Disseminated Intravascular Coagulation

D I C

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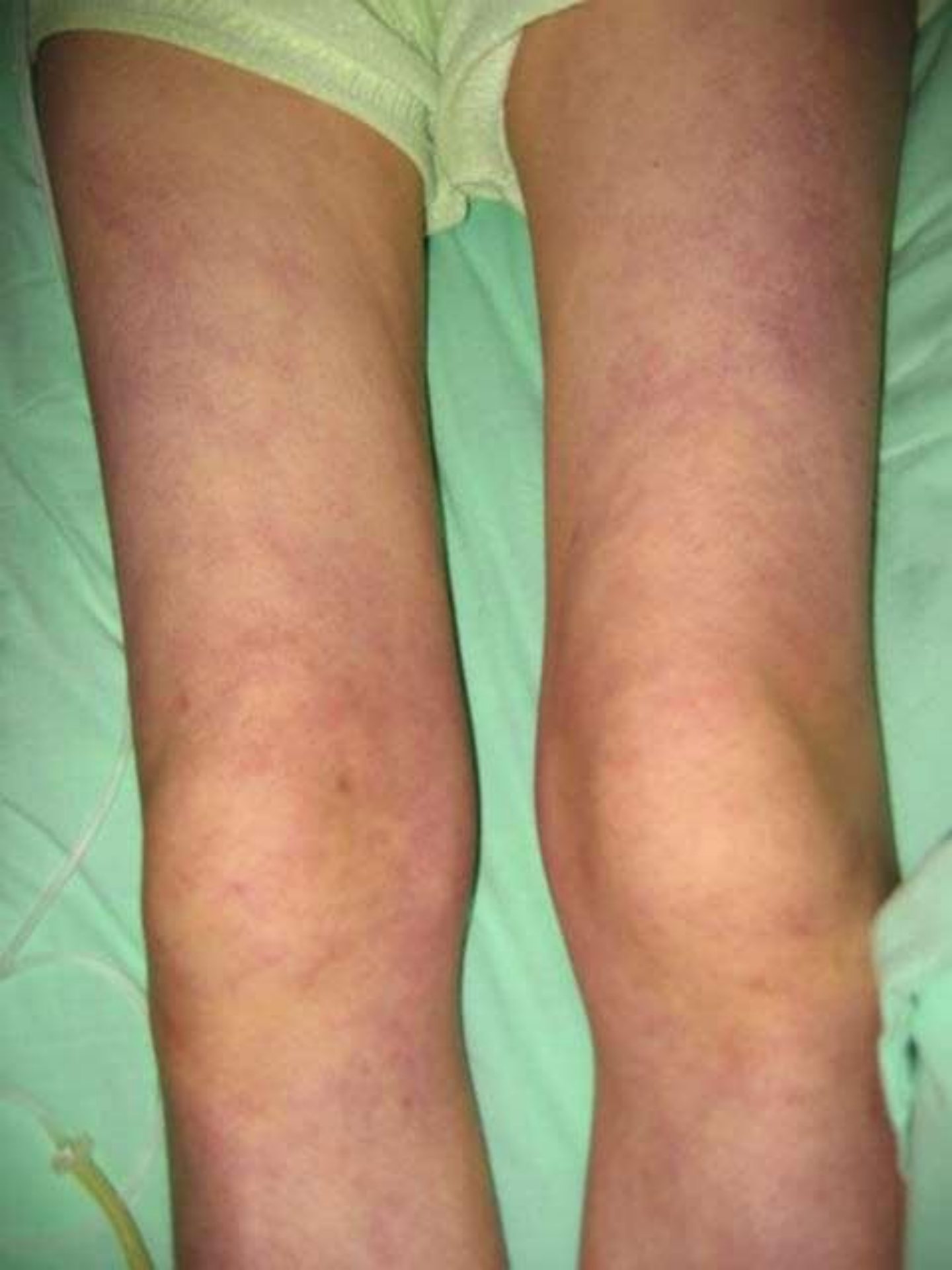


General Considerations

DIC is not a kind of independent disease, but a middle process or complication of some diseases .

It is essentially an imbalance between the coagulation process and anticoagulation process. It is a syndrome characterized by massive activation and consumption of coagulation proteins, fibrinolytic proteins and platelets.

Coagulation is usually confined to a localized area by the combination of blood flow and circulating inhibitors of coagulation, especially antithrombin III . If the stimulus to coagulation is too great, these control mechanisms can be overwhelmed, leading to the syndrome of DIC.

Classification

Acute DIC :It happened rapidly, the coagulopathy is dominant and major symptoms are bleeding and shock, mainly seen in severe infection, amniotic fluid embolism.

Chronic DIC: it happened slowly and last several weeks, thrombosis and clotting may predominate mainly seen in cancer.

