Diagnosis and management of Thrombosis and thrombocytopenia Syndrome or Vaccine induced Thrombosis and Thrombocytopenia (TTS/VITT)

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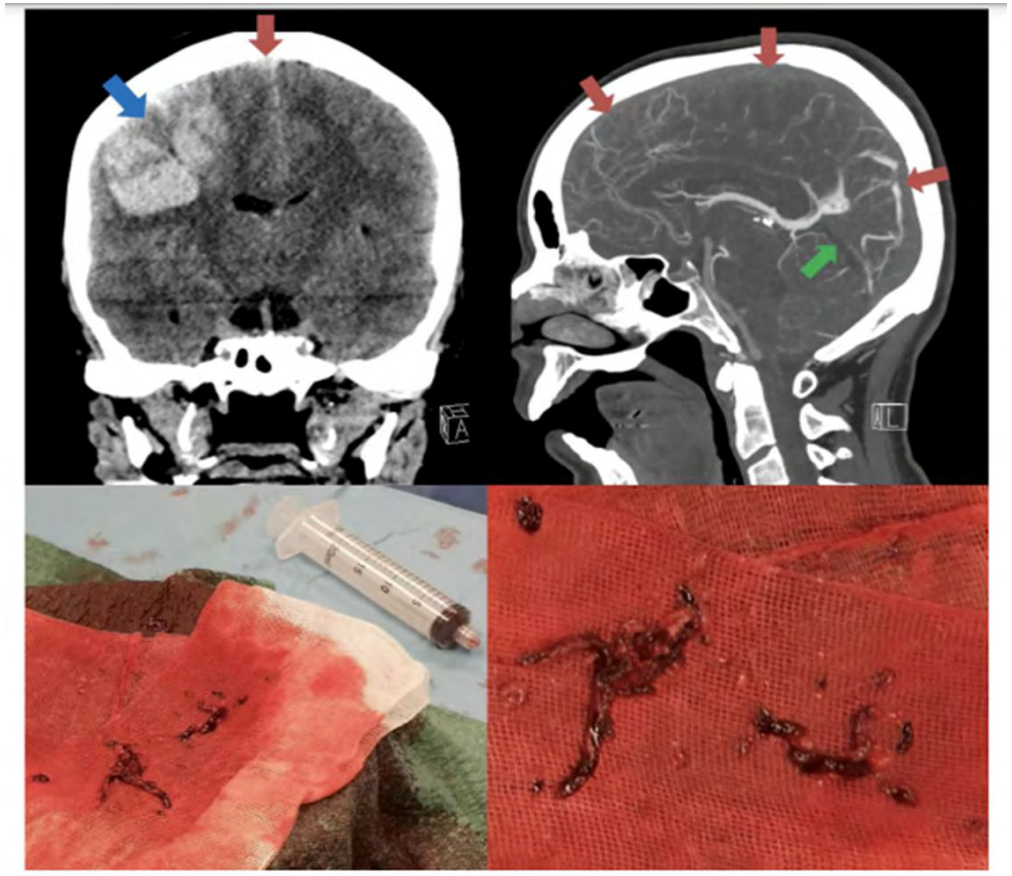
THANZ VITT Advisory Group.



Objectives

- Perspective of serious thrombotic complications of AZ vaccine (ChadOx1)
- Understand the diagnostic algorithm for TTS
- Early recognition of TTS
- Example of Management of TTS
- Management of TTS presenting as CVST
- Conclusion
- Q&A

Abbreviation	Stands for	Comments
VIPIT	Vaccine Induced Prothrombotic Immune Thrombocytopenia	Original term reported by German researchers.
VITT	Vaccine Induced immune Thrombotic Thrombocytopenia or Vaccine Induced immune	Term used in subsequent report by the German group, as well as separate case series by Norwegian, UK and French based groups publishing in NEJM. Probably reflecting a

Abbreviation	Stands for	Comments
TTS	Thrombosis with Thrombocytopenia Syndrome	A term favoured by some reporting agencies that does not specifically reference any 'vaccine' association. Term not typically utilised by researchers for the condition associated with COVID-19 vaccine use, since essentially can encompass any condition where thrombosis can be associated with thrombocytopenia, including HITT, severe or catastrophic antiphospholipid (antibody) syndrome (APS or CAPS) and thrombotic thrombocytopenia purpura (TTP).

NEJM – April 2021

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Thrombotic Thrombocytopenia after ChAdOx1 nCov-19 Vaccination

Andreas Greinacher, M.D., Thomas Thiele, M.D., Theodore E. Warkentin, M.D., Karin Weisser, Ph.D., Paul A. Kyrle, M.D., and Sabine Eichinger, M.D.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Pathologic Antibodies to Platelet Factor 4 after ChAdOx1 nCoV-19 Vaccination

Marie Scully, M.D., Deepak Singh, B.Sc., Robert Lown, M.D., Anthony Poles, M.D., Thomas Solomon, M.D., Marcel Levi, M.D., David Goldblatt, M.D., Ph.D., Pavel Kotoucek, M.D., William Thomas, M.D., and William Lester, M.D.

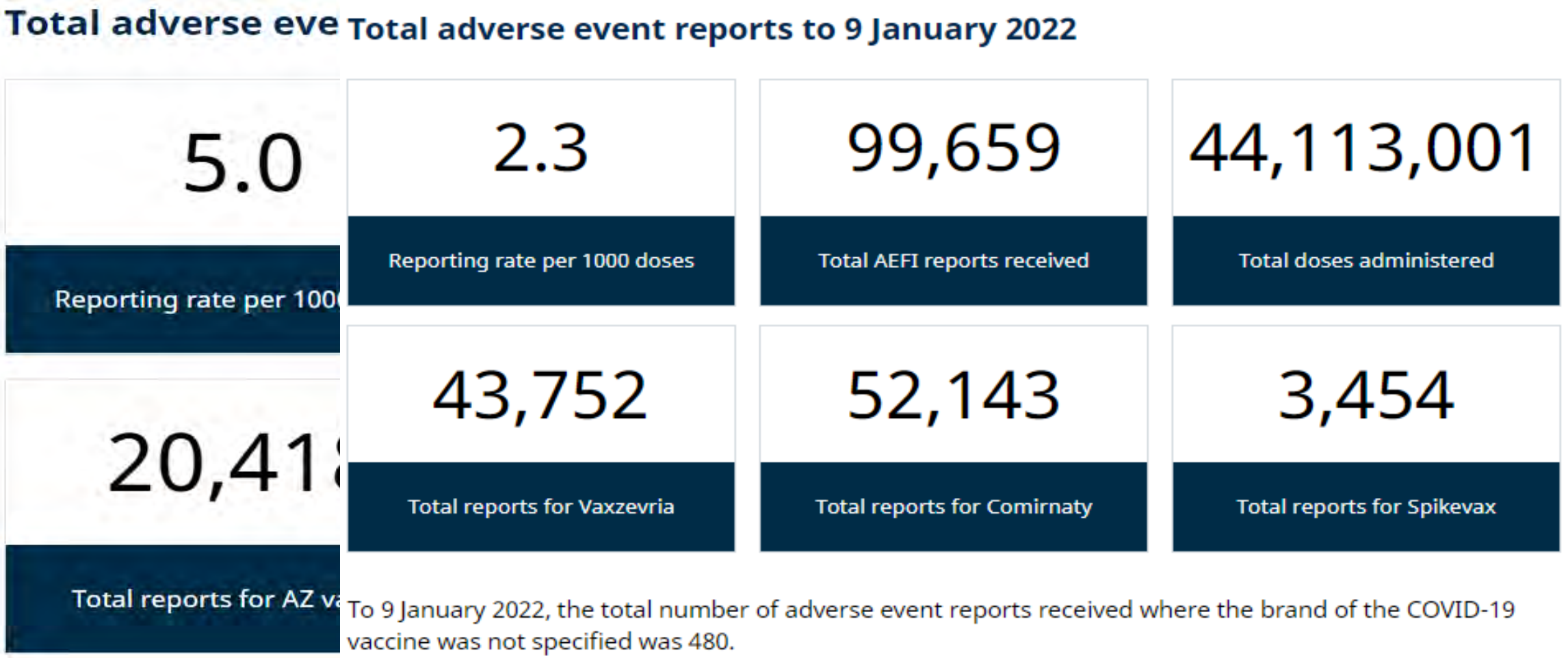
The NEW ENGLAND JOURNAL of MEDICINE

BRIEF REPORT

Thrombosis and Thrombocytopenia after ChAdOx1 nCoV-19 Vaccination

Nina H. Schultz, M.D., Ph.D., Ingvild H. Sørvoll, M.D., Annika E. Michelsen, Ph.D., Ludvig A. Munthe, M.D., Ph.D., Fridtjof Lund-Johansen, M.D., Ph.D., Maria T. Ahlen, Ph.D., Markus Wiedmann, M.D., Ph.D., Anne-Hege Aamodt, M.D., Ph.D., Thor H. Skattør, M.D., Geir E. Tjønnfjord, M.D., Ph.D., and Pål A. Holme, M.D., Ph.D.

Perspective and context : Australian data



Source TGA 21 June 2021
and Jan 2022

Table 4: Newly confirmed and probable TTS cases for 7-13 January 2022‡

New confirmed TTS	New probable TTS
No cases	No cases

Table 5: Australian TTS cases to date by age and CDC classification A. First dose cases

Age	Reported cases (6.9 million doses given)	Tier 1 CDC classification†	Reports per 100,000 doses‡
<30 years	8	2	2.0 (<50 years)
30-39	5	4	
40-49	11	6	
50-59	33	18	3.0
60-69	37	11	1.8
70-79	37	10	2.2
80+	16	4	1.9
All ages	**147 (74 men, 73 women)**	**55 (18 men, 37 women)**	**2.1**

B. Second dose cases

Age	Reported cases (6.7 million doses given)	Tier 1 CDC classification†	Reports per 100,000 doses‡
<30 years	0	0	0 (<50 years)
30-39	0	0	
40-49	0	0	
50-59	3	1	0.4 (≥50 years)
60-69	8	1	
70-79	9	1	
80+	3	0	
All ages	**23 (15 men, 8 women)**	**3 (2 men, 1 woman)**	**0.3**

‡ Rates of TTS are calculated as of 30 December 2021 to account for the time to onset of TTS. These rates are estimates of risk based on small numbers of cases so far. Aggregated rates are given for some age ranges where the number of cases for a 10-year age bracket is too low to calculate reliable estimates.

† The US CDC classification of Tier 1 is defined as clots in an unusual location (such as the brain or abdomen) and a low platelet count with or without antibodies that activate platelets (anti-PF4 antibodies).

TGA Jan 2022

Table 6: Time to onset, treatment and outcomes for TTS cases*

Vaccine dose	Median time to onset/ diagnosis	Treated in ICU at any point	Currently in ICU	Outcome†		
				Discharged	In hospital	Fatal
First	13 days (1-94)	47	0	137	1	8
Second	12 days (2-69)	2	0	23	0	0

**Data is based on the most recent medical information available to the TGA for first and second dose TTS cases.*

†As previously reported, one patient died from unrelated medical conditions while being treated for TTS. The outcome for this patient is not included in this table.

Table : Confirmed and probable TTS cases by age and CDC classification

†The US CDC classification is defined as:

- Tier 1 = clots in an unusual location (such as the brain or abdomen) and a low platelet count with or without antibodies that activate platelets (anti-PF4 antibodies)
- Tier 2 = clots found in common locations (such as the leg or lungs) **and** a low platelet count **and** anti-PF4 antibodies
- Not classified = case does not meet the criteria for Tier 1 or Tier 2 (for example clots in common locations with low platelet count but no evidence of anti-PF4 antibodies).

Cases have most often occurred about two weeks after vaccination, although the time to onset (or diagnosis) has ranged from two days to 52 days (Table 3). In some cases, with a longer time to diagnosis, diagnosis, patients had experienced symptoms at an earlier stage but complicating factors, including symptoms from comorbidities, may have delayed a clear diagnosis. Approximately one in four TTS cases has required Intensive Care Unit (ICU) treatment, although all but four patients have since been released from ICU.

