Peripartum haemorrhage

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CZECH REPUBLIC
DEVELOPMENT COOPERATION

Definition

Bleeding in human childbirth

Vaginal delivery: ˂ 500 ml
Caesarean section: ˂1000 ml

2017 - revision of the definition of PPH

- blood loss **> 500 ml** vaginal delivery

  or

- blood loss **>1 000 ml** Caesarean section

  or

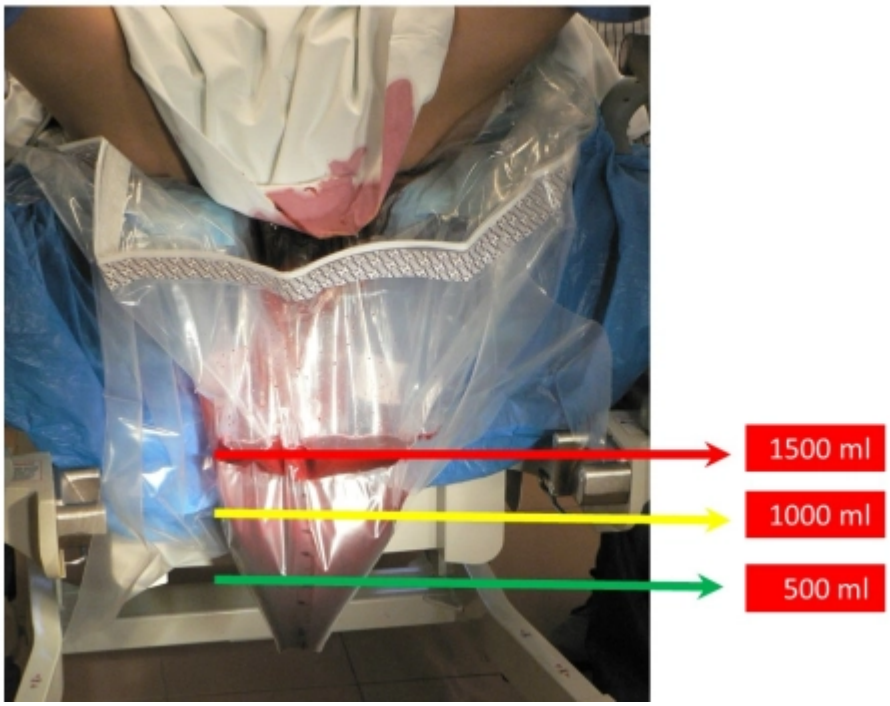
- **change in vital functions**
  - **heart rate** >15% >110 bpm

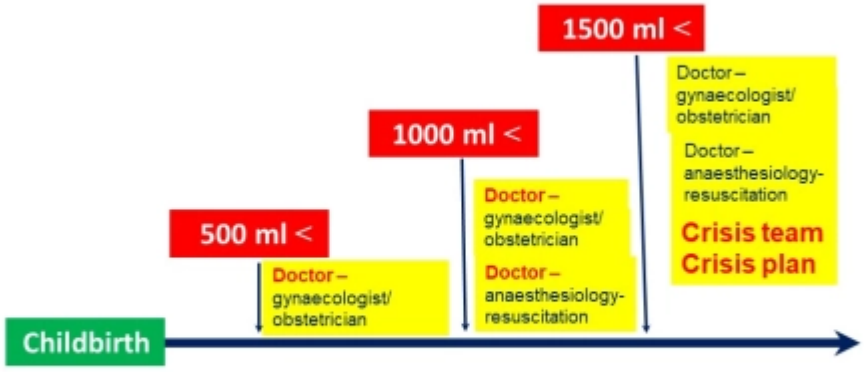
- **heart rate** >15% ≥110 bpm,
- **blood pressure** ≤ 85/45 mmHg,
- **saturation** < 95%

There is strength in simplicity…
An acute, life-threatening condition

Peripartum haemorrhage – definition Czech Republic
According to the amount of blood loss:

- minor blood loss (500 – 1 000 ml)
- severe blood loss (> 1 000 ml)
- life-threatening peripartum hemorrhage (LTPPH) (> 1 500 ml)
  (clinical and/or laboratory signs of tissue hypoperfusion)





