Hyperviscosity I.

Common hematological emergency, defined as increase in whole blood viscosity as a result of an increase in:

- Red cells
- White cells
- Plasmatic components, (Ig)

Other additional conditions:

- temperature,
- hydratation status,
- size of cell (CLL vs. AML)

Hyperviscosity II.

Hyperviscosity cause tissue hypoperfusion and consequent complications and clinical features coming from multiple organ hypoxemia:

- Central nervous system disturbancies
- Renal impairment
- Respiration insuficiency
- Myocardial infarction

Etc.…

Clinicaly relevat hyperviscosity syndrom must be managed inpatient settigns and urgent treatment in specialised hematological centre is warranted.

Red cells:

Polycythaemia vera - increased red cell volume, Hb > 180 gr/l.

Clinical features:

lethargy, headache, hypertension, arterial tromboses (MI, visual loss – central retinal artery occlusion).

Emergency treatment: = Isovolaemic venesection.

removal of 500mL blood volume from large vein with simultaneous replacement into another vein of 500mL 0,9% saline.

If present or not emergent – **Erytrocytaferesis**

On cell separator machine until syndrom resolves or until hematocrit decrease bellow 45%

White cells = Hyperleukocytosis

Acute leukemia – AML, ALL
Chronic leukemia – CML, CLL

Typicaly high blast cell numbers circulating in peripheral blood at presentation/diagnosis.
Leukocytes are sludging in capillaries causing organ damage

More common in AML and blast crises of CML (size of blasts!)

Tumor burden… WBC > 50-100 $x10^9$/L

Pulmonary haemorhage and haemoptysis may occur

White cells = Hyperleukocytosis

Clinical features:

- pulmonary leucostasis – caugh, dyspnoe, respiratory distress syndrom, tachypnoea, hypoxaemia, diffuse interstitial infiltrate on CRX
  Differentiation from bacterial or fungal pneumoia may be difficult…

- cerebral leucostasis – encefalopathy, confusion, decreased conscious level, isolated cranial nerve paresis

- visual loss (arteria centralis retinae hemmorhage/trombosis)
- renal impariment – lab, oliguria…

White cells = Hyperleukocytosis

Emergency treatment:

Anaemia may protect patient from hyperviscosity. Transfusion of RBCs to correct anaemia may initiate leucostasis and worsen the clinical status

Leucapheresis on cell separator machine immediately, ussually 2 hour procedure

Continue leucoapheresis daily until leucostasis syndrom is resolved or until WBC < 50 x 10E9/L

Start chemotherapy as soon as criteria allow.

Leucoaferesis is some kind of emergency and bridge to the chemotherapy.

Dubling time of acute leukemia could be faster then leucoapheresis

Plasma components - Immunoglobulins

group of diseases characterized by monoclonal proliferation of the cells of B-lymphoid line, secreting immunoglobulins:

Monoclonal protien in plasma

Multiple myeloma - IgG/IgA paraprotein

Waldenstrom macroglobulinaemia - IgM

Clinical features:

Neurological symptoms: sleepiness, headache, dizziness, coma

Bleeding: interference of Ig with clotting factors

Myelomic nefropathy: Accumulation of Bence-Jones proteinuria in renal tubules, hypercalciemia.

Plasma components - Immunoglobulins

Hyperviscosity usually develop when total protein in blood is >110 gr/L

Emergency treatment = **Plasmapheresis** on cell separator machine with the aim of 1,5-2,0 x blood volume exchange.

Repeating daily until symptoms are resolved or total protein < 110g/L.

After stabilization specific chemotheraphy should be initiated

Neutropenic fever

One of the commonest hemato-oncological emergencies.

Definition:

- Presence of symptoms or signs of infection in a patient with absolute netrophil count < **0,5 x10^{9}/L.**

- Fever – 1x TT > 38,3 C, 2x in 1 hour 38,0 C

- Neutrophils are the natural barrier against bacterial and fungal agents

Neutropenic fever - specialities

Neutropenia=

- Limited ability to produce inflammatory infiltrate
  - infections do not behave as usual:
  no absces but flegmonous infection

- Pneumonia without pneumonia at CRX
  clinical signs (cough, auscultation,CRP) and no finding on CRX (HRCT)

