

A TEN YEAR OLD BOY WITH NO SIGNIFICANT PMH PRESENTS TO THE EMERGENCY DEPARTMENT WITH A FEVER OF 103, RR IN THE 40S, HR OF 110, AND A BP OF 80/50. HE'S ILL APPEARING AND PALE, WITH DELAYED CAPILLARY REFILL OF >3 SECONDS AND 1+ PULSES. TWO LARGE BORE IVS ARE PLACED AND FLUID RESUSCITATION IS STARTED, LAB AND CULTURES ARE DRAWN, ANTIBIOTICS STARTED. A FEW MINUTES AFTERWARD THE NURSE CALLS YOUR ATTENTION TO PERSISTENT OOZING OF BLOOD FROM BOTH CATHETER SITES. YOU NOTICE NEW SCATTERED PETECHIAE ON THE PATIENT'S SKIN. THE LAB CALLS WITH CRITICAL VALUES FOR SOME OF THE LABS YOU ORDERED:

**PT 18**

**PTT 121**

**INR 1.7**

**D DIMER 3**

**FIBRINOGEN 120**

**PLATELETS 75,000.**

YOU KNOW THE PATIENT IS MANIFESTING DISSEMINATED INTRAVASCULAR COAGULATION. THE NEXT BEST STEP IN TREATING THIS PATIENT'S DIC IS:

- A. Antifibrinolytics
- B. Transfusing FFP
- C. Transfusing cryoprecipitate
- D. Hemodialysis

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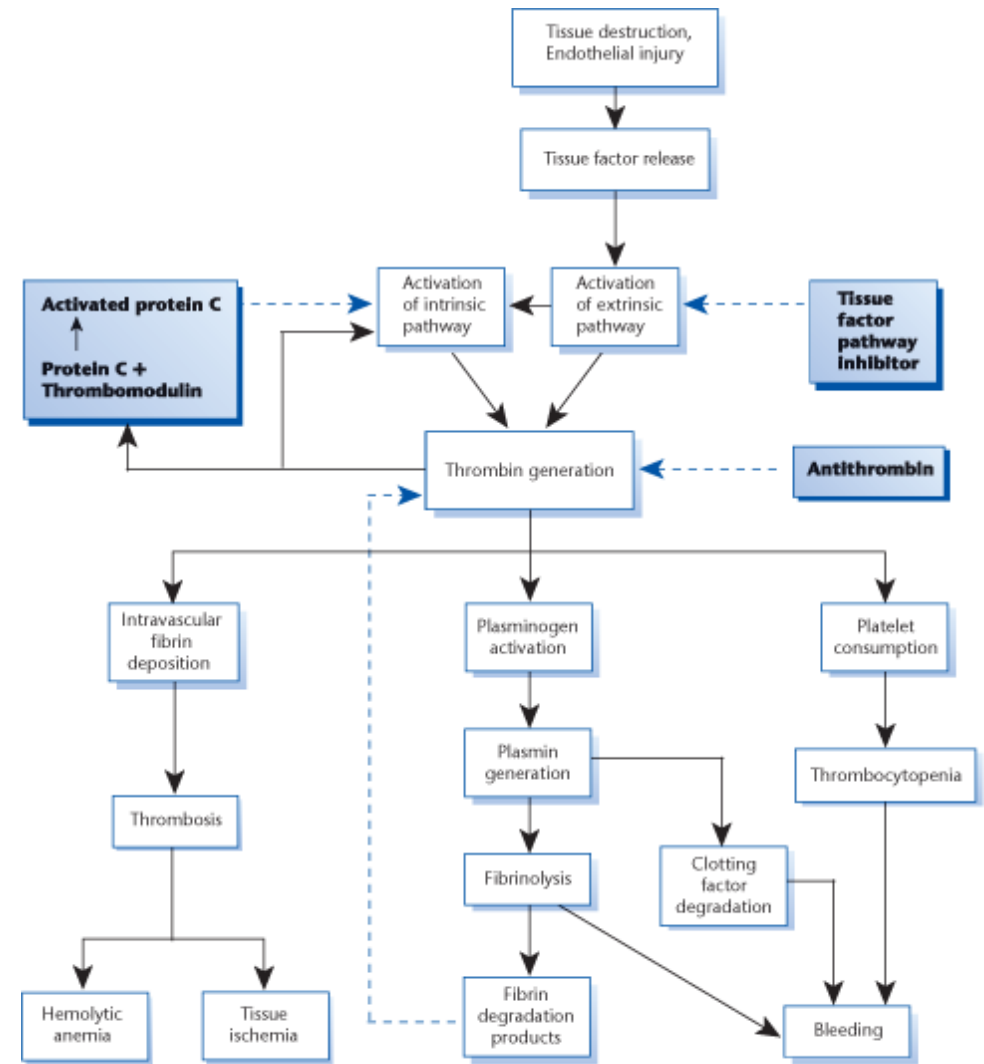
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# DIC: BLEEDING AND CLOTTING



