MANAGEMENT OF HIT IN THE HEMODIALYSIS PATIENT

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RPN Education Day
April 8, 2011

Objectives

- Review basis for anticoagulation during HD
- List components of clinical and laboratory diagnosis of HIT
- Consider treatment options for HIT in HD and for drug selection in patient scenario

Anticoagulation in HD

- Platelet and clotting cascade activated during HD
  - turbulence
  - shear stress
  - contact with artificial surfaces
- UFH to achieve systemic anticoagulation during HD
  - Bolus-infusion versus repeat boluses
  - Regular versus tight

Hemodialysis International 2007;11:178-189

Anticoagulation in HD

- Alternative anticoagulant
  - LMWH
  - Citrate
- Alternatives in active bleeding or high-risk of bleeding
  - Saline bolus/infusion
  - UFH priming of circuit only

Hemodialysis International 2007;11:178-189

Case Presentation

- 34 year old female
- Pregnant (~4 weeks)
- ESRD secondary to IgA nephropathy
- Initiated NHD training December 2009
- HD via CVC
  - Unsuccessful fistula and graft creation

Case Presentation

- Regular UFH given during dialysis
- Lab alerted to platelet count decline

Date	Platelets (bil/L)
September 28	315
November 13	327
December 10	207
December 16	167
December 31	56
December 31	15
December 31	13

Clinical Features

The diagnosis of HIT is based on 3 criteria:

1. An unexplained fall (> 50%) in platelet count, even if the absolute count remains above 100 x 10^9 platelets/L
2. Patient is currently receiving or has had recent exposure to heparin (within last 100 days)
3. HIT-associated IgG antibody formation

Kuo KH and Kovacs MJ. Hematology. 2005

Differential Diagnosis (Drug-Induced)

1. Heparin
2. LMWH
3. Chemotherapeutic agents
4. Quinine
5. GP IIb/IIIa receptor antagonists (Abciximab, Eptifibatide)
6. Sulfonamides (Trimethoprim/sulfamethoxazole)
7. Anticonvulsants (Valproic acid, Carbamazepine)
8. NSAIDs (Diclofenac, Naproxen)

Hemostasis and Thrombosis: Basic Principles and Clinical Practice, 5th Ed. 2006.

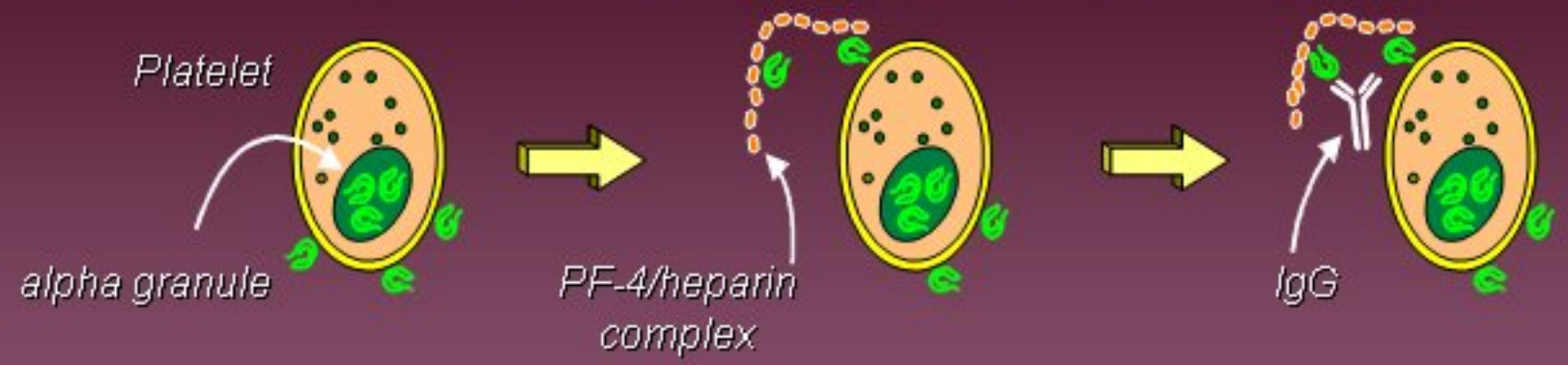
HIT Type II: Heparin-Induced Thrombocytopenia (HIT)

3 categories of HIT:

- Latent (HIT-associated IgG antibody positive but without thrombocytopenia)
- HIT (with thrombocytopenia)
- HIT/T (with thrombocytopenia and thrombosis)

Kuo KH and Kovacs MJ. Hematology. 2005

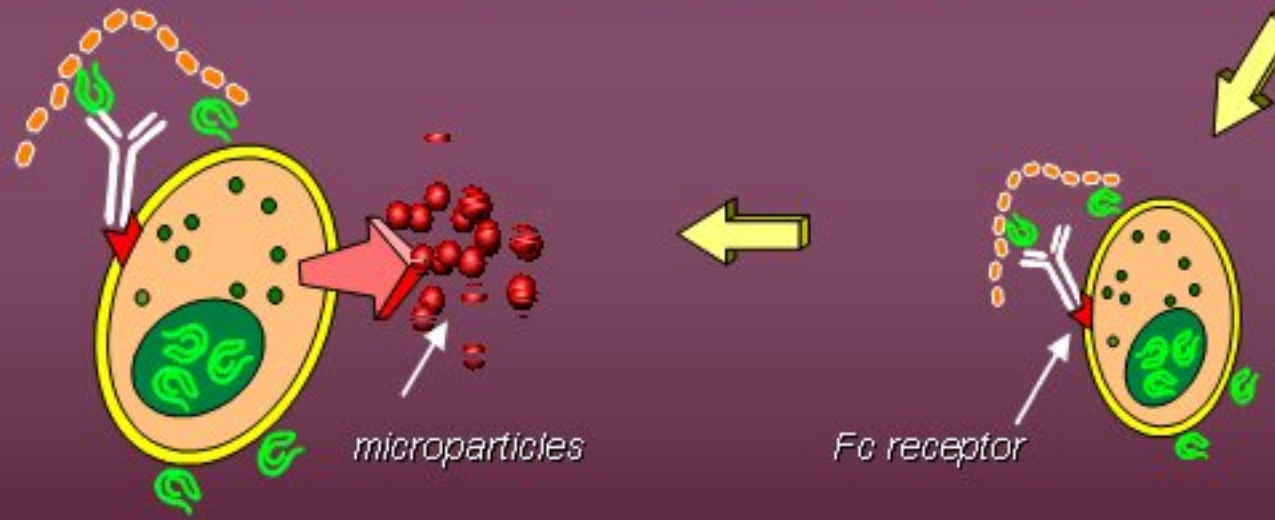
Pathophysiology



PF-4 binds to surface of platelet following activation

Complexes of heparin (GAG) and PF-4 molecules form

IgG binds to the PF-4/ heparin complex



Fc stimulation leads to the generation of procoagulant-rich microparticles

IgG/PF-4/heparin complex activates via the Fc receptor

Courtesy of Dr John G. Kelton, McMaster University. Hirsh et al. *Arch Intern Med.* 2004;164:361-369.