- Occasionally the fever is the only sign of infekction

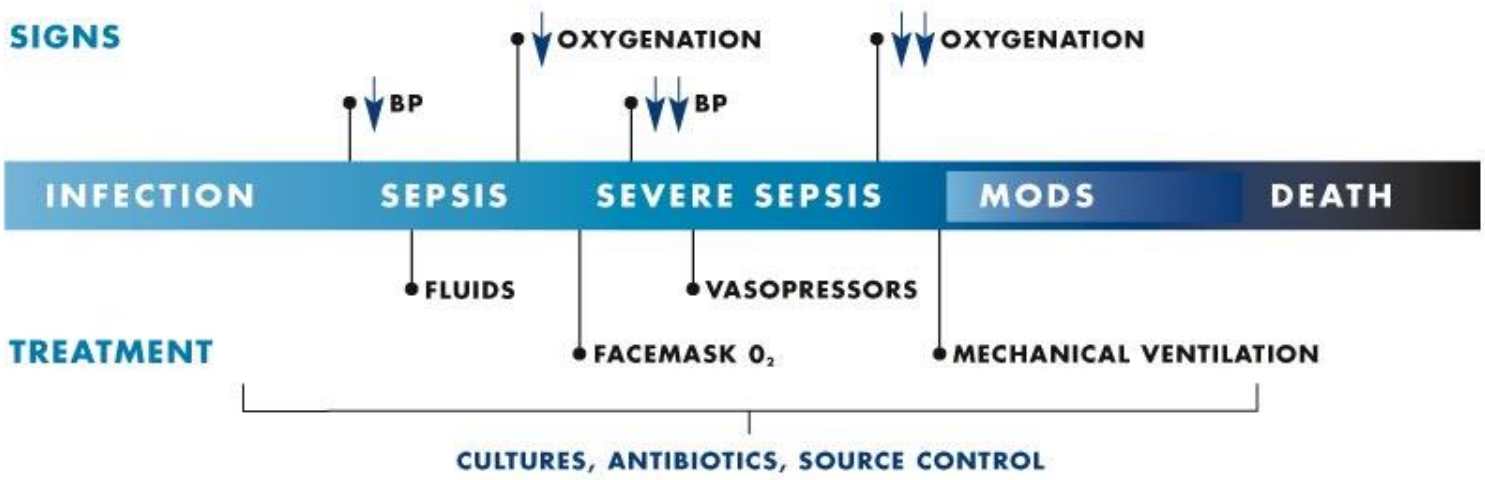
Neutropenic sepsis

Similarly to polytraumas, MI and stroke, speed and accurate management strongly influence the patient survival

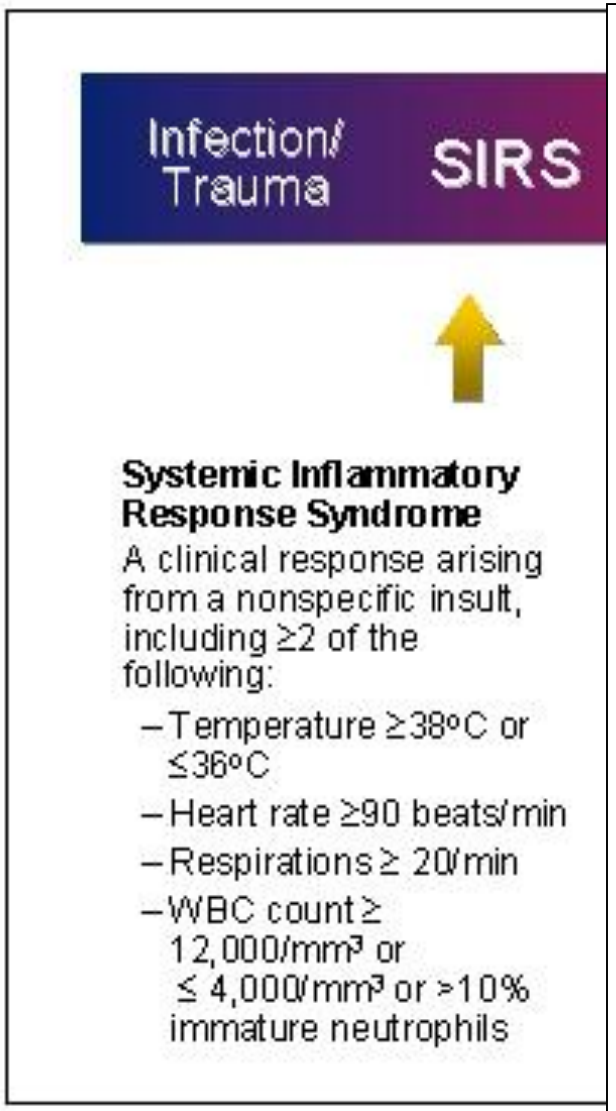
Progression of sepsis to acute organ failure direcly affects martality:

- cca 15% mortality in sepsis without organ failure
- cca 70% mortality in ≥3 selhávajících orgánů

Neutropenic sepsis



1.SIRS = systemic inflammatory response syndrome



2. SEPSIS = SIRS + presumed / proven infection

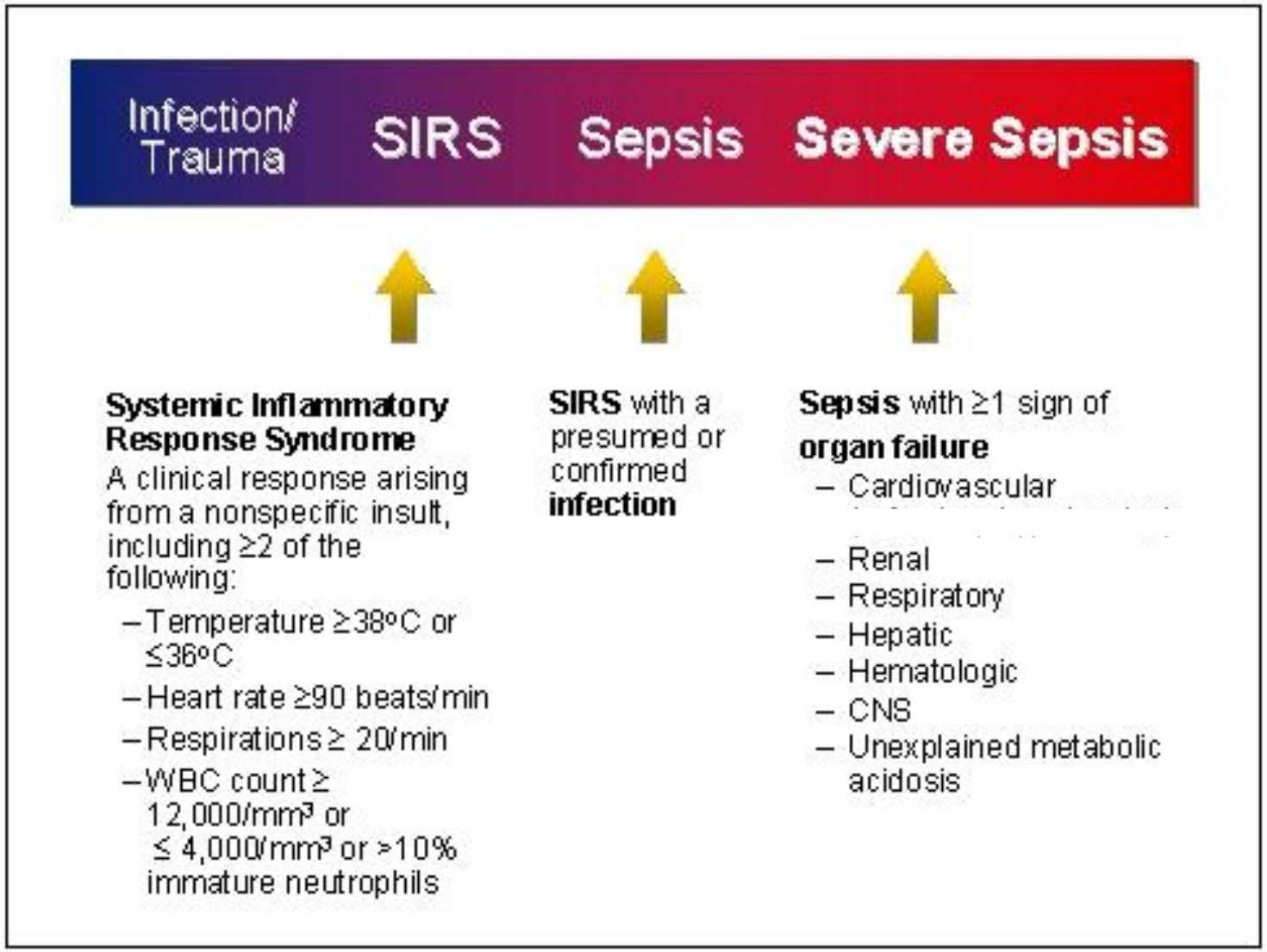
Systemic Inflammatory Response Syndrome

A clinical response arising from a nonspecific insult, including ≥2 of the following:

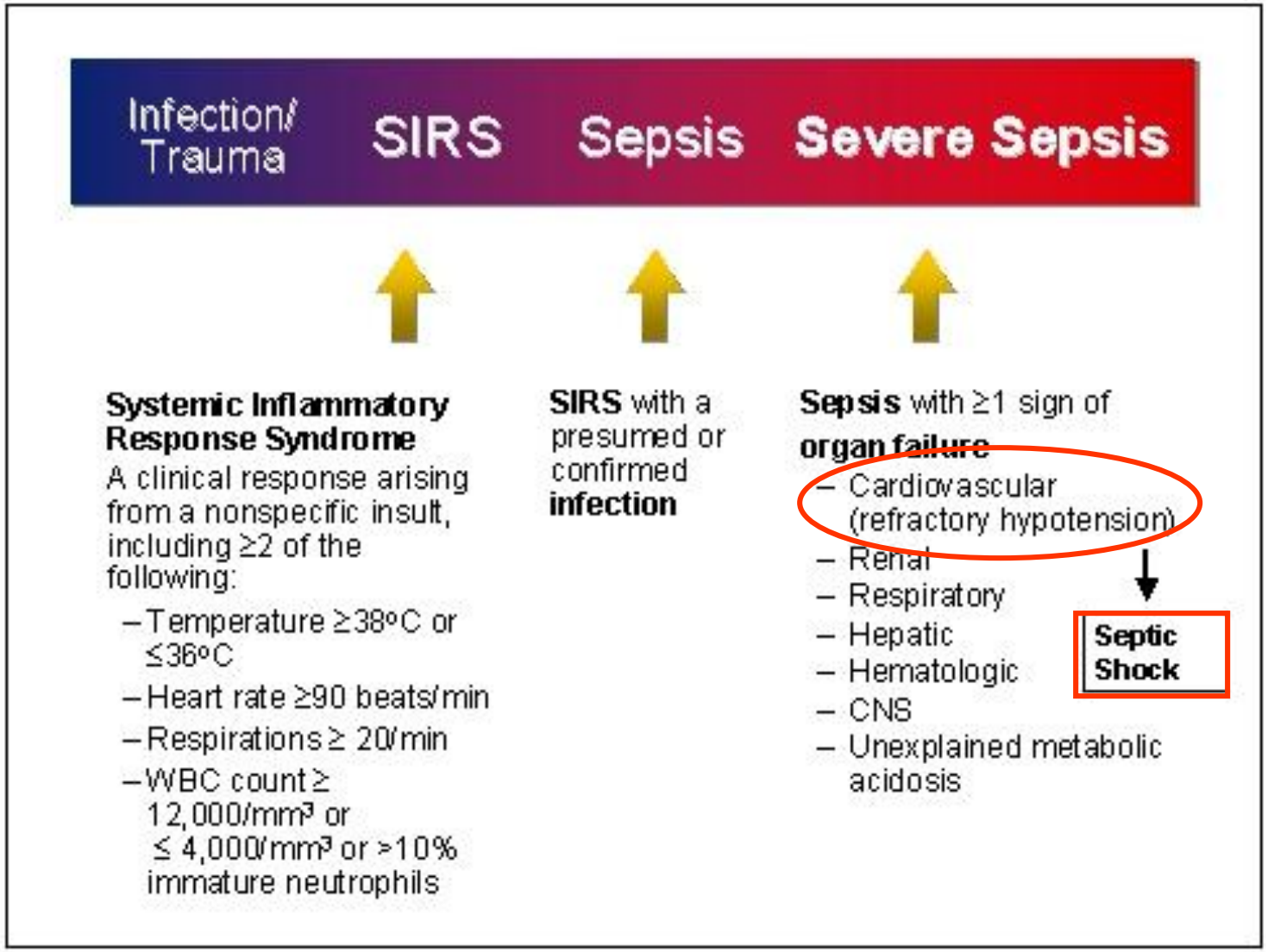
- Temperature ≥38°C or ≤36°C
- Heart rate ≥90 beats/min
- Respirations ≥ 20/min
- WBC count ≥ 12,000/mm³ or ≤ 4,000/mm³ or >10% immature neutrophils

SIRS with a presumed or confirmed **infection**

3. SEVERE SEPSIS = sepsis + ≥1 organ failure



4. SEPTIC SHOCK = severe sepsis + hypotension not responding to parenteral volume resucitation



Patient risc stratification

- Neutropenia.
  - severity of neutropeni:
    (<1x10^9 ….. <0.5x10^9 …..<0.1x10^9)
  - lenght:
    (7.... 30 days)
- Basic diagnose:
  (solid tumor….akuce leukemia….HSCT)
- Status of the disease:
  (remission…..progression)

- ICU patient with multiple invasions a organ failure

The Severe Sepsis Resuscitation Bundle

Management of severe sepsis:

6 interventions in, first 6 hours from diagnosis

Decrease in mortality in 35%

The Severe Sepsis Resuscitation Bundle

First of all, patient must be provided by 2 save cannulas

1. Plasma lactate level

Excellent marker of tissue/organ hypoperfussion and hypoxia

Usually increasing earlier then patient becomes hypotensive.