TGA Jan 2022

Case 1

- 69 yr old male
- Presenting **2 weeks** post bilateral TKR
- Referred to JHH from GP with left leg swelling
- No abdominal pain, fevers, haematuria
- Nil medical history
- Regular meds: 100 mg Aspirin daily (post TKR), PRN Indomethacin
- Lives with wife, non smoker, occ ETOH

Case 1

- **Bleeding history**
  - No history of significant bleeding post surgical or post dental extraction
- **Heparin exposure**
  - Given for 10 days post op TKR
- **Any other constitutional symptoms**
  - Some weight loss since surgery
  - Nil lymphadenopathy
  - Nil fevers
- **Any evidence of thrombosis?**
- **Family history**
  - Father – bowel cancer – still alive – has never had a colonoscopy

Blood results . . . .

WBC	13.2 H	NEUT	75	%	9.9 H		WCC Reference Range fail		
RBC	4.77	BAND	0	%	0.0	OTHER	0	%	0.0
HGB	130 L	LYMPH	13	%	1.7	NRC	0	/100	WBC
HCT	0.392	MONO	9	%	1.2 H	ANRC		/100	WBC
MCV	82	EOSIN	2	%	0.3				
MCH	27	BASO	0	%	0.0				
MCHC	331	MET	0	%	0.0	WBC	13.2 H		
RDW	13.8	MYE	2	%	0.3	UNWBC	13.2		
PLT	44 C	PRO	0	%	0.0				
MPV	9.0	BLA	0	%	0.0				

WBCFLGB1

RBCFLG[Read PLTFLG

COMMENT: Age : 61 years Differential Status : Automated. Film YES

Thrombocytopenia with platelet anisocytosis. Neutrophilia with left shift and toxic granulation and vaculoation. Monocytosis. Occasional reactive

Blood results

BIOCHEMISTRY - GENERAL			Fasting: ?	(result)	(range)		(result)	(range)
Sodium	139	(135 - 145)	T.Protein	78	(60 - 80)	CRP	70 H	(< 5)
Potassium	4.5	(3.5 - 5.2)	Albumin	42	(30 - 44)	Lipase	21	(10 - 60)
Chloride	101	(95 - 110)	Calc.Glob.	36	(22 - 42)			
Bicarb.	24	(22 - 32)	Total Bilirubin	29 H	(< 20)			
Urea	9.8 H	(4.0 - 9.0)	GGT	67 H	(5 - 50)			
Creatinine	105	(60 - 110)	Alk.Phos.	74	(30 - 110)			
GFR Est.	66	(> 60)	ALT	53 H	(10 - 50)			
Anion Gap	18 H	(7 - 17)	AST	43 H	(10 - 35)			
			LD	475 H	(120 - 250)			

Further results…

HAEMATOLOGY - Heparin induced thrombocytopaenia screen

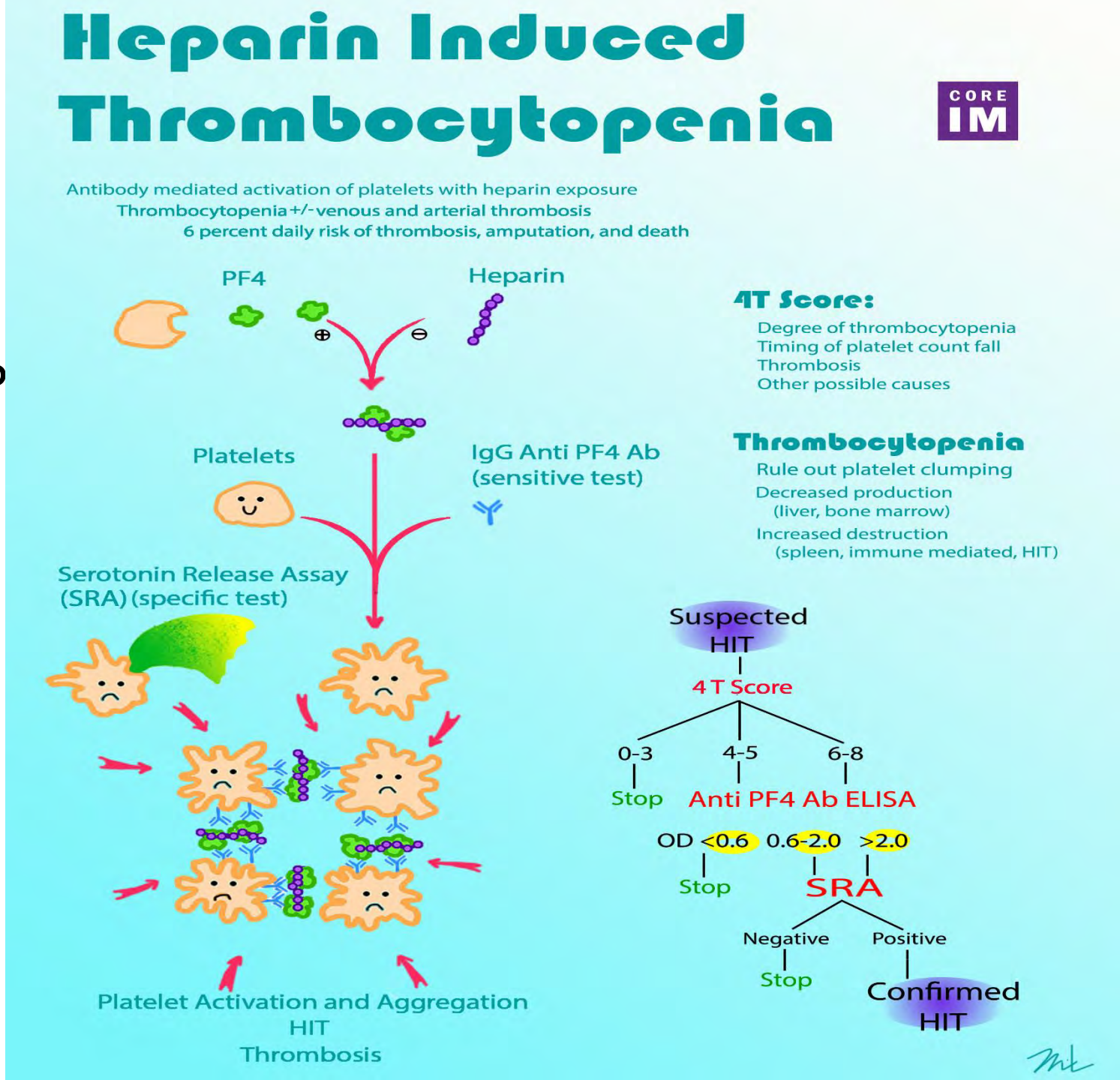
Ig Heparin dependent Platelet Antibody:DETECTED

Patient result: 2.55 U/ml Cut-off: 1.000 U/ml
Kit Lot No. :1285 Expiry :28-Jun-19

COMMENT
Heparin dependent platelet antibodies were DETECTED using an chemiluminescent technique. Suggest correlation of this result with the pre-test clinical probability for HITS (i.e. 4Ts score) and repeat testing, including a functional test for HITS (i.e. serotonin release assay), if clinically indicated.

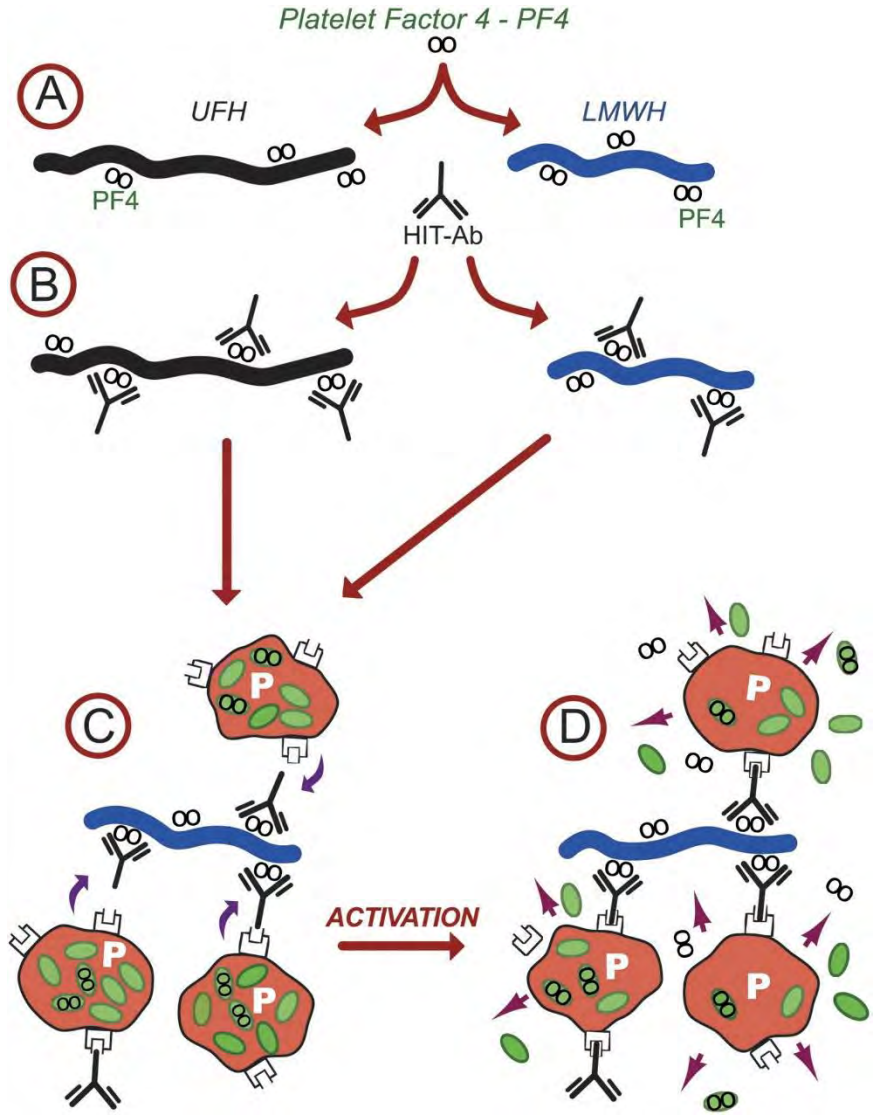
HITTS

- 4T score high probability
- Positive Acustar for HITTs (anti-P
- Confirmed by Serotonin Release



Pathophysiology of TTS/VITT

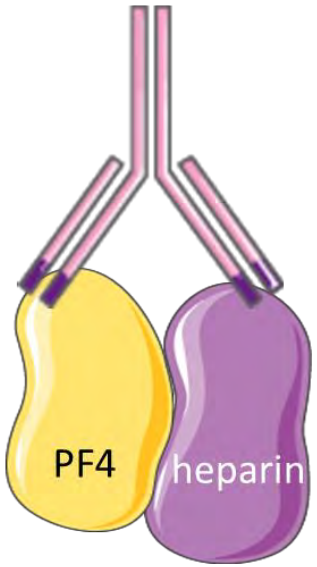
- VIPIT = TTS = VITT
- Majority of cases appear to have detectable pathological antibodies directed against Platelet Factor 4 (PF4)
- Similar to another prothrombotic immune-mediated thrombocytopenia, Heparin-induced Thrombotic Thrombocytopenic syndrome (HITT, or HITS)