HIT – Clinical Syndrome

- Heightened risk of organized thrombus formation
  - Up to 50% of patients develop clinically significant thrombosis
  - Up to 10% of patients require amputation
  - Up to 5% mortality

New England Journal of Medicine 2006;355:809-817

Risk Factors

- Heparin preparation
  - Bovine UFH > Porcine UFH > LMWH
- Patient population receiving heparin
  - Post-surgical > Medical > Pregnancy > HD
- Duration of Heparin therapy
  - ≥ 1 week
- Patient sex
  - Female > Male

CHEST Supplement 2008: Antithrombotic and Thrombolytic Therapy 8th Ed: ACCP Guidelines

Risk Factors

- Highest risk with UFH
  - IV treatment dosing > SC prophylaxis dosing
- Lower risk with LMWH
  - SC treatment dosing ~ UFH prophylaxis dosing > SC prophylaxis dosing

New England Journal of Medicine 2006;355:809-817
Hemodialysis International 2007;11:178-189
Chest 2008;133:340S-380S

HIT IN HD- Risk Factors

- Rare in HD despite "universal" UFH exposure
- Presents as clotting of circuit or access malfunction:
  - Graft or fistula thrombosis
  - CVC stenosis

HIT - Diagnosis

- Pre-test probability of HIT
  - "4 T's" – thrombocytopenia, timing, thrombosis, other causes of thrombocytopenia
  - Stratify patient to low (≤ 3), intermediate (4-5), or high (6-8) likelihood

Journal of Thrombosis and Haemostasis 2006;4:759-765

HIT - Diagnosis

- Pre-test probability of HIT

	2 points	1 point	0 points
Thrombocytopenia	•Fall > 50 % •Nadir > 20	•Fall 30-50% •Nadir 10-19	•Fall < 30% •Nadir < 10
Timing (onset)	•Clearly day 5-10 •< 1 day (if exposure within 30 days)	•Consistent with day 5-10, but missing data •> 10 days •< 1 day (if exposure 30-100 days)	< 4 days without recent exposure
Thrombosis	•New thrombosis •Skin necrosis, •Acute systemic reaction post bolus	•Progressive/ recurrent thrombosis •Suspected thrombosis	None
Other causes of thrombocytopenia	None	Possible	Definite

Journal of Thrombosis and Haemostasis 2006;4:759-765

Laboratory Diagnosis of HIT

Serologic Assay

- ELISA

- Detects circulating IgG, IgA and IgM antibodies
- >97% sensitivity
- Limited specificity (74-86%): also detects PF4-heparin antibodies in HIT-negative patients
- 10-93% positive predictability
- >95% negative predictability

Arepally GM and Ortel TL. NEJM. 2006

Laboratory Diagnosis of HIT

Functional Assay

- Serotonin Release Assay (SRA)

- Measures platelet activation and detects heparin-dependent antibodies capable of binding to and activating Fc receptors on platelets
- >90% sensitivity
- 77-100% specificity
- 89-100% positive predictability
- 81% negative predictability

Arepally GM and Ortel TL. NEJM. 2006

Treatment of Suspected HIT

1. Discontinue and avoid all heparins

Arepally GM and Ortel TL. NEJM. 2006

Treatment of Suspected HIT

1. Discontinue and avoid all heparins
   - UFH (IV continuous infusion, SC injection)
   - LMWH
   - Heparin lock
   - Heparin flush
   - TPN

Arepally GM and Ortel TL. NEJM. 2006

Treatment of Suspected HIT

2. Give a non-heparin alternative anticoagulant
   - Treat for suspected HIT
   - Consider the non-HIT indication requiring anticoagulation
   - Renal/hepatic impairment
   - Bleeding risk

