include the choice among non-heparin anticoagulants (argatroban, bivalirudin, danaparoid, fondaparinux, direct oral anticoagulants) for treatment of acute HIT.

Summary of recommendations

These guidelines are based on updated and original systematic reviews of evidence conducted under the direction of the McMaster University Grading of Recommendations Assessment, Development and Evaluation (GRADE) Centre with international collaborators. The panel followed best practice for guideline development recommended by the Institute of Medicine and the Guidelines International Network.[1-4] The panel used the GRADE approach[5-11] to assess the certainty in the evidence and formulate recommendations.

Heparin-induced thrombocytopenia (HIT) is a prothrombotic adverse drug reaction, mediated in most cases by immunoglobulin G antibodies that target complexes of platelet factor 4 (PF4) and heparin.[12] Unfractionated heparin (UFH) and low-molecular-weight heparin (LMWH) are the most widely used

Submitted 9 August 2018; accepted 14 September 2018. DOI 10.1182/bloodadvances.2018024489.

Resources for implementing these guidelines, including apps, patient decision aids, and teaching slide sets, may be accessed at the ASH web page hematology.org/vte.

The full-text version of this article contains a data supplement.

ASH Clinical Practice Guidelines on VTE

1. Prevention of VTE in Surgical Hospitalized Patients
2. Prevention of VTE in Medical Hospitalized Patients
3. Treatment of Acute VTE (DVT and PE)
4. Optimal Management of Anticoagulation Therapy
5. Prevention and Treatment of VTE in Patients with Cancer
6. **Heparin-Induced Thrombocytopenia (HIT)**
7. Thrombophilia
8. Pediatric VTE
9. VTE in the Context of Pregnancy
10. Diagnosis of VTE

How were these ASH guidelines developed?

PANEL FORMATION

Each **guideline panel** was formed following these key criteria:

- Balance of expertise (including disciplines beyond hematology, and patients)
- Close attention to minimization and management of conflicts of interest

CLINICAL QUESTIONS

10 to 20 **clinically-relevant questions** generated in **PICO format** (population, intervention, comparison, outcome)

Example: PICO question

"In patients with suspected HIT and an intermediate probability 4Ts score, should non-heparin anticoagulants be provided at therapeutic or prophylactic intensity?"

EVIDENCE SYNTHESIS

Evidence summary generated for each PICO question via systematic review of health effects plus:

- Resource use
- Feasibility
- Acceptability
- Equity
- Patient values and preferences

MAKING RECOMMENDATIONS

Recommendations made by guideline panel members based on evidence for all factors.

ASH guidelines are reviewed annually by expert work groups convened by ASH. Resources, such as this slide set, derived from guidelines that require updating are removed from the ASH website.

How patients and clinicians should use these recommendations

	STRONG Recommendation ("The panel recommends…")	**CONDITIONAL Recommendation** ("The panel suggests…")
For patients	Most individuals would want the intervention.	A majority would want the intervention, but many would not.
For clinicians	Most individuals should receive the intervention.	Different choices will be appropriate for different patients, depending on their values and preferences. Use **shared decision making**.

Objectives

By the end of this module, you should be able to

1. Describe a diagnostic algorithm for patients with suspected heparin-induced thrombocytopenia (HIT)

2. Compare non-heparin anticoagulants for the treatment of acute HIT

3. Describe recommendations for managing anticoagulation for cardiac surgery in patients with a previous history of HIT

HIT is a profoundly hypercoagulable state

HIT is an iatrogenic disorder usually mediated by IgG antibodies that bind **PF4-heparin** complexes

These antibodies cause a **hypercoagulable state** by activating platelets and procoagulant microparticles

One-third to one-half of patients with HIT develop venous, arterial, or microvascular thrombosis

Unfractionated heparin (UFH) associated with 10-fold increase in risk of HIT compared with LMWH

Case 1: Medical Inpatient Admission

82 year old male

Past Medical History: Diabetes, hypertension, congestive heart failure

Medications: Metformin, ramipril, aspirin, furosemide

Admitted to: Internal Medicine ward with exacerbation of congestive heart failure, secondary to poor compliance with diet and diuretics