BASIS OF HITT/VITT IMMUNOLOGICAL DIAGNOSTIC ASSAY

PF4 ELISA

HIT



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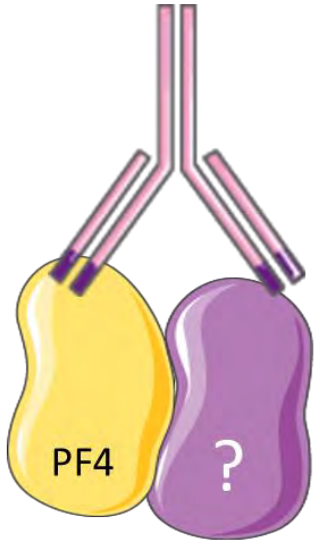
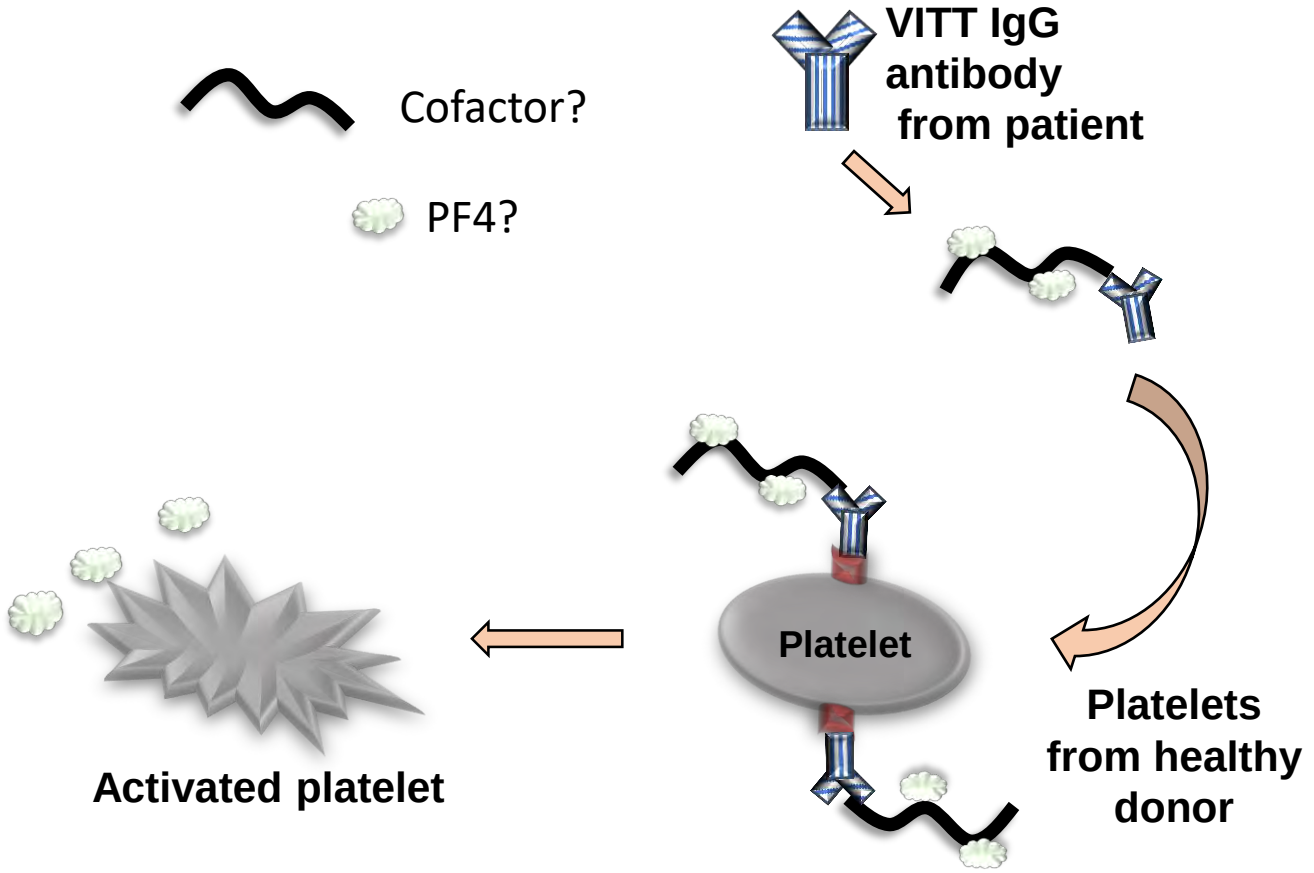
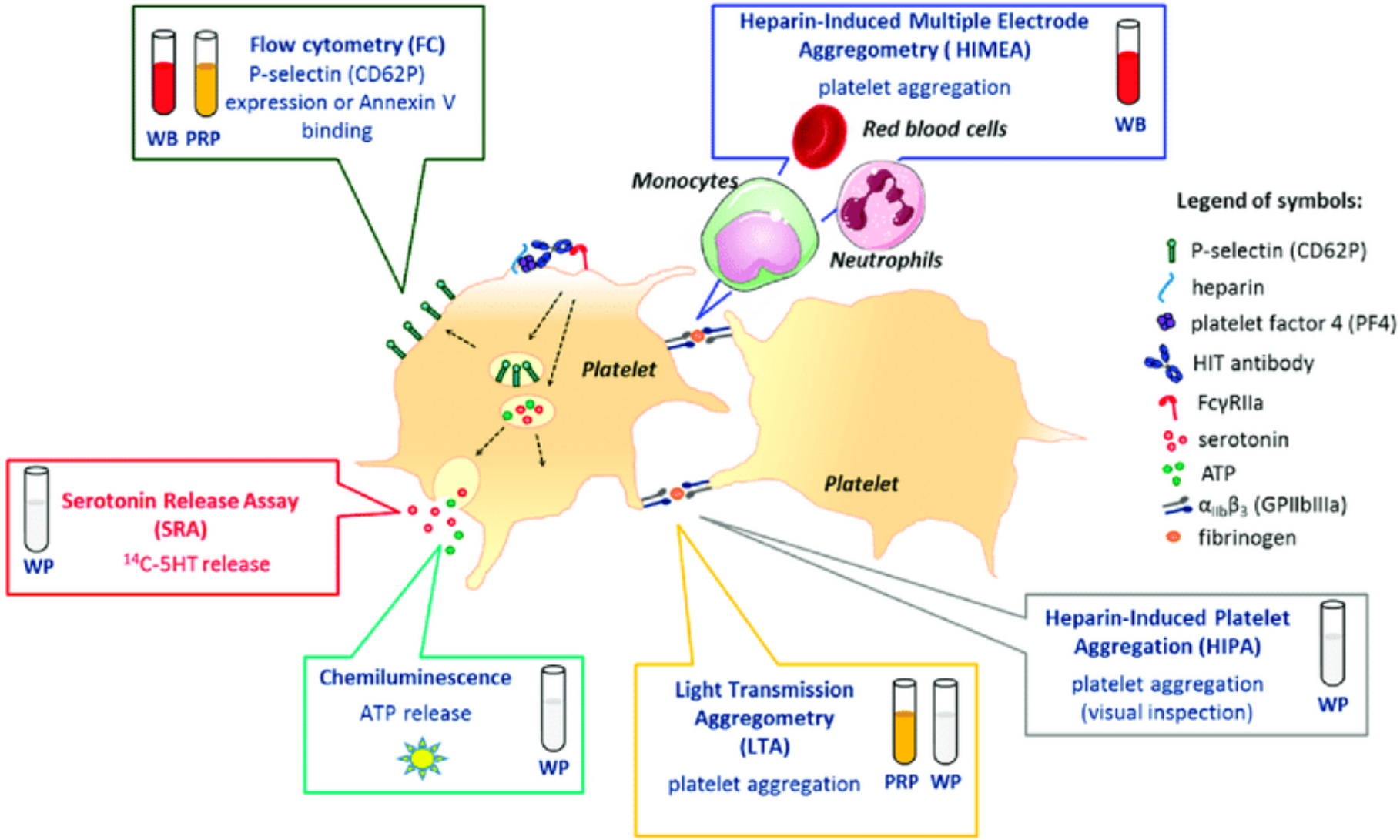
VITT



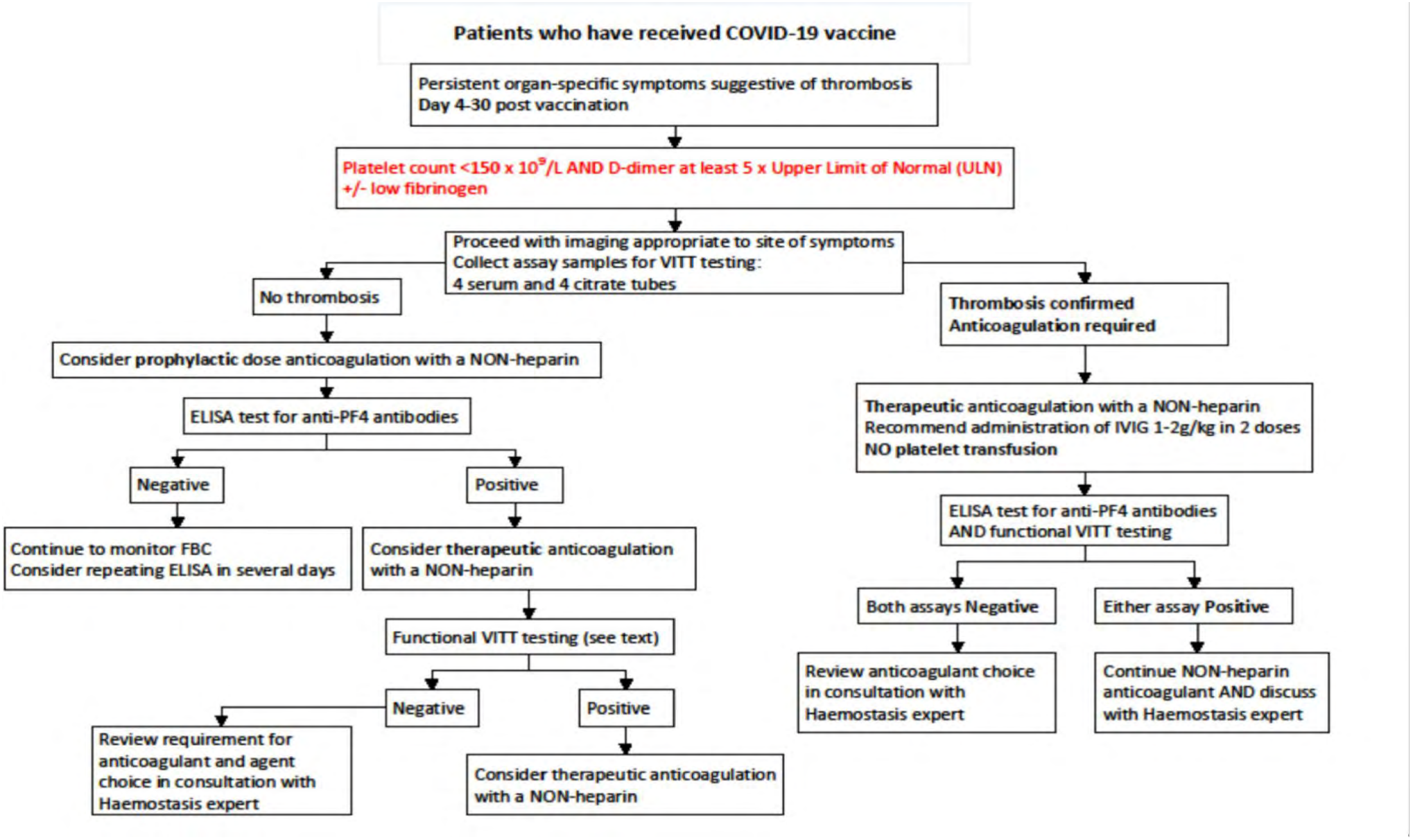
Different co-factor in VITT?