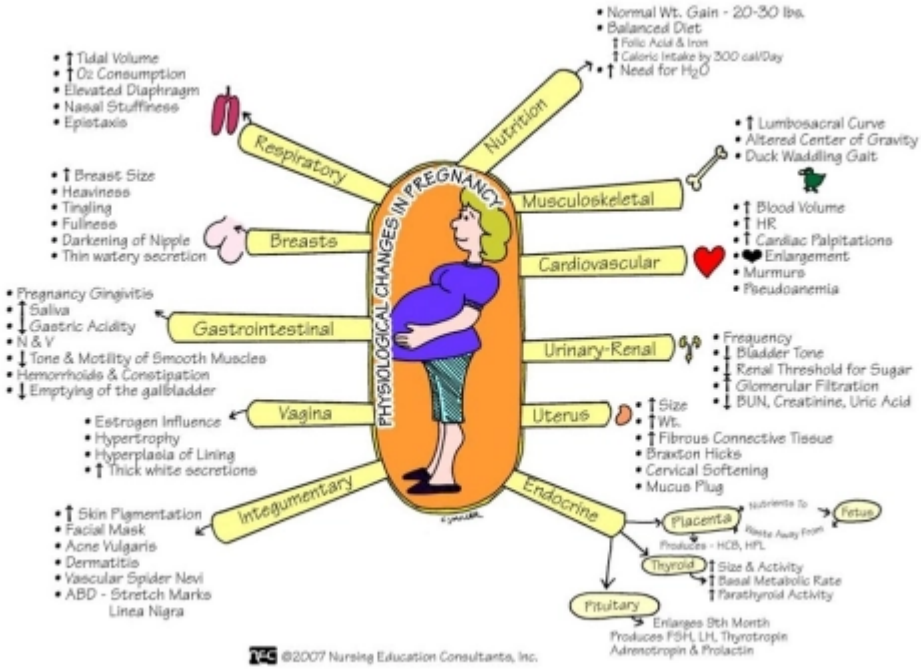
Incidence 7-8%

The incidence of LTPPH/PPH varies greatly depending on the criteria used to diagnose the pathology.
Estimate: **1 - 5% of births**
Sheldon WR, Blum J, Vogel JP, et al. Postpartum haemorrhage management, risks, and maternal outcomes: findings from the World Health Organization Multicountry Survey on Maternal and Newborn Health. BJOG 2014; 121 Suppl 1:5.
Reale SC, Easter SR, Xu X, et al. Trends in Postpartum Hemorrhage in the United States From 2010 to 2014. Anesth Analg 2020; 130:e119.
Prospective study: **10% of births**
Deneux-Tharaux C, Bonnet MP, Tort J. [Epidemiologie poporodního krvácení]. J Gynecol Obstet Biol Reprod (Paříž) 2014; 43: 936.

Physiology of postpartum haemostasis

Woman

- pregnant woman
- 2nd half of pregnancy



Haemostasis mechanism
=
combination of two factors

Mechanical haemostasis

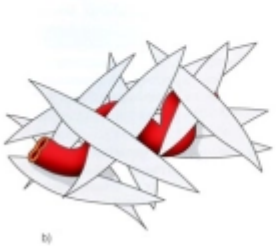
- **retraction** of the myometrium → **compression = tourniquet** of the vascular system of the uterus

Coagulation haemostasis

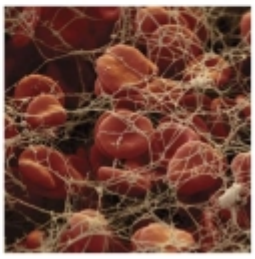
- **decidual/**tissue factors
- **plasminogen activator type 1 inhibitor**
- **systemic coagulation factors** (circulating haemostasis factors, platelets, etc.)
  Pathogenesis of most cases of PPH = **disruption of one or both mechanisms**.
  Pathogenesis of **other cases** of PPH is **loss of intact vasculature** (i.e. trauma).

Combination

Mechanical haemostasis
Retraction - tourniquet



Coagulation factors
Fibrinogen



LTPPH	DIC
95%	5%

Physiology of retraction-tourniquet myometrium

- perfusion
- oxygenation
- energy reserves
- receptor readiness

Risk factors Specific etiology

Study (690,000 births): 4 risk factors **associated with the highest probability of predicting**
the need for massive blood transfusion (n = 406) during hospitalization for delivery
Mhyre JM, Shilkrut A, Kuklina EV, et al. Massive blood transfusion during hospitalization

for delivery in New
York State, 1998-2007. Obstet Gynecol 2013; 122:1288.

1. **abnormal placentation (pl. accreta or previa)** (1.6/10,000 births, OR 18.5, 95% CI 14.7-23.3)
2. **placental abruption (**1.0/10,000 births, OR 14.6, 95% CI 11.2-19.0)
3. **severe preeclampsia** (0.8/10,000 births, OR 10.4, 95% CI 7.7–14.2)
4. **intrauterine fetal death** (0.7/10,000 births, OR 5.5, 95% CI 3.9–7.8)

Other risk factors for PPH

personal or family history of previous PPH, obesity, multiparity, Asian or Hispanic race, precipitous delivery, excessive uterine distention (e.g. multiple pregnancy, polyhydramnios, fetal macrosomia), chorioamnionitis, uterine inversion, uterine fibroids, Couvelair uterus, inherited bleeding diathesis, acquired bleeding diathesis (e.g. amniotic fluid embolism, abruptio placentae, sepsis, fetal death), assisted reproduction technology, anaemia and the use of certain drugs: muscle relaxants, antithrombotics.**ANTIDEPRESSANTS**, especially selective serotonin reuptake inhibitors (SSRIs) and serotonin and noradrenaline reuptake inhibitors (SNRIs) - **ANAEMIA**

Preventive measures

Recommendation
We recommend **treatment of antenatal anaemia.** Pregnant women should be given iron preparations if their hemoglobin level falls **below 110g/l in the first trimester** or **below 105g/l in the 28th week** of pregnancy.

Recommendation
We suggest considering **parenteral iron** in women with sideropenic anaemia unresponsive to oral iron supplementation. Life-threatening peripartum haemorrhage

Anamnesis

Risk factors 40%

A.

- multiple pregnancy
- preeclampsia/gestational hypertension

- placenta praevia
- suspected premature separation of the placenta
- suspected amniotic fluid embolism

B.

- Life-threatening peripartum haemorrhage in previous childbirth
- Asians
- Obesity (BMI > 35)
- Anaemia (< 9g/ml)

C.

- Acute Caesarean section
- Induction of labour
- Placenta adhaerens
- Operative vaginal delivery
- Prolonged labour (> 12 hours)
- Large fetus (> 4 kg)
- Fever during labour
- Morther's age (> 40 years)

Risk Factors 60%

Review > Curr Opin Anaesthesiol. 2019 Jun;32(3):278-284. doi: 10.1097/ACO.0000000000000717.

Postpartum hemorrhage revisited: new challenges and solutions

Nicole Higgins [1], Samir K Patel [1], Paloma Toledo [1 2]

Affiliations + expand

PMID: 31045634 DOI: 10.1097/ACO.0000000000000717

Summary: Although postpartum hemorrhage itself may not be preventable, early identification of blood loss, and mobilization of resources may prevent adverse outcomes. Multidisciplinary planning at the system level, ensuring that hemorrhage protocols exist, as well as for management of high-risk patients is important for improving patient outcomes.

Preventive measures

Recommendation
Women with risk factors for life-threatening PPH should give birth in medical facilities **appropriately staffed and materially equipped to deal with life-threatening PPH**.