Etiology

DIC is not a primary disease, but a disorder secondary to numerous triggering events such as serious illnesses.

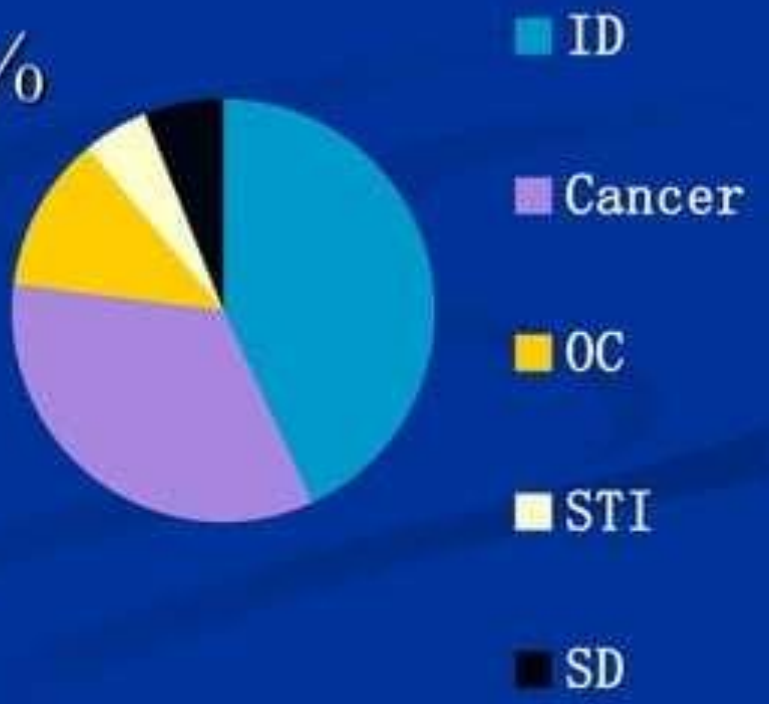
infectious disease 31%~43%

cancer 24%~34%

obstetric complications 4%~12%

severe tissue injury 1%~5%

systemic disease



- infectious disease 31%~43%

(bacterial, viral, rickettsial, parasitic diseases and so on) Bacterial infection, in particular septicemia, is commonly associated with DIC. However, systemic infections with other microorganisms, such as viruses and parasites, also may lead to DIC.

- cancer 24%~34%

(Acute promyelocytic leukemia, acute myelomonocytic or monocytic leukemia, disseminated prostatic carcinoma
Lung, breast, gastrointestinal malignancy)

- obstetric complications

4%~12%

(amniotic fluid embolus, septic abortion, retained fetus and so on)

- severe tissue injury 1%~5%

(burn, heart shock, fracture and so on)

Head trauma in particular is strongly associated with DIC; both local and systemic activation of coagulation may be detected after such an event. The increased risk of DIC after head trauma is understandable in view of the relatively large amount of tissue factor in the cerebral compartment.

- systemic disease

(malignant hypertension , Acute respiratory distress syndrome<ARDS>, hemolytic transfusion reaction)

Pathophysiology

DIC occurs when monocytes and endothelial cells are activated or injured by toxic substances elaborated in the course of certain diseases. The response of monocytes and endothelial cells to injury is to generate tissue factor on the cell surface, activating the coagulation cascade .