BASIS OF HITT/VITT FUNCTIONAL DIAGNOSTIC ASSAY

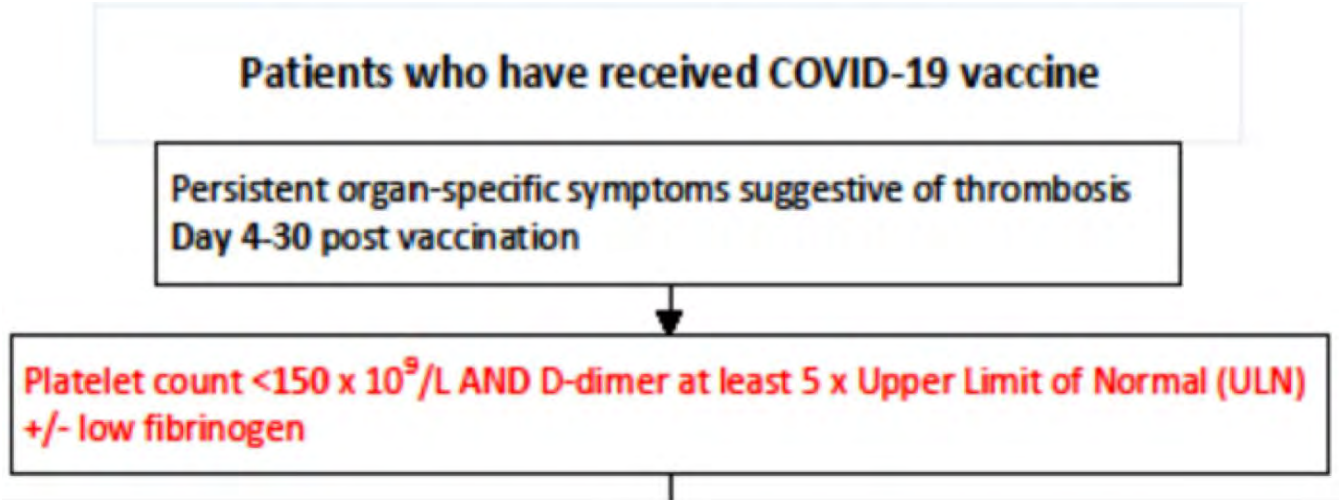



Flow cytometry (FC)
P-selectin (CD62P) expression or Annexin V binding
WB PRP
Heparin-Induced Multiple Electrode Aggregometry (HIMEA)
platelet aggregation
WB
Red blood cells
Monocytes
Neutrophils
Platelet
Platelet
Legend of symbols:
P-selectin (CD62P)
heparin
platelet factor 4 (PF4)
HIT antibody
FcγRIIa
serotonin
ATP
$\alpha_{IIb}\beta_3$ (GPIIbIIIa)
fibrinogen
Serotonin Release Assay (SRA)
^{14}C-5HT release
WP
Chemiluminescence
ATP release
WP
Light Transmission Aggregometry (LTA)
platelet aggregation
PRP WP
Heparin-Induced Platelet Aggregation (HIPA)
platelet aggregation (visual inspection)
WP

THANZ Advisory Group on VITT

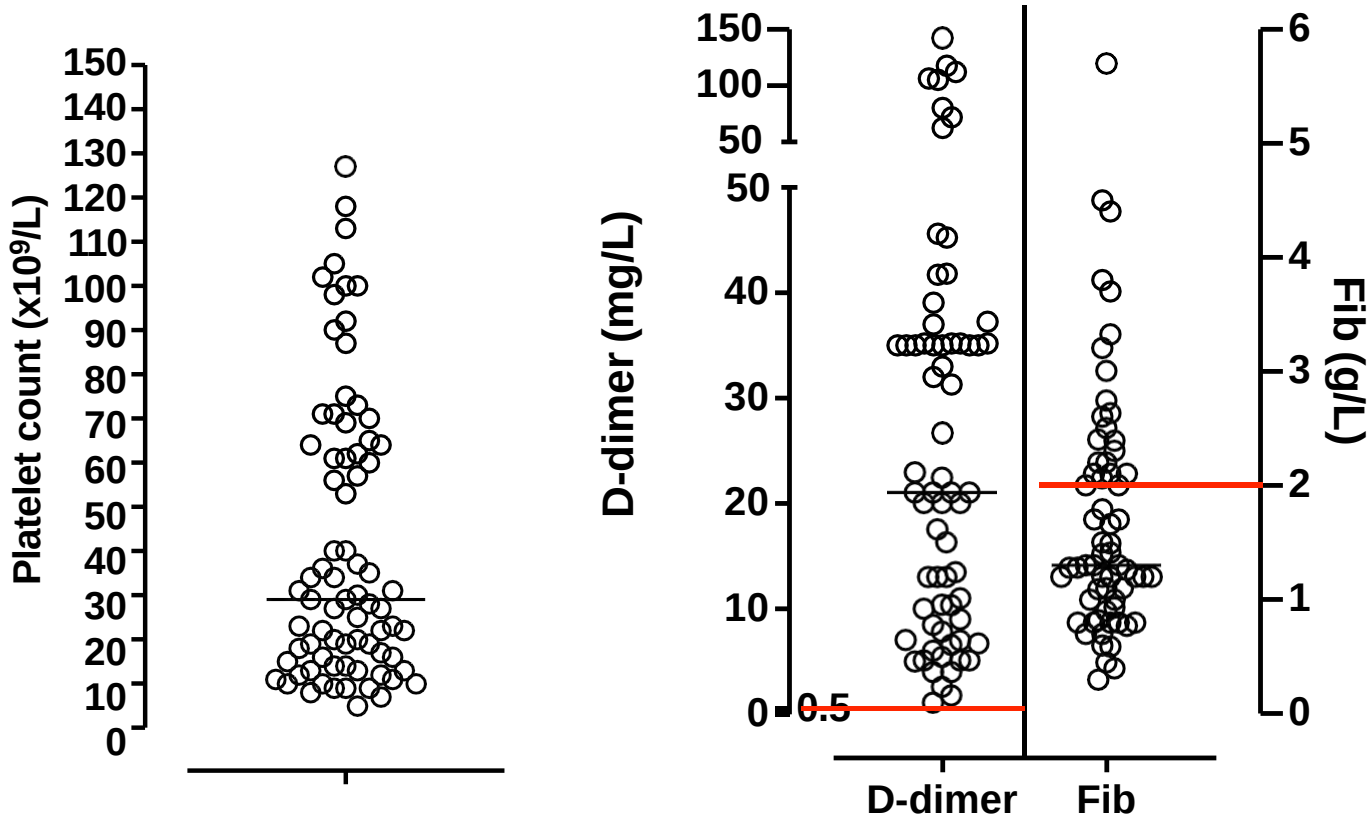


First tier lab tests in suspected VITT



- Most published cases to date…
- Thrombocytopenia (platelet count <150 x 10^9/L)
- High D-dimer (typically very high, or > 5 x upper limit of normal)
- Most cases (~70%) fibrinogen <2g/L

First tier lab tests in suspected VITT

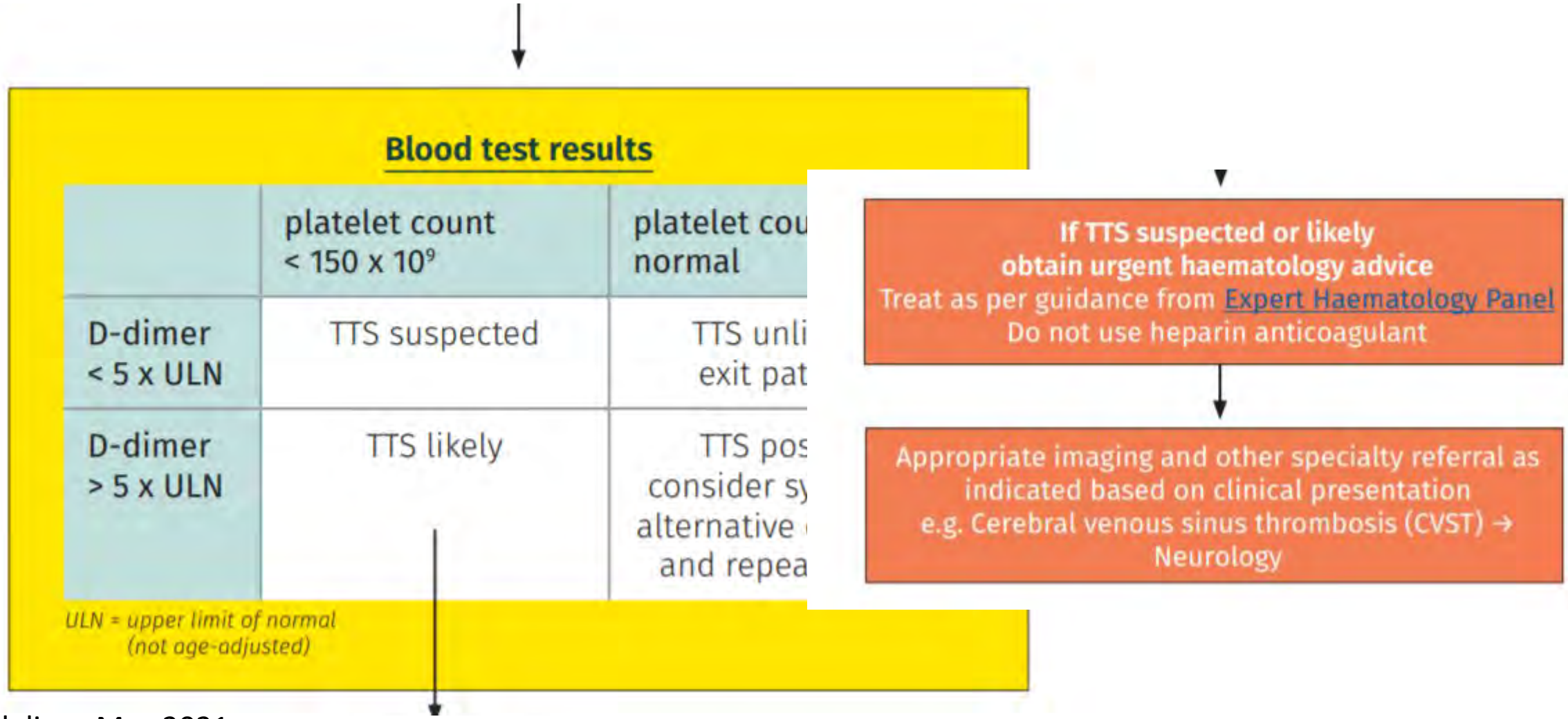


N=81-133 cases reported in the literature to date

Favaloro EJ. Laboratory testing for suspected COVID-19 vaccine induced (immune) thrombotic thrombocytopenia. IJLH, 2021.