Blue color indicates inhibitors of coagulation

**Bleeding type**

**Massive bleeding  
type**



**Asymptomatic  
type**



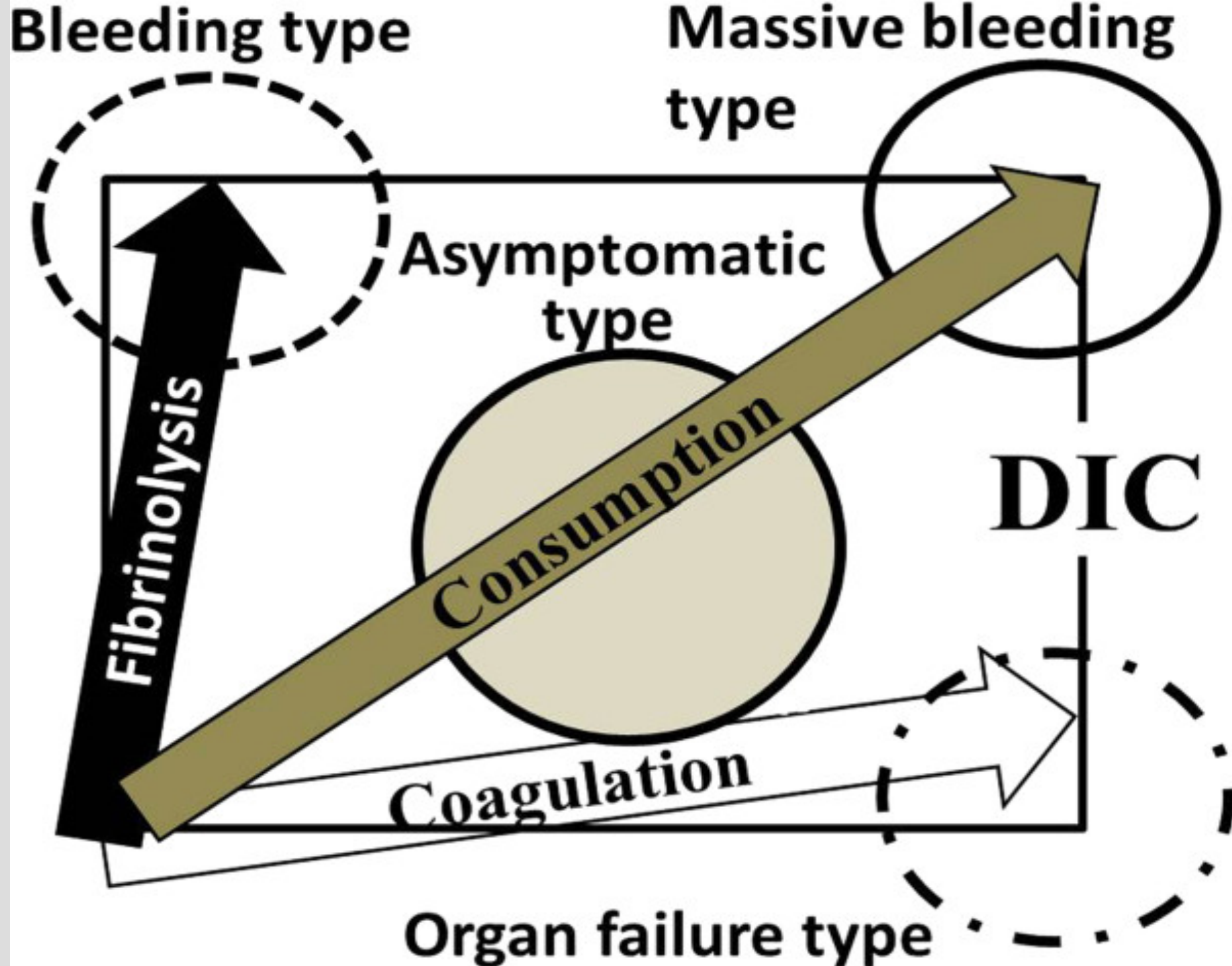
**Fibrinolysis**

**Consumption**

**DIC**

**Coagulation**

**Organ failure type**



## Japanese Association for Acute Medicine (JAAM) scoring system for disseminated intravascular coagulation (DIC)

	Score
<b>SIRS criteria met*:</b>	
≥3	1
0 to 2	0
<b>Platelet count (per microl):</b>	
<80 or >50% decrease within 24 hours	3
81 to 120 or 30 to 50% decreased within 24 hours	1
≥120	0
<b>Prothrombin time (PT):</b>	
INR ≥1.2	1
INR <1.2	0
<b>Fibrinogen level (mg/dL):</b>	
<35	1
≥35	0
<b>Fibrin/fibrinogen degradation products (mcg/mL):</b>	
≥25	3
10 to 24	1
<10	0
<b>Score interpretation: DIC is diagnosed if total score is ≥4.</b>	

JAAM: Japanese Association for Acute Medicine; DIC: disseminated intravascular coagulation; SIRS: systemic inflammatory response syndrome; PT: prothrombin time; INR: international normalized ratio.

\* SIRS criteria include abnormal (high or low) core temperature, tachycardia, tachypnea, and abnormal (high or low) leukocyte count. For details of SIRS criteria, refer to UpToDate topic reviews on sepsis and SIRS in adult and pediatric patients.

From: Gando S, Iba T, Eguchi Y, et al. A multicenter, prospective validation of disseminated intravascular coagulation diagnostic criteria for critically ill patients: comparing current criteria. *Crit Care Med* 2006; 34:625. DOI: 10.1097/01.CCM.0000202209.42491.38. Copyright © 2006 Society of Critical Care Medicine. Reproduced with permission from Wolters Kluwer Health. Unauthorized reproduction of this material is prohibited.

Additional information from:

- Gando S, Saitoh D, Ogura H, et al. Natural history of disseminated intravascular

## International Society on Thrombosis and Haemostasis (ISTH) scoring system for disseminated intravascular coagulation (DIC)

1. Risk assessment: Does the patient have an underlying disorder known to be associated with overt DIC?*	
<ul style="list-style-type: none"> <li>■ If yes, proceed.</li> <li>■ If no, do not use this scoring system.</li> </ul>	