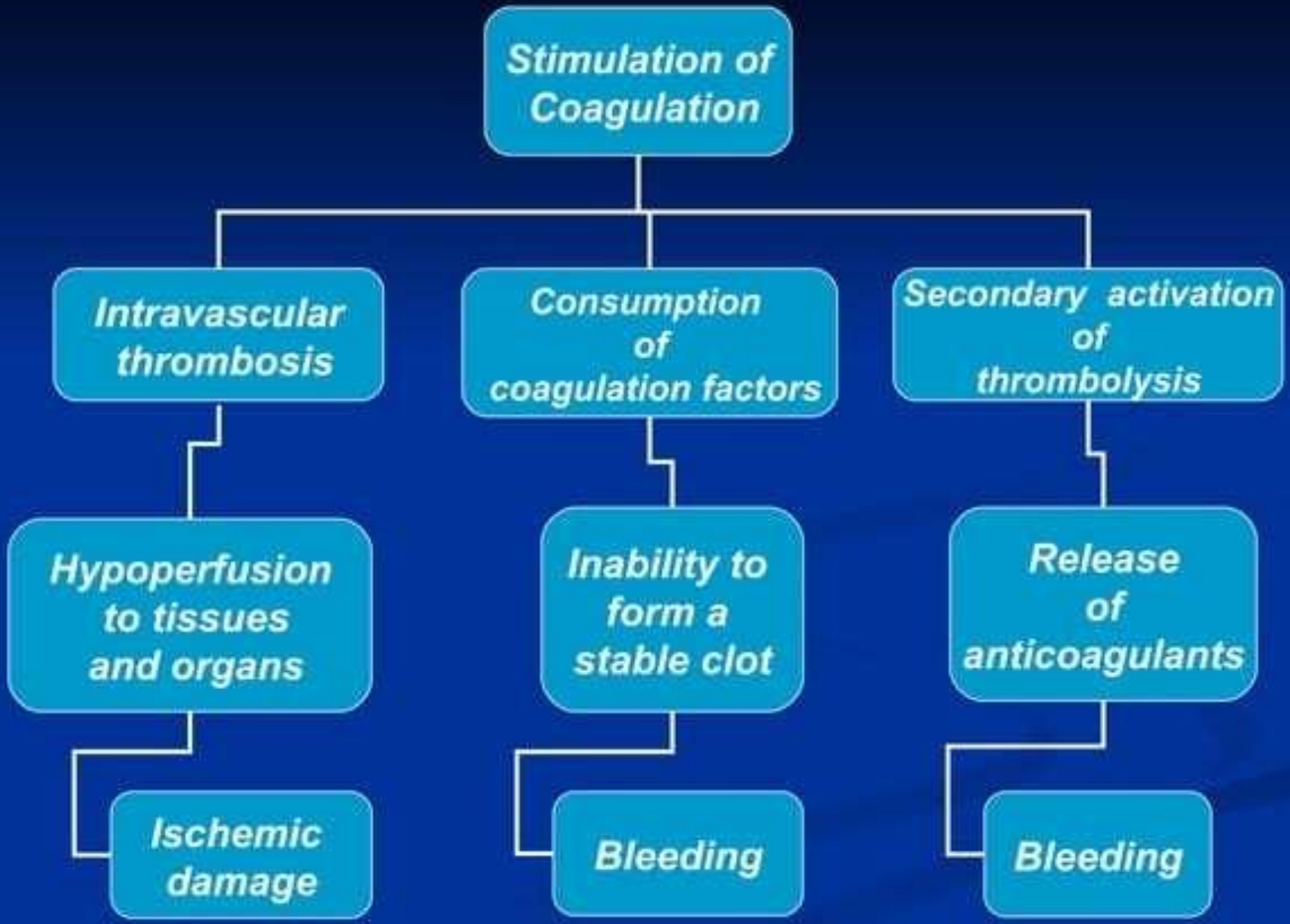
In acute DIC, an explosive generation of thrombin depletes clotting factors and platelets and activates the fibrinolytic system. Bleeding into the subcutaneous tissues, skin, and mucous membranes occurs, along with occlusion of blood vessels caused by fibrin in the microcirculation.

In chronic DIC, the process is the same, but it is less explosive. Usually there is time for compensatory responses to take place, which diminish the likelihood of bleeding but give rise to a hypercoagulable state.

These changes in the blood can be detected by testing the coagulation system.

Thromboembolism occurs in this setting, and when oral anticoagulants are given following heparin therapy, there is a tendency for it to recur.

Long-term therapy with low-molecular-weight heparin may be a solution to this problem until the underlying cause can be brought under control.


Stimulation of Coagulation
Intravascular thrombosis
Consumption of coagulation factors
Secondary activation of thrombolysis
Hypoperfusion to tissues and organs
Inability to form a stable clot
Release of anticoagulants
Ischemic damage
Bleeding
Bleeding