Slide courtesy E Favalaro

Approach to VITT in the emergency department



ACEM Guidelines May 2021

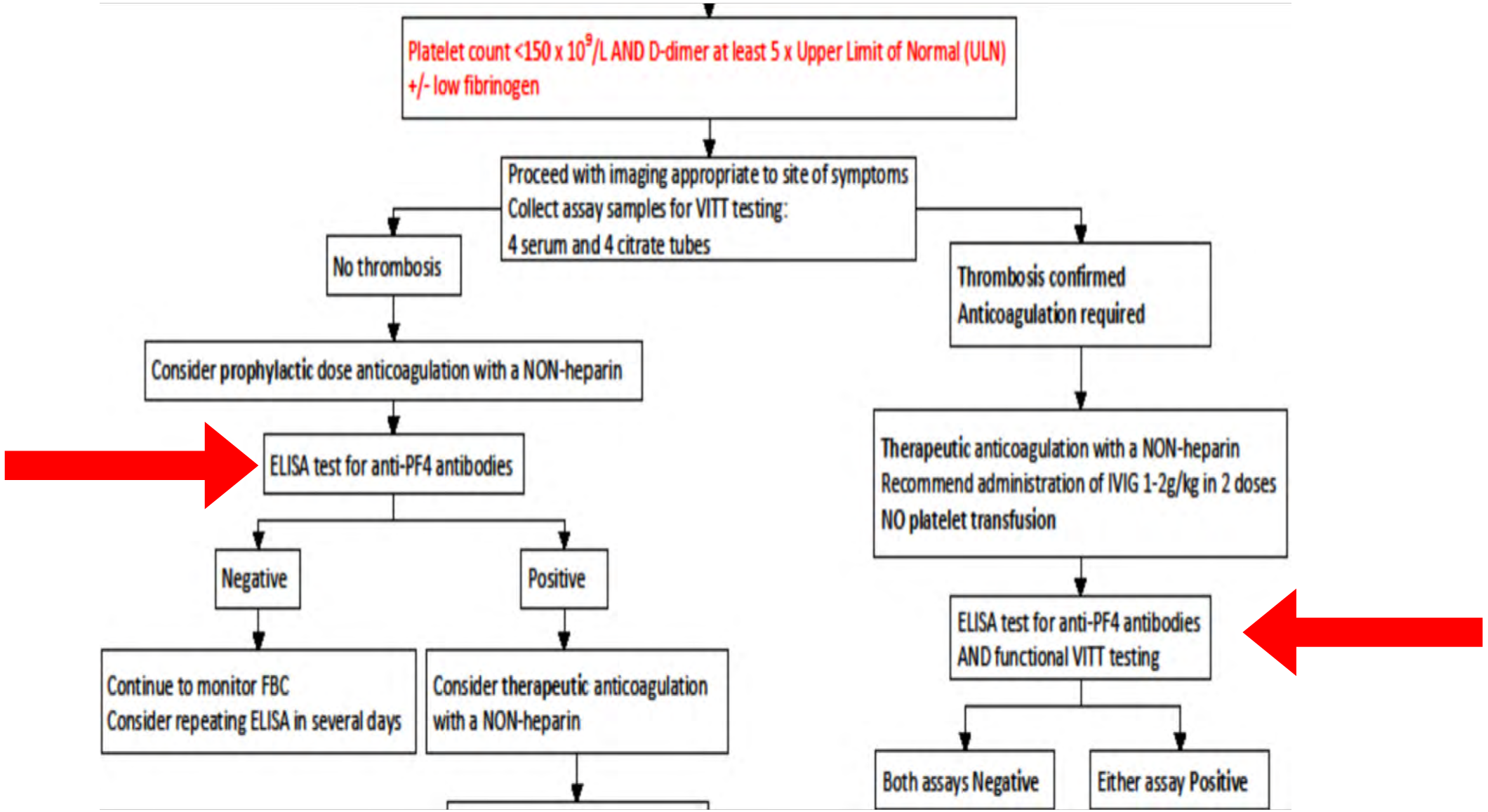
Tier 1 lab tests (pre- anticoagulation)

Wd Emergency (JHH) Doc Dr Dragan Petkovi* Sp Blood CollT 15:15 02-Jun-21

HAEMATOLOGY - COAGULATION TESTING Specimen: Blood

		Range	Units
PT	12	(11 - 16)	s
INR	0.8		
Fibrinogen	4.2 H	(2.0 - 4.0)	g/L
D-dimer	>20 C	(< 0.50)	mg/L
D-Dimer Interpretation	POSITIVE (refer to comment)		

Second tier lab tests in suspected VITT



THANZ Advisory statement May 2021

Lab testing in suspected VITT triaged according to information received

Australia and New Zealand VITT/VIPIT ELISA and functional testing request form

Suspected Vaccine-induced Thrombotic Thrombocytopenia Blood test request form

*Please complete this form whenever samples from patients with suspected VITT (previously VIPIT) are sent for testing by heparin-induced thrombocytopenia (HIT/VITT) ELISA and functional 'VITT' assays. Please refer to the most recent **THANZ VITT/VIPIT Advisory statement** for guidance on appropriate testing (https://www.thanz.org.au/).*

Patient Name: Last: _____ First: _____
Patient ID Number: _____ Sex: M ☐ / F ☐
Date of birth (DD-MMM-YYYY): _____
Sample Collection Date (DD-MMM-YYYY): _____ Collection Time: _____
Hospital/ clinic: _____
Ordering physician name: _____
Ordering physician phone number: _____
Fax for report: _____
Billing Address: _____

Sample requirements:	Separated serum from 4x red top (serum); AND
	Separated plasma 4x blue top (sodium citrate- plasma)

Sample Instructions	Please take plasma and serum samples PRIOR to IVIg therapy and anticoagulation. Treatment may result in false negatives.
	Separate serum and plasma into 500µL aliquots where possible. Ship frozen.
	Samples will need to be shipped as per the following instructions and include a copy of the completed form.

Samples will need to be shipped to these sites:

1. **NSW Referrals: send all sample aliquots (PLASMA and SERUM) for both ELISA and functional testing to:**

   Attn: VITT test samples, C/- Dr Vivien Chen
   Diagnostic Pathology unit
   Concord Repatriation General Hospital
   Hospital Road, CONCORD NSW 2139
   Tel: 02 9767 5892, Fax: 02 9767 8302

2. **Referrals from other Australian sites (all states other than NSW):**
   a. **Send 2 x serum aliquots to your local referral laboratory for ELISA VITT testing.** (Details on page 2).
   b. **Send the remaining SERUM sample aliquots and <u>all</u> PLASMA sample aliquots to:**

   VITT functional test samples
   Attn: Dr Vivien Chen
   Diagnostic Pathology unit - Coagulation laboratory
   Concord Repatriation General Hospital
   Hospital Road, CONCORD NSW 2139
   Tel: 02 9767 5892, Fax: 02 9767 8302

THANZ VITT/VIPIT Working Party Version 3.0 07/MAY/2021

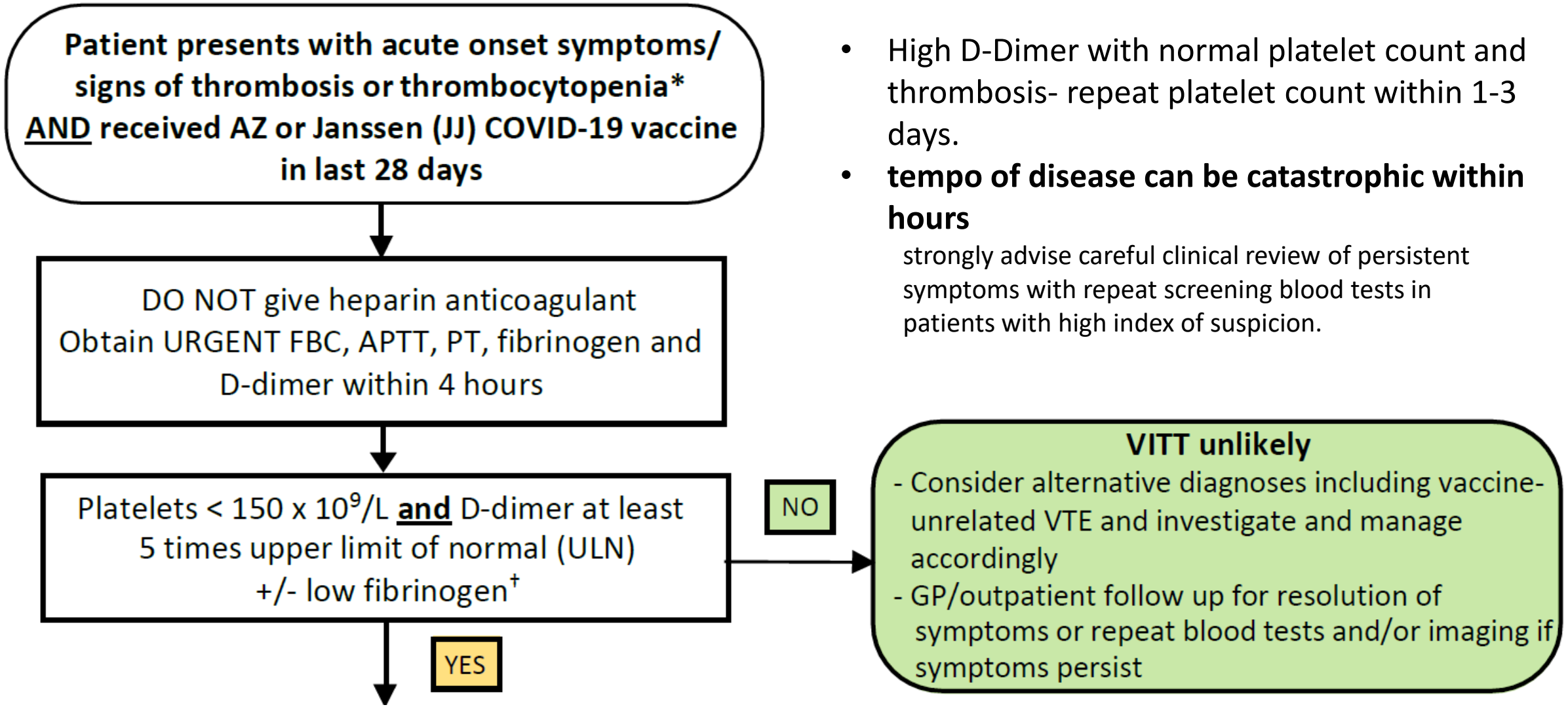
Second tier lab tests in suspected VITT

- Immunological assays for anti-platelet factor 4 (PF4) antibodies
- Only ELISA based assays consistently identify anti-PF4 antibodies in suspected VITT
- Other rapid assays used to successfully identify anti-PF4/heparin antibodies in suspected HITT **do not** (in general) identify anti-PF4 antibodies in suspected VITT
- Important to identify samples as being for suspected VITT (vs for suspected HITT) in order to have correct tests performed
- If testing for suspected VITT not indicated or no VITT form, then HITT testing may be performed (potential false negative for VITT)

Third tier lab tests in suspected VITT

- Functional assays for anti-platelet factor 4 (PF4) antibodies able to activate platelets
- Serotonin Release Assay (SRA)
- Heparin induced platelet aggregation (HIPA)
- Multiplate multiple electrode aggregometry (MEA) (platelet adhesion assay)
- Various flow-cytometry based assays of platelet activation
- Assay ‘modifications’ increase sensitivity & specificity for suspected VITT (vs HITT)

VITT: How to investigate



- High D-Dimer with normal platelet count and thrombosis- repeat platelet count within 1-3 days.
- **tempo of disease can be catastrophic within hours**

  strongly advise careful clinical review of persistent symptoms with repeat screening blood tests in patients with high index of suspicion.

Case 2

- 52 year old female
- Headache , nausea, vomiting
- No lower limb swelling
- 12 days post AZ vaccine

- ECOG 0, very active
- OCP related below knee DVT in her twenties
- SLE (non –active) and not on any treatment

CASE 2 day 7 post AZ vaccine (5 days prior)

Wd Emergency (JHH) Doc Dr Dragan Petkovi* Sp Blood CollT 11:11 26-Apr-21

Full Blood Count Report Status - FINAL Specimen Received Time - 11:58

WBC	4.5	NEUT	74	%	3.3			
RBC	4.28	BAND		%		OTHER		%
HGB	132	LYMPH	22	%	1.0	NRC		/100 WBC
HCT	0.392	MONO	3	%	0.1 L	ANRC	0.0	/100 WBC
MCV	92	EOSIN	0	%	0.0			
MCH	31	BASO	1	%	0.0			
MCHC	337	MET		%		WBC	4.5	
RDW	13.6	MYE		%		UNWBC	4.5	
PLT	151	PRO		%				
MPV	9.2	BLA		%				