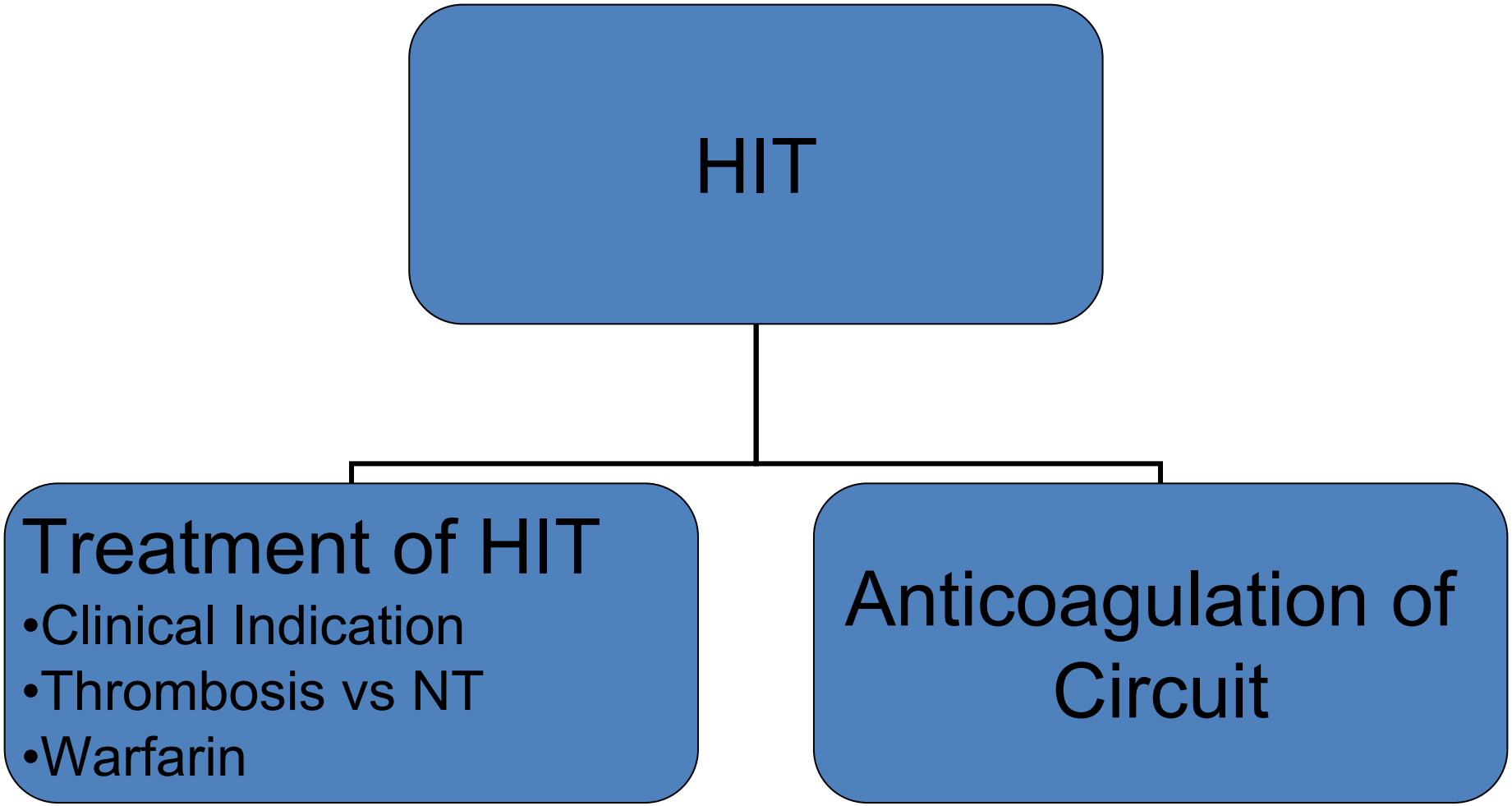
Arepally GM and Ortel TL. NEJM. 2006

Treatment of Suspected HIT

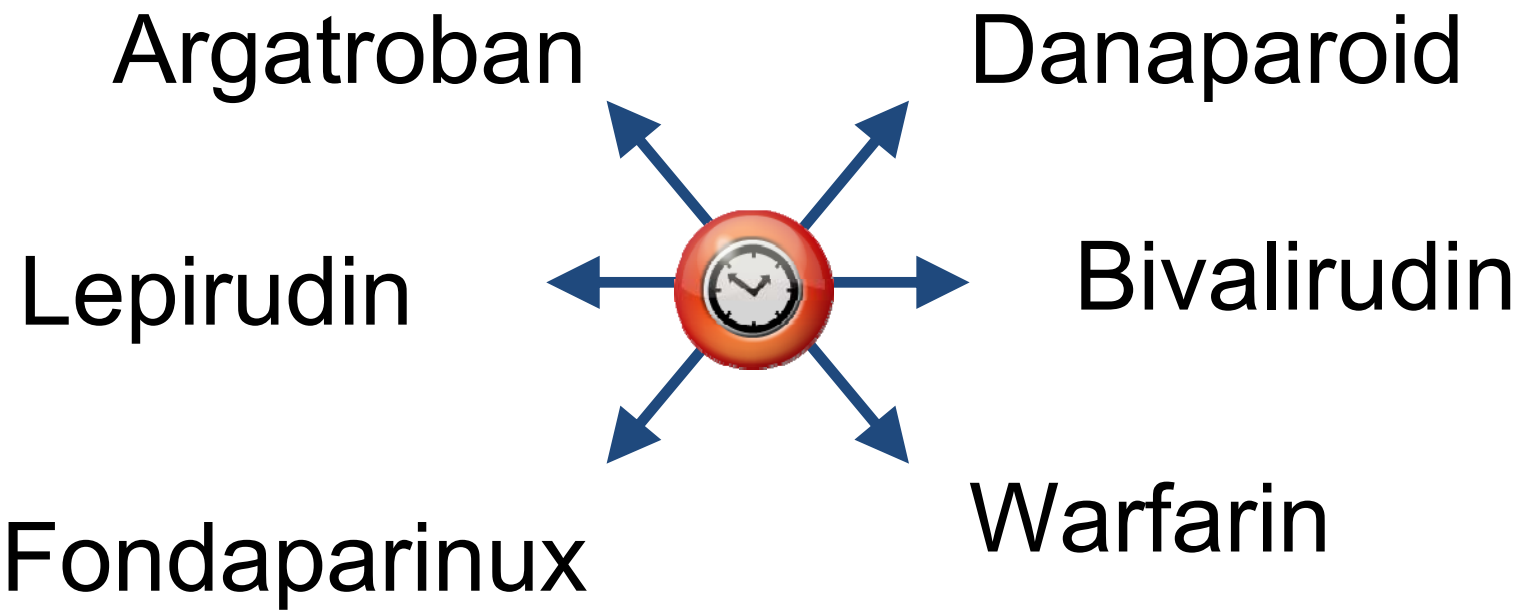
3. Test for HIT antibodies
4. Postpone warfarin therapy pending platelet count recovery
5. Monitor for signs & symptoms of thrombosis