The Severe Sepsis Resuscitation Bundle

2. Blood sampling for hemoculture

before starting any antibiotic therapy

If any catheter is present, hemoculteres should be drawn from the device as well to exclude catheter infection

The Severe Sepsis Resuscitation Bundle

3. Start proper parenteral antibiotics

with broad spectrum (antipseudomonal activity!) at the very latest 1 hour from the diagnosis of severe sepsis

Antipseudomonal pennicilin with clavulanic acid (Tazocin)

In combination with aminoglycoside (Amikin, Gentamycin)

Alternative – karbapenems

Any restrictive speculation icould be fatal – we start with broad spectrum ATB, waiting for culteres and after defining the exact pathogen, we can deescale ATB.

The Severe Sepsis Resuscitation Bundle

4. Presence of hypotension

(SBP< 90 mmHg nebo MAP< 65 mmHg)

Urgently start parenteral fluid challange

= 1000 ml of crystalloid or 500ml of colloid solution over 30 minutes

Close monitoring of vital signs

Assess effect: BP, pulse….

The Severe Sepsis Resuscitation Bundle

5. Hypotension persists after fluid challange

Contact ICU specialist, reserve ICU bed

Central venous catheter, further fluids and CVP (>10 cm H2O)

Start vasopressors (norepinephrin), invasive blood pressure
goal = MAP > 65 mmHg

Close monitoring of diuresis

The Severe Sepsis Resuscitation Bundle

6. Persisting lactate level despite of fluid and vasopressor optimalization

Signing high mortality…

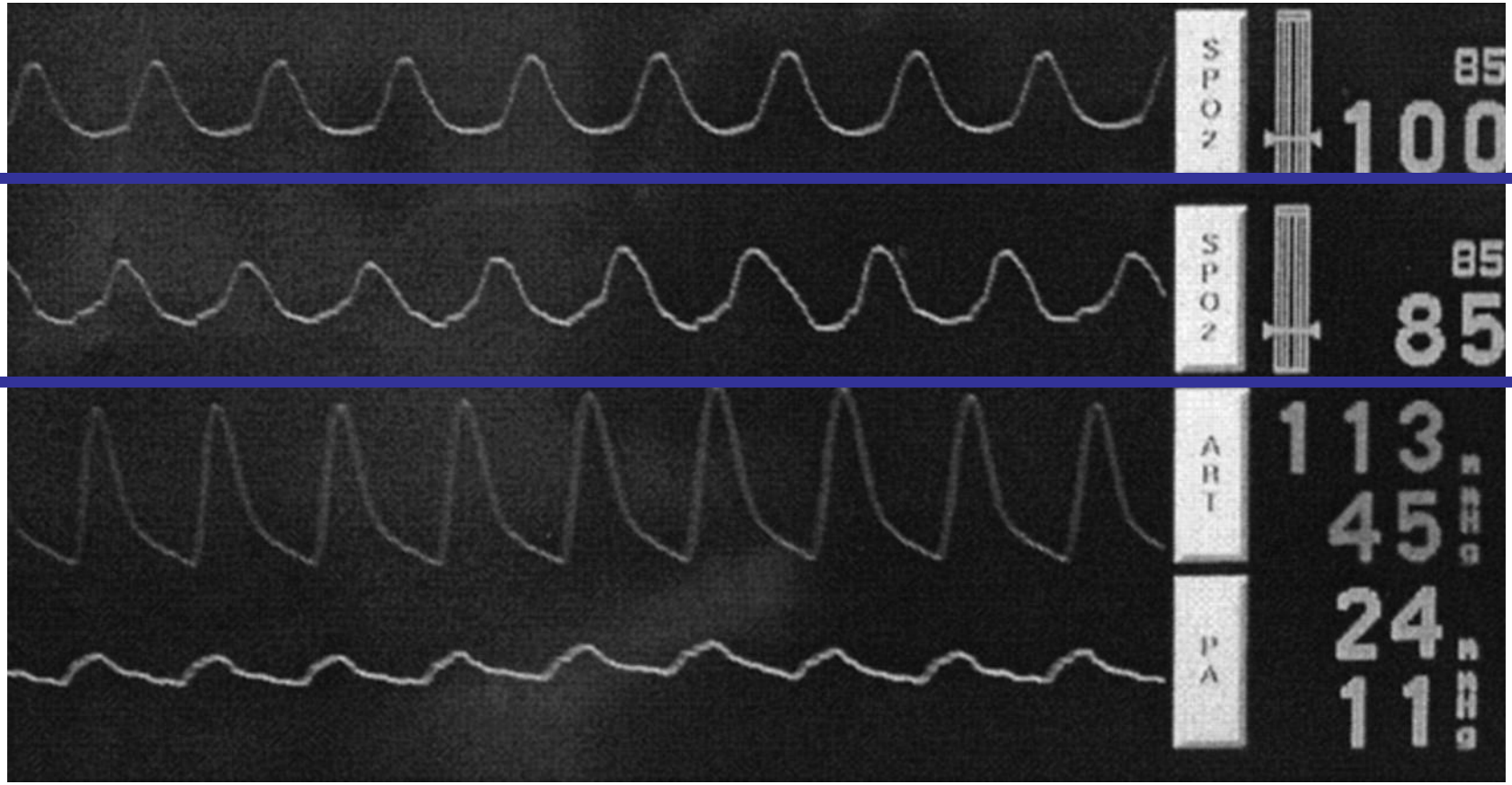
Continue with fluid overload to CVP 15-20 (pulmonary edema)