Recommendation
For patients with a high risk of PCOS (abnormal placentation), we recommend **formulating a care plan with the participation of a multidisciplinary team** in a reasonable time before delivery.

Bleeding in human childbirth

Before delivery - DIC, Life-threatening PPH

- placental abruption
- amnioticfluid embolism
- endo/myometritis
- preeclampsia/HELLP

During delivery - Life-threatening PPH, DIC

- in III. stage of labour (delivery of the placenta)
- during the operation

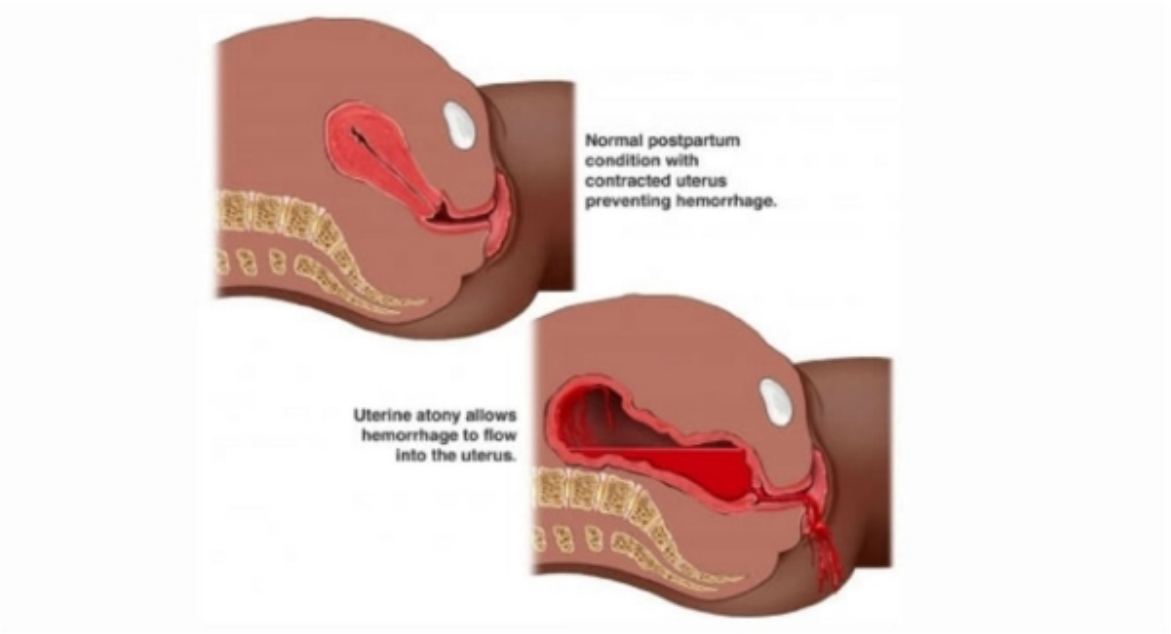
After delivery - Life-threatening PPH

- hysterotomy

4 T

Disorders of uterine Tonus 70 – 80%

- postpartum uterine hypo-/atony



Birth Trauma 10 – 15%

- laceration of the cervix, vagina, perineum
- pelvic haematomas
- uterine rupture, intraoperative complications
- inversion of the uterus

Trauma related to bleeding = **tissue laceration** (including uterine rupture) or **surgical incisions.**

Lacerations/ruptures of the cervix and vagina will be caused by

- fetus – passage through the birth canal
- assistance - intervention during childbirth

Lacerations/ruptures

- obvious
- hidden (haematomas of the vulva, paracolpia, retroperitoneum)

Tissue pathology 1 – 5%

- placenta adherens, placenta accreta

Coagulopathy (**T**hrombin) **1 – 5%**

- DIC early (amniotic fluid embolism, abruption!!!)

Coagulopathy (**T**hrombin)

- about 1 in 500 births in the U.S.
    - **< 7% of PPH cases** (placental abruption, amniotic fluid embolism)
      Reale SC, Easter SR, Xu X, et al. Trends in Postpartum Hemorrhage in the United States From 2010 to 2014. Anesth Analg 2020; 130:e119.
    - **Congenital coagulopathies**
      von Willebrand disease = high risk of PPH
        - von Willebrand factor level during pregnancy ↑, after delivery ↓↓↓
    - **Acutely acquired coagulopathy**
        - **amniotic fluid embolism**
        - **placental abruption**
        - severe preeclampsia

- HELLP syndrome (haemolysis, elevated liver enzymes, low platelets)

International society on thrombosis and haemostasis diagnostic scoring system for overt DIC.

1. Risk assessment: Does the patient have an underlying disorder known to be associated with overt DIC?
If yes: proceed
If no: do not use this algorithm
2. Order global coagulation tests (prothrombin time, platelet count, fibrinogen, fibrin related marker)
3. Score the test results
Platelet count (>100 = 0, <100 = 1, <50 = 2)
Elevated fibrin marker (e.g. D-dimer, fibrin-degradation products) (no increase = 0, moderate increase = 2, strong increase = 3)
Prolonged prothrombin time (<3 s = 0, >3 but <6 s = 1, >6 s = 2)
Fibrinogen level (>1 g/L = 0, <1 g/L = 1)
4. Calculate score:
⩾5 compatible with overt DIC: repeat score daily
<5 suggestive for non-overt DIC: repeat next 1–2 days

Causes of PPH
Disorders of uterine tonus 70 – 80%

- postpartum uterine hypo-/atony

Delivery trauma 10 – 15%

- laceration of the cervix, vagina, perineum
- pelvic haematomas
- uterine rupture, intraoperative complications
- uterus inversion