Treated with:

- Intravenous furosemide, nitroglycerin patch
- ***Subcutaneous unfractionated heparin (UFH)*** 5,000 IU Q12H started on admission date for DVT prophylaxis

Case 1: Medical Inpatient Admission

- **Bloodwork: Day 0 is admission date**
- No fever, no other new medications. Normal blood pressure and heart rate. No signs or symptoms of venous thromboembolism.
- No bleeding or bruising
- No exposure to heparin in the 3 months prior to this admission

Date	Day 0	+1	+2	+3	+4	+5	+6	+7
Platelets (x 10^9)	200	220	206	210	220	230	150	67

Considering your patient's progressive thrombocytopenia and heparin exposure, you are concerned about the possibility of HIT.

Which of the following most accurately describes his clinical probability of HIT?

A. Probably low probability, given overall clinical context
B. Probably high probability, given overall clinical context
C. Low probability, based on 4Ts score
D. Intermediate probability, based on 4Ts score
E. High probability, based on 4Ts score

Recommendation

In patients with **suspected HIT**, the panel recommends using the **4Ts score** to estimate the probability of HIT **rather than a gestalt approach** *(strong recommendation, moderate certainty)*

Remarks:

- Missing or inaccurate information may lead to a faulty 4Ts score and inappropriate management
- Every effort should be made to obtain ***accurate and complete information*** necessary to calculate the 4Ts score. If key information is missing it may be prudent to err on the side of a higher 4Ts score.
- Reassess frequently. If there is a change in clinical picture, the 4Ts score should be recalculated.

The 4Ts Score: Clinical Probability Model

Our patient:
Platelets 67, > 50% drop.
Onset of drop on day +6.
No thrombosis.
No other cause for thrombocytopenia.

HIGH probability: 6-8 points

INTERMEDIATE probability: 4-5 points

LOW probability: ≤ 3 points

4Ts	2 Points	1 Point	0 Points
Thrombocytopenia	Platelet count fall > 50% **and** platelet nadir ≥20 x 10^9/L	Platelet count fall 30-50% **or** platelet nadir 10-19 x 10^9/L	Platelet count fall < 30% **or** platelet nadir < 10 x 10^9/L
Timing of platelet count fall	Clear onset between days 5-14 **or** platelet fall ≤ 1 day (prior heparin exposure within 30 days)	Consistent with days 5-14 fall, but not clear (e.g., missing platelet counts) **or** onset after day 14 **or** fall ≤ 1 day (prior heparin exposure 30-100 days ago)	Platelet count fall ≤4 days without recent exposure
Thrombosis or other sequelae	New thrombosis (confirmed); skin necrosis at heparin injection sites; anaphylactoid reaction after IV heparin bolus; adrenal hemorrhage	Progressive or recurrent thrombosis; Non-necrotizing (erythematous) skin lesions; Suspected thrombosis (not confirmed)	None
Other causes of thrombocytopenia	None apparent	Possible	Definite

Lo *J Thromb Haemost* 2006
ASH 2009 Clinical Guide

Your patient's 4Ts score indicates a high clinical probability for HIT.

What diagnostic tests would you recommend at this point to confirm or exclude a diagnosis of HIT?

A. None; patient is high probability and diagnosis is confirmed
B. Immunoassay only (ex. HIT PF4/heparin ELISA)
C. Functional test only (ex. serotonin release assay)
D. Immunoassay, and if positive then perform functional test

Laboratory Diagnostic Testing for HIT

HIT Immunoassay Tests *Detect the presence of anti-PF4/heparin antibodies*	**Functional HIT Assays** *Assays that detect antibodies capable of binding and activating platelets*
• ELISA (detect IgG) • ELISA (detect polyspecific antibodies) • IgG-specific chemiluminescent assay • Particle gel immunoassay (PaGIA) • Latex agglutination assay	• Serotonin release assay (SRA) • Heparin-induced platelet activation test (HIPA) • Platelet aggregation test (PAT) • Flow cytometry-based assays

