Universitätsspital Basel

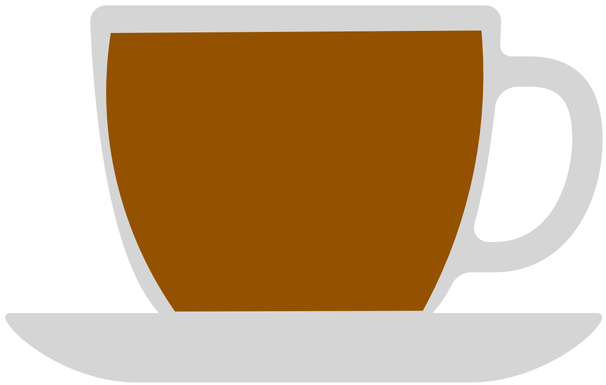
Update of the Swiss PPH guidelines

Thierry Girard
Basel

Universitätsspital Basel

Update of the DACH PPH guidelines

Thierry Girard
Basel

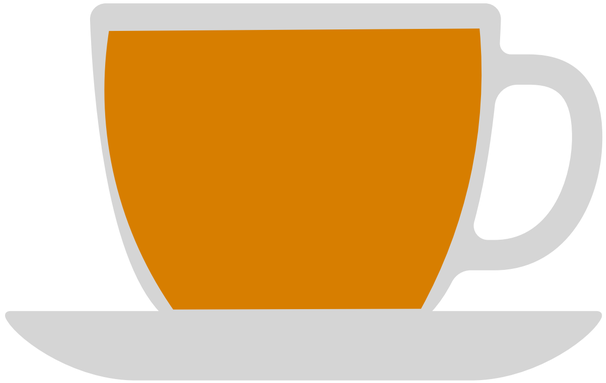


hematocrit	hemoglobin
27%	9 g/l

hematocrit	hemoglobin
27%	9 g/l

hematocrit	hemoglobin
18%	6 g/l

normovolemia



heart rate

peripheral resistance

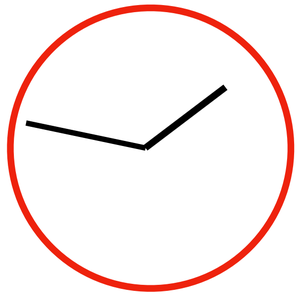
urine output

normovolemia

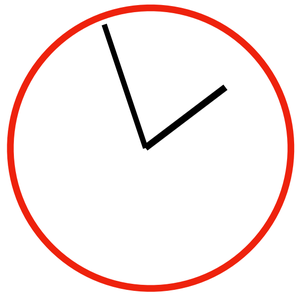
cardiac filling

cardiac output

blood pressure



14:00
IR 2524
Genève-Aéroport
8



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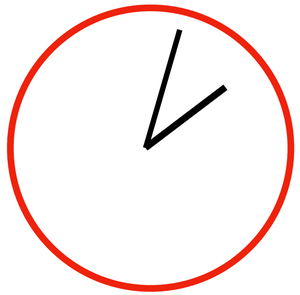

14:00
IR 2524
Genève-Aéroport
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Leitlinien

Leitlinien-Detailansicht

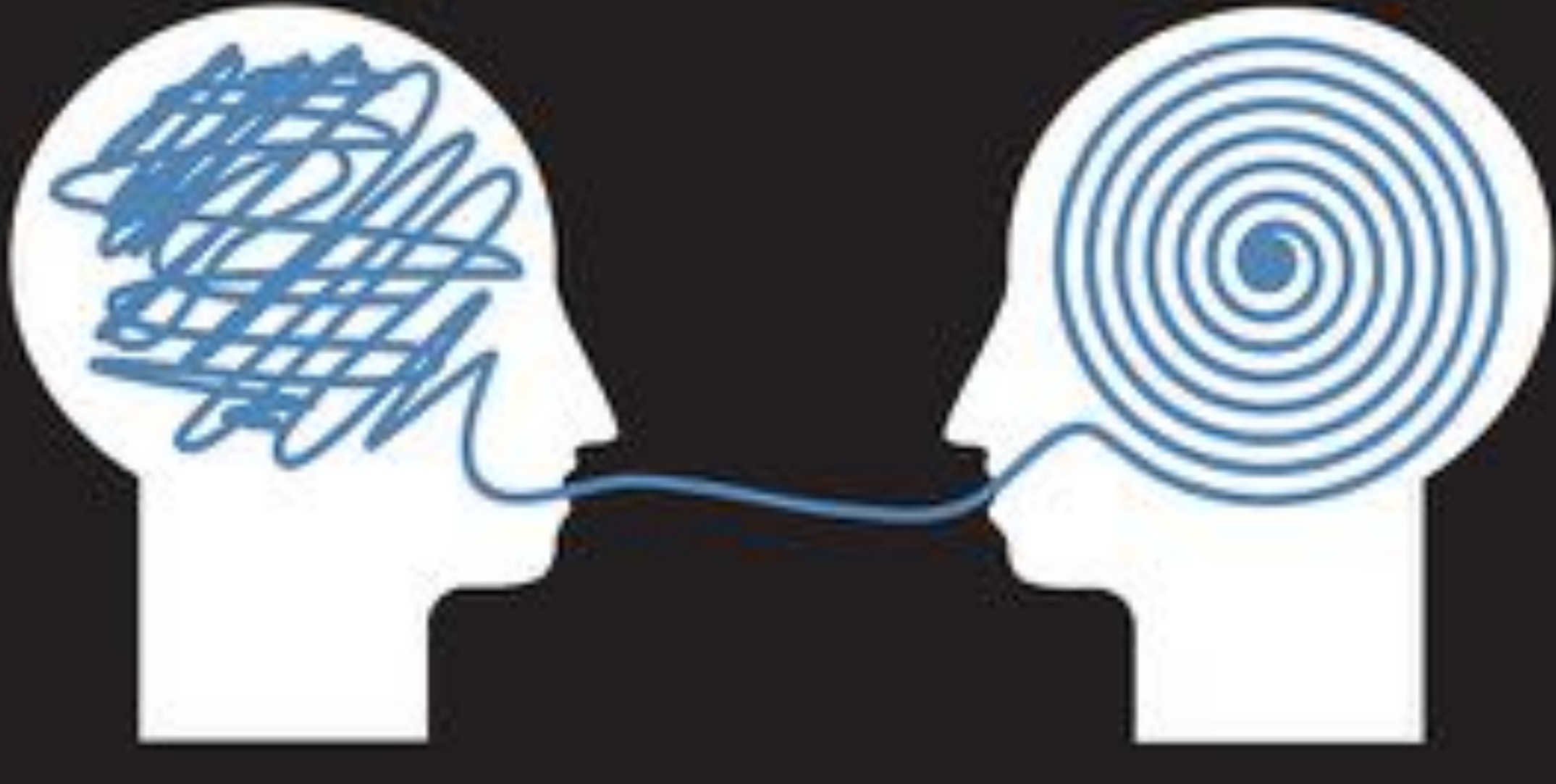
Peripartale Blutungen, Diagnostik und Therapie

Registernummer 015 - 063

Klassifikation S2k

Stand: 01.08.2022 , gültig bis 31.07.2027

28.9.2022: redaktionell überarbeitete Langfassung eingestellt; 27.9.2022: redaktionell überarbeitete Langfassung eingestellt



70%

DACH 2011

POSTPARTALE BLUTUNG | Handlungsalgorithmus

nach vaginaler Geburt oder in der postoperativen Überwachungsphase nach Sectio caesarea

© 2011: PPH-KONSENSUS – Gruppe (D-A-Ch)

	klinische Symptome	allgemeine/operative Maßnahmen	Medikamente
STEP 1	Dauer max. 30 min nach Diagnosestellung	HINZUZIEHEN Oberarzt | Facharzt Geburtshilfe | INFORMATION Anästhesie	

	• **vaginale Blutung**
	>500 ml nach vaginaler Geburt
	>1500 ml nach Sectio caesarea
	
	CAVE: Unterschätzung
	! Messsystem !
	
