

M U N I
M E D

Major bleeding

Kamil Vrbica

Learning outcomes

- The student will learn to recognize major bleeding.
- The student will learn about the management of major bleeding.
- The student is able to initiate treatment of major bleeding.

Lecture content

- 1. Definition
- 2. Causes
- 3. Initial assessment of patient
- 4. Laboratory tests and radiological imaging
- 5. Lethal triad
- 6. Goals of therapy
- 7. Management of therapy

1. Definition of major bleeding (czech guidelines)

- Loss of blood volume over 24 hours (equivalent to about 10 units of erythrocytes in an adult)
- 50% blood volume loss within 3 hours
- Continued blood loss in excess of 150 ml/min
- Blood loss in a localization leading to a threat to vital functions (e.g. intracranial hemorrhage)

2. Causes of major bleeding

- Trauma (the most common cause under the age of 40)
- Bleeding in the gastrointestinal tract (gastric and duodenal ulcers, esophageal varices, tumors)
- Obstetric bleeding (uterine hypotonia, placental abruption, placenta praevia, uterine rupture)
- Perioperative bleeding

3. Initial assessment of patient

- Algorithm ABCDE
- Exception: **visible massive external bleeding – immediately STOP bleeding** (direct wound compression/pressure dressing/tourniquet)
- **A**: airway management
- **B**: management of ventilation and oxygenation
- **C**: evaluation of pulse, blood pressure, skin color, capillary refill, signs of bleeding (external, chest, abdomen, extremities, p.r.)
Adequate tissue perfusion
- **D**: quantity and quality of consciousness, GCS, pupils
- **E**: temperature

3. Initial assessment of patient

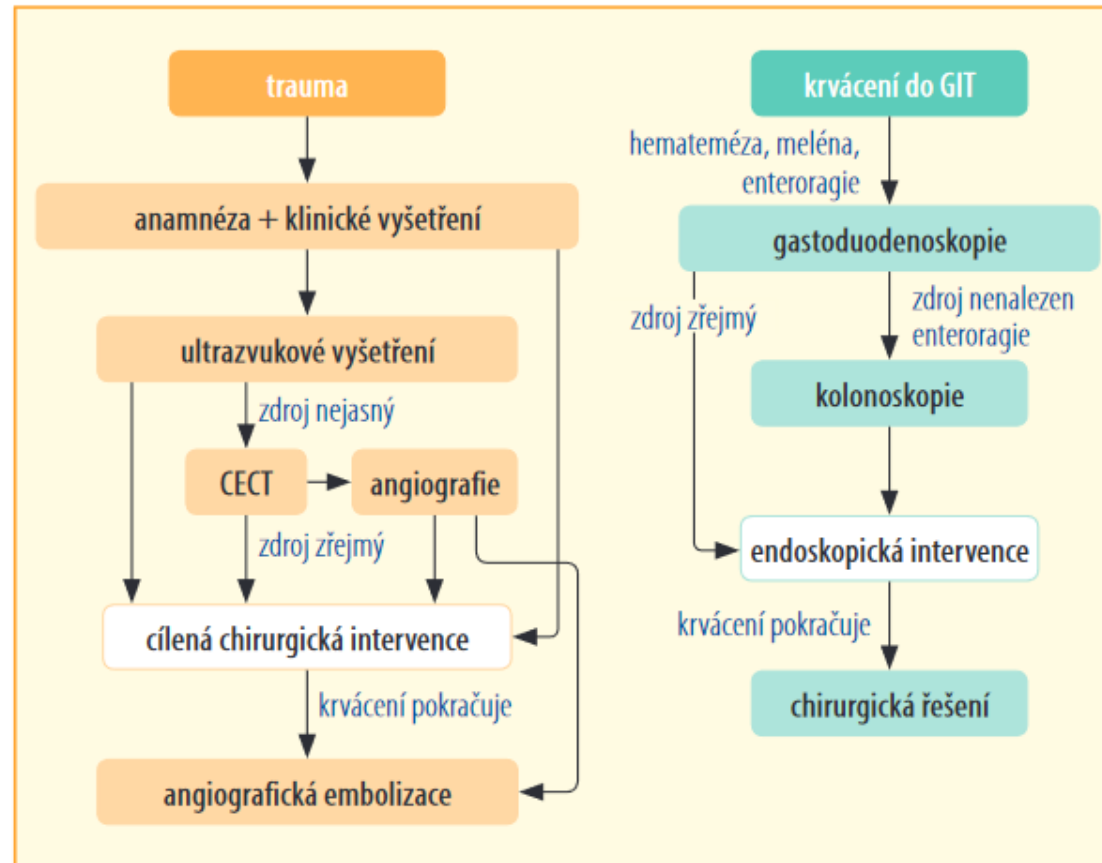
PARAMETER	CLASS I	CLASS II (MILD)	CLASS III (MODERATE)	CLASS IV (SEVERE)
Approximate blood loss	<15%	15-30%	31-40%	>40%
Heart rate	↔	↔/↑	↑	↑/↑↑
Blood pressure	↔	↔	↔/↓	↓
Pulse pressure	↔	↓	↓	↓
Respiratory rate	↔	↔	↔/↑	↑
Urine output	↔	↔	↓	↓↓
Glasgow Coma Scale score	↔	↔	↓	↓
Base deficit*	0 to -2 mEq/L	-2 to -6 mEq/L	-6 to -10 mEq/L	-10 mEq/L or less
Need for blood products	Monitor	Possible	Yes	Massive Transfusion