Tissue pathology 1 – 5%

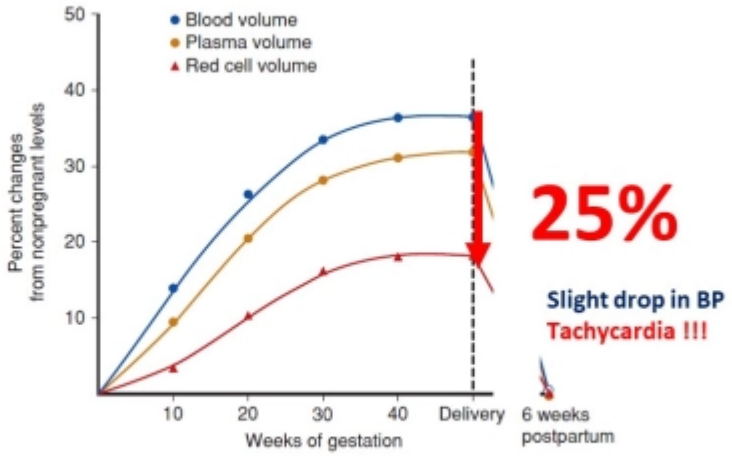
- placenta adherens, placenta accreta

Coagulopathy 1 – 5%

- DIC early (amniotic fluid embolism, abruption!!!)

Clinical note:
During pregnancy, a woman's blood volume increases physiologically, where at the end of pregnancy the increase is up to **40%** of the original volume.

Initial symptoms of a haemorrhagic shock are therefore less pronounced during pregnancy.
As long as the blood loss does not exceed **1000 ml,** the systemic pressure and the heart rate of the pregnant/partum/six-weeks-postpartum woman are **maintained within the physiological range.**



Clinical count in peripartum bleeding

Volume of blood loss	Blood pressure (systolic)	Symptoms	Degree of shock
500–1000 mL (10–15%)	Normal	Palpitation Tachycardia Dizziness	Compensated Class I
1000–1500 mL (15–25%)	Slight drop (100–80 mmHg)	Weakness Tachycardia Perspiration	Light Class II
1500–2000 mL (25–35%)	Moderate drop (80–70 mmHg)	Unrest Pallor Oliguria	Medium Class III
2000–3000 mL (35–50%)	Significant drop (70–50 mmHg)	Collapse Shortness of breath Anuria	Severe Class IV

Causes of non-standard care for a woman with PPH

- **delayed diagnosis**

- **delayed treatment** due to **underestimated blood loss**
- **delayed preparation** of blood products **and coagulation factors**
- **lack of management** protocols
- **insufficient** professional **training of personnel**
- **poor communication** between the interdisciplinary team
- deficiencies in organization and **delays in initiation of treatment**

Reduction of maternal mortality and morbidity

- **timely** identification of PPH
- **timely** and correct diagnosis of the cause of bleeding
- **rapid intervention**/treatment of PPH

High risk of excessive bleeding during delivery

- **III. stage of labour** = myometrial perfusion **600 ml/min. about 15%** of the mother's cardiac output
- **Haemostasis** = after delivery of the placenta

Life-threatening peripartum bleeding
When? = start (time)

Where? = localization

How? = amount

Management of life threatening peripartum haemorrhage – applies !!!

1. **rapid** anti-shock measures
2. **rapid** surgical treatment
3. .**rapid** intensivist treatment = **substitution of blood factors**

Real time

- collection time
- time required for transport to the laboratory
- material processing
- result available.....???

45 minutes

We recommend **monitoring coagulation** and the initiation of measures **to adjust coagulations as soon as possible**
after identifying the condition of life-threatening PPH.

To identify the type of coagulation disorder in life-threatening PPH we recommend using **viscoelastometric methods (TEG, ROTEM)**, if available.

Thromboelastograph (TEG ®)

Thromboelastometer

Recommendation

We recommend **fibrinogen substitution** in patients with life-threatening PPH when its level drops below **2 g/l** and/or when its functional deficit is detected by viscoelastometric methods or when there is a justified clinical assumption of fibrinogen deficiency **even without knowledge of its levels**.
As a minimum initial dose for life-threatening PPH, we recommend the administration of an initial dose of at least 3 g **(4 g)** of **fibrinogen** or the **equivalent** of this dose when using transfusion preparations with increased fibrinogen content.

Recommendation

We recommend prophylactic administration of uterotonics in **III. stage of labour** immediately after the birth of the child before ligation of the umbilical cord. The drug of first choice is **oxytocin**.

Recommendation
We suggest considering the administration of **carbetocin** in women with an increased risk of life-threatening PPH.

Recommendation
For women with an increased risk of life-threatening PPH undergoing Caesarean

section, we suggest considering a single administration of **tranexamic acid (TXA)** along with **carbetocin**.

Midwife

1. statim mask for oxygen supply
2. IV securing with a strong cannula
3. permanent urinary catheter

Doctor

ANAMNESIS - informed by the midwife

- inquiry about the suspected cause of bleeding
- blood loss estimation query
- Monitoring of BP, P, saturation
- BP falls and heart rate rises

Identifying the source of bleeding:

1. examination in mirrors
2. palpation bimanual examination
3. ultrasound examination

Differential diagnostics

1. uterine hypotonia/atony
2. retention of the placenta
3. retention of part of the placenta
4. uterine rupture/dehiscence
5. uterus inversion
6. birth canal injury
7. DIC (PLT, APTT, PT, fibrinogen, D-dimers, antithrombin)
8. primarily haematological disorder

The doctor checks the previous procedures:

1. assessment and provision of basic life functions
2. initiation of monitoring of basic vital functions
3. initiation of oxygen therapy

4. ensuring/controlling entry into the bloodstream
5. initiation of fluid replacement/fluid resuscitation
6. IV administration of uterotonics

He will recommend an initial laboratory examination:

1. blood count
2. basic coagulation examination *(aPTT, PT)*
3. fibrinogen level
4. pre-transfusion examination (blood group, screening for irregular antibodies against erythrocytes, compatibility test)
5. orientation test of blood clotting with thrombin

Initial requirements for transfusion products:

- **plasma** *(in the initial phase of ensuring the availability of at least 4 transfusion units)*
- **erythrocytes** *(in the initial phase of ensuring the availability of at least 4 transfusion units)*

Uterine hypotonia/atony

Step 1

1. uterine massage
2. uterotonics
    I. oxytocin, better carbetocin
    II. methylergometrine
3. prostaglandins
4. digital or instrumental revision of the uterine cavity

In case of failure - Step 2

1. removal of coagulum
2. uterotonics
3. Bakri balloon catheter, *(eventual vaginal tamponade)*

In case of failure, immediately - Step 3.