Arepally GM and Ortel TL. NEJM. 2006

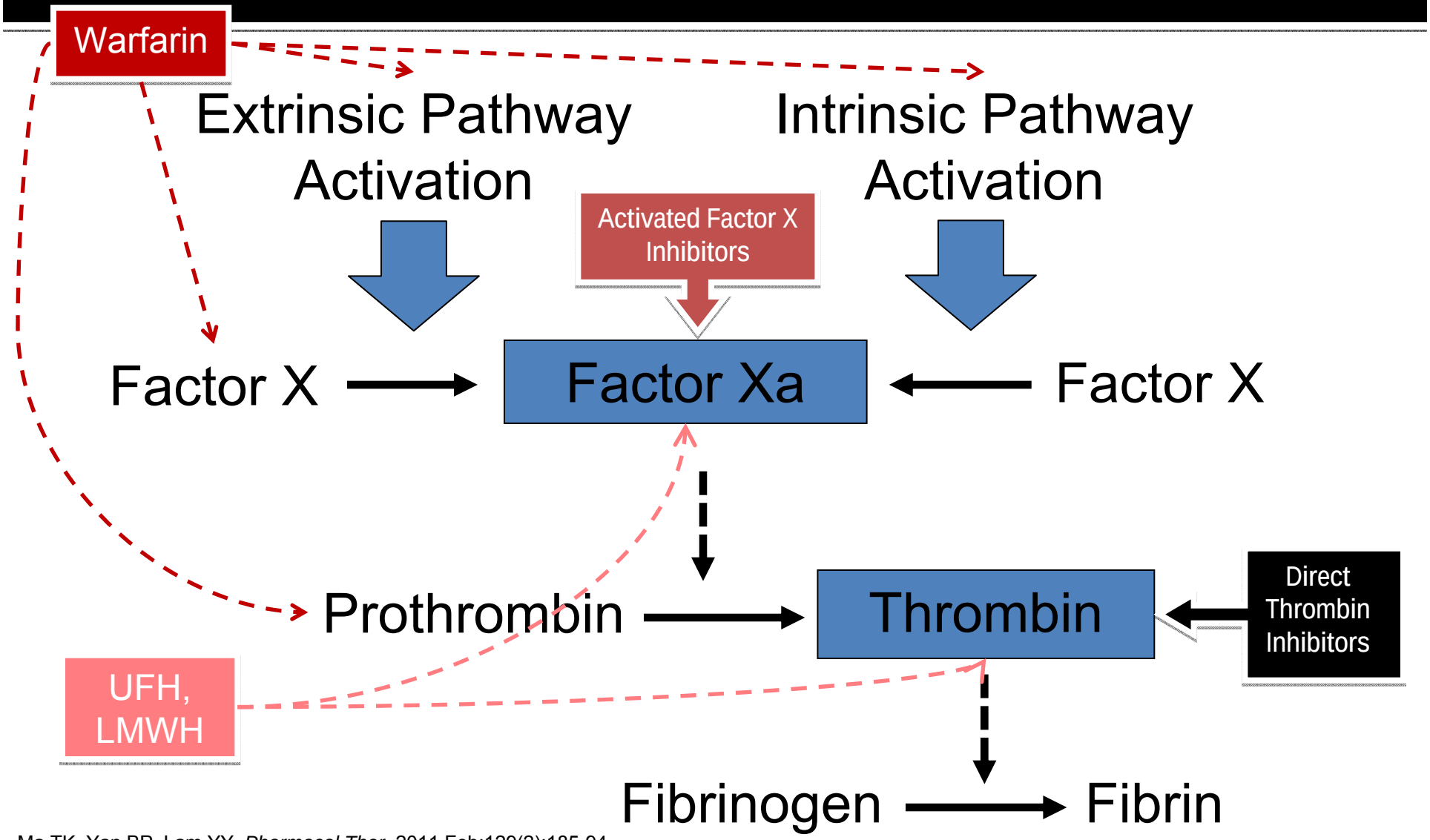
Issues with Treatment of HIT in CKD



Assessment of Therapeutic Alternatives



Targets in Coagulation Pathway

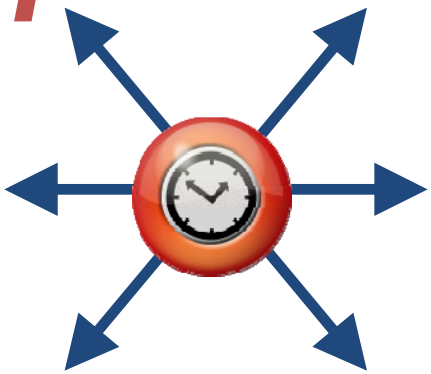


Ma TK, Yan BP, Lam YY. *Pharmacol Ther.* 2011 Feb;129(2):185-94.

Assessment of Therapeutic Alternatives

Argatroban

Danaparoid



Lepirudin

Bivalirudin

Fondaparinux

Warfarin

Argatroban (Argatroban®)

- Direct thrombin inhibitor
- Health Canada Indication:
  - Anticoagulant therapy for patients with HIT and HIT/T requiring anticoagulation

Argatroban (Argatroban®)

- Dosing:
  - No thrombus present, high risk of bleeding, hepatic impairment = 0.5 mcg/kg/min
  - Thrombus present = 1 mcg/kg/min
- Monitor:
  - Argatroban level: Target = 0.2-0.5 mcg/mL
  - aPTT level: Target = 70-90 seconds
- Levels done:
  - Daily
  - 6 hrs post-rate changes

UHN Argatroban Protocol, 2008.

Argatroban (Argatroban®)

Elimination	Hepatobiliary
Cross-reactivity	None
Side effects	Headache, dizziness, rash, phlebitis at injection site
Reversibility	None
Cost	$267.23 (100mg/100mL D5W)

Argatroban (Argatroban®)

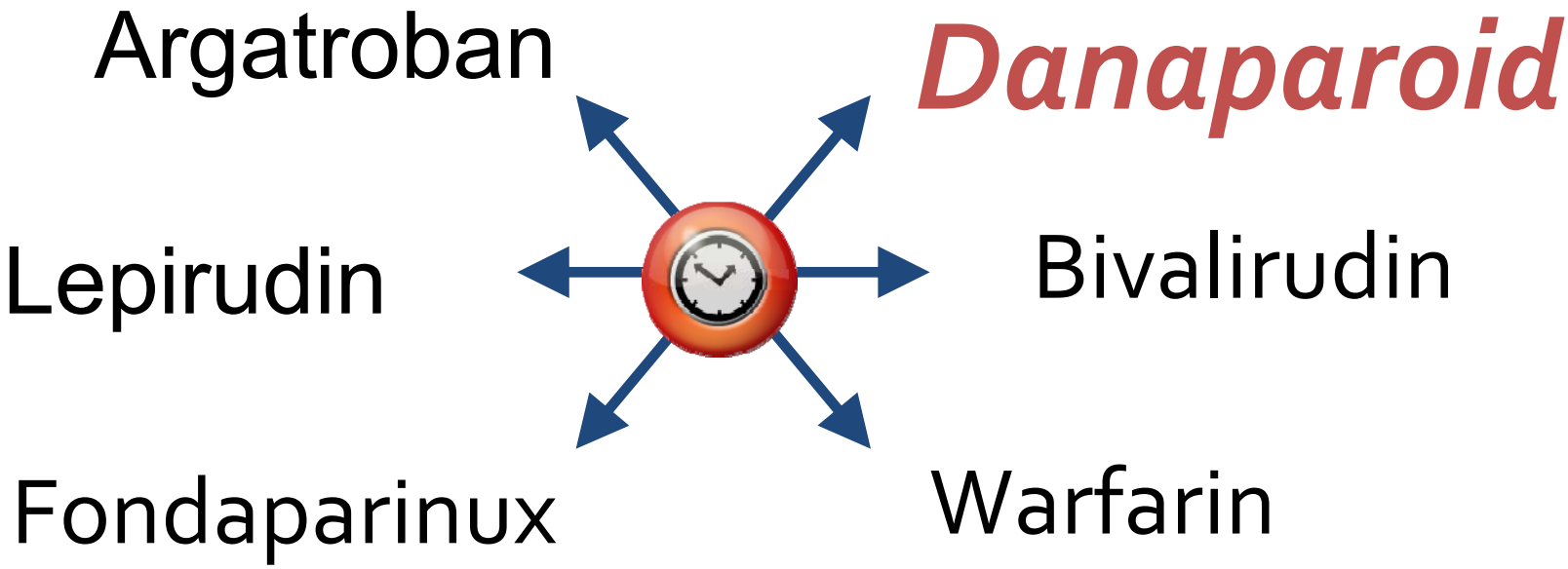
- Special Considerations
  - No dosage adjustment required in patients with renal impairment
  - Dialyzable – not significant
  - Requires careful monitoring of argatroban levels and aPTT
  - Artificial increase in INR
  - $t_{1/2}$=45 mins, stop anticoagulation 6 hrs pre-procedure