Source: American college of Surgeons. *ATLS student course manual*. 10th edition, 2018

4. Laboratory tests and radiological imaging

- Indicated according to **medical history, stability of vital signs, physical examination**
- **Ultrasound** (polytrauma – eFAST (extended Focused Assessment with Sonography of Trauma))
- **CT scan/CECT** (hemodynamic stable polytrauma, unclear source of abdominal bleeding)
- **X-ray** (fractures of long bones)
- **Gastrointestinal endoscopy** (hematemesis, melena, enterorrhagia)
- **Colonoscopy** (enterorrhagia with unexplained source during gastrointestinal endoscopy)
- **Laboratory tests** (ABG, blood count, ions, iCa^{2+} , lactate, coagulation; viscoelastic methods)

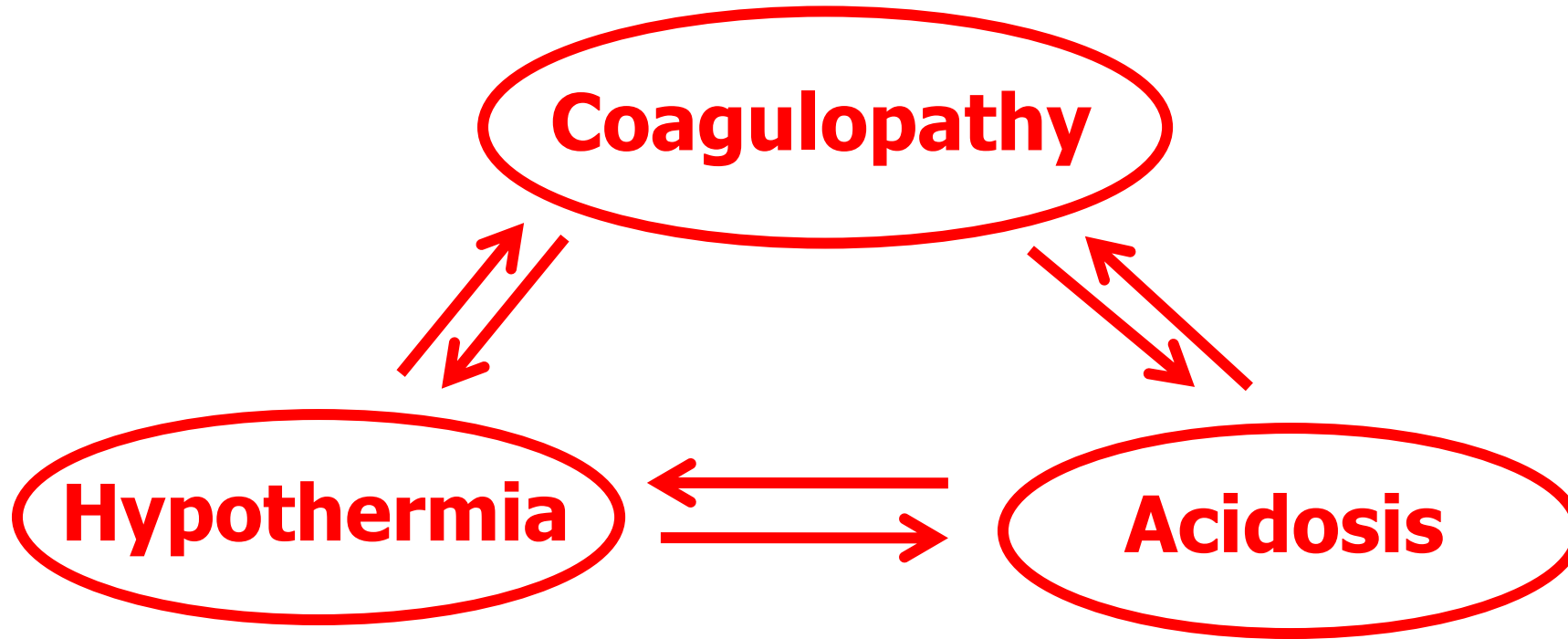
4. Laboratory tests and radiological imaging



Source: Malaska J, Stasek J, Kratochvíl M, Zvonicek V. Intenzivní medicína v praxi. Praha: Maxdorf, 2020 Jessenius.