Recommendation

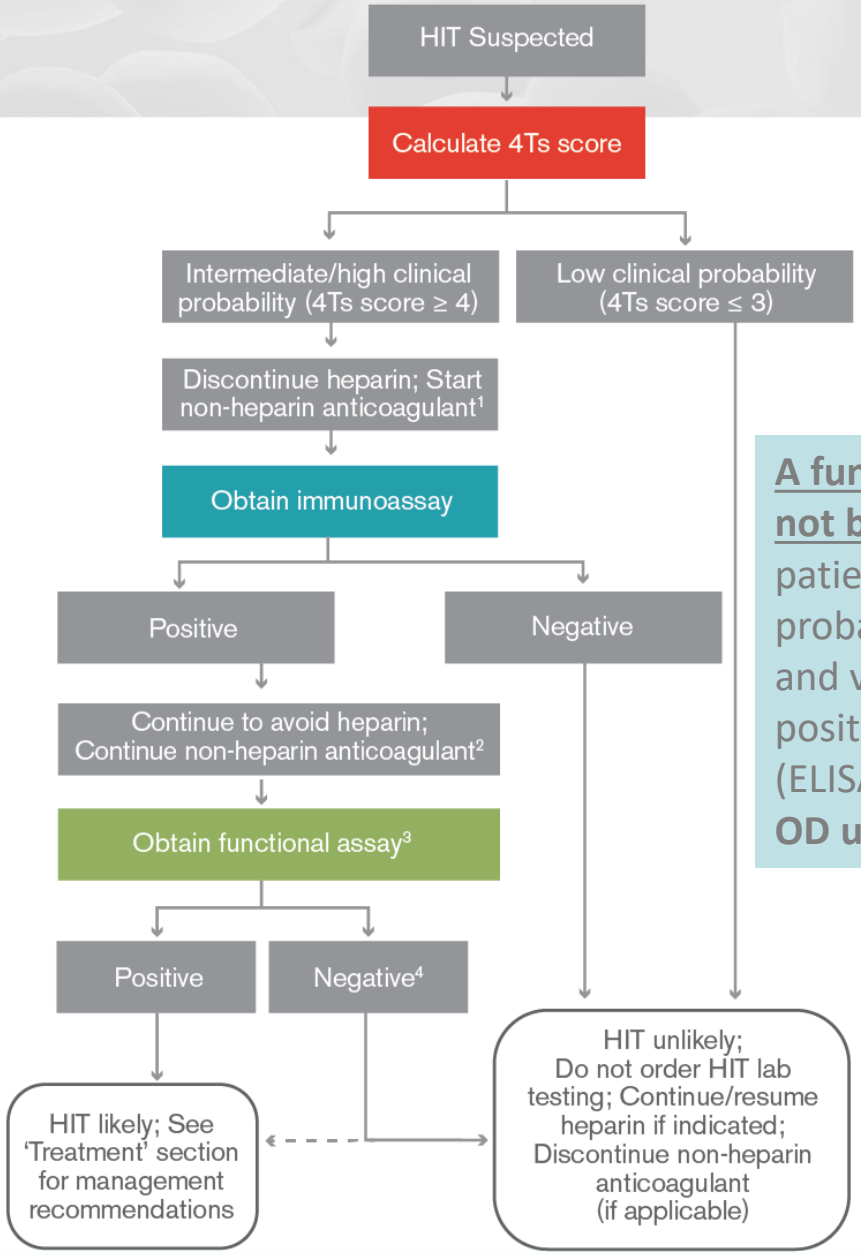
- If there is an **intermediate- or high-probability 4Ts score**, the panel **recommends an immunoassay** *(strong recommendation, moderate certainty)*
- If the **immunoassay is positive** and a functional assay is available (locally or as a send-out test to a reference laboratory), the panel suggests a **functional assay** *(conditional recommendation, moderate certainty)*

Remark:

- Likelihood of HIT increases with a higher 4Ts score and a higher ELISA OD (Optical Density)

A ***diagnostic algorithm*** of **intermediate/high 4Ts score**, followed by **immunoassay**, followed by **functional testing** results in:

- Few false negatives (missed HIT diagnoses), and
- Few or no false positives (incorrect diagnoses of HIT)



A functional assay may not be necessary for patients with high probability 4Ts score and very strongly positive immunoassay (ELISA value of **> 2.0 OD units**)

Your patient's 4Ts score indicates high probability for HIT, and you have sent off the HIT ELISA (result is pending). Currently, your patient is receiving subcutaneous UFH 5,000 units twice daily.