Argatroban in ESRD

- One case report and One Observational study (5 pts) used between 1mcg/kg/min and 2mcg/kg/min for HIT management
- aPTT aimed at 2.5x normal
- No bleeding or thrombotic consequences & plts recovered
- One Case report in PD pt- used 2mcg/kg/min and then decreased to 0.5mcg/kg/min
- aPTT was prolonged after D/C of drug

Am J Hematol 2008; 83:245-246; Clin Nephrology 2010;73: 326-330;Ann Pharmacother 2005;39:231-6

Assessment of Therapeutic Alternatives



Danaparoid (Orgaran®)

- Heparinoid
- Health Canada Indication:
  - Treatment of patients with an acute episode of HIT
  - Prophylaxis in patients with a history of HIT

Danaparoid (Orgaran®)

- Anticoagulation Dosing
  - Loading dose:
    - 2250 units IV bolus or IV infusion over 15mins
  - Maintenance dose:
    - First SC injection to be given at same time as IV loading dose
    - < 60kg = 1500 units SC q12h
    - 60–90kg = 2000 units SC q12h
    - > 90kg = 2250 units SC q12h

UHN Cardiovascular Pharmacotherapy Handbook. 2002

Danaparoid (Orgaran®)

- Prophylaxis Dosing
  - Low risk:
    - 750 units SC q12h
    - >90kg = 1500 units SC q12h
  - High risk (cancer, hypercoagulable state, major trauma, spinal cord injury, hip or knee arthroplasty, hip fracture surgery, major surgery in patients >40 yrs old with prior VTE):
    - 750 units SC q8h
    - > 90kg: 1500 units SC q8h

UHN Cardiovascular Pharmacotherapy Handbook. 2002

Danaparoid (Orgaran®)

- Monitor:
  - anti-Xa levels
    - Treatment: Target = 0.35-0.7 units/mL
    - Prophylaxis: Target = 0.15-0.4 units/mL
- Levels done:
  - On or after day 3
  - 6hrs post-dose

UHN Cardiovascular Pharmacotherapy Handbook. 2002

Danaparoid (Orgaran®)

Elimination	Renal
Cross-reactivity	3% cross-reactivity with HIT antibodies
Side effects	New thromboembolic event, extension of existing embolus, transient elevation of LFTs
Reversibility	None, plasmaphoresis in emergency situations
Cost	$19.34/amp, treatment dose for a 70kg male, no IV bolus = $116.22/day

Danaparoid (Orgaran®)

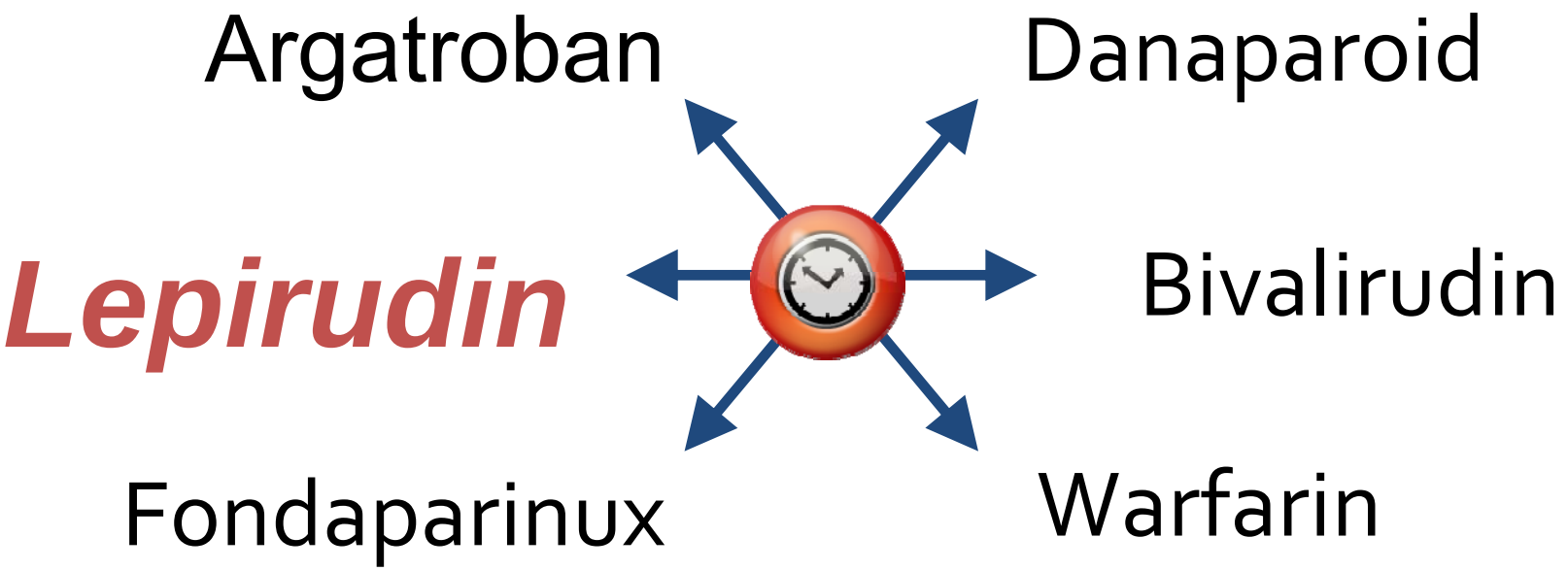
- Special Considerations
  - Anticoagulant of choice in:
    - Patients with a history of HIT
    - Low index of suspicion for HIT
    - Pregnant women with HIT
  - Dosage adjustment and monitoring of anti-Xa levels required in patients with renal impairment
  - $t_{1/2}$=24 hrs, stop anticoagulation 5 days pre-procedure

Danaparoid in ESRD

- In Europe recommendation:
  - 2500u iv bolus followed by 600u/h for 4hr- then 400u/hr for 4hr and then 200-600u/h- based on anti Xa levels
  - Target anti Xa levels at 0.5-1 anti Xa units.
- At UHN continued with same dosing but follow levels.