Obr. 18.1 Zjednodušený algoritmus vyšetření u pacientů s polytraumatem a krvácením do GIT; poznámka: CECT – Contrast Enhanced Computer Tomography, CT s aplikovanou kontrastní látkou

5. Lethal triad



6. Goals of therapy

DAMAGE CONTROL RESUSCITATION

- Maintain blood perfusion pressure
- Maintain oxygen supply to tissues
- Control of bleeding

6. Goals of therapy

- Access to venous system – at least **2x PVC (18G and larger)**
 - if it cannot be inserted - intraosseous access
 - do not insert central venous catheter
- arterial cannulation (IBP) only at systolic blood pressure around 100 mmHg - until then massive circulatory resuscitation and stop bleeding

- **Permissive hypotension – systolic blood pressure 80-90mmHg**
- **Hb \approx 9 g/dL**
- **Plt $>$ 50 or 100 $\times 10^9/L$ (continued bleeding/TBI – trauma brain injury)**
- **Pulse $<$ 120/min, SpO₂ $>$ 96%**
- **iCa²⁺ $>$ 1,1mmol/L, temperature $>$ 34°C**
- **pH $>$ 7,2; monitoring of lactate + BE, efforts to maintain the standard**

- **Diuresis $>$ 0,5 ml/kg/hod**

7. Management of therapy

In case of a clear source of bleeding or severe hemorrhagic shock with a presumed source of bleeding, immediate surgical control of the bleeding is indicated !!!

- **Damage control surgery** - perform a surgical procedure to stop the bleeding and stabilize the patient

7. Management of therapy

MAINTENANCE OF PERFUSION PRESSURE AND OXYGEN SUPPLY TO TISSUES

- Restrictive fluid administration – max. 1500ml of fluids
- Isotonic balanced crystalloid solutions preferred
- Fresh frozen plasma (FFP) IS NOT a volume replacement
- Goal – **systolic blood pressure 80-90 mmHg** (polytrauma with GCS < 8 - MAP \geq 80mmHg)
 - Crystalloids – restrictive administration in bolus
 - Norepinephrin
 - Colloids
- Administration of red blood cells (RBC) – **Hb 7-9 g/dL** (transfusion trigger)
- Adequate ventilation and oxygenation

7. Management of therapy

Treatment of coagulopathy

Based on laboratory tests or viscoelastic methods

- PT, aPTT, Fbg, Hb, Plt
- ROTEM/TEG/CLOTPro, ROTEM Platelet/Multiplate
- **Tranexamic acid** – do not wait for results, 1g as soon as possible (within 3h)
- **FFP** – not intended for the treatment of coagulopathy except for severe bleeding, not intended for the treatment of hypofibrinogenemia, administer at least FFP:RBC 1:2
- **Fbg (Fibrinogen)** – administered on the basis of laboratory tests or viscoelastic methods or even when depletion is suspected
- **PCC (Prothrombin complex concentrate)** – administered in case of sufficient fibrinogen level and signs of clotting factor deficiency
- **TAD (Thrombocytes by apheresis)** – thrombocytes min. $50 \times 10^9/L$, in trauma brain injury (TBI)/continued bleeding - $100 \times 10^9/L$
- **Calcium** – maintain iCa^{2+} over 1,1 mmol/L (*Calcium gluconicum*)