What management strategy would you recommend while awaiting the HIT ELISA test results?

A. Continue heparin as the diagnosis of HIT is not confirmed
B. Stop heparin, wait for ELISA result
C. Stop heparin, start non-heparin anticoagulant at prophylactic intensity
D. Stop heparin, start non-heparin anticoagulant at therapeutic intensity
E. Stop heparin, transfuse platelets

Recommendation

In patients with suspected HIT and HIGH PROBABILITY 4Ts score:

- The panel recommends discontinuation of heparin and initiation of a non-heparin anticoagulant at **therapeutic intensity** *(strong recommendation, moderate certainty)*

In patients with suspected HIT and INTERMEDIATE PROBABILITY 4Ts score:

- The panel recommends **discontinuation of heparin** *(strong recommendation, moderate certainty)*
- The panel suggests initiation of non-heparin anticoagulant at **prophylactic intensity** if patient is at high bleeding risk, **therapeutic intensity** if patient not at high bleeding risk

In patients with **INTERMEDIATE-risk 4Ts score** who have high bleeding risk, there could be greater harm with therapeutic-intensity treatment (bleeding) with less potential benefit, because fewer such patients will have HIT

Therapeutic versus Prophylactic Intensity

- **Non-heparin anticoagulant at therapeutic intensity** is recommended over prophylactic intensity based on *very low certainty of evidence*
  - 3 small studies comparing therapeutic versus prophylactic anticoagulation with Danaparoid, Lepirudin, or Fondaparinux
  - Danaparoid showed 50% reduction in thrombosis with therapeutic dosing
  - No difference in outcomes with Lepirudin and Fondaprainux

- However, strong recommendation based on likely large magnitude of benefit (prevention of thrombosis)

Schindewolf *Thromb Res* 2012
Greinacher A *Circulation* 1999
Farner *Thromb Haemost* 2001

Recommendation

In patients with HIT who are at average bleeding risk, the panel suggests **against routine platelet transfusion** *(conditional recommendation, low certainty)*

Remark:

- Platelet transfusion may be an option for patients with active bleeding or at high bleeding risk

Low certainty for beneficial or adverse effects of platelet transfusions in HIT
Mixed results from observational studies

→ One large database study (n = 6,332) suggested increase in arterial thrombotic events (adjusted odds ratio 3.4, 95% CI 1.2 to 9.5); other small cohort studies suggest no difference

Goel *Blood* 2015
Refaai *J Thromb Haemost* 2010

Case 1: HIT Laboratory Test Results

- Your HIT immunoassay (ELISA) results are reported back that afternoon as **optical density (OD) = 1.8** (NORMAL OD is < 0.4 at your lab).

- You ask your lab to send a sample to your local reference lab for a confirmatory functional assay (**serotonin release assay**).

- Your patient continues to be clinically stable with no symptoms or signs of pulmonary embolism, deep vein thrombosis, or arterial thrombosis.

Your patient has acute isolated HIT (without thrombosis), and platelet count is currently 67.

Which of the following non-heparin anticoagulants would NOT be appropriate at this point?

A. Argatroban
B. Warfarin (vitamin K antagonist)
C. Rivaroxaban
D. Fondaparinux
E. Danaparoid

Recommendation

In patients with **acute HITT or acute isolated HIT**, the panel recommends **against initiation of a VKA prior to platelet count recovery** (platelets ≥ 150 x 10^9/L) (*strong recommendation, moderate certainty)*

Remarks:

- Also applies to those taking VKA at onset of acute HITT or acute isolated HIT
- In these patients, VKA would be discontinued and intravenous Vitamin K administered concomitant with initiation of a non-heparin anticoagulant

In case series, early initiation of VKA associated:	Warfarin-induced skin necrosis	Venous limb gangrene	Recurrent thrombosis	Limb amputation