	• **Patientin kreislaufstabil**
		• 2 i.v.-Zugänge (mindestens 1 großlumiger)
		• Kreuzprobe / Notfalllabor / EKG's bereitstellen
		• Volumengabe (z.B. Kristalloide / Kolloide)
		• Blase katheterisieren
		• Blutverlust messen
		• rasche Abklärung der Blutungsursache (4T's)
		  • Uterustonus (Tonus-Atonie?)
		  • Plazentainspektion (Tissue-Plazentarest?)
		  • Speculumeinstellung (Trauma-Geburtskanal?)
		  • Gerinnung (Thrombin-Laborwerte?)
		• Uteruskompression – Ultraschall
		
		PARALLEL
			• OXYTOCIN
			3-5 IE (1 Amp.) als Kurzinfusion und
			40 IE in 30 min (Infusion/Perfusor)
			ODER
			• CARBETOCIN (off label use)
			100 µg (1 Amp.) in 100 ml NaCl 0,9%
			als Kurzinfusion
			
			bei starker persistierender Blutung STEP 2,
			bei moderat persistierender Blutung evtl.
			• MISOPROSTOL (off label use)
			800 µg (4 Tbl. á 200 µg) rektal

STEP 2	Dauer max. weitere 30 min (= 60 min nach Diagnosestellung)	HINZUZIEHEN Anästhesie | Alarmierung OP Team | ORGANISATION OP-Saal TRANSFERKRITERIEN überdenken	

	• **anhaltend schwere Blutung**
	• **Patientin kreislaufstabil**
		• OP-Vorbereitung
		• Ausschluss Uterusruptur
		  • Nachtastung / Ultraschall
		• bei V. a. Plazentarest (nach US oder Inspektion)
		  • manuelle Nachtastung
		  • ggf. Curettage (US-Kontrolle)
			Bestellung FFP / EK / TK
			(kreuzen und in den Kreissaal/OP bringen lassen)
			
			• SULPROSTON
			500 µg (1 Amp.; max. 3 Amp. pro 24 h)
			nur über Infusomat/Perfusor
			• 2 g TRANEXAMSÄURE i.v.
			vor Fibrinogengabe
			Bei persistierender schwerer Blutung
			(ca. 1500 ml Gesamtblutverlust)
			• FIBRINOGEN 2–4 g
			• FFP / EK erwägen

STEP 3		TRANSFERKRITERIEN überdenken | HINZUZIEHEN Oberarzt Anästhesie INFORMATION der bestmöglichen personellen Expertise	
	• **therapierefraktäre schwere Blutung und kreislaufstabile Patientin** oder • **hämorrhagischer Schock** ZIEL • hämodynamische Stabilisierung (temporärer Blutungsstop • Optimierung von Gerinnung und • Erythrozytenkonzentration • Organisation von STEP 4	**CAVUMTAMPONADE** BALLONAPPLIKATION • Balloneinführung unter Ultraschallkontrolle • ausreichendes Auffüllen des Ballons (Sulproston weiter) • leichten Zug applizieren • alternativ Streifentamponade BLUTUNGSSTOP • Intensivüberwachung • BALLONDEBLOCKADE nach 12-24 Std. (ggf. nach Transfer im Zentrum) PERSISTIERENDE oder ERNEUE BLUTUNG (Blutung bei liegendem Ballon oder nach Deblockade) • ggf. erneute Ballonapplikation („bridging") • obligat STEP 4	ZIELKRITERIEN • Hämoglobin > 8-10 g/dl (5-6,2 mmol/l) • Thrombozyten > 50 Gpt/l • RR systolisch > 80 mmHg • pH > 7,2 • Temperatur > 35° C • Calcium > 0,8 mmol/l
STEP 4		HINZUZIEHEN der bestmöglichen personellen Expertise	
	• **persistierende Blutung**	Definitive Versorgung | (chirurgische) Therapie **KREISLAUFINSTABILITÄT** BLUTSTILLUNG ↓ Laparotomie / Gefäßklemmen / Kompression STABILISIERUNG Kreislauf / Temperatur / Gerinnung eventuell rekomb. Faktor VIIa	**KREISLAUFSTABILITÄT** DEFINITIVE CHIRURGISCHE THERAPIE Kompressionsnähte Gefäßligaturen Hysterektomie EMBOLISATION

Transferkriterien
- Fehlen von operativem oder interventionellem Equipment oder fehlende Anwesenheit von geschultem Personal
- temporärer Blutungsstop durch Cavumtamponade
- hämodynamische Transportstabilität der Patientin
- existierende SOP zw. Zielkrankenhaus und transferierendem Krankenhaus

rekombinanter Faktor VIIa (! off label use !)
- initial 90 µg/kg KG (Bolus)
- ggf. Wiederholungsdosis bei persistierender Blutung nach 20 min

Voraussetzungen

pH	≥ 7,2
Fibrinogen	> 1,5 g/l
Thrombozyten	> 50 Gpt/l

Hyperfibrinolyse ausgeschlossen/therapiert

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klinische Symptome	allgemeine/operative Maßnahmen	Medikamente
STEP 1		
STEP 2		
S		

Interdisziplinärer PPH-Behandlungsalgorithmus: „PPH 2022“

nach: PPH-Leitlinie 2022 AWMF Register 015/063 der BVF, DGGG (AGG), DeGIR, DEGUM, DGAI, DGHWI, DGKL, DGPM, DGPGM, DHV, DIVI, EFCNI (Pat.), GTH, OEGARI, OEGGG, SGGG, SSAPM (alphabetische Listung)

Klinische Symptome

Geburtsmedizin

Anästhesiologie / Gerinnung

Interdisciplinary algorithm for the therapy of PPH: „PPH 2022“

PPH-guideline 2022 AWMF Registry number 015/063 by BVF, DGGG (AGG), DeGIR, DEGUM, DGAI, DGHWI, DGKL, DGPM, DGPGM, DHV, DIVI, EFCNI (Pat.), GTH, OEGARI, OEGGG, SGGG, SSAPM (alphabetical order)