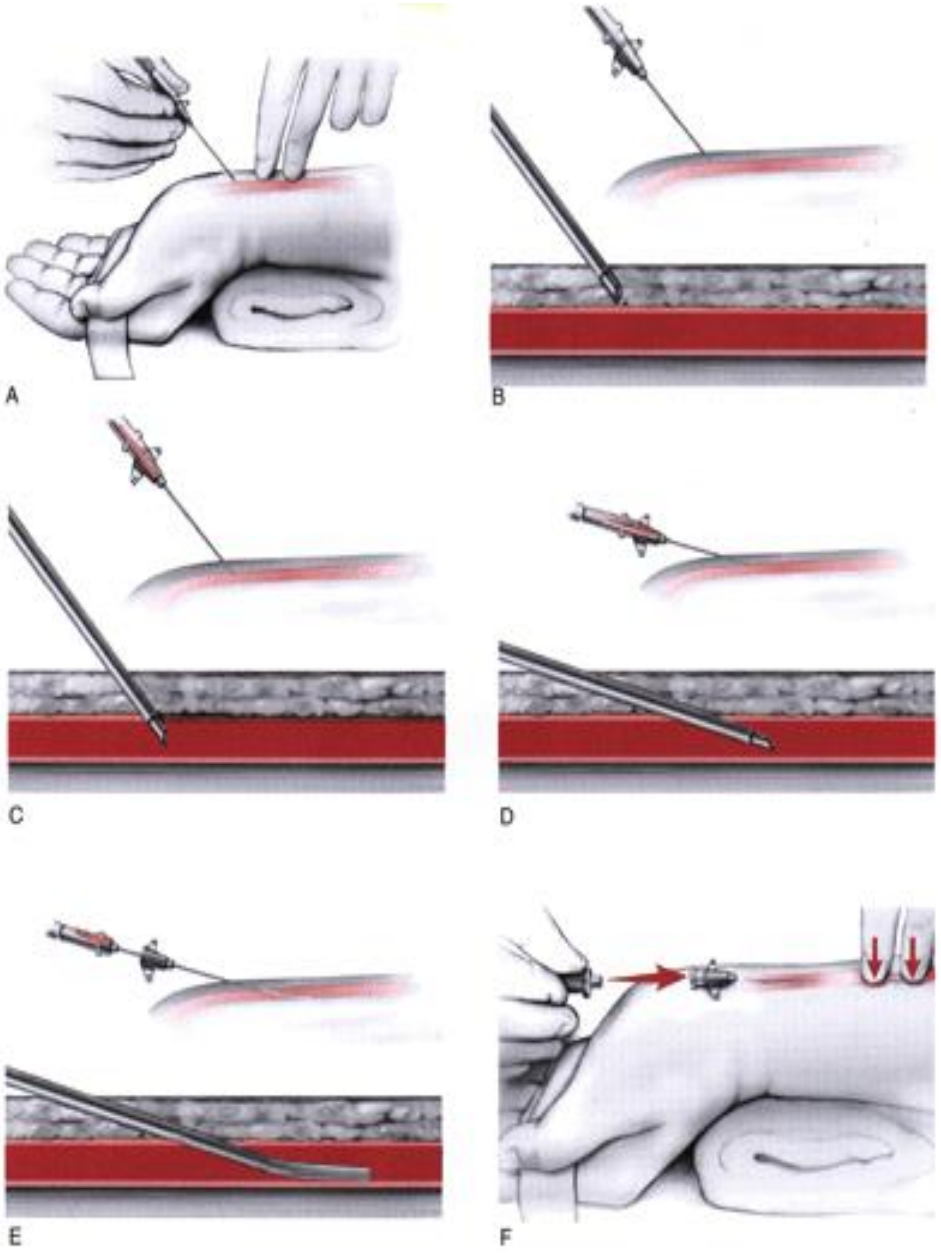
Correct anaemia, Htc more 30%

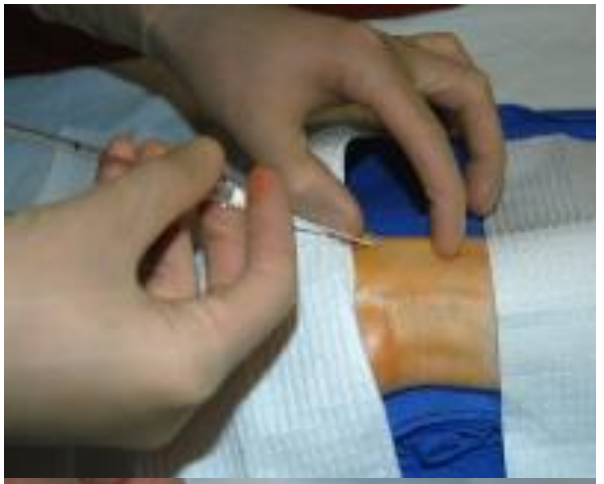
Start inotropic agents (dobutamin)