Magnani et al. THromb Haemost 2006; 95:967-981

Assessment of Therapeutic Alternatives



Lepirudin (Refludan®)

- Direct thrombin inhibitor
- Health Canada Indication:
  - For anticoagulation in patients with HIT and associated thromboembolic disease in order to prevent further thromboembolic complications
  - For anticoagulation in adult patients with ACS (unstable angina, acute NSTEMI)

Lepirudin (Refludan®)

- Dosing
  - Treatment of Thromboembolism
    - Loading dose:
      - 0.2-0.4 mg/kg IV bolus , max of 44 mg in pts ≥110 kg
    - Maintenance dose
      - 0.1 mg/kg/hr, max of 11 mg/hr in pts ≥110 kg
  - Prevention of Thromboembolism
    - Loading dose:
      - None
    - Maintenance dose
      - 0.05-0.1 mg/kg/hr

UHN Cardiovascular Pharmacotherapy Handbook. 2002

Lepirudin (Refludan®)

- Monitor:
  - aPTT
    - Treatment and prevention: Target = 60-100 seconds (1.5-2.5 x control)
- Levels done:
  - Baseline
  - Daily
  - 4hrs post-rate changes

Lepirudin (Refludan®)

Elimination	Renal
Cross-reactivity	None
Side effects	Hypersensitivity reaction (dyspnea, bronchospasm), anaphylactic reaction upon re-exposure (skin reaction, angioedema)
Reversibility	None, hemo-filtration/dialysis with high-flux dialysis membrane may be helpful
Cost	$106.70/vial, maintenance dose for a 70kg male x 24 hrs, no bolus = $365.83

Lepirudin (Refludan®)

- Special Considerations
  - $t_{1/2}$=80 mins, stop anticoagulation 8 hrs pre-procedure
  - Prolonged $t_{1/2}$ with >5 days therapy
  - $t_{1/2}$~50 hrs in renal failure, dosage adjustment required
  - Monitor aPTT closely
  - Anti-hirudin antibodies in 40% of HIT patients (drug development)- pts should be treated only once.
  - Antibodies may increase anticoagulant effects due to delayed renal elimination of lepirudin-antihirudin complexes

Lepirduin in ESRD

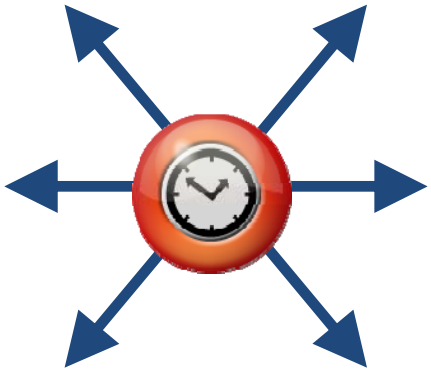
- Literature is inconclusive- prolonged aPTT & increased bleeding
- Dependent on residual renal function
- Suggested no bolus and start with CI of 0.005-0.01mg/kg/hr & monitor aPTT 1.5-2x N or 0.1mg/kg iv bolus dose every other day

Am J Hematol 2007;82:391-393; Am J Health-Syst Pharm 2003;60:2588-93; Ann Pharmacother 2001;35:885-90

Assessment of Therapeutic Alternatives

Argatroban

Danaparoid



Lepirudin

Bivalirudin

Fondaparinux

Warfarin

Bivalirudin (Angiomax®)

- Direct thrombin inhibitor
- Health Canada Indication:
  - For anticoagulation in patients undergoing percutaneous coronary intervention (PCI)
  - For patients with or at risk of HIT or HIT/T undergoing PCI or cardiac surgery

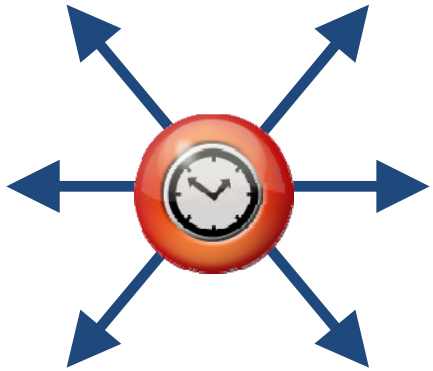
Bivalirudin (Angiomax®)

Elimination	20% renal, 80% proteolysis metabolized
Cross-reactivity	None
Side effects	Back pain, nausea, headache, hypotension
Reversibility	None, hemodialysis (25%)
Cost	$410.00/vial/elective PCI

Bivalirudin (Angiomax®)

- Monitor:
  - ACT: Target = 300-350 secs
- Special Considerations:
  - At UHN, used only during PCI
  - $t_{1/2}$ = 25 mins, stop anticoagulation 2 hrs pre-procedure
  - $t_{1/2}$ = 1 hr in renal failure, no dose adjustment required in patients with mild/moderate renal impairment
  - Expensive

Assessment of Therapeutic Alternatives



Argatroban

Danaparoid

Lepirudin

Bivalirudin

Warfarin

Fondaparinux

Fondaparinux (Arixtra®)

- Synthetic antithrombotic
- Health Canada Indication:
  - Prophylaxis of VTE for up to 1 month post-orthopedic lower limb surgery (i.e. fracture, hip or knee surgery, hip replacement surgery)
  - Treatment of acute DVT and PE
  - Management of unstable angina or NSTEMI for the prevention of death and subsequent MI
  - Management of STEMI

Fondaparinux (Arixtra®)

Elimination	Renal
Cross-reactivity	None
Side effects	Thrombocytopenia, increase in LFTs
Reversibility	None, recombinant factor VIIa may be effective
Cost	$30-40/day

Fondaparinux in ESRD

- Case reports
  - HIT on dialysis (unspecified mode, frequency) for acute renal failure
    - 0.5 mg SC daily
    - Resolution of HIT without consequence
  - HIT on dialysis (IHD, 3 times weekly) for transplant failure
    - 2.5 mg IV on dialysis days
    - Resolution of HIT without consequence
  - HIT patient – acute renal failure starting HD
    - 2.5mg daily and then every other day
    - Resolution of HIT without consequence

Haematologica 2003;88:147-148; Nephrology Dialysis Transplantation 2005;20:444-446; AJ Health Syst Pharm 201; 67;1075-1079.