	persistent bleeding	Blood loss >1000 ml	Blood loss >1500 ml (~¼ blood volume)	Blood loss >2000 ml
clinical symptoms	CALL IN registrar obstetrician & INFORM anaesthesiologist	CALL IN senior obstetrician & anaesthesiologist | consider TRANSFER	Ensure sufficient staff and expertise (senior level for obs and anaesth) | haematology / radiology advice?	sufficient staff and expertise? Haematology advice? Is embolisation possible?
	• Pt. haemodynamically stable • blood loss: – >500 mls with vag. delivery – >1000 mls with caesarean section **CAUTION**: underestimation of blood loss → measure, don't estimate!!!	• Pt. haemodynamically stable • ongoing severe blood loss	• Pt. haemodynamically **un**stable (Shock-Index [HF / BPsys] > 0.9) with persistent severe bleeding (Caution: BE <-6 mmol/l and lactate >4 mmol/l)	• **Haemorrhagic shock**
obstetrics	• **Measure** blood loss • exclude **internal bleeding** (e.g. uterine rupture) • 2x i.v. access (large bore, if possible) • **type and screen** / **lab.** (blood count, BGA, aPTT, PT/INR and, if available, fibrinogen, FXIII,VHA), crossmatch RBC • adapted fluid therapy (crystalloids) or fluid bolus • urinary catheter • multidisciplinary assessment of cause of bleeding (**4T's**): – **tone**: atony? – **tissue**: retained placenta? – **trauma**: birth canal? – **thrombin**: coagulation? (lab. / VHA) • uterine compression – US	• ALERT the theatre team • exclude uterine rupture – manual placenta extraction • suspected retained placenta (following US or inspection) – manual placenta extraction – Curettage? (ultrasound control-control) • consider HAMILTON manoeuvre / compression of aorta • tamponade? • call additional staff	• **BLEEDING CONTROL** – laparotomy / vascular clamps / compression – Compression sutures / ligatures • **UTERINE TAMPONADE** – with haemostatics (Celox®, *off-label!*) / stripe tamponade • **BALLOON-TAMPONADE OF THE UTERUS** – insertion of balloon (US guided) (sufficient inflation, sulprostone cont'd) – gentle pull – balloon-deflation / -removal after 24 h	• Multidisciplinary team to consider **HYSTERECTOMY** • **PERSISTENT or recurrent BLEEDING** (with applied balloon-tamponade) – consider new balloon-tamponade („bridging“) – **Packing** – **Balloon occlusion of aorta** – **Embolisation** (radiology) • **following haemostasis** – stabilisation – ICU – Balloon-deflation after 24 h (PRN after obstetric advice)
anaesthesiology / uterotonics or oxytocics	(if not given by **obstetrician**) • **OXYTOCIN** – 3–5 IU by short infusion – PRN followed by infusion of 10-40 IU in 500-1000 ml (or local standard) • **TRANEXAMIC ACID** – 1 g i.v. • PRN **MISOPROSTOL** (as therapeutic backup) – 800-1000 µg p.r. or 600 µg orally – *off-label!*	• request **4 FFP / 4 RBC / 1 PC** (delivered to labour ward / operation room) trigger major haemorrhage protocol • if >25 IU oxytocin: change to **SULPROSTONE** (in that case stop oxytocin; only iv.; haemodynamic monitoring); dosage: 500 µg in 500 ml by infusion: de-escalating!, i.e., 3 min 500 ml/h (83 µg/min), then 7 min 100 ml/h (1.7 µg/min), then cont'd at 10-20 ml/h; max. 1500 µg/d • O_2 supplementation • large bore i.v. access (≧14-16 G) • titrate fluids / blood products • consider IOCS & RID	• O_2 supplementation, consider intubation • Shaldon cath. (PRN US) / prepare invasive blood pressure • prepare IOCS & RID • PRN **VASOPRESSORS** (z.B. NOREPINEPHRINE, PHENYLEPHRINE or THEODRENALIN / CAFEDRIN) • start coagulation therapy according to hospital's resources (give blood products to treat coagulopathy) **HAEMOSTASIS** (if plasma levels are reduced): • PRN **FIBRINOGEN** 30-60 mg/kgBW; aim: ≥2-2,5 g/l ($A5_{FIB}$ >12mm) and / or • PRN **FXIII** 20 IU/kgBW ; aim: FXIII >60% • PRN **PCC** initially 25 IE/kgB • for replacement of plasma volume **FFP** ≥30 ml/kgBW (RBC:FFP:PC = 4:4:1) • PRN second dose **TRANEXAMIC ACID** 1 g • **DDAVP** 0,3 µg/kgBW within 30 min poss. (for (suspected) von Willebrand disease; only after cord clamping)	• Endotracheal intubation • Shaldon cath. (PRN US) / arterial blood pressure monitoring • process **CS** if collected volume is >1000 ml • preferably „**hybrid approach**“ (initially RBC:FFP:PC = 4:4:1, then as fast as possible goal-directed protocol, guided by lab / VHA) • „**Damage control**“ with permissive hypotension **COAGULATION** • consider **RECOMBINANT FACTOR VIIa** initially 60-90 µg/kgBW (bolus), only if >35.0°C & fibrinogen >1,5 g/l & platelets >50 Gpt/l; PRN second dose for persistent bleeding after 30 min

	persistent bleeding	Blood loss >1000 ml	Blood
clinical symptoms	CALL IN registrar obstetrician & INFORM anaesthesiologist • Pt. haemodynamically stable • blood loss: – >500 mls with vag. delivery – >1000 mls with caesarean section **CAUTION**: underestimation of blood loss → measure, don't estimate!!!	CALL IN senior obstetrician & anaesthesiologist | consider TRANSFER • Pt. haemodynamically stable • ongoing severe blood loss	Ens (se h • Pt. ha Index seve lactate
obstetrics	• **Measure** blood loss • exclude **internal bleeding** (e.g. uterine rupture) • 2x i.v. access (large bore, if possible) • **type and screen** / **lab. (**blood count, BGA, aPTT, PT/INR and, if available, fibrinogen, FXIII,VHA), crossmatch RBC • adapted fluid therapy (crystalloids) or fluid bolus • urinary catheter • multidisciplinary assessment of cause of bleeding (**4T's**): – **tone**: atony? – **tissue**: retained placenta? – **trauma**: birth canal? – **thrombin**: coagulation? (lab. / VHA) • uterine compression – US	• ALERT the theatre team • exclude uterine rupture – manual placenta extraction • suspected retained placenta (following US or inspection) – manual placenta extraction – Curettage? (ultrasound control-control) • consider HAMILTON manoeuvre / compression of aorta • tamponade? • call additional staff	• **BLEE** – lapa – Com • **UTER** – wit stri • **BALL** **UTER** – inse (suf – gen – ball 24 h
tonics or	(if not given by **obstetrician**) • **OXYTOCIN** – 3–5 IU by short infusion – PRN followed by infusion of 10-40 IU in	• request **4 FFP / 4 RBC / 1 PC** (delivered to labour ward / operation room) trigger major haemorrhage protocol • if >25 IU oxytocin: change to **SULPROSTONE**	• O_2 supp • Shaldo pressur • prepare • PRN **vA** PHENYL

	persistent bleeding	Blood loss >1000 ml	Blood
clinical symptoms	CALL IN registrar obstetrician & INFORM anaesthesiologist	CALL IN senior obstetrician & anaesthesiologist | consider TRANSFER	Ens (se h
	• Pt. haemodynamically stable • blood loss: – >500 mls with vag. delivery – >1000 mls with caesarean section **CAUTION**: underestimation of blood loss → measure, don't estimate!!!	• Pt. haemodynamically stable • ongoing severe blood loss	• Pt. ha Index seve lactate
obstetrics	• **Measure** blood loss • exclude **internal bleeding** (e.g. uterine rupture) • 2x i.v. access (large bore, if possible) • **type and screen** / **lab. (**blood count, BGA, aPTT, PT/INR and, if available, fibrinogen, FXIII,VHA), crossmatch RBC • adapted fluid therapy (crystalloids) or fluid bolus • urinary catheter • multidisciplinary assessment of cause of bleeding (**4T's**): – **tone**: atony? – **tissue**: retained placenta? – **trauma**: birth canal? – **thrombin**: coagulation? (lab. / VHA) • uterine compression – US	• ALERT the theatre team • exclude uterine rupture – manual placenta extraction • suspected retained placenta (following US or inspection) – manual placenta extraction – Curettage? (ultrasound control-control) • consider HAMILTON manoeuvre / compression of aorta • tamponade? • call additional staff **Viscoelastic Haemostatic Assay**	• **BLEE** – lapa – Com • **UTER** – wit stri • **BALL UTER** – inse (suf – gen – ball 24 h
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obstetrics	aPTT, PT/INR and, if available, fibrinogen, FXIII,VHA), crossmatch RBC • adapted fluid therapy (crystalloids) or fluid bolus • urinary catheter • multidisciplinary assessment of cause of bleeding (**4T's**): – **tone**: atony? – **tissue**: retained placenta? – **trauma**: birth canal? – **thrombin**: coagulation? (lab. / VHA) • uterine compression – US	or inspection) – manual placenta extraction – Curettage? (ultrasound control-control) • consider HAMILTON manoeuvre / compression of aorta • tamponade? • call additional staff	– wit stri • **BALL** **UTER** – inse (suf – gen – ball 24 h
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PRN: pro re nata = "in the circumstances"

Therapeutic goals

bleeding control I haemodynamic stabilisation I o

haemoglobin 7-9 g/dl (4,3-5,5 mmol/l), platelets ≥70-100 Gpt/l, MAD ≥55-65 mmHg, pH ≥7,2, tempe

BGA blood gas analysis; **ICU** intensive care unit; **IOCS** intraoperative cell salvage; **PC** platelet concentrate; **RBC** red bloo

obstetrics

aPTT, PT/INR and, if available, fibrinogen, FXIII,VHA), crossmatch RBC
- adapted fluid therapy (crystalloids) or fluid bolus
- urinary catheter
- multidisciplinary assessment of cause of bleeding (**4T's**):
  – **tone**: atony?
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  – **trauma**: birth canal?
  – **thrombin**: coagulation? (lab. / VHA)
- uterine compression – US

or inspection)
– manual placenta extraction
– Curettage? (ultrasound control-control)
- consider HAMILTON manoeuvre / compression of aorta
- tamponade?
- call additional staff

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- **BALL**
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24 h

anaesthesiology / uterotonics or oxytocics

(if not given by **obstetrician**)
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  – 3–5 IU by short infusion
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- **TRANEXAMIC ACID**
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- PRN **MISOPROSTOL** (as therapeutic backup)
  – 800-1000 µg p.r. or 600 µg orally
  – *off-label!*