Recommendation

- In patients with acute HIT complicated by thrombosis (HITT) or acute HIT without thrombosis (isolated HIT), the panel *recommends* **discontinuation of heparin** and initiation of a **non-heparin anticoagulant** (*strong recommendation, moderate certainty)*

- The panel suggests **argatroban, bivalirudin, danaparoid, fondaparinux or a direct oral anticoagulant (DOAC)**

Rationale for Anticoagulant Selection

- **Using a non-heparin anticoagulant** *(compared with stopping heparin +/- starting VKA)* associated with:
  - Fewer thrombotic events
  - BUT probably increase in risk of major bleeding

- **No direct comparisons of DOACs** vs. parenteral anticoagulants in HIT

- **Small numbers of patients treated with DOACs in case series**
  - Few thrombotic events *(rivaroxaban 1/46, apixaban 0/12, dabigatran 1/11)*
  - Benefits and harms of DOACs compare favorably to parenteral agents

Rationale for Anticoagulant Selection

Clinical Context	Implications for Anticoagulant Selection
Critical illness Increased bleeding risk Possible urgent procedures	**Argatroban** or **Bivalirudin** (shorter duration of effect) • If ***moderate or severe hepatic dysfunction*** (Childs-Pugh B or C), may be advisable to avoid argatroban or use a reduced dose
Life- or limb-threatening VTE (massive PE or venous limb gangrene)	Parenteral non-heparin anticoagulant preferred (**Argatroban, Bivalirudin, Danaparoid, Fondaparinux**) • *Few such patients treated with DOACs*
Clinically stable patients at average bleeding risk	**Fondaparinux** or **DOACs** reasonable • Most published DOAC experience with Rivaroxaban

Anticoagulant (mechanism, route)	Dosing	Clearance & Monitoring
Argatroban (direct thrombin inhibitor) IV	***Bolus:*** None ***Infusion:*** STANDARD (2 mcg/kg/min), REDUCED DOSE for liver dysfunction, CHF, post-cardiac surgery (0.5-1.2 mcg/kg/min)	• Hepatobiliary clearance • Adjusted to aPTT 1.5-3.0 times baseline
Bivalirudin (direct thrombin inhibitor) IV	***Bolus:*** None ***Infusion:*** STANDARD (0.15 mg/kg/hr); consider REDUCED DOSE for renal or liver dysfunction	• Enzymatic clearance • Adjusted to aPTT 1.5-2.5 times baseline
Danaparoid (indirect Xa inhibitor) IV	***Bolus:*** Weight-based (1500-3750 units) ***Infusion:*** INITIAL ACCELERATED (400 units/hr x 4 hr, then 300 units/hr x 4 hr), then MAINTENANCE (150-200 units/hr)	• Renal clearance • Adjusted to anti-Xa activity 0.5-0.8 units/mL
Fondaparinux (indirect Xa inhibitor) SC	< 50 kg → 5 kg daily 50-100 kg → 7.5 mg daily > 100 kg → 10 mg daily	• Renal clearance • No monitoring
Rivaroxaban (direct Xa inhibitor) PO	***HITT:*** 15 mg twice daily x 3 weeks, then 20 mg daily ***Isolated HIT:*** 15 mg twice daily until platelet count recovery (≥ 150)	• Renal clearance • No monitoring

Case 1: Treatment

- You decide to start your patient on rivaroxaban 15 mg PO BID and discontinue subcutaneous UFH.

- Over the next 8 days, your patient's platelet count gradually rises from 67 to 165, and there is no evidence of bleeding.

Your patient has no symptoms of deep vein thrombosis or pulmonary embolism.

Which of the following tests would you suggest to screen for asymptomatic VTE?

A. There are no symptoms, so imaging is not indicated
B. Bilateral upper extremity compression ultrasound (US)
C. Bilateral lower extremity compression ultrasound (US)
D. CT pulmonary angiogram
E. Choices C & D

Recommendation

In patients with **acute isolated HIT**, the panel suggests:

- **Bilateral lower extremity compression US** to screen for asymptomatic proximal DVT *(conditional recommendation, very low certainty)*

- **Upper-extremity US** in patients with an upper extremity central venous catheter, in the limb with the catheter, to screen for asymptomatic DVT *(conditional recommendation, very low certainty)*

Ultrasound studies have identified silent lower extremity DVT in 12-44% of asymptomatic patients with HIT

Case 1: HITT

- He is found to have an **occlusive left popliteal vein DVT**. He continues rivaroxaban 15 mg BID for 3 weeks, then takes rivaroxaban 20 mg daily for a total of 3 months.