Fondaparinux (Arixtra®)

- Special Considerations
  - Limited clinical experience with fondaparinux in treatment of HIT
  - Subcutaneous administration
  - Once daily dosing
  - $t_{1/2}$ = 17-21hrs, stop anticoagulation 4-5 days pre-procedure

HD Experience With HIT

- Limited data available for most agents
  - Argatroban – minimal changes in drug disposition
  - Danaparoid – prolonged half-life, accumulation, dose adjusted
  - Lepirudin – prolonged half-life, accumulation, dose adjusted
  - Bivalirudin – prolonged half-life, accumulation, dose adjusted
  - Fondaparinux – prolonged half-life, accumulation, dose adjusted

CHEST *2008:* VKAs

2.2.1 Management of DTI/Danaparoid-VKA Overlap

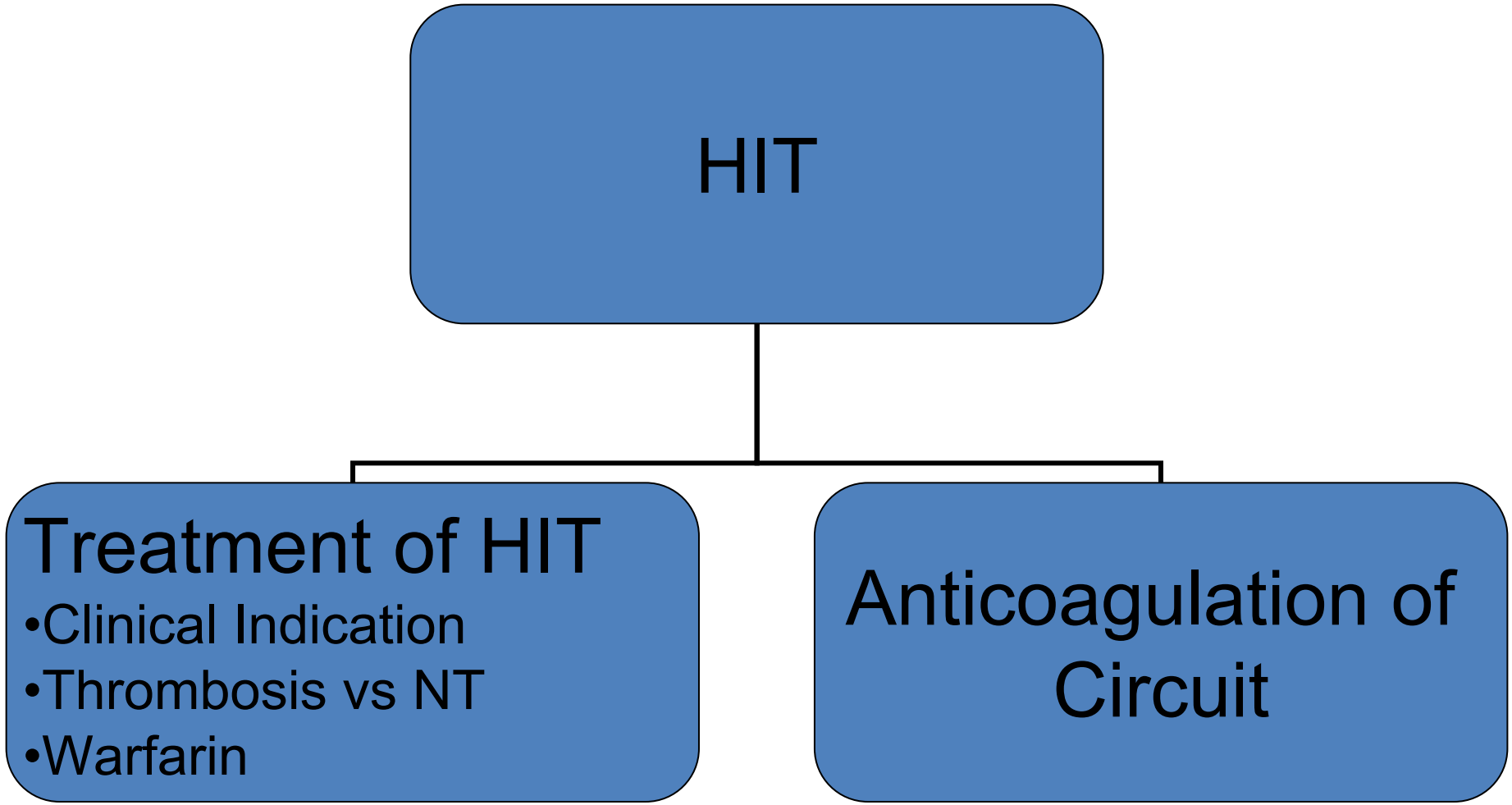
For patients with strongly suspected or confirmed HIT, we recommend *against* the use of VKA therapy until after the platelet count has substantially recovered (*ie*, usually to at least $150x10^9$/L) over starting VKA therapy at a lower platelet count (Grade 1B).

Warfarin (Coumadin®)

- HIT
  - Anticoagulate for 4 weeks
- HIT with thrombosis
  - Anticoagulate for 3-6 months

Arepally GM and Ortel TL. NEJM. 2006

Issues with Treatment of HIT in CKD



Argatroban for HD circuit patency

- Two case reports using 100mcg/kg bolus followed by 100-200mcg/kg/hr infusion over HD
  - No clotting of dialyzer
  - aPTT at 1.5x normal
  - Hemostasis of puncture site: 20-30 mins

Nephrol Dial Transplant 1995;10:2137-2140; CANNT Journal 2008;18(4):32-35

Argatroban for HD circuit patency

- Prospective Comparison of 3 Tx (cross over):
  - 250mcg/kg bolus + 250mcg/kg bolus allowed
  - 250mcg/kg bolus followed by 120mcg/kg/hr infusion
  - 120mcg/kg/hr infusion initiated 4 hrs prior to HD
- 13 pts received each regimen x 3 with 2 HD sessions as washout.
- aPTT remained between 66 and 91s with all 3 regimens
- No thrombotic events or clotting of dialyzer