1. surgical intervention *(gradual devascularization of the uterus)*

    - ligation aa. uterinae and aa. ovaricae

- B-Lynch uterine suture

- ligation aa. iliacae internae

2. selective catheter embolization aa. uterinae *(if interventional radiology is available)*

3. consideration of administration of recombinant activated factor VII *(NovoSeven®)*

Coagulation supportGeneral principles

Basic initial procedures to restore the effectiveness of the body‘s hemostatic mechanisms and to support coagulation:

- maximum possible **correction of hypothermia**
- maximum possible **correction of acidosis**
- **correction of hypocalcemia**
- correction of other system homeostasis parameters

  - fibrinogen
  - tranexamic acid

Ensuring/control of entry into circulation *(insertion of at least 2 peripheral catheters with the largest possible diameter is recommended)*

Initiate/continue fluid resuscitation *(crystalloids and/or colloids)*

- **crystalloids**, balanced solutions are preferred, the usual starting dose is **approx. 2000 ml**
- **colloids**, usual starting dose **500-1000 ml**

Medicines and their dosage

Oxytocin *(Oxytocin®)*
Initiation of treatment: 10 IU i.m. and 20-40 IU in 1000 ml infusion solution, rate: 60 drops/min,
further: 20 IU in 1000 ml of infusion solution.
Rate: 40 drops/min, until bleeding stops.

Carbetocin *(Duratocin®)*
Replacement of oxytocin infusion 100 µg IV (administration time 1 minute)

Methylergometrine
Initiation of treatment: 0.2 mg i.m. or slowly i.v.

further: after 15 minutes, repeat administration of 0.2 mg methylergometrine i.m.
r: 0.2 mg i.m. or slowly i.v. every 4 hours, do not exceed a dose of 1 mg *(five doses of 0.2 mg)*

Tranexamic acid (Exacyl®)
Initial dose 1 g in 10 minutes,
further: continue infusion at a dose of 1 g during 8 hours.
An alternative is a dosage of 20-25 mg/kg.

Fibrinogen'
The administration of fibrinogen is recommended for life-threatening PPH when its concentration drops below 2 g/l i.v.
Initial dose: for life-threatening PPH, 3 – 4 g i.v. is recommended.

Prostaglandins F2α
If bleeding continues even after administration of oxytocin, carbetocin, or ergometrine, prostaglandins are in order.

Dinoprost *(Enzaprost F®)*5 mg in 500 ml of infusion solution, rate: 5 ml/min (= 300 ml/h) do not exceed a dose of 20 mg, if there is no response, give carboprost *(Prostin 15M®).*

Carboprost *(Prostin 15M®)*
Initiation of treatment: 0.25 mg i.m. alternatively intramyometrially,
further: as needed every 15 minutes 0.25 mg i.m., do not exceed a dose of 2 mg *(eight doses of 0.25 mg).*

Erythrocytes

- the target hemoglobin value is recommended to be at least 70 g/l *(significant anaemia reduces the effectiveness of haemostasis mechanisms)*
- recommended ratio of the number of TU erythrocytes and plasma is 1:1 to 1.5:1

Plasma

- administration of plasma is recommended for clinical signs of bleeding and prolongation of PT and/or aPTT to 1.5 times normal values or more
- the recommended minimum initial dose of plasma for life-threatening PPH is 15-20 ml/kg

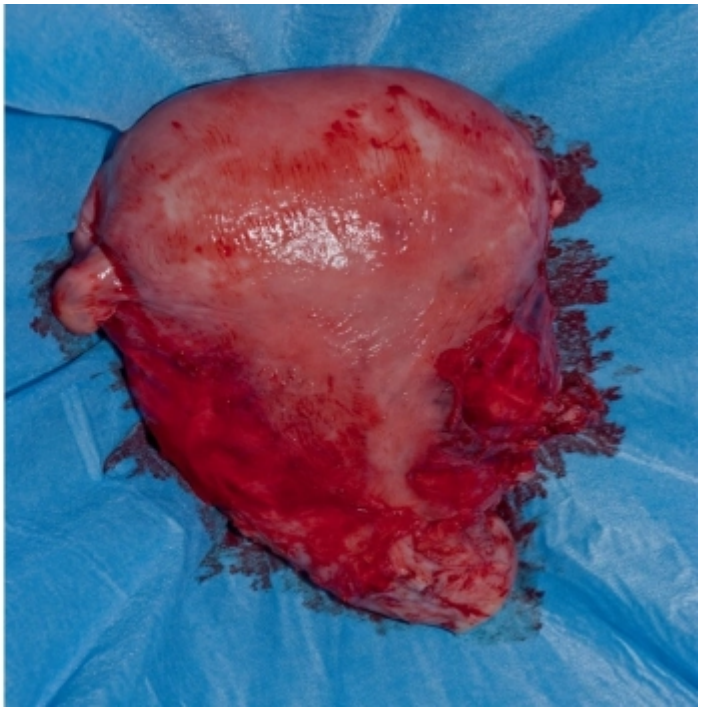
Platelets

- administration of platelets is recommended for life-threatening PPH when the number of platelets drops below 70 x 109/l

The role of interventional radiology

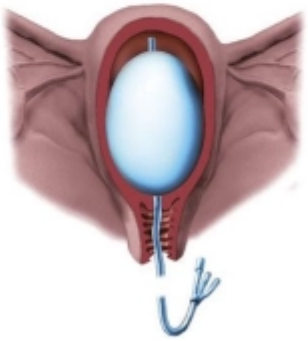
In all cases of peripartum life-threatening bleeding due to hypotony or atony of the uterus, we recommend **using radiological interventional methods** (selective embolization of the uterine arteries), **if available**, when the usual standard surgical procedures fail (or are impossible to perform) in the workplace.