- At 3 months, his platelet count is normal (205 x 10^9/L) and he is at his baseline health status. You ask him to stop rivaroxaban.

- 15 months later, he returns to hospital with CHF again and is found to have severe aortic stenosis, with an aortic valve area of 0.6 cm^2. He requires a valve replacement.

Your patient with a history of HITT requires open heart surgery, with intraoperative anticoagulation while on pump. His platelet count is normal. You repeat his HIT ELISA and OD is 0.2 (NORMAL < 0.4).

What would you suggest that your patient receive for intraoperative anticoagulation?

A. Preoperative plasma exchange and intraoperative heparin
B. Intraoperative heparin only
C. Intraoperative heparin with an antiplatelet agent
D. Intraoperative bivalirudin only
E. Intraoperative bivalirudin with an antiplatelet agent

Five Phases of HIT

Phase	Platelet count	Immunoassay	Functional assay
Suspected HIT	Decreased	?	?
Acute HIT	Decreased	+	+
Subacute HIT A	Normal	+	+
Subacute HIT B	Normal	+	–
Remote HIT	Normal	–	–

Recommendation

In patients with **subacute HIT B or remote HIT who require cardiovascular surgery**, the panel suggests **intraoperative anticoagulation with heparin** rather than treatment with a non-heparin anticoagulant, plasma exchange and heparin, or heparin combined with antiplatelet agent *(conditional recommendation, very low certainty)*

Remarks:

- Treatment with heparin would be ***limited to the intraoperative setting***, and avoided before and after surgery
- ***Postoperative platelet count monitoring*** for HIT may be necessary, even when postoperative heparin is not given, because “delayed-onset (autoimmune) HIT” beginning 5 to 10 days after intraoperative heparin exposure has been reported

Case 2: Medical Inpatient Admission

82 year old male

Past Medical History: Diabetes, hypertension, congestive heart failure

Medications: Metformin, ramipril, aspirin, furosemide

Admitted to: Internal Medicine ward with exacerbation of congestive heart failure, secondary to poor compliance with diet and diuretics

Treated with:

- Intravenous furosemide, nitroglycerin patch
- ***Subcutaneous unfractionated heparin (UFH)*** 5,000 IU Q12H started on admission date for DVT prophylaxis

Case 2: Medical Inpatient Admission

- **Bloodwork: Day 0 is admission date**
- No fever, no other new medications. Normal blood pressure and heart rate. No signs or symptoms of venous thromboembolism
- No bruising or bleeding
- No exposures to heparin in the 3 months prior to this admission

Date	Day 0	+1	+2	+3	+4	+5	+6	+7
Platelets (x 10^9)	200	220	206	145	140	145	130	125

Considering your patient's progressive thrombocytopenia and heparin exposure, you are concerned about the possibility of HIT.

Which of the following most accurately describes his clinical probability of HIT?

A. Probably low probability, given overall clinical context
B. Probably high probability, given overall clinical context
C. Low probability, based on 4Ts score
D. Intermediate probability, based on 4Ts score
E. High probability, based on 4Ts score

The 4Ts Score: Clinical Probability Model

Our patient:
Platelets 125, 30-50% drop
Drop at Day +2
No thrombosis
No other cause for thrombocytopenia