Kidney International 2004; 66:2246-2453

Danaparoid for HD circuit patency

Thrombosis Research 1985;38:811-822; Kidney & Dialysis 1990;13:103-108; AJKD 2002; 40:990-995

Study Type	N	Dosing	Monitoring	Adverse Events
ESRD on HD 2x/week	6	1. 22.4 u/kg pre-HD inj (i.e. 1570 units) 2. 34.4u/kg pre HD inj (i.e 2400 units) 3. Heparin 4500u IV followed by CI 950-1370u/h Washout was 5 days	Anti-Xa levels around 0.4 with danaparoid	No clotting in any dialysis procedures Limitation: single dose trial
ESRD on HD	36	1. iv bolus: 3250-4750 iu heparin start of HD followed by CI of 1000-1250u/hr 2. iv bolus: 2400 u of danaparoid at start of dialysis 3. iv bolus: 3200u of danaparoid at start of dialysis Cross over design Washout by 2 HD	Anti-Xa levels: Overall remained between 0.4-0.8u/ml during 4 hr dialysis session for both doses Anti-Xa levels 0.4 with heparin	No difference in clots on membrane Limitation: single dose trial with each different dose
ESRD on HD	21	Randomized to 1) dalteparin 2500 u IV bolus 2) Enoxaparin 40mg IV bolus 3) Danaparoid 35 u/kg IV bolus (eg for 70kg pt = 2400 units) Pts received tx for 4 weeks	Antifactor Xa activity remained elevated up to 48 hours after injection.	No fibrin clots on dialyzer

Lepirudin for HD circuit patency

Two Case reports with Lepirudin for HD

- **Case 1**
  - Bolus dose of 0.14mg/kg prior to dialysis
  - Resulted in lepirudin blood conc of 0.5mcg/ml (MTC)
  - No aPTT reported
- **Case 2**
  - Bolus dose of 0.06mg/kg prior to HD
  - Pt developed spontaneous hemorrhage in left quadricept (aPTT was 44 sec)
  - Reduced dose to 0.018mg/kg –no bleed or clotting over next 3 months

Nowak et al. Wien Klin Wochenschr 1997;109:354-8; Muller et al Nephrol Dial Transplant 1999;14:2482-3

Fondaparinux for HD circuit patency

Study Type	N	Dose of Fonda	Adverse Events	Monitoring	% Removal from Dialysis
Circuit patency Part 1: UFH vs fonda Part 2: fonda x 9 HD sessions	12 HD patients	0.05mg/kg every dialysis day (70kg = 3.5mg) into arterial line prior to dialysis session	No bleeding episodes when peak anti-Xa < 0.7mcg/L On average, clotting was lower at higher anti-Xa activity but only complete clotting occurred at 0.94mcg/mL	Pre-dialysis anti-Xa: ↑ from 0 to 0.32 ±0.09mcg/L Peak anti-Xa: ↑ from 0.61 ± 0.14 to 0.89± 0.24 mcg/L SQCS score (clotting score): ↓ from 1.5± 0.52 to 1.00± 0.43 ($p<0.05$) Puncture site compression times: ↑ from 23.9 ± 7.5 to 26.3 ±9.2 min ($p<0.05$)	NR

Kalicki et al. Thromb Haemost 2007;98:1200-1207

Fondaparinux for HD circuit patency

Study Type	N	Dose of Fonda	Adverse Events	Monitoring	% Removal from Dialysis
Circuit patency High flux vs low flux	16 patients- 8 with high flux and 8 with low flux dialyzers Dialyzers primed with 5000IU UFH, pts received tinzaparin 50-75IU/kg x 1 month.	2.5mg once	Fibrin/clot score (0= no clot, 3= complete clot) 1h: 0.12± 0.35 2h: 0.62 ± 0.51 3h: 1.12± 0.64	Anti-Xa_{pre}: 0.04 ± 0.03IU/mL Anti-Xa_{post}: 0.16 ± 0.04 IU/mL Anti-Xa_{next}: 0.06 ± 0.04IU/mL	NR

Sombolos et al. International J Clin Pharm & Therap 2008; 46:198-203

Comparison of Non-Heparin Alternatives

Agent	Argatroban	Danaparoid	Bivalirudin	Lepirudin	Fondaparinux	Warfarin
Elimination	Hepatobiliary	Renal	Renal & Proteolysis	Renal	Renal	Hepatic
Cross-reactivity	None	~3%	None	None	None	None
Monitoring Parameters	Argatroban level, aPTT	anti-Xa level	ACT	aPTT	anti-Xa level	INR
Side Effects	Headache, dizziness, rash	Worsening thrombosis, increase in LFTs	Back pain, nausea, headache, hypotension	HSR/ anaphylaxis	Thrombo-cytopenia, increase in LFTs	Bruising, skin necrosis
Reversibility	None	None, plasma-phoresis	None	None, hemo-filtration/ dialysis	None, recombinant factor VIIa	Vitamin K, plasma transfusio
COST	$3500	$1200	$2800	$2500	$300	N/A
HIT tx	$250-1000	$100-500	$25-100	$20-100	$50-100	
HD circuit						

Case Presentation

- Drug selection
  - Safety
    - Pregnancy?
    - Dosing in HD?
    - Monitoring?
  - Efficacy
  - Administration
    - Route?
    - Method?
    - Convenience?

Case Presentation

- Therapeutic drug monitoring
  - Therapeutic anti-Xa range not established
  - Reported reference ranges for fondaparinux are for drug concentration
    - 0.2 – 0.4 mcg/mL expected with 2.5 mg SC daily dosing (prophylaxis)
    - 0.5 – 1.5 mcg/mL expected with 7.5 mg SC daily dosing (treatment)

Chest 2008;133:141S-159S

Case Presentation

- Fondaparinux drug levels (mcg/mL)

Date	Pre-HD	Mid-HD	Post-HD
January 7	0.74		
January 8	0.80	0.66	0.54
January 11	0.60	0.50	0.47
January 12	0.83		0.52
January 13	0.73		0.48

Rechallenge with Heparin

- Hit antibodies are transitory with a median time to disappear of 50 – 80 days but may persist for several years
- No official guidelines for HD pts
- Suggest ELISA test q 3 months and if neg retest in 2 weeks and then start on LMWH

Am J Kid Disease 2009;54: 361-374

Conclusions

- HIT in HD rare despite UFH exposure
- Pattern of exposure (3 times weekly) and frequency of platelet monitoring may complicate diagnosis
- Drug selection influenced by numerous factors
  - Safety, efficacy, convenience, cost

Questions