Diagnosis

- Symptoms and Signs
- Laboratory Findings
- Different Diagnosis

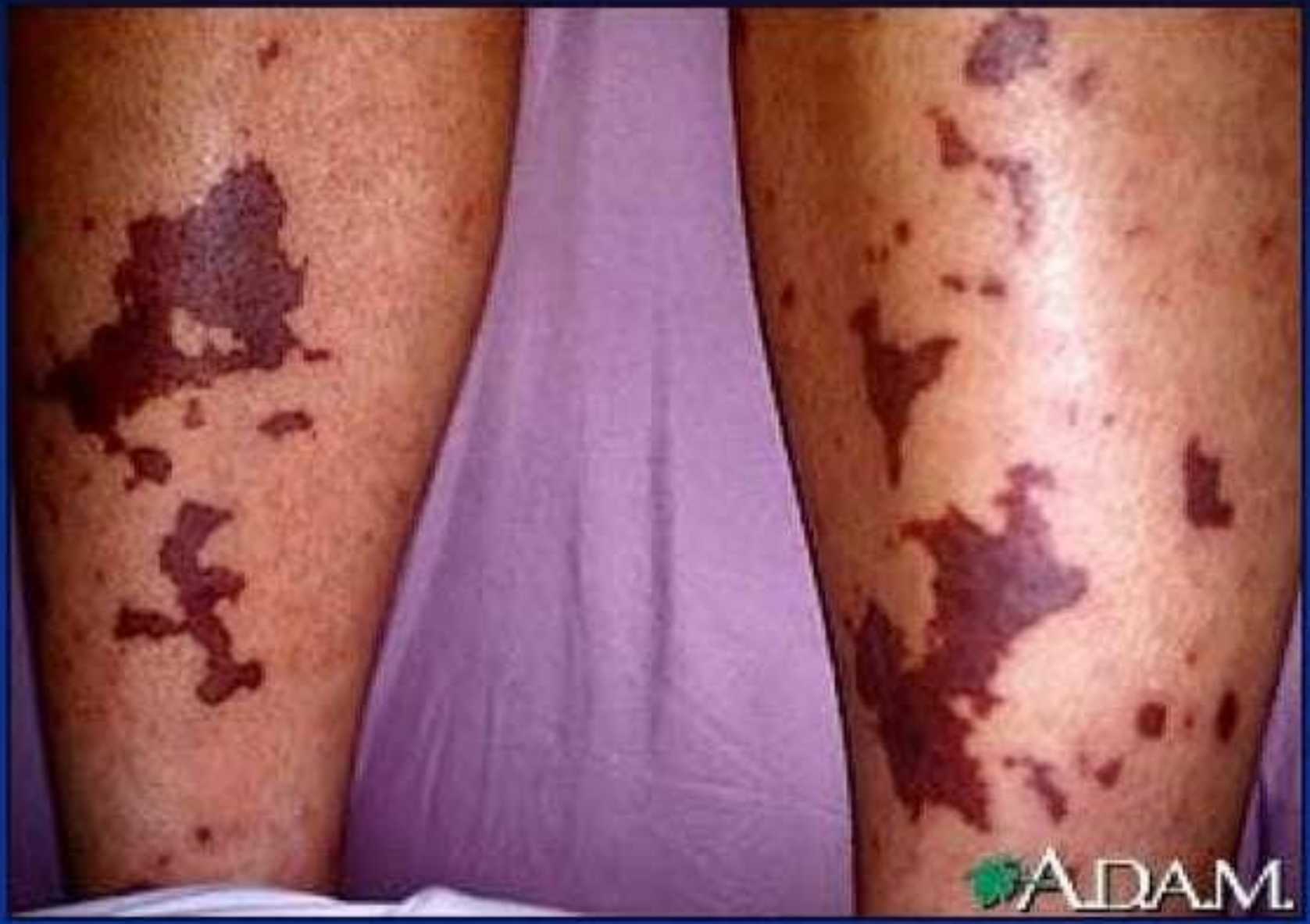
Symptoms and Signs

- Bleeding
- Thrombosis
- Hypotension or shock
- Organ dysfunction