Hysterectomy = last resort



Non-pneumatic Anti-Shock Garment (NASG)

Nonpneumatic Antishock Garment Combined with Bakri Balloon as a Nonoperative "Uterine Sandwich" for Temporization of Massive Postpartum Hemorrhage from Disseminated Intravascular Coagulation



Morbidity and mortality

Mortality of PPH approx. **2%** (large differences worldwide)

- **0.6%** Great Britain
- **20%** in some parts of Afric

Transfusion Women Trial (study of approx. 20,000 women)

- **54%** blood transfusion

Risks of transfusion infection, abnormalities ofelectrolytes, allergic reactions, alloimmunization

Hysterectomy (Women Trial)

- **3.5%** of women hysterectomies postpartum for PPH
- USA 2014 hysterectomy **2.1%** of women with PPH(atony 60%
- Czech Republic

Thromboembolism (Women Trial)

- **0.3%** of women with PPH have a thromboembolic event within 42 days after birth.

Haemodynamic instability and organ failure (Women Trial)

- 4% kidney, heart, respiratory, liver failure

Sheehan syndrome

- postpartum hypopituitarism rare but potentially life-threatening complications

Abdominal compartment syndrome

- organ dysfunction caused by intra-abdominal hypertension is a rare but life-threatening complication of PPH with intra-abdominal bleeding

Asherman syndrome

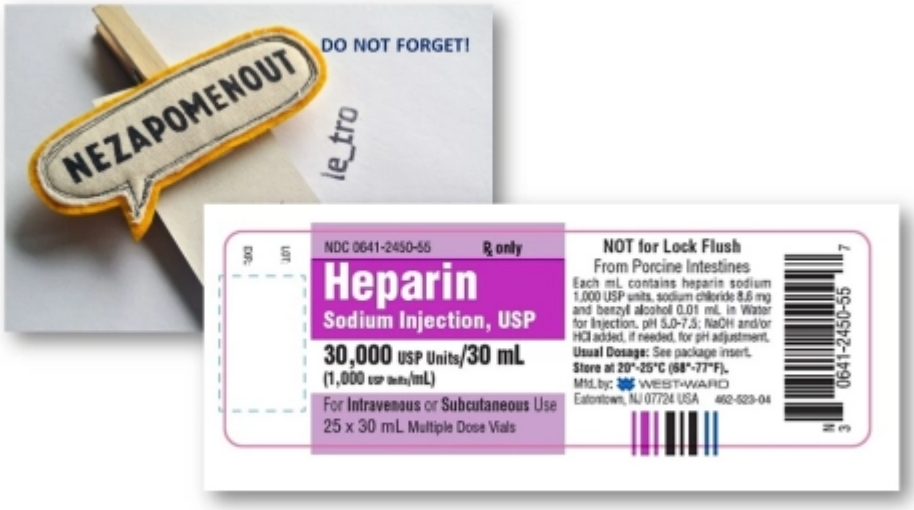
- up to 90% of cases of severe intrauterine adhesions is related to revision/curettage of the uterus

Postpartum anaemia

- postpartum anaemia is **commo**

Recurrence

Women with previous PPH have up to an **18% risk of recurrence** in subsequent pregnancy.
Oberg AS, Hernandez-Diaz S, Palmsten K, et al. Patterns of recurrence of postpartum hemorrhage in a large population- based cohort. Am J Obstet Gynecol 2014; 210:229.e1.
Ford JB, Roberts CL, Bell JC, et al. Postpartum haemorrhage occurrence and recurrence: a population-based study. Med J Aust 2007; 187:391.
Ruiter L, Kazemier BM, Mol BWJ, Pajkrt E. Incidence and recurrence rate of postpartum hemorrhage and manual removal of the placenta: A longitudinal linked national cohort study in The Netherlands. Eur J Obstet Gynecol Reprod Biol 2019; 238:114.



Prophylaxis of thromboembolism
12 to 24 hours after PPH pharmacological thromboprophylaxis, even if coagulation tests are normal

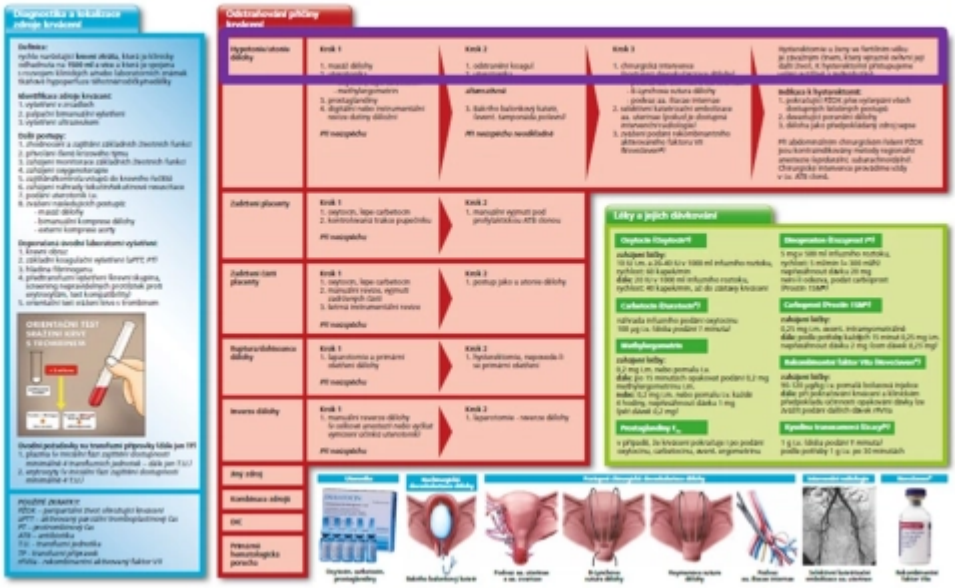
Conclusion

Recommended practices

Life-threatening PPH treatment principle
Myometrial **P**erfusion **O**xygenation **U**terotonics **P**lasma factors