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- O_2 supplementation
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haemoglobin 7-9 g/dl (4,3-5,5 mmol/l), platelets ≥70-100 Gpt/l, MAD ≥55-65 mmHg, pH ≥7,2, tempe

BGA blood gas analysis; **ICU** intensive care unit; **IOCS** intraoperative cell salvage; **PC** platelet concentrate; **RBC** red bloo

Interdisciplinary algorithm for the therapy of PPH: „PPH

PPH-guideline 2022 AWMF Registry number 015/063 by BVF, DGGG (AGG), DeGIR, DEGUM, DGAI, DGHWI, DGKL, DGPM, DGPGM, DHV, DIVI, EFCNI (Pat.), GTH,

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	• Pt. haemodynamically stable • blood loss: – >500 mls with vag. delivery – >1000 mls with caesarean section **CAUTION**: underestimation of blood loss → measure, don't estimate!!!	• Pt. haemodynamically stable • ongoing severe blood loss	• Pt. haemodynamically **unstable** (Shock-Index [HF / BPsys] > 0.9) with persistent severe bleeding (Caution: BE <-6 mmol/l and lactate >4 mmol/l)
obstetrics	• **Measure** blood loss • exclude **internal bleeding** (e.g. uterine rupture) • 2x i.v. access (large bore, if possible) • **type and screen** / **lab. (**blood count, BGA, aPTT, PT/INR and, if available, fibrinogen, FXIII,VHA), crossmatch RBC • adapted fluid therapy (crystalloids) or fluid bolus • urinary catheter • multidisciplinary assessment of cause of bleeding (**4T's**): – **tone**: atony? – **tissue**: retained placenta? – **trauma**: birth canal? – **thrombin**: coagulation? (lab. / VHA) • uterine compression – US	• ALERT the theatre team • exclude uterine rupture – manual placenta extraction • suspected retained placenta (following US or inspection) – manual placenta extraction – Curettage? (ultrasound control-control) • consider HAMILTON manoeuvre / compression of aorta • tamponade? • call additional staff	• **BLEEDING CONTROL** – laparotomy / vascular clamps / compression – Compression sutures / ligatures • **UTERINE TAMPONADE** – with haemostatics (Celox®, *off-label!*) / stripe tamponade • **BALLOON-TAMPONADE OF THE UTERUS** – insertion of balloon (US guided) (sufficient inflation, sulprostone cont'd) – gentle pull – balloon-deflation / -removal after 24 h

obstetrics

rupture)
- 2x i.v. access (large bore, if possible)
- **type and screen** / **lab. (**blood count, BGA, aPTT, PT/INR and, if available, fibrinogen, FXIII,VHA), crossmatch RBC
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- uterine compression – US

- exclude uterine rupture
  – manual placenta extraction
- suspected retained placenta (following US or inspection)
  – manual placenta extraction
  – Curettage? (ultrasound control-control)
- consider HAMILTON manoeuvre / compression of aorta
- tamponade?
- call additional staff

– Compression sutures / ligatures

- **UTERINE TAMPONADE**
  – with haemostatics (Celox®, *off-label!*) / stripe tamponade

- **BALLOON-TAMPONADE OF THE UTERUS**
  – insertion of balloon (US guided) (sufficient inflation, sulprostone cont'd)
  – gentle pull
  – balloon-deflation / -removal after 24 h

anaesthesiology / uterotonics or oxytocics

(if not given by **obstetrician**)
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- O_2 supplementation
- large bore i.v. access (≧14-16 G)
- titrate fluids / blood products
- consider IOCS & RID

- O_2 supplementation, consider intubation
- Shaldon cath. (PRN US) / prepare invasive blood pressure
- prepare IOCS & RID
- PRN **VASOPRESSORS** (z.B. NOREPINEPHRINE, PHENYLEPHRINE or THEODRENALIN / CAFEDRIN)
- start coagulation therapy according to hospital's resources (give blood products to treat coagulopathy

HAEMOSTASIS (if plasma levels are reduced):
- PRN **FIBRINOGEN** 30-60 mg/kgBW; aim: ≥2-2,5 g/l ($A5_{FIB}$ >12mm) and / or
- PRN **FXIII** 20 IU/kgBW ; aim: FXIII >60%
- PRN **PCC** initially 25 IE/kgB
- for replacement of plasma volume **FFP** ≥30 ml/kgBW (RBC:FFP:PC = 4:4:1)
- PRN second dose **TRANEXAMIC ACID** 1 g
- **DDAVP** 0,3 µg/kgBW within 30 min poss. (for (suspected) von Willebrand disease; only after cord clamping)

Therapeutic goals:

bleeding control I haemodynamic stabilisation I optimization of haemostasis

obstetrics

rupture)
- 2x i.v. access (large bore, if possible)
- **type and screen** / **lab. (**blood count, BGA, aPTT, PT/INR and, if available, fibrinogen, FXIII,VHA), crossmatch RBC
- adapted fluid therapy (crystalloids) or fluid bolus
- urinary catheter
- multidisciplinary assessment of cause of bleeding (**4T's**):
  – **tone**: atony?
  – **tissue**: retained placenta?
  – **trauma**: birth canal?
  – **thrombin**: coagulation? (lab. / VHA)
- uterine compression – US

- exclude uterine rupture
  – manual placenta extraction
- suspected retained placenta (following US or inspection)
  – manual placenta extraction
  – Curettage? (ultrasound control-control)
- consider HAMILTON manoeuvre / compression of aorta
- tamponade?
- call additional staff

  – Compression sutures / ligatures

- **UTERINE TAMPONADE**
  – with haemostatics (Celox®, *off-label!*) / stripe tamponade

- **BALLOON-TAMPONADE OF THE UTERUS**
  – insertion of balloon (US guided) (sufficient inflation, sulprostone cont'd)
  – gentle pull
  – balloon-deflation / -removal after 24 h

anaesthesiology / uterotonics or oxytocics

(if not given by **obstetrician**)
- **OXYTOCIN**
  – 3–5 IU by short infusion
  – PRN followed by infusion of 10-40 IU in 500-1000 ml (or local standard)

- **TRANEXAMIC ACID**
  – 1 g i.v.

- PRN **MISOPROSTOL** (as therapeutic backup)
  – 800-1000 µg p.r. or 600 µg orally
  – *off-label!*

- request **4 FFP / 4 RBC / 1 PC** (delivered to labour ward / operation room) trigger major haemorrhage protocol
- if >25 IU oxytocin: change to **SULPROSTONE** (in that case stop oxytocin; only iv.; haemodynamic monitoring); dosage: 500 µg in 500 ml by infusion: de-escalating!, i.e., 3 min 500 ml/h (83 µg/min), then 7 min 100 ml/h (1.7 µg/min), then cont'd at 10-20 ml/h; max. 1500 µg/d
- O_2 supplementation
- large bore i.v. access (≧14-16 G)
- titrate fluids / blood products
- consider IOCS & RID

IntraOperative Cell Salvage

- O_2 supplementation, consider intubation
- Shaldon cath. (PRN US) / prepare invasive blood pressure
- prepare IOCS & RID
- PRN **VASOPRESSORS** (z.B. NOREPINEPHRINE, PHENYLEPHRINE or THEODRENALIN / CAFEDRIN)
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ciplinary algorithm for the therapy of PPH: „PPH 2022“

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Blood loss >1000 ml	Blood loss >1500 ml (~¼ blood volume)	Blood loss >2000 ml
CALL IN senior obstetrician & anaesthesiologist | consider TRANSFER	Ensure sufficient staff and expertise (senior level for obs and anaesth) | haematology / radiology advice?	sufficient staff and expertise? Haematology advice? Is embolisation possible?
• Pt. haemodynamically stable • ongoing severe blood loss	• Pt. haemodynamically **un**stable (Shock-Index [HF / BPsys] > 0.9) with persistent severe bleeding (Caution: BE <-6 mmol/l and lactate >4 mmol/l)	• **Haemorrhagic shock**
• ALERT the theatre team • exclude uterine rupture – manual placenta extraction • suspected retained placenta (following US or inspection) – manual placenta extraction – Curettage? (ultrasound control-control) • consider HAMILTON manoeuvre / compression of aorta • tamponade? • call additional staff	• **BLEEDING CONTROL** – laparotomy / vascular clamps / compression – Compression sutures / ligatures • **UTERINE TAMPONADE** – with haemostatics (Celox®, *off-label!*) / stripe tamponade • **BALLOON-TAMPONADE OF THE UTERUS** – insertion of balloon (US guided) (sufficient inflation, sulprostone cont'd) – gentle pull – balloon-deflation / -removal after 24 h	• Multidisciplinary team to consider **HYSTERECTOMY** • **PERSISTENT or recurrent BLEEDING** (with applied balloon-tamponade) – consider new balloon-tamponade („bridging“) – **Packing** – **Balloon occlusion of aorta** – **Embolisation** (radiology) • **following haemostasis** – stabilisation – ICU – Balloon-deflation after 24 h (PRN after