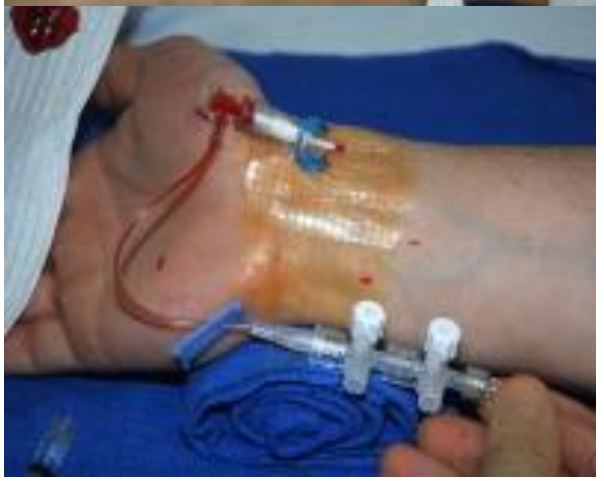
IX. Neinvazivní monitorace - poznámky

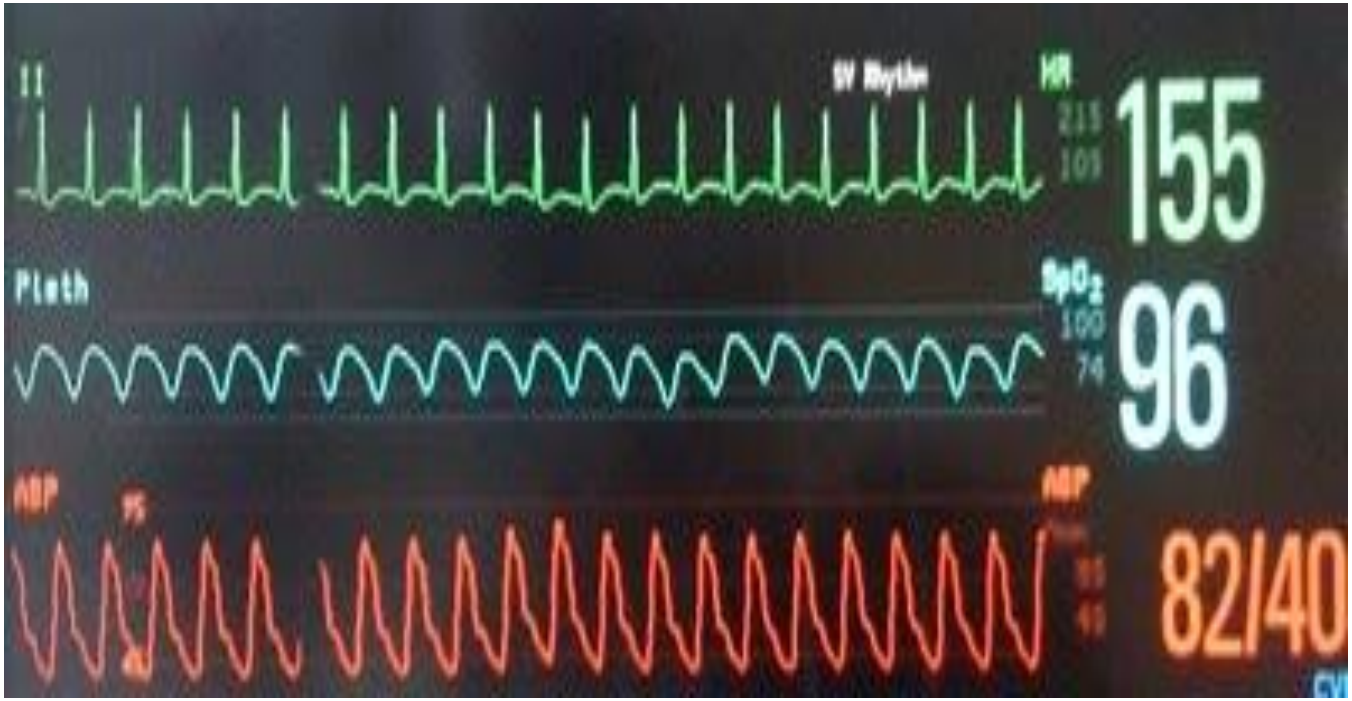
Pulzní oxymetrie

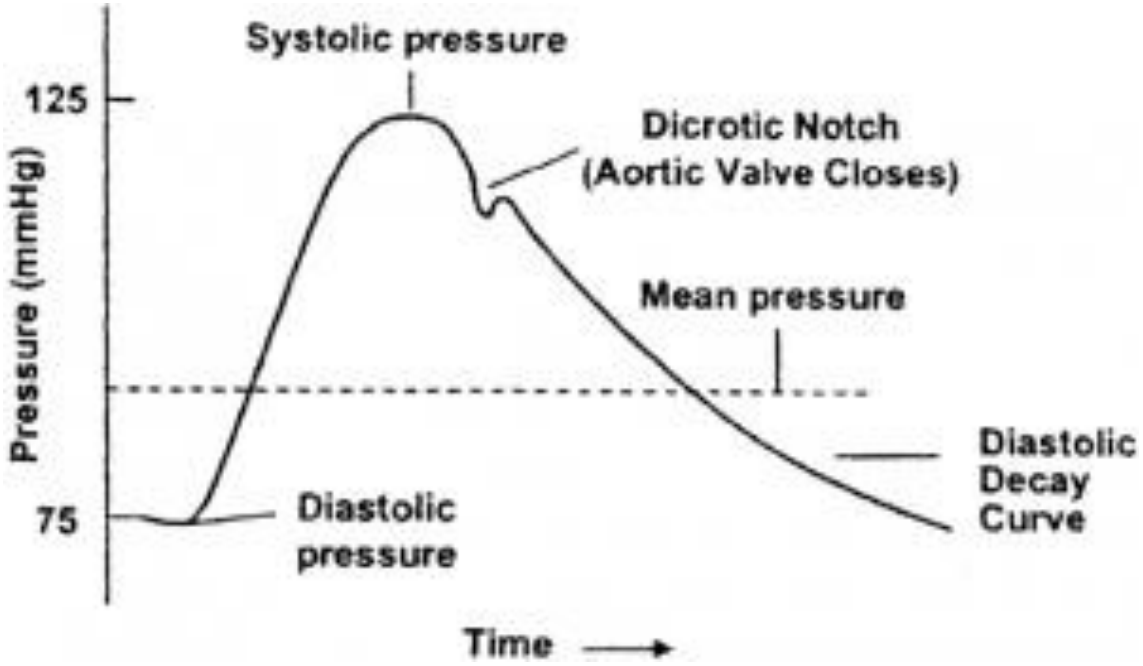



A
B
C
D
E
F






II
SV Rhythm
HR
155
Pleth
SpO2
96
ABP
ABP
82/40


Systolic pressure
125
Dicrotic Notch
(Aortic Valve Closes)
Mean pressure
Pressure (mmHg)
Diastolic
Decay
Curve
75
Diastolic
pressure
Time