Peripartum life-threatening bleeding - obstetrician procedures

PORODNICE.CZ



2016

OBSTETRIC EMERGENCY DRILLS

Trainer's Manual

Improve the quality of care *for* women having obstetric emergencies

Institute for Clinical Effectiveness and Health Policy | Mother and Child Health Research Department

Training (of model situations) is necessary...

training → drill
simulation of catastrophic events

Why drill in obstetrics...???

- very few opportunities for exposure to acute conditions
- very little personal experience
- practicing a series of procedures in planned simulated
- event is the only means of education (especially in obstetrics)

Proper management:

- saving your own skin

Organizational principles

physiological blood loss	**1**
less severe blood loss	**2**
severe blood loss	**3**
life threatening blood loss	**4**

(1) physiological blood loss → **midwife**

(2) less severe blood loss → doctor is called – **obstetrician**

(3) severe blood loss → doctor is called – **anaesthetist**

(4) life-threatening blood loss

→ **crisis plan** (standard formalized procedure)

→ **crisis team** (organizational and professional role of individual members)

UPMC LIFE CHANGING MEDICINE

Obstetric Crisis Drills

Magee-Womens Hospital of UPMC
Peter M. Winter Institute for Simulation, Education and Research
University of Pittsburgh School of Medicine

R Rapid
R Response
T Team

Model situation – everyone runs...

Peripartum haemorrhage

What needs to be available:

- knowledge
- elaborate procedures
- necessary medication
- technology – operative, intensiviste


LÉKÁRNA


PŽOK
DURATOCIN

Simulation Centre

1. LÉKAŘSKÁ FAKULTA
Univerzita Karlova

Obstetrics Forum.cz

VITA ET FUTURA

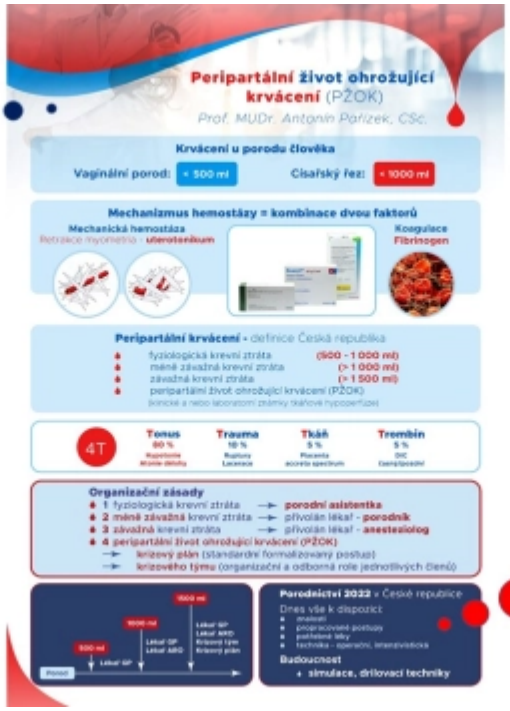
The application is free to download for **iOS** and **Android** and from your **internet browser**:

Download on the App Store | GET IT ON Google Play | Web

Leading cause of death

Atony of the uterus

Prevention and treatment



Timely estimation of blood loss

Strategy and speed of treatment

Training in life-saving procedures

Simulation, simulators... Drilling techniques...

Guidelines for postpartum haemorrhage
Obstetric procedures

Pařízek A. and co-authors

CZECH REPUBLIC DEVELOPMENT COOPERATION

Cambodia Obstetrics Forum

Diagnosing and identifying the source of bleeding

Definitions:
Peripartum haemorrhage can be defined and classified according to estimated blood loss:
1. **Moderate blood loss** (blood loss 500-1000 mL)
2. **Severe blood loss** (blood loss >1000 mL)
3. **Life-threatening blood loss**, defined as rapidly increasing blood loss clinically estimated as >1500 mL or any blood loss associated with the development of clinical and/or laboratory signs of shock/tissue hypoperfusion

Organisation of care management:
1. **Moderate blood loss:** an obstetrician should be called in all cases
2. **Severe blood loss:** an anaesthesiologist should also be called in all cases
3. **Life-threatening blood loss:** a multidisciplinary crisis team should be activated in all cases

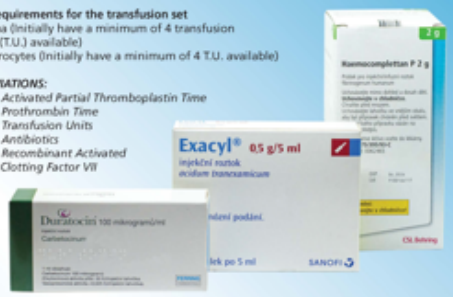
Identifying the source of bleeding:
1. Examination in specula
2. Bi-manual palpation examination
3. Ultrasound examination

Further steps:
1. Evaluating and determining basic vital signs
2. Calling in members of the crisis team
3. Initiating vital sign monitoring
4. Initiating oxygen therapy
5. Initiating/controlling access to the bloodstream
6. Intravenous uterotonic
7. Considering the following steps:
   - massaging the uterus
   - bimanual compression of the uterus
   - external aortal compression