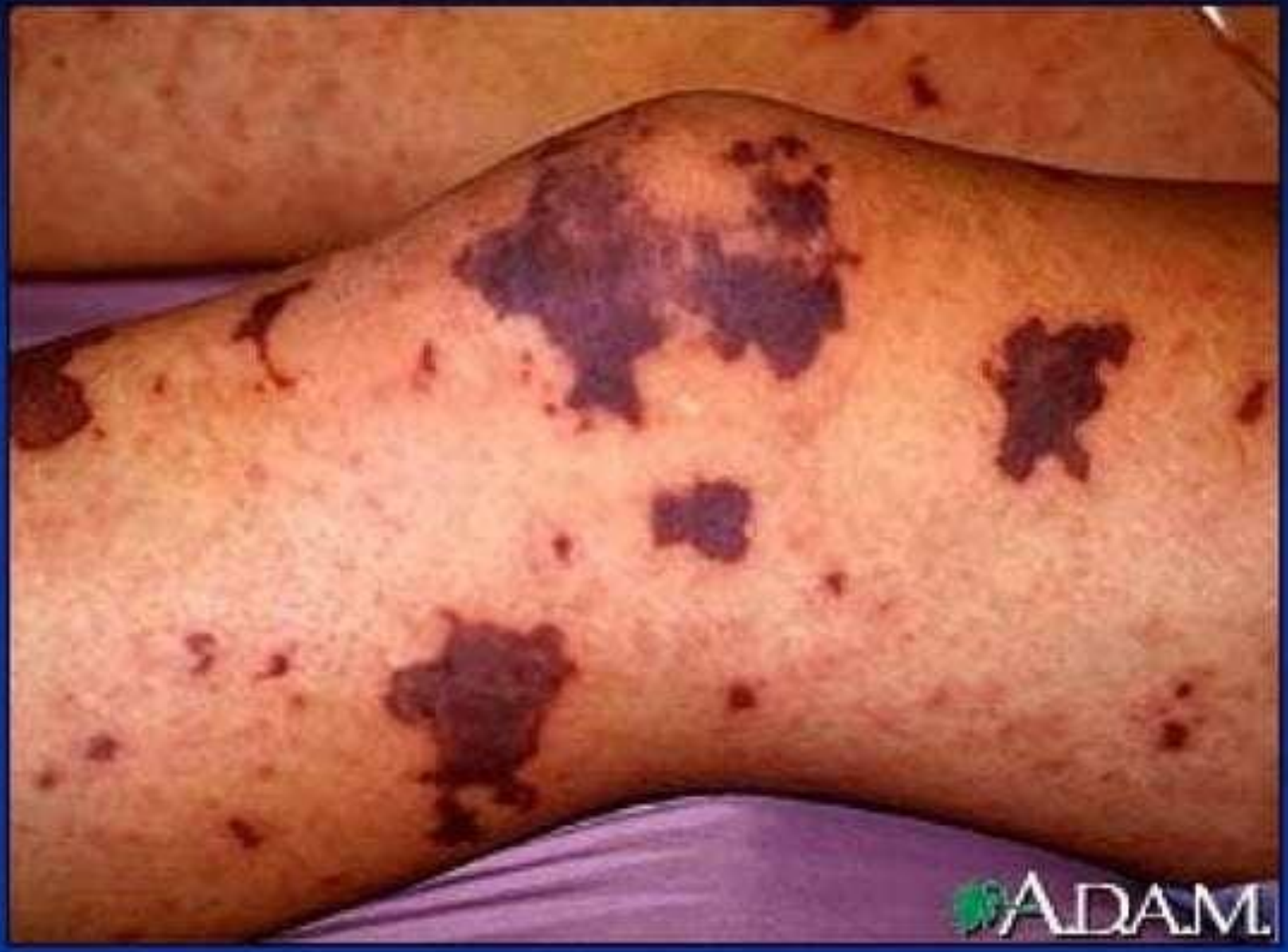
- Bleeding :84%~95%

It may occur at any site, but spontaneous bleeding and oozing at venipuncture sites or wounds are important clues to the diagnosis.