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  - stabilisation
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- Endotracheal intubation
- Shaldon cath. (PRN US) / arterial blood pressure monitoring
- process **CS** if collected volume is >1000 ml
- preferably „**hybrid approach**" (initially RBC:FFP:PC = 4:4:1, then as fast as possible goal-directed protocol, guided by lab / VHA)
- „**Damage control**" with permissive hypotension

COAGULATION
- consider **RECOMBINANT FACTOR VIIa** initially 60-90 µg/kgBW (bolus), only if >35.0°C & fibrinogen >1,5 g/l & platelets >50 Gpt/l; PRN second dose for persistent bleeding after 30 min

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resources (give blood products to treat coagulopathy)

HAEMOSTASIS (if plasma levels are reduced):
- PRN **FIBRINOGEN** 30-60 mg/kgBW; aim: ≥2-2,5 g/l ($A5_{FIB}$ >12mm) and / or
- PRN **FXIII** 20 IU/kgBW ; aim: FXIII >60%
- PRN **PCC** initially 25 IE/kgB
- for replacement of plasma volume **FFP** ≥30 ml/kgBW (RBC:FFP:PC = 4:4:1)
- PRN second dose **TRANEXAMIC ACID** 1 g
- **DDAVP** 0,3 µg/kgBW within 30 min poss. (for (suspected) von Willebrand disease; only after cord clamping)

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Therapeutic goals:

bleeding control I haemodynamic stabilisation I optimization of haemostasis

-5,5 mmol/l), platelets ≥70-100 Gpt/l, MAD ≥55-65 mmHg, pH ≥7,2, temperature ≥34°C , ionised calcium ≥0,9 mmol/l

CU intensive care unit; **IOCS** intraoperative cell salvage; **PC** platelet concentrate; **RBC** red blood cells; **RID** rapid infusion device; **US** ultrasound; **VHA**

n: de-
n 7 min
max.

resources (give blood products to treat coagulopathy)

HAEMOSTASIS (if plasma levels are reduced):

- PRN **FIBRINOGEN** 30-60 mg/kgBW; aim: ≥2-2,5 g/l ($A5_{FIB}$ >12mm) and / or
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- **DDAVP** 0,3 µg/kgBW within 30 min poss. (for (suspected) von Willebrand disease; only after cord clamping)

guided by lab / VHA)

- „**Damage control**“ with permissive hypotension

COAGULATION

- consider **RECOMBINANT FACTOR VII**a initially 60-90 µg/kgBW (bolus), only if >35.0°C & fibrinogen >1,5 g/l & platelets >50 Gpt/l; PRN second dose for persistent bleeding after 30 min

eutic goals:

bilisation I optimization of haemostasis

pH ≥7,2, temperature ≥34°C , ionised calcium ≥0,9 mmol/l, BE >-6 mEq/l, lactat <4 mmol/l.

ntrate; **RBC** red blood cells; **RID** rapid infusion device; **US** ultrasound; **VHA** viscoelastic haemostatic assays

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The Impact of Prepartum Platelet Count on Postpartum Blood Loss and Its Association with Coagulation Factor XIII Activity

Romana Brun[a] Torsten Hothorn[b] Eva Eigenmann[c] Marie Louise Frevert[a] Roland Zimmermann[a] Wolfgang Korte[d] Christian Haslinger[a]

[a]Department of Obstetrics, University Hospital of Zurich, Zurich, Switzerland; [b]Epidemiology, Biostatistics and Prevention Institute, University of Zurich, Zurich, Switzerland; [c]University of Zurich, Zurich, Switzerland; [d]Center for Laboratory Medicine, Hemostasis and Hemophilia Center, St. Gallen, Switzerland

Keywords
Postpartum hemorrhage · Thrombocytopenia · Factor XIII · Platelet transfusion · Platelets

Abstract

Background: Postpartum hemorrhage is a leading cause of maternal morbidity and mortality worldwide. Contradictory information exists regarding the relevance of prepartum platelet count on postpartum hemorrhage. We have shown prepartum coagulation factor XIII to be associated with postpartum blood loss; however, little is known about the association of platelet count with factor XIII activity. Our objectives were, first, to evaluate the impact of prepartum platelet count on measured postpartum blood loss in the context of prepartum measurements of coagulation factors I, II, and XIII and, second, to evaluate the association of platelet count with coagulation factor XIII, both pre- and postpartum. ***Material and Methods:*** This is a secondary analysis of a prospective cohort study (PPH 1,300 study) which analyzed the impact of prepartum blood coagulation factors on postpartum blood loss in 1,300 women. Blood loss was quantified using a validated technique. The impact of prepartum platelet count on measured blood loss was assessed by continuous outcome logistic regression; the association of platelet count with factor XIII activity by Spearman rank correlation. ***Results:*** Prepartum platelet count was significantly associated with measured postpartum blood loss: every one unit (G/L) increase in prepartum thrombocytes was associated with an odds ratio of 1.002 (95% confidence interval, 1.001–1.004, $p = 0.005$) to keep blood loss below any given cut-off level. This means that the probability of postpartum hemorrhage decreases with increasing prepartum platelet levels. Moreover, a significant association of platelet count with factor XIII activity was shown (Spearman rank correlation coefficient for prepartum values 0.228, $p < 0.001$, and for postpartum values 0.293, $p < 0.001$). ***Discussion/Conclusion:*** The significant association of prepartum platelet count and postpartum blood loss as well as the association of platelet count with blood coagulation factor XIII activity support the likely role of platelets in preventing postpartum hemorrhage and support the new guidelines for the treatment of postpartum hemorrhage in Germany, Austria, and Switzerland, which calls for optimizing platelet counts peripartally in case of postpartum hemorrhage. A possible effect of platelets on the level of circulating factor XIII cannot be ruled out and should prompt further investigation.

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Introduction

Thrombocytopenia in pregnancy is frequently encountered by obstetricians or hematologists. Its prevalence in all pregnancies is estimated to be 10% [1]. Little

Wolfgang Korte and Christian Haslinger contributed equally to this work.