2. Obtain the following laboratory tests:	
<ul style="list-style-type: none"> <li>■ Platelet count</li> <li>■ Fibrin-related markers (eg, fibrin degradation products [FDPs], soluble fibrin monomers, D-dimer<sup>†</sup>)</li> <li>■ Prothrombin time (PT)</li> <li>■ Fibrinogen</li> </ul>	
3. Assign score for each laboratory parameter:	Score:
Platelet count (per microl):	
<ul style="list-style-type: none"> <li>■ &gt;100,000</li> </ul>	0
<ul style="list-style-type: none"> <li>■ 50,000 to 100,000</li> </ul>	1
<ul style="list-style-type: none"> <li>■ &lt;50,000/microl =</li> </ul>	2
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<ul style="list-style-type: none"> <li>■ No increase</li> </ul>	0
<ul style="list-style-type: none"> <li>■ Moderate increase</li> </ul>	2
<ul style="list-style-type: none"> <li>■ Strong increase</li> </ul>	3
PT:	
<ul style="list-style-type: none"> <li>■ Prolonged &lt;3 seconds</li> </ul>	0
<ul style="list-style-type: none"> <li>■ Prolonged 3 to 6 seconds</li> </ul>	1
<ul style="list-style-type: none"> <li>■ Prolonged &gt;6 seconds</li> </ul>	2
Fibrinogen level:	
<ul style="list-style-type: none"> <li>■ &gt;100 mg/dL (&gt;1.0 g/L)</li> </ul>	0
<ul style="list-style-type: none"> <li>■ &lt;100 mg/dL (&lt;1.0 g/L)</li> </ul>	1
4. Calculate total score: Add individual scores for each laboratory parameter.	
5. Score interpretation:	
<ul style="list-style-type: none"> <li>■ ≥5: Compatible with overt DIC. Repeat scoring daily.</li> <li>■ &lt;5: Suggestive (not affirmative) for non-overt DIC. Repeat in 1 to 2 days.</li> </ul>	

\* Causes of DIC in children include infection, trauma, burns, malignancy, acute and chronic liver disease (including Reye syndrome), microangiopathic disorders (eg, Kasabach-Merritt syndrome), and congenital thrombotic disorders (eg, homozygous deficiencies of protein C and S, antithrombin III deficiency). Additional causes in neonates include birth asphyxia, respiratory distress syndrome, meconium aspiration, amniotic fluid aspiration, necrotizing enterocolitis.