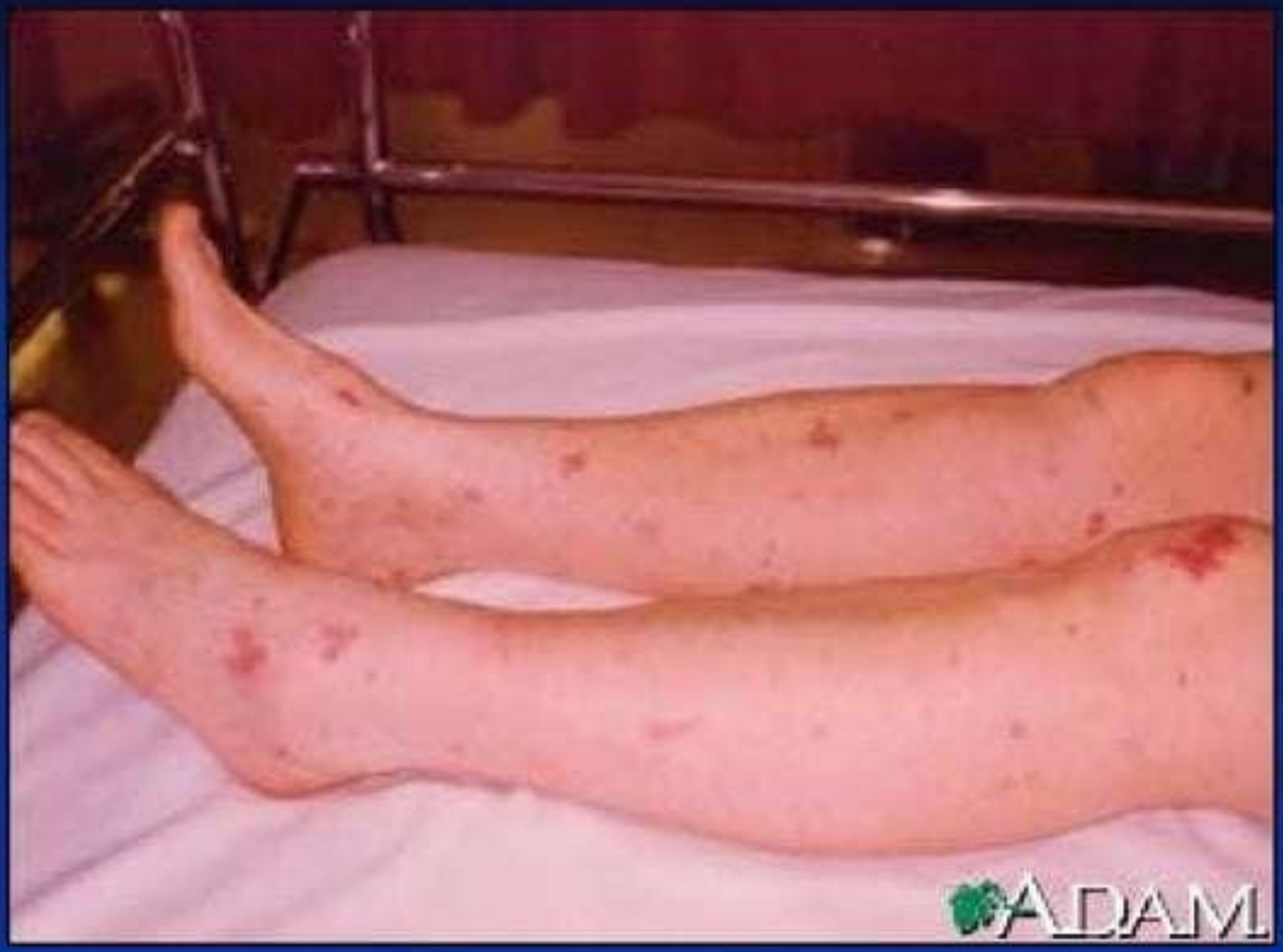
Meningococcemia on the Calves



Meningococcemia on the Leg

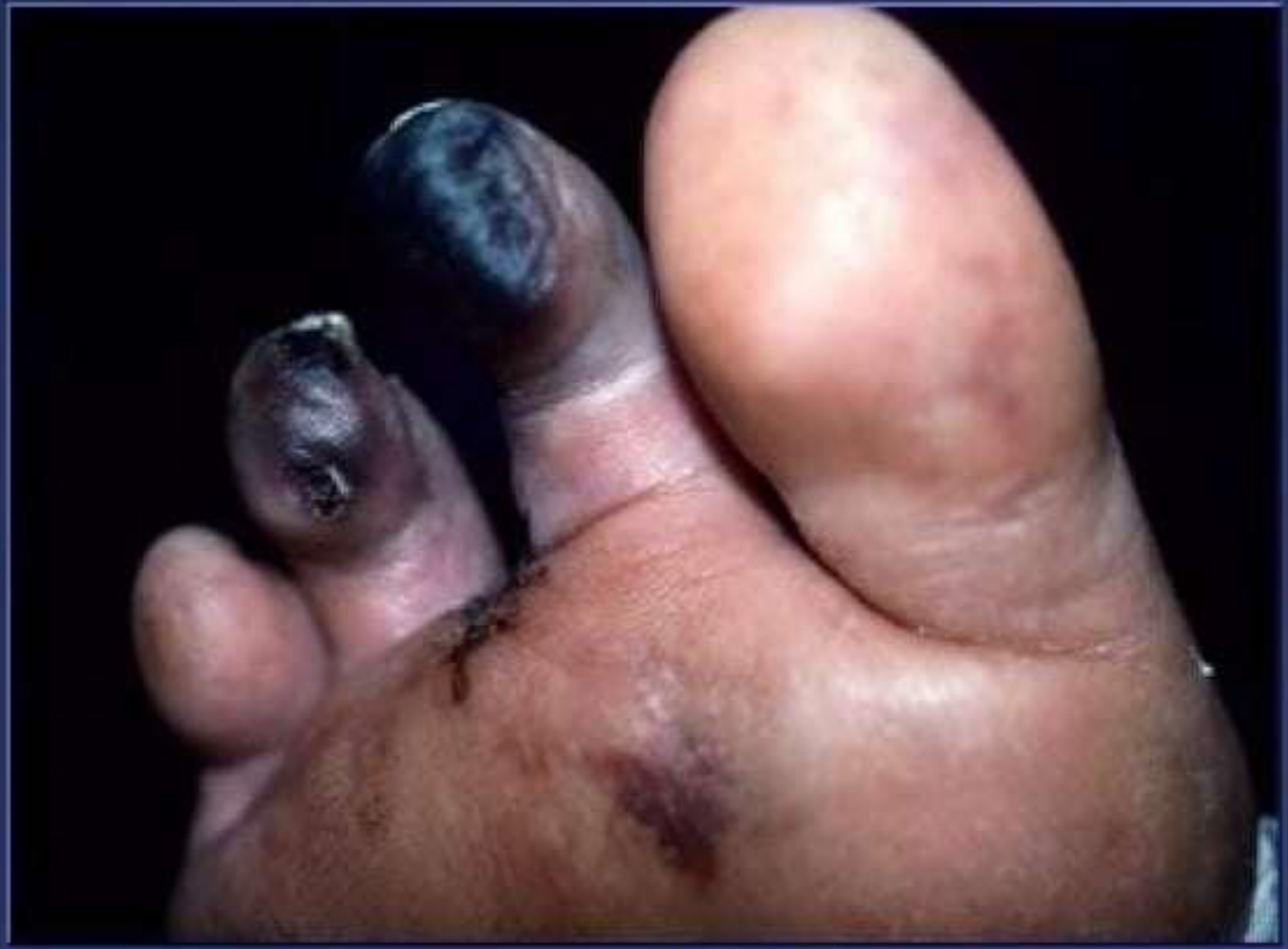


Meningococcemia Associated Purpura



Thrombosis: It is most commonly manifested by digital ischemia and gangrene, renal