Lower limb pain
USG lower limb normal

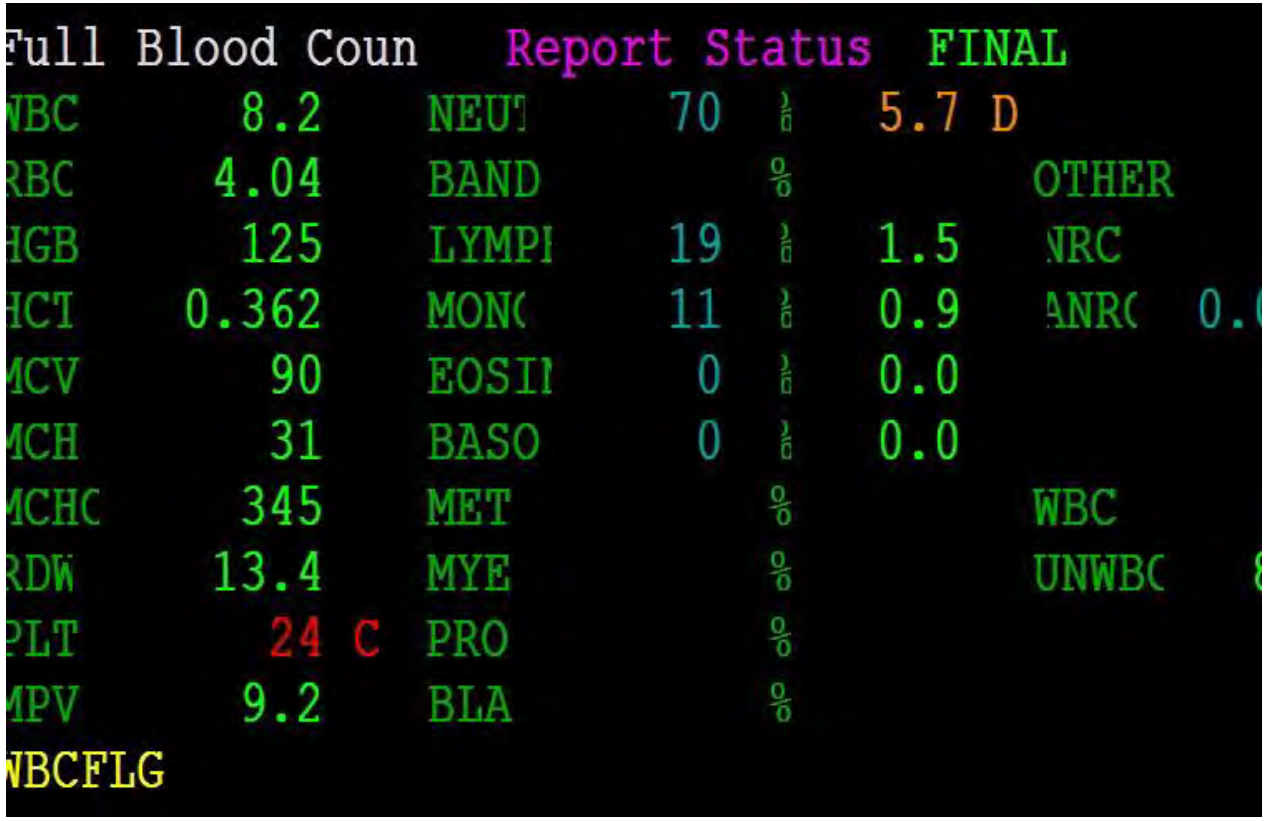
HAEMATOLOGY - COAGULATION TESTING Specimen: Blood

		Range	Units
PT	14	(11 - 16)	s
INR	0.9		
APTT	28	(24 - 36)	s
Fibrinogen	4.5 H	(2.0 - 4.0)	g/L
D-dimer	11 C	(< 0.50)	mg/L
D-Dimer Interpretation	POSITIVE (refer to comment)		

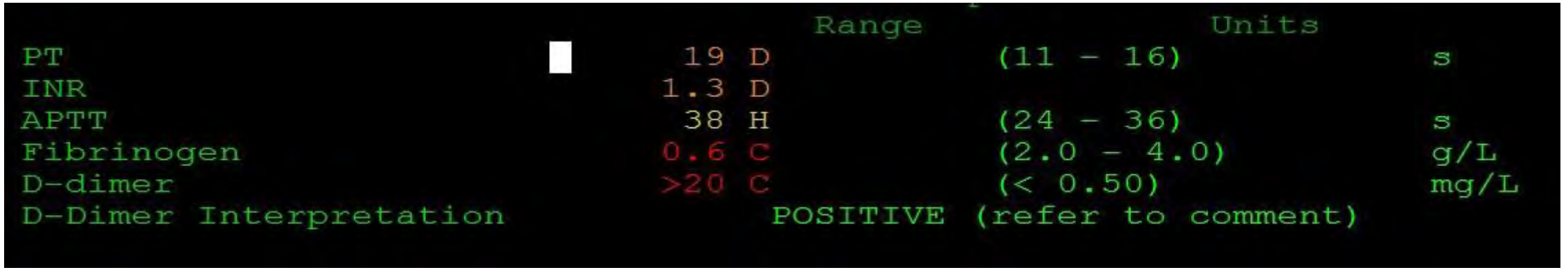
CASE 2 RETURNS

- D/C Home from ED as pain had resolved
- On day 11 post AZ developed worsening generalised headache, malaise, and rigours
- Day 12, headache persisted and progressed to intractable vomiting. Presented to Private ED and subsequently transferred to JHH ED
  - No focal neurology at that time on examination
  - No other symptoms to suggest other sites of pathology

CASE 2 RETURNS



Full Blood Coun		Report Status	FINAL		
WBC	8.2	NEUT	70 %	5.7 D	
RBC	4.04	BAND	%		OTHER
HGB	125	LYMPH	19 %	1.5	NRC
HCT	0.362	MONO	11 %	0.9	ANRC 0.(
MCV	90	EOSIN	0 %	0.0	
MCH	31	BASO	0 %	0.0	
MCHC	345	MET	%		WBC
RDW	13.4	MYE	%		UNWBC 8
PLT	24 C	PRO	%		
MPV	9.2	BLA	%		
WBCFLG					



		Range	Units
PT	19 D	(11 - 16)	s
INR	1.3 D		
APTT	38 H	(24 - 36)	s
Fibrinogen	0.6 C	(2.0 - 4.0)	g/L
D-dimer	>20 C	(< 0.50)	mg/L
D-Dimer Interpretation	POSITIVE (refer to comment)		

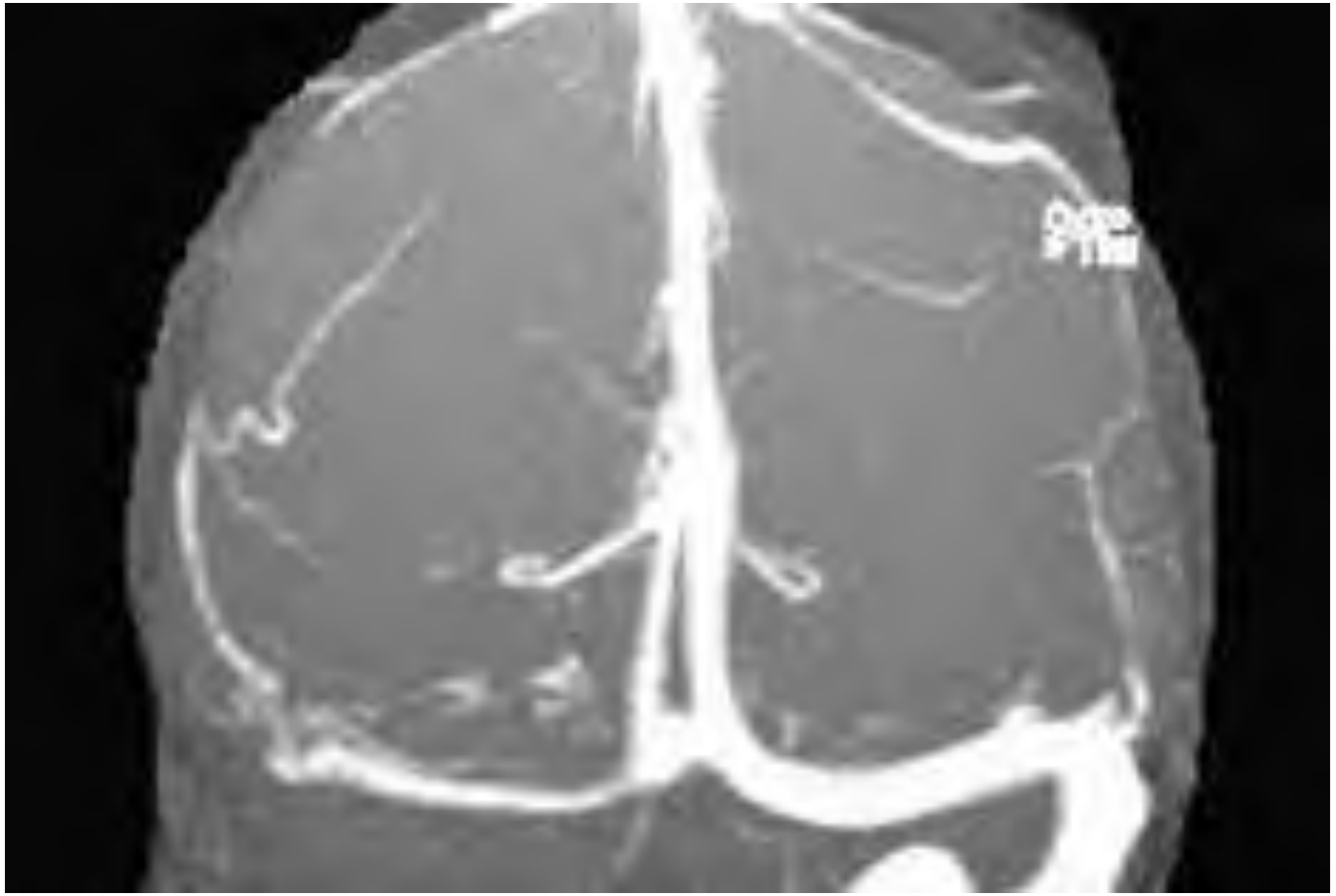
CASE 2 RETURNS

HAEMATOLOGY - LUPUS ANTICOAGULANT TESTING.

APTTLS	47.9	(25.0 - 53.0)
DRVLS	50.4	(29.0 - 51.0)

Lupus Anticoagulant :
No evidence of a Lupus Inhibitor.