<sup>†</sup> Although D-dimer is not explicitly included in this scoring system, elevated D-dimer is a strong indicator of fibrinolysis and is more specific than FDPs.

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Table 2

**Laboratory tests for DIC**

	<b>Abnormality in DIC</b>	<b>Other cause for the abnormality</b>	<b>Adequate type of DIC</b>
PT	Prolongation	Liver dysfunction, vitamin K deficiency	OF, BL, MB
FDP, D-dimer	Elevation	Venous thromboembolism, operation	BL, NS, OF
Fibrinogen	Reduction	Liver dysfunction	BL, MB
Platelet count	Reduction	Bone marrow disorders	OF, MB, BL, NS
AT/PC	Reduction	Liver dysfunction, capillary leak syndrome	OF
SF/TAT	Elevation	Venous thromboembolism, operation	OF, NS, BL, MS
TM	Elevation	Renal dysfunction, organ failure	OF
VWFpp, PAI-I	Elevation	Organ failure	OF
ADATMTS13	Reduction	Liver dysfunction, thrombotic microangiopathy	OF
APTT	Biphasic waveform	Infection	OF
PPIC	Elevation	Venous thromboembolism, operation	BL, MB

PT, prothrombin time; FDP, fibrinogen and fibrin degradation products; SF, soluble fibrin; AT, antithrombin; PC, protein C; TAT, thrombin AT complex; VWFpp, von Willebrand factor propeptide; PAI-I, plasminogen activator inhibitor-I; APTT, activated partial thromboplastin time; PPIC, plasmin-plasmin inhibitor complex; OF, organ failure type of DIC; BL, bleeding type of DIC; MB, massive bleeding type of DIC; NS, non-symptomatic type of DIC.

# COMMON CAUSES OF DIC IN KIDS

- Sepsis
- Trauma (ie severe brain injuries)
- Malignancies (ie AML)
- Newborns – especially preterm - are vulnerable to DIC because the anticoagulants (antithrombin and protein C) are normally low at this age
  - sepsis
  - birth asphyxia
  - respiratory distress syndrome (RDS)
  - necrotizing enterocolitis (NEC)



# COMMON THINGS THAT LOOK LIKE DIC IN KIDS

- Liver failure
- HELLP syndrome
  - pregnant teens with HTN
- Massive transfusion
  - replacement of more than 1 blood volume in 24 hours or the replacement of 50% of the total blood volume within 3 hours.
- TTP
  - fever, thrombocytopenia, microangiopathic hemolytic anemia, renal failure, and neurologic signs.
  - Screening coagulation tests (PT,PTT) are usually normal
- HUS
  - microangiopathic hemolytic anemia, thrombocytopenia, and renal insufficiency in a kid <3 years

## TREATMENT:

1. Treat underlying cause
2. Supportive care: transfuse for:
  1. platelet counts  $<50,000/\mu\text{L}$
  2. fibrinogen concentration  $<100 \text{ mg/dL}$
  3. prolonged APTT or PT (greater than 1.5 times the normal value)

**Table 3****Treatment of DIC in four types of DIC**

<b>Treatment</b>	<b>Non-symptomatic type</b>	<b>Organ failure type</b>	<b>Bleeding type</b>	<b>Massive bleeding type</b>
Underlying conditions	R	R	R	
Blood transfusion			R	R
Heparin	R		NR	NR
Anti-Xa			NR	NR
Synthetic protease inhibitor			R	R
Natural protease inhibitor		R		NR
Antifibrinolytic treatment	NR	NR	R	R

R, recommended; NR, not recommended.

## TAKE HOME POINTS

1. Number one treatment for DIC is to aggressively treat the underlying cause
2. Key labs to get: Coags, Platelets, Ddimer, Fibrinogen
3. Multiple Scoring Systems to dx

### References:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4267589/>

<https://pediatriccare.solutions.aap.org/chapter.aspx?sectionid=137957861&bookid=1626#160127442>

[https://www.uptodate.com/contents/disseminated-intravascular-coagulation-in-infants-and-children?source=history\\_widget#H2](https://www.uptodate.com/contents/disseminated-intravascular-coagulation-in-infants-and-children?source=history_widget#H2)