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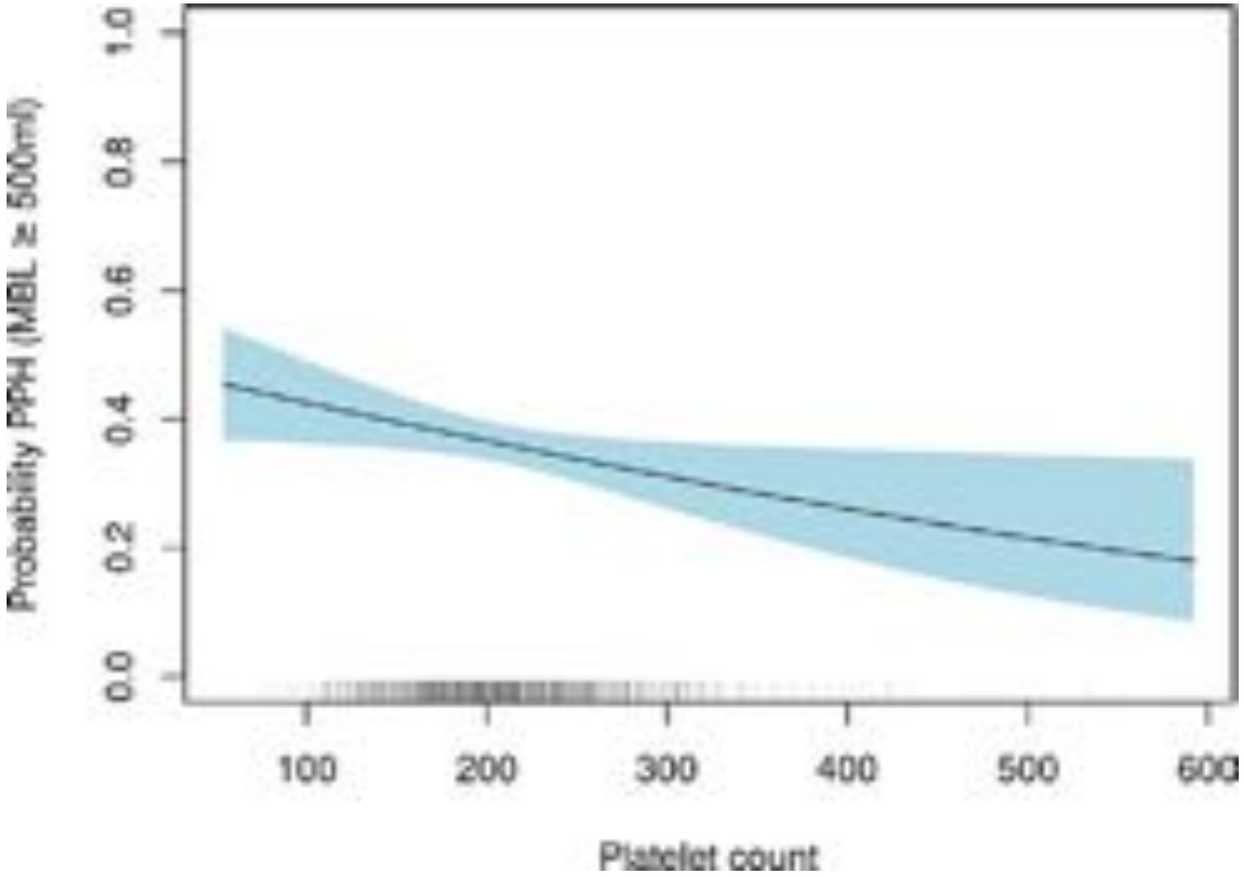

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[a]Department of Obstetrics, University Hospital of Zurich, Zurich, Switzerland; [b]Epidemiology, Biostatistics and Prevention Institute, University of Zurich, Zurich, Switzerland; [c]University of Zurich, Zurich, Switzerland; [d]Center for Laboratory Medicine, Hemostasis and Hemophilia Center, St. Gallen, Switzerland

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Prepartum platelet counts significantly influenced MBL: every one unit (G/L) increase in prepartum platelets was associated with an odds ratio of 1.002 (95% confidence interval, 1.001–1.004, $p = 0.005$) to keep blood loss below any given volume (continuous outcome logistic regression model). In other words, the probability of postpartum hemorrhage decreased with increasing prepartum platelet counts. After stratification for delivery mode, the effect observed in the continuous outcome logistic regression model remained significant for vaginal deliveries (OR 1.002, 95% CI 1.000–1.005, $p = 0.05$) and showed a similar trend for cesarean deliveries (OR 1.002, 95% CI 1.000–1.005, $p = 0.08$).

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Roland Zimmermann[a] Wolfgang Korte[d] Christian Haslinger[a]

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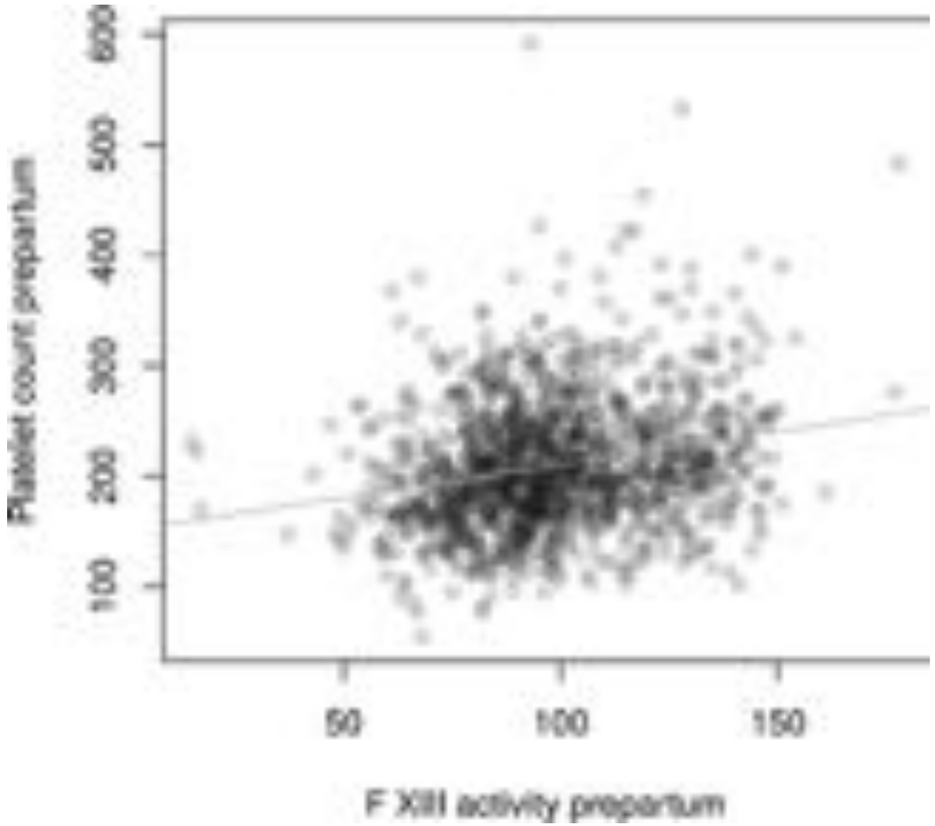

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≤ 2 grams

tranexamic acid

AJKD

Original Investigation

Renal Cortical Necrosis in Postpartum Hemorrhage: A Case Series

Marie Frimat, MD, PhD,[1,] Melanie Decambron, MD,[2,*] Celine Lebas, MD,[3] Anissa Moktefi, MD,[4] Laurent Lemaitre, MD, PhD,[5] Viviane Gnemmi, MD, PhD,[6] Benedicte Sautenet, MD,[7] François Glowacki, MD, PhD,[1] Damien Subtil, MD, PhD,[8] Mercedes Jourdain, MD, PhD,[9] Agnes Rigouzzo, MD,[10] Isabelle Brocheriou, MD, PhD,[4] Jean-Michel Halimi, MD, PhD,[7] Eric Rondeau, MD, PhD,[11] Christian Noel, MD, PhD,[1] François Provôt, MD,[1] and Alexandre Hertig, MD, PhD[11]*

Frimat et al. Am J Kidney Dis 2016; 68, 50-57.

Renal cortical necrosis with permanent renal insufficiency

- 18 obstetric patients
- Blood loss 2600ml (1500 - 4600ml)
- Tranexamic acid:
  - 1-4g bolus
  - Continuous infusion of 0.5 - 1 g/h for 2-16 hours

A5 12mm

fibrinogen

BJOG An International Journal of Obstetrics and Gynaecology

Royal College of Obstetricians & Gynaecologists

DOI: 10.1111/1471-0528.16699
www.bjog.org

Randomised Controlled Trial
Intrapartum care

Early and systematic administration of fibrinogen concentrate in postpartum haemorrhage following vaginal delivery: the FIDEL randomised controlled trial

AS Ducloy-Bouthors,[a,b] FJ Mercier,[c,*] JM Grouin,[d] F Bayoumeu,[e] J Corouge,[a] A Le Gouez,[c] T Rackelboom,[f] F Broisin,[g] F Vial,[h] A Luzi,[i] O Capronnier,[j] C Huissoud,[g,k,*] A Mignon,[f,*] the FIDEL working group[†]