7. Management of therapy

- **Massive transfusion protocol**

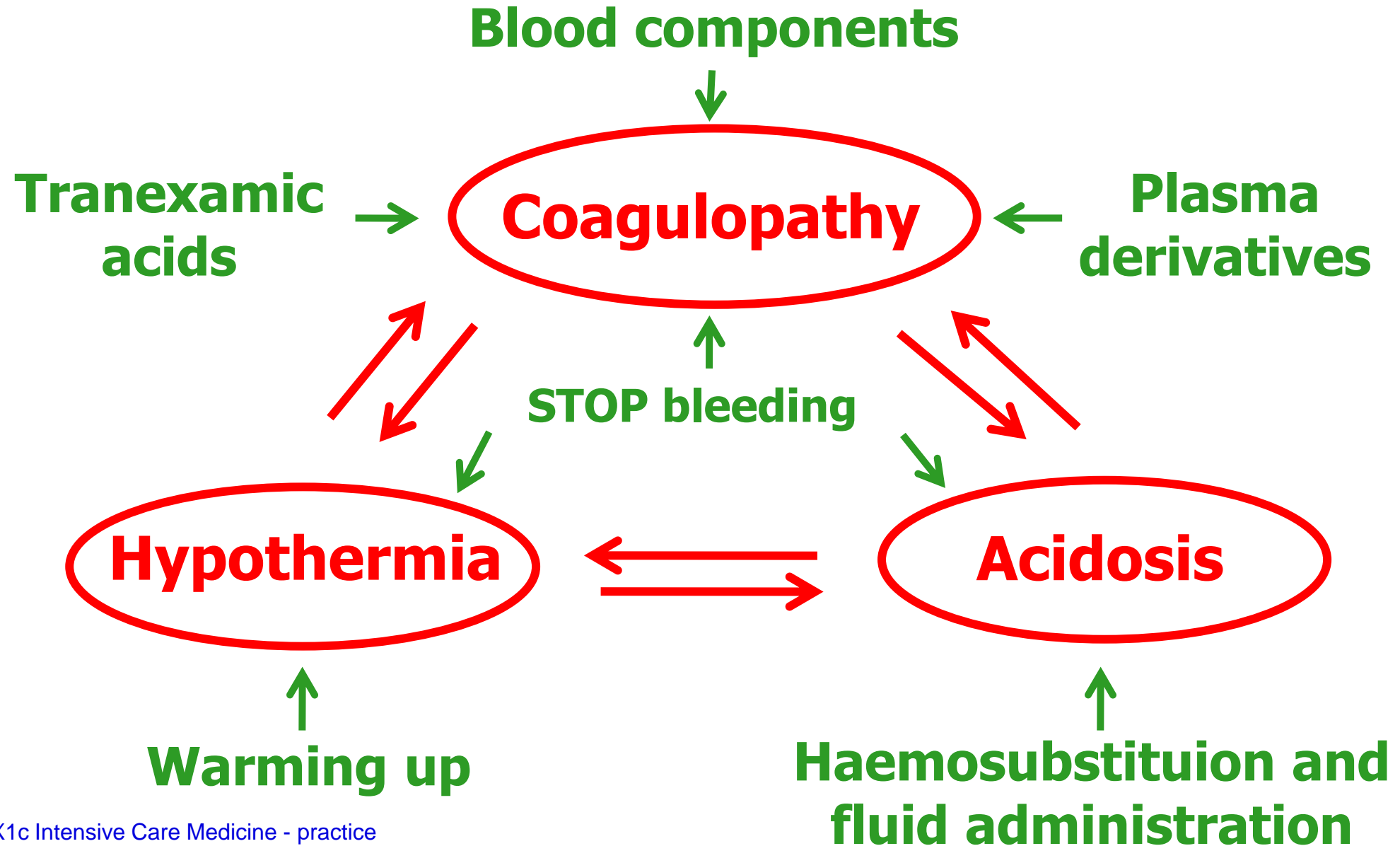
- 4x RBC + 4x FFP + 1x TAD
- further empirically according to blood loss

- **Goal directed therapy**

- 4x RBC + 4-6g Fibrinogen + 1x TAD
- Further according to point-of-care tests – viscoelastic methods, bedside monitoring

- It is possible to switch between the two approaches

7. Management of therapy



Take home messages

- Stop the bleeding is the most important part of treating major bleeding.
- It is necessary to maintain tissue perfusion and sufficient oxygen supply to the tissues.
- We prevent the development of lethal triad - coagulopathy, acidosis and hypothermia.

References

- Malaska J, Stasek J, Kratochvil M, Zvonicek V. Intenzivní medicína v praxi. Praha: Maxdorf, 2020 Jessenius.
- Marini, J. J., & Dries, D. J. Critical care medicine: The essentials and more, 2019
- Blatný J, Blaha J, Cvachovec K, et al. Diagnostika a léčba život ohrožujícího krvácení u dospělých pacientů v intenzivní a perioperační péči. Anesteziologie a intenzivní medicína, Praha: Česká lékařská společnost J.E. Purkyně, 2017, roč. 28, č. 4, s. 263-269
- Spahn DR, Bouillon B, Cerny V, Duranteau J, Filipescu D, Hunt BJ, Komadina R, Maegele M, Nardi G, Riddez L, Samama CM, Vincent JL, Rossaint R. The European guideline on management of major bleeding and coagulopathy following trauma: fifth edition. *Crit Care*. 2019 Mar 27;23(1):98.
- Rossaint R, Bouillon B, Cerny V, et al. The European guideline on management of major bleeding and coagulopathy following trauma: fourth edition. *Crit Care*. 2016;20:100. Published 2016 Apr 12.
- ŠEVČÍK, Pavel, Vladimír ČERNÝ a Jiří VÍTOVEC. *Intenzivní medicína*. 3. rozš. vyd. Praha: Galén, 2016

MUNI
MED