cortical necrosis and hemorrhagic adrenal infarction may occur.

Necrosis of the toes



Acute DIC

Clinical findings

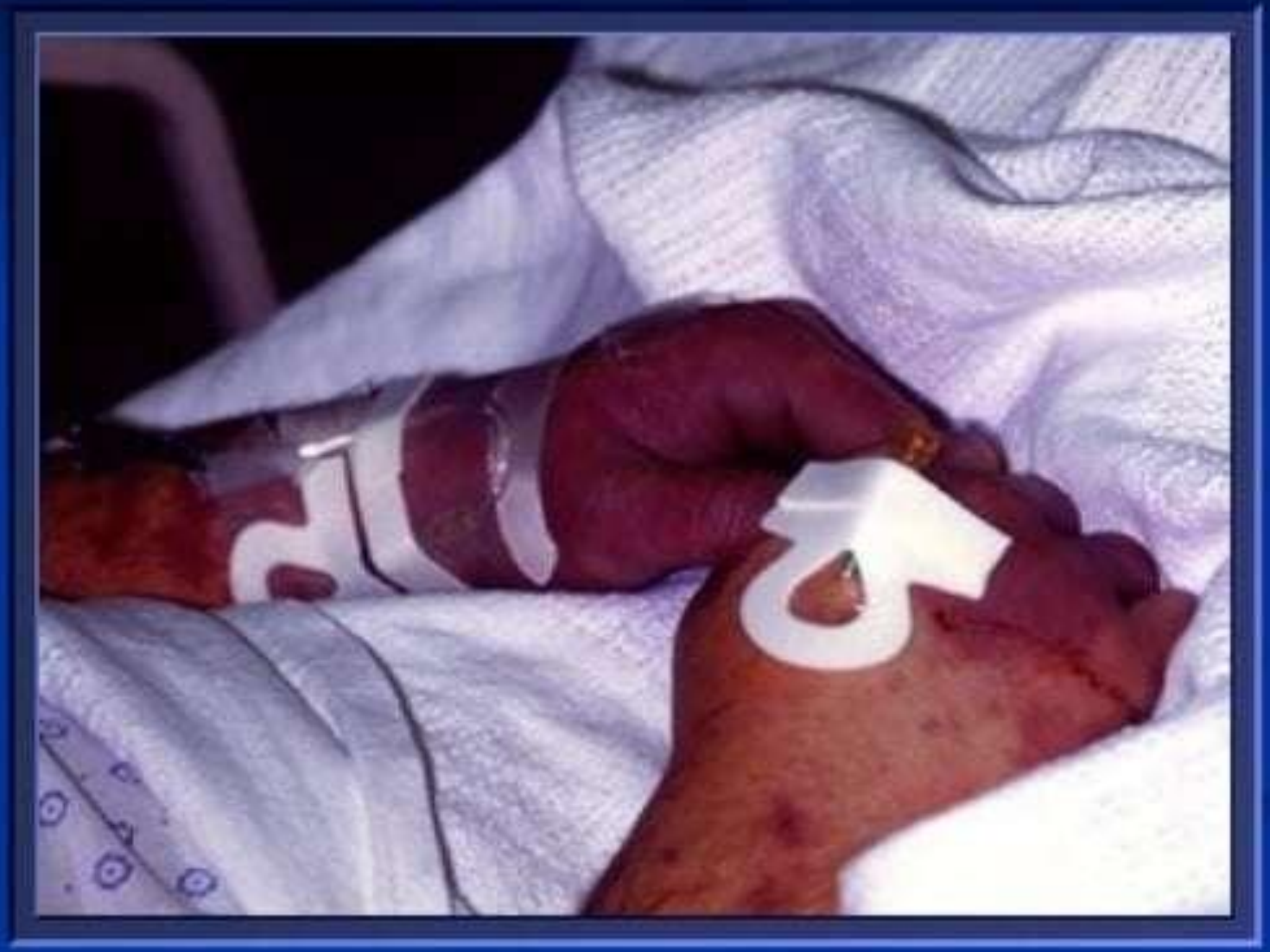
- Multiple bleeding sites
- Ecchymoses of skin, mucous membranes
- Visceral hemorrhage
- Ischemic tissue