Cardiolipin IgG-CIA	12
Cardiolipin IgG	Negative
Anti-B2GP1	< 6



CT Venogram

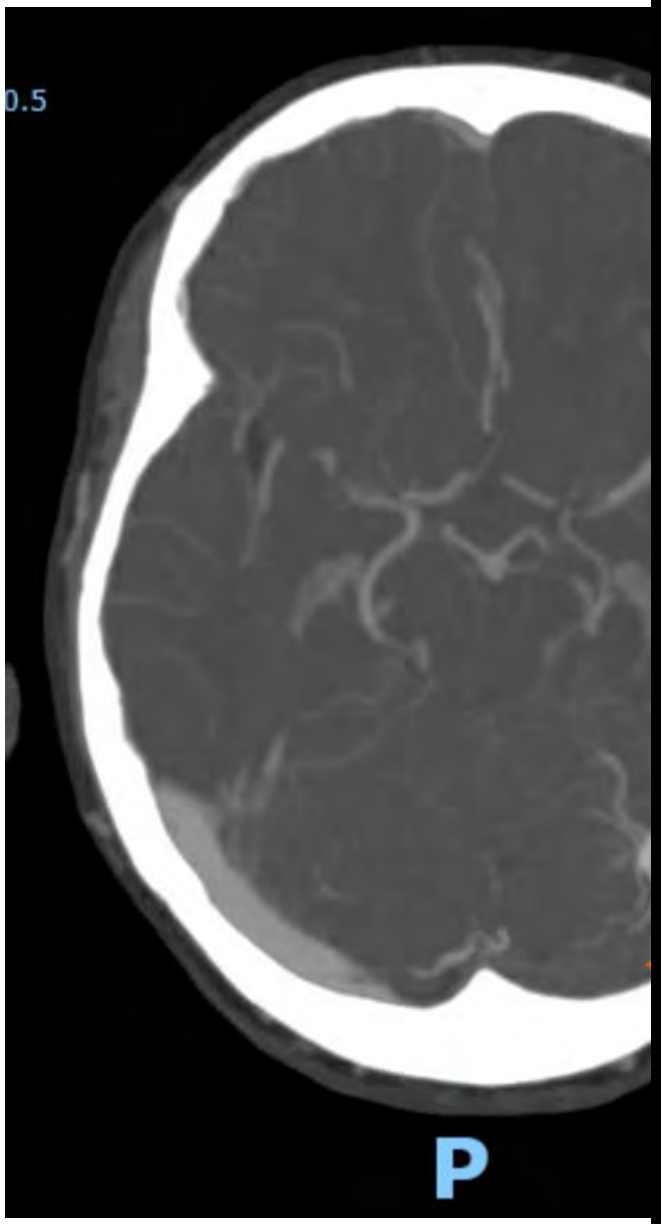
CASE 3 RETURNS - PROGRESS

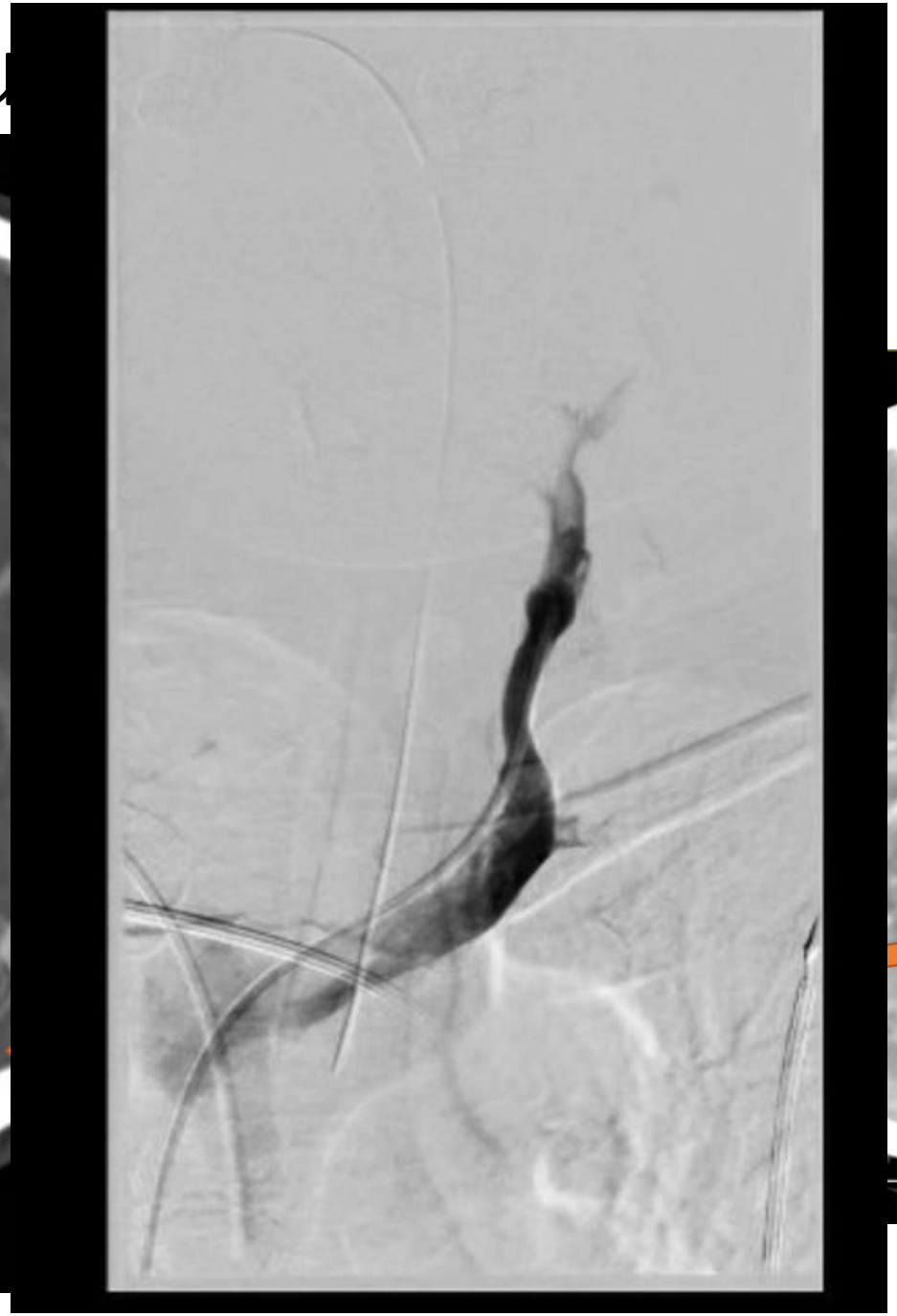
Initial VITT treatment:

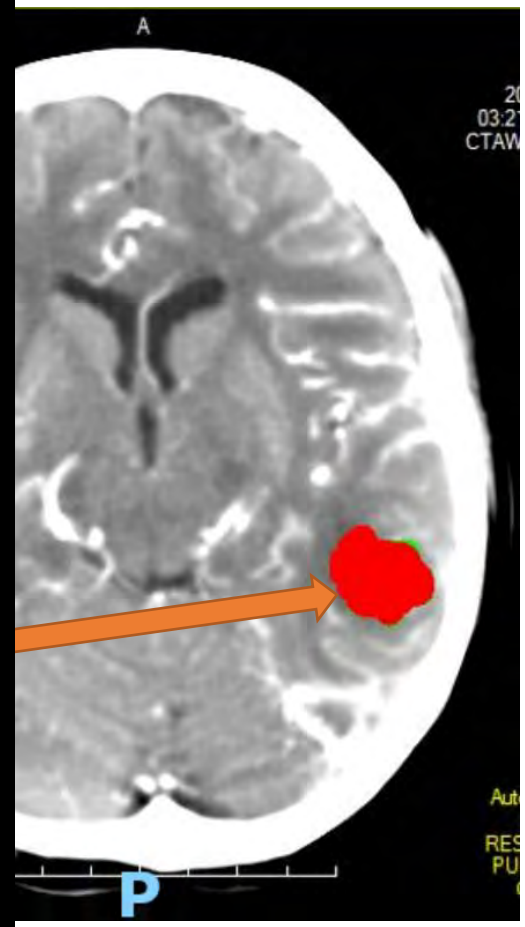
- Given 4 units of Cryoprecipitate due to low Fibrinogen
- Given IVIG 2G/KG over 2 doses
- Commenced on Argatroban infusion
- Monitored using aPTT

Day 2 of admission, developed new expressive dysphasia and ataxia

The next 24 hou







Management and recovery

- Platelets recovered to 164 on day 4 of admission (day 16 post AZ)
- Neurology stabilized and over the next several days began to improve
- Continued on Argatroban for 4 days post clot retrieval until
- neurology began to improve and haemorrhage appearance stable on
- repeat imaging
- Transitioned to Dabigatran
- Discharged to Stroke Rehab and progressing well

VITT Testing

- AcuStar heparin:PF4 Ab - not detected
- Further testing
  - HITS/VITT ELISA - positive
  - Functional SRA - positive
  - Flow cytometry - positive
  - Multiplate - positive

Management principles of suspected TTS/VITT

- Testing for presence of anti-PF4 antibodies (**selected reference labs only**)
- Use non-heparin anticoagulants (e.g. IV Argatroban, IV bivalrudin, IV danaparoid, SC fondaparinux, or direct oral anticoagulants)
- Avoid platelet transfusions, except if bleeding or for neurosurgical interventions
- Consider IV immunoglobulin (or plasma exchange for very severe cases)

THANZ Advisory Statement May 2021 https://www.thanz.org.au/documents/item/591
British Society Guideline May 2021 https://b-s-h.org.uk/media/19718/guidance-v20-20210528-002.pdf
ASH guidelines https://www.hematology.org/covid-19/vaccine-induced-immune-thrombotic-thrombocytopenia

FAQ 1. What anticoagulant to use?

Non-heparin anticoagulation, chosen based on the clinical status and organ function of the patient:

- Parenteral direct thrombin inhibitors (argatroban or bivalrudin provided the baseline aPTT is normal), OR
- Direct oral anticoagulants without lead-in heparin phase, OR
- Fondaparinux, OR
- Danaparoid

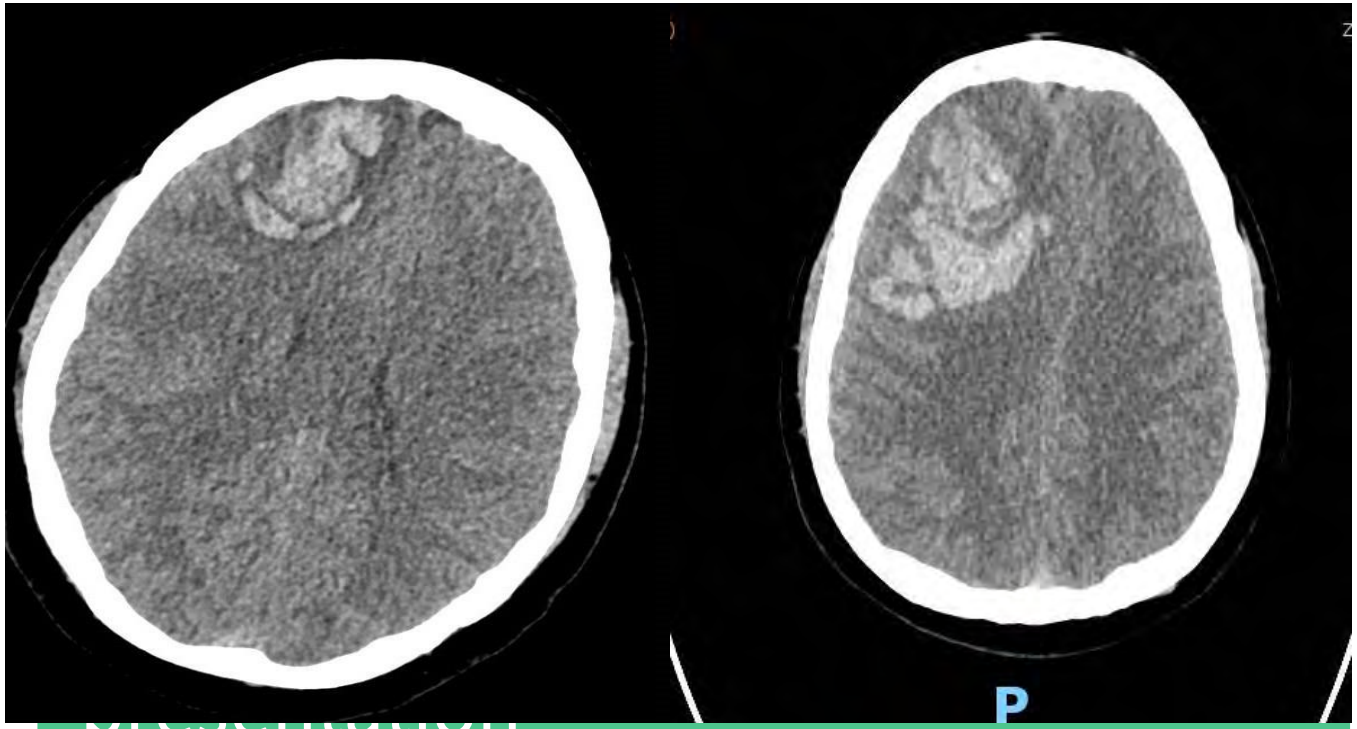
If clot burden significant – parenteral followed by a DOAC

Initial therapy continued……

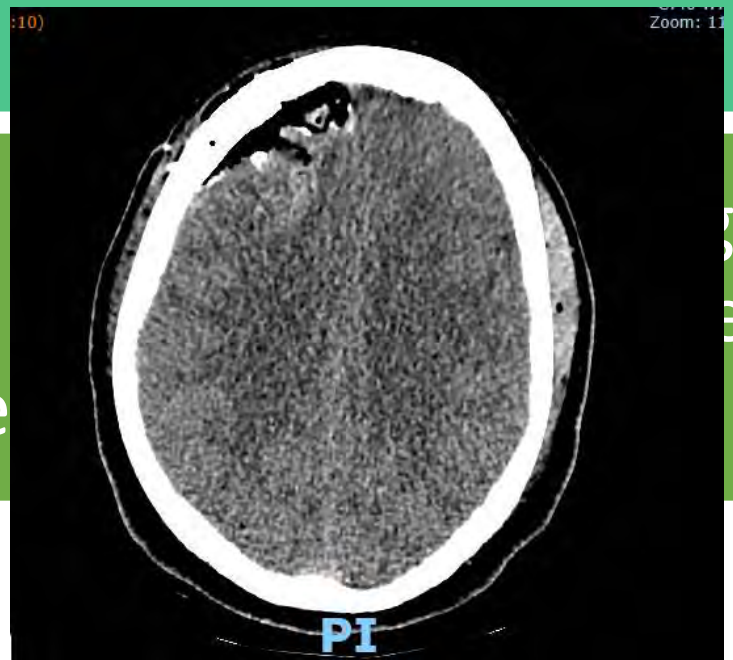
While there is no direct evidence that heparin products worsen TTS, the similarities of the syndrome to HIT **suggest avoidance of unfractionated or low-molecular-weight heparin** in patients with a positive PF4 ELISA, or while awaiting test results.