HIGH probability: 6-8 points

INTERMEDIATE probability: 4-5 points

LOW probability: ≤ 3 points

4Ts	2 Points	1 Point	0 Points
Thrombocytopenia	Platelet count fall > 50% **and** platelet nadir ≥20 x 10^9/L	Platelet count fall 30-50% **or** platelet nadir 10-19 x 10^9/L	Platelet count fall < 30% **or** platelet nadir < 10 x 10^9/L
Timing of platelet count fall	Clear onset between days 5-14 **or** platelet fall ≤ 1 day (prior heparin exposure within 30 days)	Consistent with days 5-14 fall, but not clear (e.g., missing platelet counts) **or** onset after day 14 **or** fall ≤ 1 day (prior heparin exposure 30-100 days ago)	Platelet count fall ≤4 days without recent exposure
Thrombosis or other sequelae	New thrombosis (confirmed); skin necrosis at heparin injection sites; anaphylactoid reaction after IV heparin bolus; adrenal hemorrhage	Progressive or recurrent thrombosis; Non-necrotizing (erythematous) skin lesions; Suspected thrombosis (not confirmed)	None
Other causes of thrombocytopenia	None apparent	Possible	Definite

Lo *J Thromb Haemost* 2006
ASH 2009 Clinical Guide

Your patient's 4Ts score (3) indicates a low clinical probability for HIT.

What diagnostic tests would you recommend at this point to confirm or exclude a diagnosis of HIT?

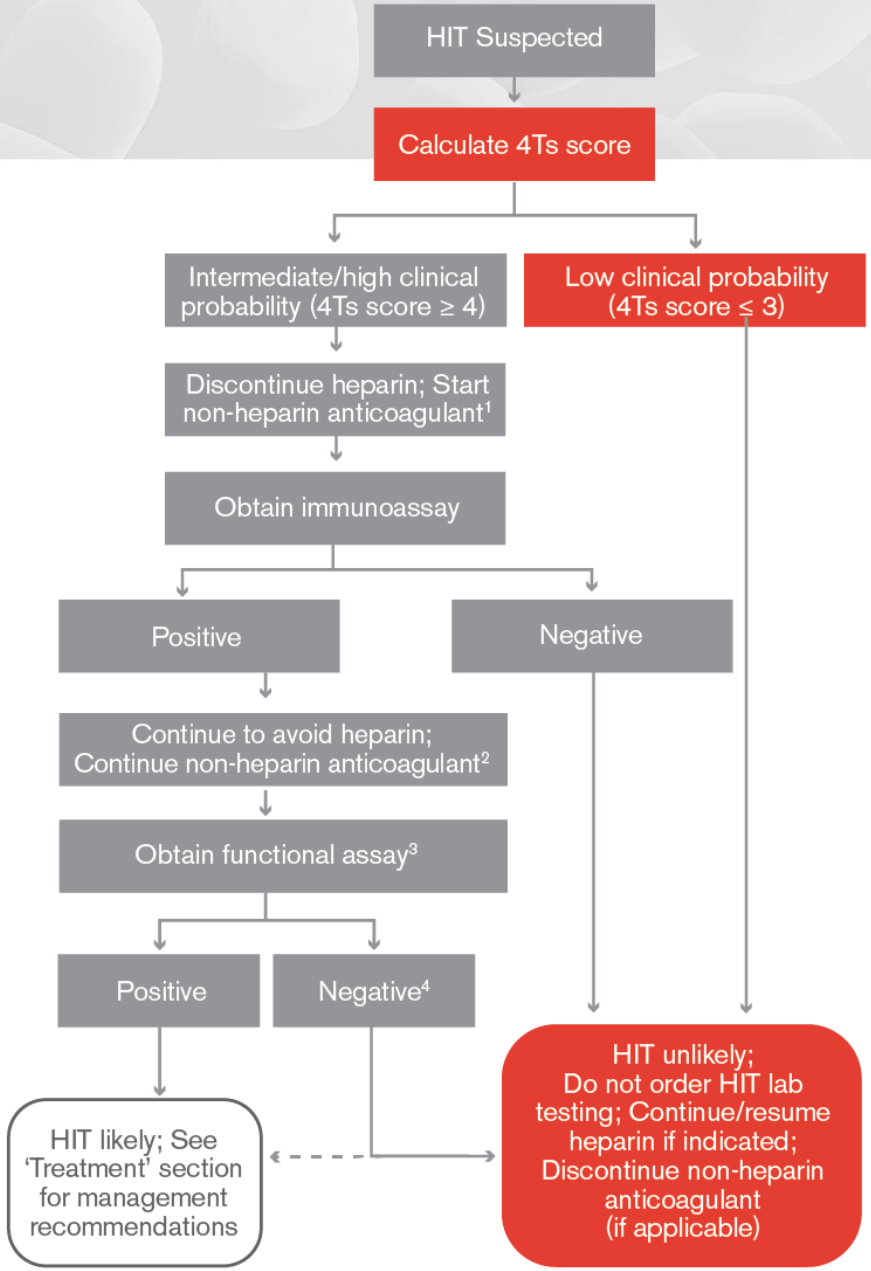
A. None; patient is low probability and HIT is highly unlikely
B. Immunoassay only (ex. HIT PF4/heparin ELISA)
C. Functional test only (ex. serotonin release assay)
D. Immunoassay, and if positive then perform functional test