Chronic DIC

Clinical findings

- Signs of deep venous or arterial thrombosis or embolism
- Superficial venous thrombosis, especially without varicose veins
- Multiple thrombotic sites at the same time
- Serial thrombotic episodes

Purpura fulminans



Purpura fulminans of a child's leg

Necrosis - of a child's toes

Laboratory Findings

Test	Result
Platelet count	Markedly decreased
Prothrombin time (PT)	Increased
Activated partial thromboplastin time (APTT)	Increased
Fibrin degradation products (FDP)	Markedly increased
Fibrinogen	Normal or decreased
Antithrombin III (AT III)	Markedly decreased
Protein C	Markedly decreased

Different Diagnosis

- Liver disease
- Vitamin K deficiency
- Sepsis
- TTP (Thrombotic thrombocytopenic purpura)

Liver disease

Liver disease may prolong both the PT and PTT, but fibrinogen levels are usually normal, and the platelet count is usually normal or only slightly reduced.

Severe liver disease may be difficult to distinguish from DIC.

Vitamin K deficiency

Vitamin K deficiency will not affect the fibrinogen level or platelet count and will be completely corrected by vitamin K replacement.

Sepsis

Sepsis may produce thrombocytopenia, and coagulopathy may be present because of vitamin K deficiency. However, in these cases, the fibrinogen level should be normal.

TTP (Thrombotic thrombocytopenic purpura)

TTP may produce fever and MAHA (microangiopathic hemolytic anemia). However, fibrinogen levels and other coagulation studies should be normal.

Treatment

- Treatment of the underlying disorder
- Replacement therapy
- Heparin therapy
- Other Treatment

Treatment of the underlying disorder

The primary focus should be the diagnosis and treatment of the underlying disorder that has given rise to DIC.

Treatment of the underlying disease is the mainstay of management of either acute or chronic DIC. Avoid delay treat vigorously (eg, shock, sepsis, obstetrical problems).

Replacement therapy

Coagulation factor deficiency require replacement with FFP (fresh frozen plasma).

Platelet transfusion should be used to maintain a platelet count greater than 30000/μl, and 50000/μl.

Fibrinogen is replaced with cryoprecipitate. One unit of cryoprecipitate usually raises the fibrinogen level by 6~8mg/dl,so that 15 units of cryoprecipitate will raise the level from 50 to 150mg/dl.

Heparin therapy

In some cases heparin therapy is contraindicated, but when DIC is producing serious clinical consequences and the underlying cause is not rapidly reversible, heparin may be necessary.

Dose:500~750u/h is necessary.

Attention:

Heparin therapy must be used in combination with replacement therapy, it can lead to severe ***bleeding***.

It cannot be effective if ATIII levels are markedly depleted. ATIII levels should be measured, and FFP used to raise levels to greater than 50%.FDP will decline over 1~2d.Improvement in the platelet count may lag as much as 1 week behind control of the coagulopathy.

Other Treatment

- Aminocaproic acid, 1g/h iv
- Tranexamic acid, 10mg/kg, iv,q8h,

Those two drugs should be added to decrease the rate of fibrinolysis, raise the fibrinogen level, and control bleeding.

Attention :Aminocaproic acid can never be used without heparin in DIC because of the risk of thrombosis.

Acute DIC

- Without bleeding or evidence of ischemia
  - No treatment
- With bleeding
  - Blood components as needed
  - Fresh frozen plasma
  - Cryoprecipitate
  - Platelet transfusions
- With ischemia
  - Anticoagulants after bleeding risk is corrected with blood products

Chronic DIC

Without thromboembolism

No specific therapy needed but prophylactic drugs (eg, low-dose heparin, low-molecular-weight heparin) may be used for patients at high risk of thrombosis

With thromboembolism

Heparin or low-molecular-weight heparin, trial of warfarin sodium (Coumadin). (If warfarin is unsuccessful, long-term use of low-molecular-weight heparin may be helpful.)

Complications

- Severe bleeding
- Stroke
- Ischemia of extremities or organs

Prognosis

Since DIC is a result of an acute medical illness, prognoses depends almost entirely upon the speed of the intensivist in handing the bleeding emergency, as well as the ability to treat the underling disorder

The underlying disease that causes the disorder will usually predict the probable outcome.

Summary

An awareness of the clinical settings in which DIC can occur and the diagnostic features that warn of its presence should enable the physician to diagnose and treat DIC appropriately.

New treatments that are more effective and less hazardous are clearly needed, and a number of such agents are now undergoing clinical trial.

Thank You