Plasma Fibrinogen

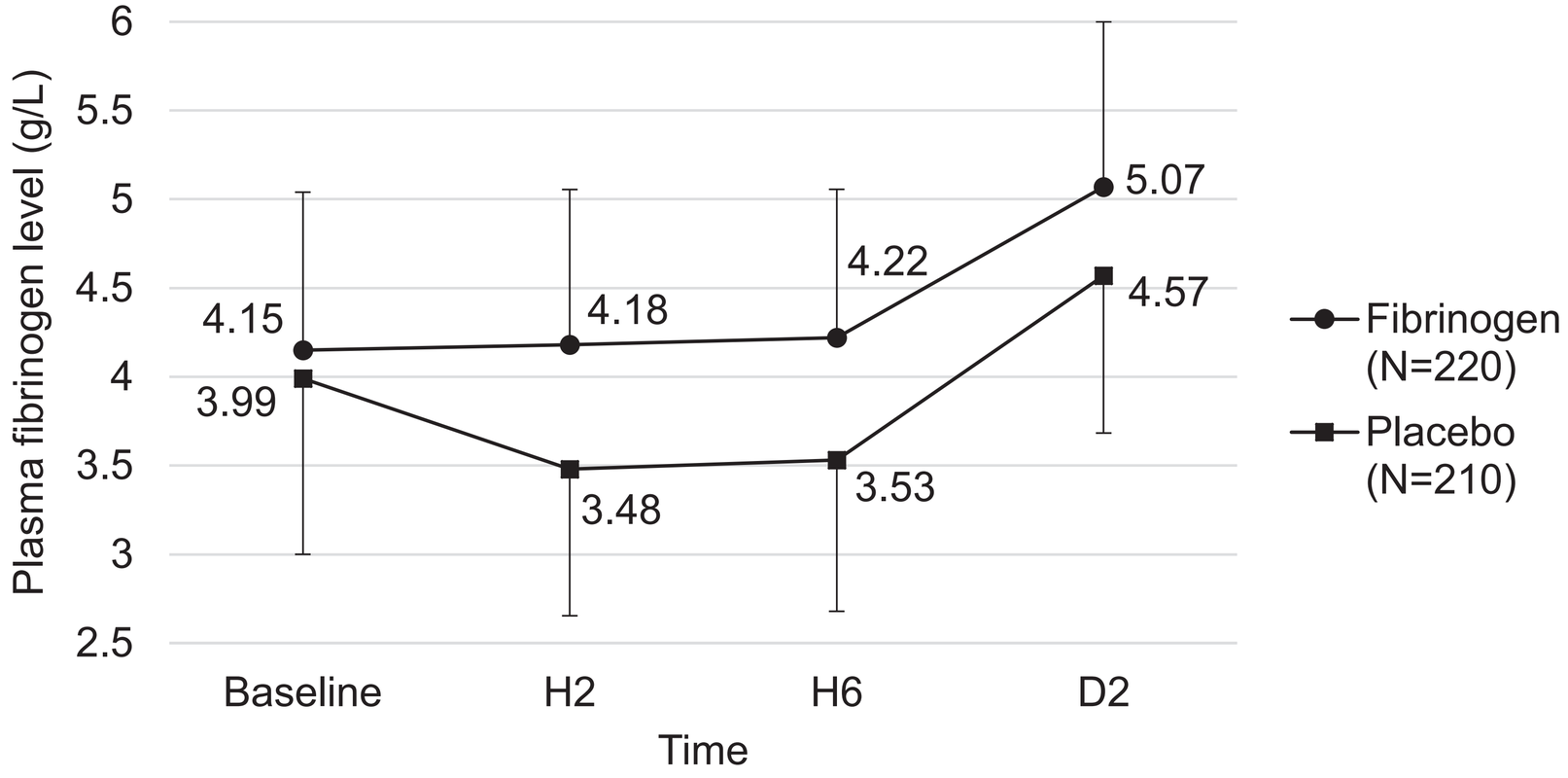

Figure 2. Mean fibrinogen concentrations in fibrinogen and placebo groups from baseline to D2 after study drug administration (ITT set with no missing data for the primary criterion). Values: mean. Error bars: SD (presented one-sided instead of two-sided for readability purposes only). The mixed model for repeated measures showed a treatment * time interaction, with an overall *P*-value = 0.023.

Wikkelsø AJ et al. Br J Anaesth. 2015;114:623-633.

British Journal of Anaesthesia **114** (4): 623–33 (2015)
Advance Access publication 13 January 2015 · doi:10.1093/bja/aeu444

BJA

Pre-emptive treatment with fibrinogen concentrate for postpartum haemorrhage: randomized controlled trial†

A. J. Wikkelsø[1]*, H. M. Edwards[2], A. Afshari[3], J. Stensballe[4], J. Langhoff-Roos[5], C. Albrechtsen[3], K. Ekelund[3], G. Hanke[3], E. L. Secher[3], H. F. Sharif[5], L. M. Pedersen[6], A. Troelstrup[6], J. Lauenborg[7], A. U. Mitchell[1], L. Fuhrmann[1], J. Svare[2], M. G. Madsen[8], B. Bødker[9], A. M. Møller[1] and FIB-PPH trial group

[1] Department of Anaesthesia and Intensive Care Medicine, [2] Department of Obstetrics and Gynaecology, Herlev Hospital, University of Copenhagen, Herlev Ringvej 75, Herlev DK-2730, Denmark
[3] Department of Anaesthesia, Mother and Child Section, Juliane Marie Centre, [4] Department of Anaesthesia, Centre of Head and Orthopaedics, and Section for Transfusion Medicine, Capital Region Blood Bank, [5] Department of Obstetrics, Juliane Marie Centre, Rigshospitalet, University of Copenhagen, Blegdamsvej 9, KBH Ø DK-2100, Denmark
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* Corresponding author. E-mail: wikkelso@gmail.com

Editor's key points

- Low fibrinogen is associated with excessive bleeding in postpartum haemorrhage.
- The effect of early empirical administration of fibrinogen concentrate on blood transfusion in postpartum haemorrhage was studied.
- In a multicentre, randomized trial of 249 subjects, pre-emptive administration of fibrinogen concentrate did not reduce red blood cell transfusion.

Background. In early postpartum haemorrhage (PPH), a low concentration of fibrinogen is associated with excessive subsequent bleeding and blood transfusion. We hypothesized that pre-emptive treatment with fibrinogen concentrate reduces the need for red blood cell (RBC) transfusion in patients with PPH.

Methods. In this investigator-initiated, multicentre, double-blinded, parallel randomized controlled trial, we assigned subjects with severe PPH to a single dose of fibrinogen concentrate or placebo (saline). A dose of 2 g or equivalent was given to all subjects independent of body weight and the fibrinogen concentration at inclusion. The primary outcome was RBC transfusion up to 6 weeks postpartum. Secondary outcomes were total blood loss, total amount of blood transfused, occurrence of rebleeding, haemoglobin <58 g litre^{-1}, RBC transfusion within 4 h, 24 h, and 7 days, and as a composite outcome of 'severe PPH', defined as a decrease in haemoglobin of >40 g litre^{-1}, transfusion of at least 4 units of RBCs, haemostatic intervention (angiographic embolization, surgical arterial ligation, or hysterectomy), or maternal death.

Results. Of the 249 randomized subjects, 123 of 124 in the fibrinogen group and 121 of 125 in the placebo group were included in the intention-to-treat analysis. At inclusion the subjects had severe PPH, with a mean blood loss of 1459 (SD 476) ml and a mean fibrinogen concentration of 4.5 (SD 1.2) g litre^{-1}. The intervention group received a mean dose of 26 mg kg^{-1} fibrinogen concentrate, thereby significantly increasing fibrinogen concentration compared with placebo by 0.40 g litre^{-1} (95% confidence interval, 0.15–0.65; P=0.002). Postpartum blood transfusion occurred in 25 (20%) of the fibrinogen group and 26 (22%) of the placebo group (relative risk, 0.95; 95% confidence interval, 0.58–1.54; P=0.88). We found no difference in any predefined secondary outcomes, per-protocol analyses, or adjusted analyses. No thromboembolic events were detected.

Conclusions. We found no evidence for the use of 2 g fibrinogen concentrate as pre-emptive treatment for severe PPH in patients with normofibrinogenaemia.

Clinical trial registration. ClinicalTrials.gov: http://clinicaltrials.gov/show/NCT01359878. Published protocol: http://www.trialsjournal.com/content/pdf/1745-6215-13-110.pdf.

Keywords: blood coagulation; erythrocyte transfusion; fibrinogen; postpartum haemorrhage

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Collins et al. Br J Anaesth. 2017;119:411-421.