IVIG 1 g/kg daily for two days , if thrombocytopenia and significant clot burden

FAQ.2. What is the role for neuro-intervention or neurosurgery in CVST?



presentation



Whilst
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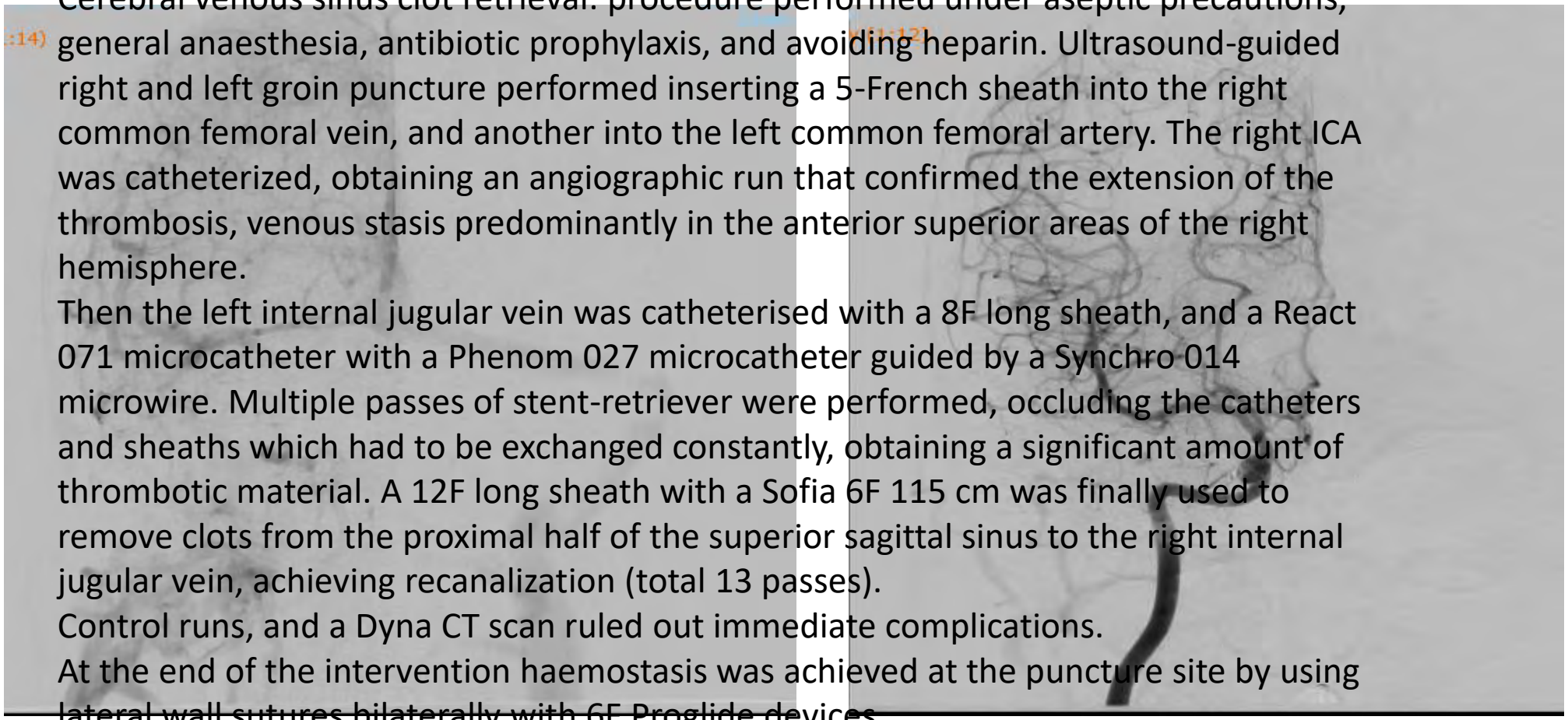
Within the next 24 hours - also underwent thrombectomy and clot retrieval



Cerebral venous sinus clot retrieval: procedure performed under aseptic precautions, general anaesthesia, antibiotic prophylaxis, and avoiding heparin. Ultrasound-guided right and left groin puncture performed inserting a 5-French sheath into the right common femoral vein, and another into the left common femoral artery. The right ICA was catheterized, obtaining an angiographic run that confirmed the extension of the thrombosis, venous stasis predominantly in the anterior superior areas of the right hemisphere.

Then the left internal jugular vein was catheterised with a 8F long sheath, and a React 071 microcatheter with a Phenom 027 microcatheter guided by a Synchro 014 microwire. Multiple passes of stent-retriever were performed, occluding the catheters and sheaths which had to be exchanged constantly, obtaining a significant amount of thrombotic material. A 12F long sheath with a Sofia 6F 115 cm was finally used to remove clots from the proximal half of the superior sagittal sinus to the right internal jugular vein, achieving recanalization (total 13 passes).

Control runs, and a Dyna CT scan ruled out immediate complications.

At the end of the intervention haemostasis was achieved at the puncture site by using lateral wall sutures bilaterally with 6F Proglide devices.

Conclusion: Extensive CVST recanalized by 13 passes of SR and aspiration.

Circulation

Indications for the Performance of Intracranial Endovascular Neurointerventional Procedures: A Scientific Statement From the American Heart Association

Clifford J. Eskey, Philip M. Meyers, Thanh N. Nguyen, Sameer A. Ansari, Mahesh Jayaraman, Cameron G. McDougall, J. Kevin DeMarco, William A. Gray, David C. Hess, Randall T. Higashida, Dilip K. Pandey, Constantino Peña, Hermann C. Schumacher, and and On behalf of the American Heart Association Council on Cardiovascular Radiology and Intervention and Stroke Council

Originally published 19 Apr 2018 | https://doi.org/10.1161/CIR.0000000000000567 | Circulation. 2018;137:e661–e689 |

Patients with CVT should be treated with systemic anticoagulation as first-line therapy.

In patients with CVT who are at high risk for deterioration (severely depressed mental status, coma, straight sinus thrombosis at presentation; those with neurological deterioration or increasing intracranial hemorrhage despite systemic anticoagulation),

the use of endovascular techniques, including direct intra-sinus thrombolysis or mechanical thrombectomy, may be considered.

FAQ.3. What if there is bleeding?

Low fibrinogen or bleeding are associated with TTS and should not absolutely preclude anticoagulation

Particularly if platelets are >20,000/µL or rising following IVIG initiation

Cryoprecipitate used in bleeding and low fibrinogen(< 1g/dl)

Avoid aspirin as either treatment or prophylaxis for TTS. Aspirin is not efficacious in preventing HIT antibodies from activating platelets and could increase the risk of bleeding in TTS.

FAQ.4. What to do if there is catastrophic thrombosis?

Corticosteroids have been administered along with IVIG in some cases, Methylprednisolone in severe thrombosis.

PEX : The large extravascular volume of distribution of IgG antibodies, and the concurrent bleeding complications in TTS may make catheter placement and prolonged apheresis challenging

Complement inhibition with eculizumab has been utilized in case reports

Early detection – clinical suspicion

Monitor platelet counts if all else is normal but d-dimer very raised

Low threshold for imaging investigation

Unusual sites of thrombosis or increased burden of thrombosis.

43 year old who ignored headaches for a week and presented with seizures and extensive CVST !

Have an ED pathway and early involvement of Haematologist

QUESTIONS please post?

THANK YOU

ACKNOWLEDGEMENTS

Local, national and international collaborators

THANZ VITT advisory group led by A/Prof Vivien Chen

VITT ELISA group led by Dr Emannuel Favaloro

Please refer to theTHANZ website which is updated weekly - https://www.thanz.org.au/

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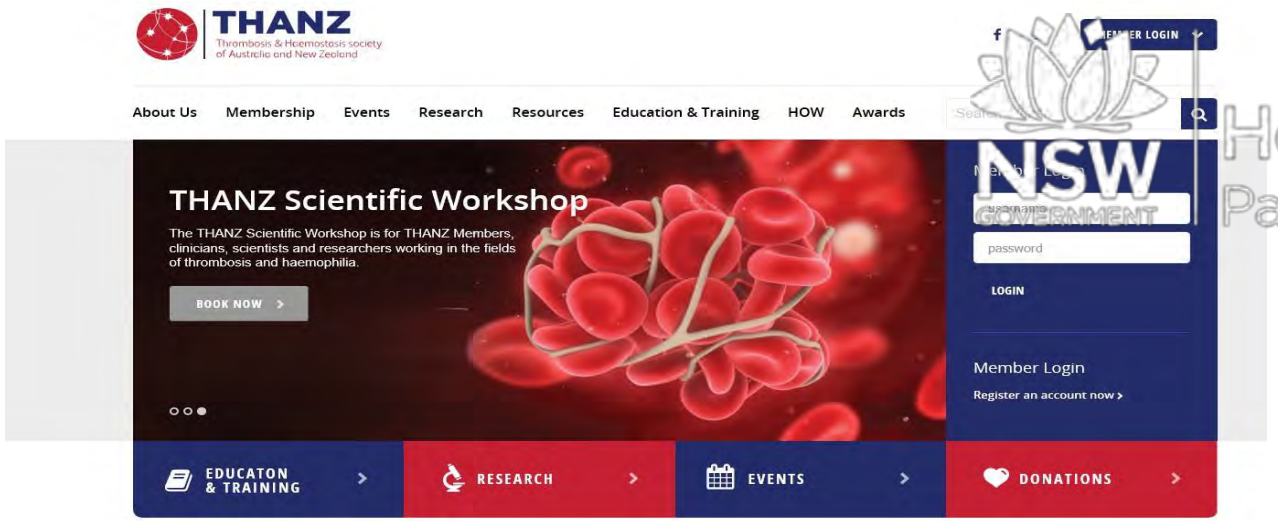

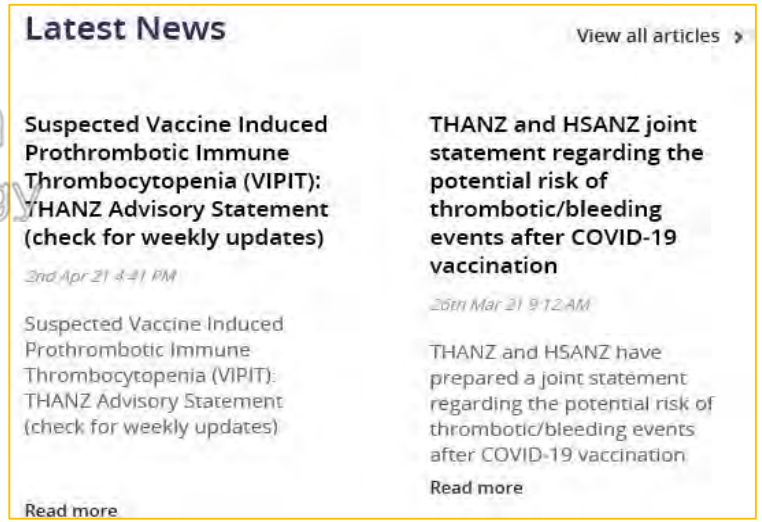

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