Recommended initial laboratory examinations:
1. Blood count
2. Basic coagulation examination (aPTT, PT)
3. Fibrinogen levels
4. Pre-transfusion examination (blood type, screening for irregular antibodies to erythrocytes, compatibility test)
5. Thrombin Test of blood clotting

Initial requirements for the transfusion set
1. Plasma (initially have a minimum of 4 transfusion units (T.U.) available)
2. Erythrocytes (initially have a minimum of 4 T.U. available)

ABBREVIATIONS:
aPTT – Activated Partial Thromboplastin Time
PT – Prothrombin Time
T.U. – Transfusion Units
ATB – Antibiotics
rFVIIa – Recombinant Activated Clotting Factor VII



Eliminating the causes of bleeding

	Step 1	Step 2	Step 3
Hypotonia/atonia of the uterus	1. Massaging the uterus 2. Administering uterotonic – oxytocin, or better carbetocin – methylergometrine – prostaglandins – digital or instrumental uterus examination through the cervix ***If unsuccessful, then***	1. Removing the blood clots 2. Uterotonic **or alternatively** 3. A Bakri balloon catheter (eventually a vaginal tamponade) ***If unsuccessful, then***	1. Surgical intervention (gradual devascularization of the uterus) – ligation of the uterine and ovarian arteries – B-Lynch suture of the uterus – ligation of the internal iliac artery 2. Selective embolization of the uterine artery by catheter (if interventional radiology is available) 3. Considering application of use abbreviation rFVIIa (NovoSeven®)
Retained Placenta	1. Oxytocin, or rather carbetocin 2. Controlled tension on umbilical cord ***If unsuccessful, then***	1. Manual removal accompanied by prophylactic antibiotic treatment	
Partially retained placenta	1. Oxytocin, or rather carbetocin 2. Manual excision, removal of retained part ***If unsuccessful, then***	1. Proceed as for uterine atonia	
Rupturing/dehiscence of the uterus	1. Laparotomy and primary treatment of the uterus ***If unsuccessful, then***	1. Hysterectomy, if primary treatment does not work	
Uterine inversion	1. Manual reversion of the uterus (under general anesthesia or wait for effects of uterotonic to subside) ***If unsuccessful, then***	1. Laparotomy – reversion of the uterus	
Other sources			
A combination of sources			
DIC			
A primary hematological disorder			

Hysterectomy in women of fertile age is an irreversible act that significantly affects their future life. Thus hysterectomy should be considered very carefully and individually.

Indications for hysterectomy:
1. Ongoing peripartum life-threatening hemorrhage despite undergoing all available treatments
2. Devastating uterine injury
3. The uterus as the presumed source of sepsis

When performing abdominal surgery for peripartum life-threatening hemorrhage, local anesthetics (epidural, subarachnoid) are contra-indicated. Surgery should always be performed with intravenous antibiotics.

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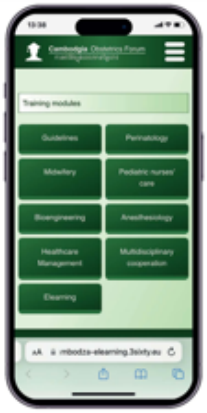


Medicines and dosing

Oxytocin (*Oxytocin®*)
Initial treatment:
10 IU oxytocin i.v. and 20-40IU in 1000ml, speed 60drops/min, further: 20 IU in 1000ml infusion, speed 40 drops/min until the bleeding stops

Carbetocin (*Duratocin®*)
Alternative to infusion-applied oxytocin 100 µg i.v. *(given for 1 minute)*

Methylergometrine
Initial treatment:
0.2 mg i.m. or slow i.v.
Further: repeat 0.2 mg dose of methyl-ergometrine i.m. every 15 minutes
or: 0.2 mg i.m. or slow i.v. every 4 hours, do not exceed a dose of 1 mg *(five 0.2 mg doses)*

Prostaglandins $F_{2\alpha}$
If bleeding persists even after oxytocine, carbetocine, ev. ergometrin.

Dinoprostum (*Enzaprost F®*)
5 mg in 500 ml infusion solution, speed: 5ml/min (= 300 ml/h)
Do not exceed a dose of 20 mg. If no response, give carboprost (*Prostin 15M®*)

Carboprostum (*Prostin 15M®*)
Initial treatment:
0.25 mg i.m., eventually intramyometrial
Further: according to need 0.25 mg i.m. every 15 minutes, do not exceed a dose of 2 mg *(eight 0.25 mg doses)*

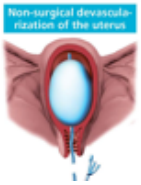
Tranexamic acid (*Exacyl®*)
Administration of tranexamic acid while peripartal life threatening bleeding can be considered. **Initial treatment:** recommended 1 g in 10 minutes and subsequent infusion of an additional 1 g every 8 hours.

Fibrinogen
Administration of fibrinogen is recommended in peripartal life threatening bleeding if the concetration is lower than 2g/l i.v.
Initial treatment: recommended 3-4g i.v.

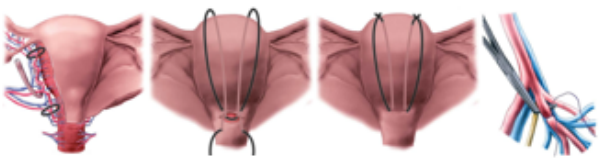
Recombinant Factor VIIa (*NovoSeven®*)
Administration of recombinant factor VIIa can be considered in the situation, where peripartal life threatening bleeding continues even through surgical intervention that stopped bleeding, administration of antifibrinolytics, correct application of blood transfusion and correction of acidosis, hypothermia and hypocalcemia.
Initial treatment: 90 µg/kg.

Uterotonic

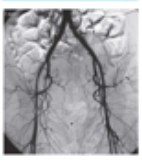
Non-surgical devascularization of the uterus



Gradual surgical devascularization of the uterus



Interventional radiology



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