Recommendation

In patients with suspected HIT and **low probability 4Ts score**, the panel recommends **against HIT laboratory testing** *(strong recommendation, moderate certainty)*

Remark:

- HIT laboratory testing may be appropriate for patients with a low probability 4Ts score if there is uncertainty about the 4Ts score (for example, due to missing data)


HIT Suspected
Calculate 4Ts score
Intermediate/high clinical probability (4Ts score ≥ 4)
Low clinical probability (4Ts score ≤ 3)
Discontinue heparin; Start non-heparin anticoagulant[1]
Obtain immunoassay
Positive
Negative
Continue to avoid heparin; Continue non-heparin anticoagulant[2]
Obtain functional assay[3]
Positive
Negative[4]
HIT likely; See 'Treatment' section for management recommendations
HIT unlikely; Do not order HIT lab testing; Continue/resume heparin if indicated; Discontinue non-heparin anticoagulant (if applicable)

Case 2: Resolution

- Given his low clinical probability, you elect not to send his HIT ELISA assay or functional assay. He continues to receive SC heparin.

- With treatment for CHF, his thrombocytopenia improves. He is discharged with a follow-up outpatient CBC to ensure resolution of thrombocytopenia

Date	Day 0	+1	+2	+3	+4	+5	+6	+7
Platelets (x 10^9)	200	220	206	145	140	145	130	125

Date	+8	+9	+20
Platelets (x 10^9)	145	160	165

Additional Topics in these Guidelines

- Platelet count monitoring in patients receiving heparin
- Prophylactic IVC filter insertion in the setting of acute HIT
- Duration of non-heparin anticoagulant therapy in acute isolated HIT
- Anticoagulant management for percutaneous coronary intervention in patients with acute HIT or previous history of HIT
- Anticoagulant therapy for HIT in renal replacement therapy

Areas of Future Investigation

- Development of novel HIT immunoassays and functional assays
- Outcomes from treatment of acute HIT with DOACs
- Comparisons of DOACs and parenteral non-heparin anticoagulants
- Role of concomitant antiplatelet and anticoagulant therapy in HIT
- Impact of screening for asymptomatic DVT in acute isolated HIT
- Optimal duration of anticoagulation in acute isolated HIT
- Intraoperative anticoagulant management for cardiovascular surgery

In Summary: Back to our Objectives

1. Describe a diagnostic algorithm for patients with suspected heparin-induced thrombocytopenia (HIT)
   - 4Ts score, immunoassay, functional assay

2. Compare non-heparin anticoagulants for treatment of acute HIT
   - DOACs or parenteral options (Argatroban, Fondaparinux, Danaparoid, Bivalirudin)

3. Describe recommendations for managing anticoagulation for cardiac surgery in patients with a previous history of HIT
   - Determination of HIT clinical status with ELISA and/or functional assay helps to determine intraoperative anticoagulation plan

Acknowledgements

- ASH Guideline Panel team members
- Knowledge Synthesis team members
- McMaster University GRADE Centre
- Author of ASH VTE Slide Sets: **Eric Tseng MD MScCH, University of Toronto** and **Adam Cuker MD MS, University of Pennsylvania**

See more about the **ASH VTE guidelines** at http://www.hematology.org/VTEguidelines

Don’t miss our updated **HIT Pocket Guide**!