BJA

British Journal of Anaesthesia, 119 (3): 411–21 (2017)

doi: 10.1093/bja/aex181
Advance Access Publication Date: 19 July 2017
Obstetrics

OBSTETRICS

Viscoelastometric-guided early fibrinogen concentrate replacement during postpartum haemorrhage: OBS2, a double-blind randomized controlled trial

P. W. Collins[1,*], R. Cannings-John[2], D. Bruynseels[3], S. Mallaiah[4], J. Dick[5], C. Elton[6], A. D. Weeks[7], J. Sanders[8], N. Aawar[2], J. Townson[2], K. Hood[2], J. E. Hall[9] and R. E. Collis[3] on behalf the OBS2 study team[†]

[1]Institute of Infection and Immunity, School of Medicine Cardiff University, UK, [2]Centre for Trials Research, College of Biomedical and Life Sciences, Cardiff University, UK, [3]Department of Anaesthetics and Pain Control, Cardiff and Vale University Health Board, UK, [4]Tom Byson Department of Anaesthesia, Liverpool Women's Hospital, Liverpool, UK, [5]Department of Anaesthetics, University College Hospital London, UK, [6]Department of Anaesthetics, Leicester Royal Infirmary, Leicester, UK, [7]Department of Women's and Children's Health, Institute of Translational Medicine, University of Liverpool, Liverpool, UK, [8]School of Healthcare Sciences, Cardiff University, Cardiff, UK and [9]Department of Anaesthetics and Pain Control, School of Medicine Cardiff University, Heath Park, UK

*Corresponding author. E-mail: peter.collins@wales.nhs.uk
[†]The OBS2 study team is listed in the Acknowledgements section.

Abstract

Background: Postpartum haemorrhage (PPH) can be exacerbated by haemostatic failure. We hypothesized that early fibrinogen replacement, guided by viscoelastometric testing, reduces blood product usage and bleed size.
Methods: Women with PPH 1000–1500 ml were enrolled. If Fibtem A5 was ≤15 mm and bleeding continued, subjects were randomized to fibrinogen concentrate or placebo. The primary outcome compared the number of units of red blood cells, plasma, cryoprecipitate and platelets transfused.
Results: Of 663 women enrolled 55 were randomized. The adjusted incidence rate ratio (IRR) (95% CI) for the number of allogeneic units transfused in the fibrinogen group compared with placebo was 0.72 (0.3–1.7), P=0.45. In pre-specified subgroup analyses, subjects who had a Fibtem A5 ≤12 mm at the time of randomization and who received fibrinogen concentrate received a median (25th–75th centile) of 1 (0–4.5) unit of allogeneic blood products and had an additional 300 (100–350) ml blood loss whereas those who received placebo also received 3 (0–6) units of allogeneic blood products and had 700 (200–1550) ml additional blood loss; these differences were not statistically significantly different. There was one thrombotic event in each group.
Conclusions: Infusion of fibrinogen concentrate triggered by Fibtem A5 ≤15 mm did not improve outcomes in PPH. Pre-specified subgroup analyses suggest that fibrinogen replacement is not required if the Fibtem A5 is > 12 mm or Clauss fibrinogen > 2 g litre^{-1}, but an effect below these levels cannot be excluded. The raised fibrinogen at term appears to be a

International Journal of Obstetric Anesthesia 47 (2021) 102983

Contents lists available at ScienceDirect

International Journal of Obstetric Anesthesia

journal homepage: www.elsevier.com/locate/ijoa

Original Article

349 patients with PPH >= 2500ml

The incidence, aetiology, and coagulation management of massive postpartum haemorrhage: a two-year national prospective cohort study

S.F. Bell [a,*], R.E. Collis [a], C. Bailey [b], K. James [a], M. John [c], K. Kelly [b], T. Kitchen [a], C. Scarr [d], E. Macgillivray [e], P.W. Collins [f]

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[c] *Department of Emergency Medicine, Aneurin Bevan University Health Board, Newport, UK*
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Original Article

521 patients with PPH >= 1000ml

The sensitivity and specificity of rotational thromboelastometry (ROTEM) to detect coagulopathy during moderate and severe postpartum haemorrhage: a prospective observational study

S.F. Bell [a,*], T.C.D. Roberts [a], J. Freyer Martins Pereira [a], L. De Lloyd [a], Z. Amir [a], D. James [b], P.V. Jenkins [c], R.E. Collis [a], P.W. Collins [d]

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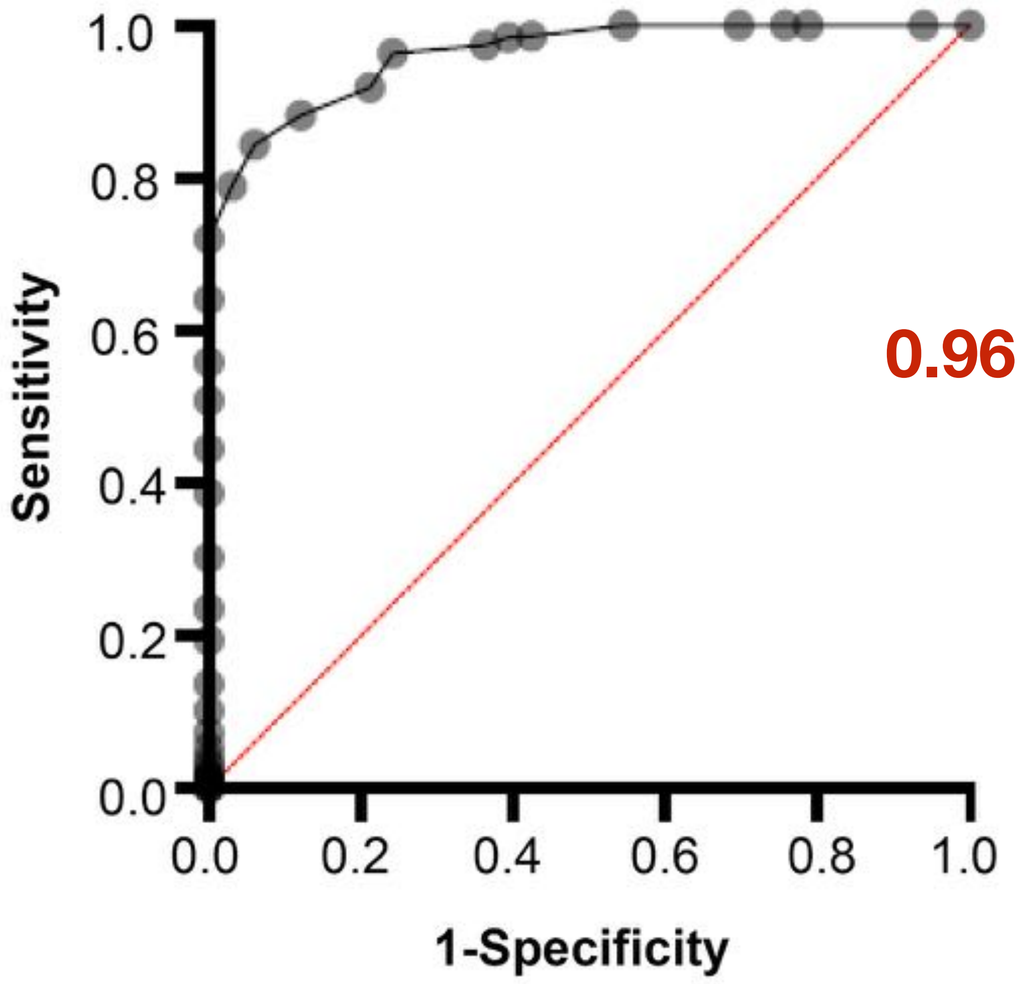
Bell et al. Int J Obstet Anesth. 2022;49:103238.

ROC for FIBTEM A5 vs. Fibrinogen < 2g/L



0.96 (95% CI 0.49-0.98)

Exclusion

of fibrinogen deficiency

Coagulopathy

laboratory values	PPH > 1000ml	PPH > 2500ml
Fibrinogen < 2g/l	5.0%	17.1%
aPTT / PT > 1.5 norm	0.9%	3.4%
Platelets < 75 G/l	2.3%	5.1%

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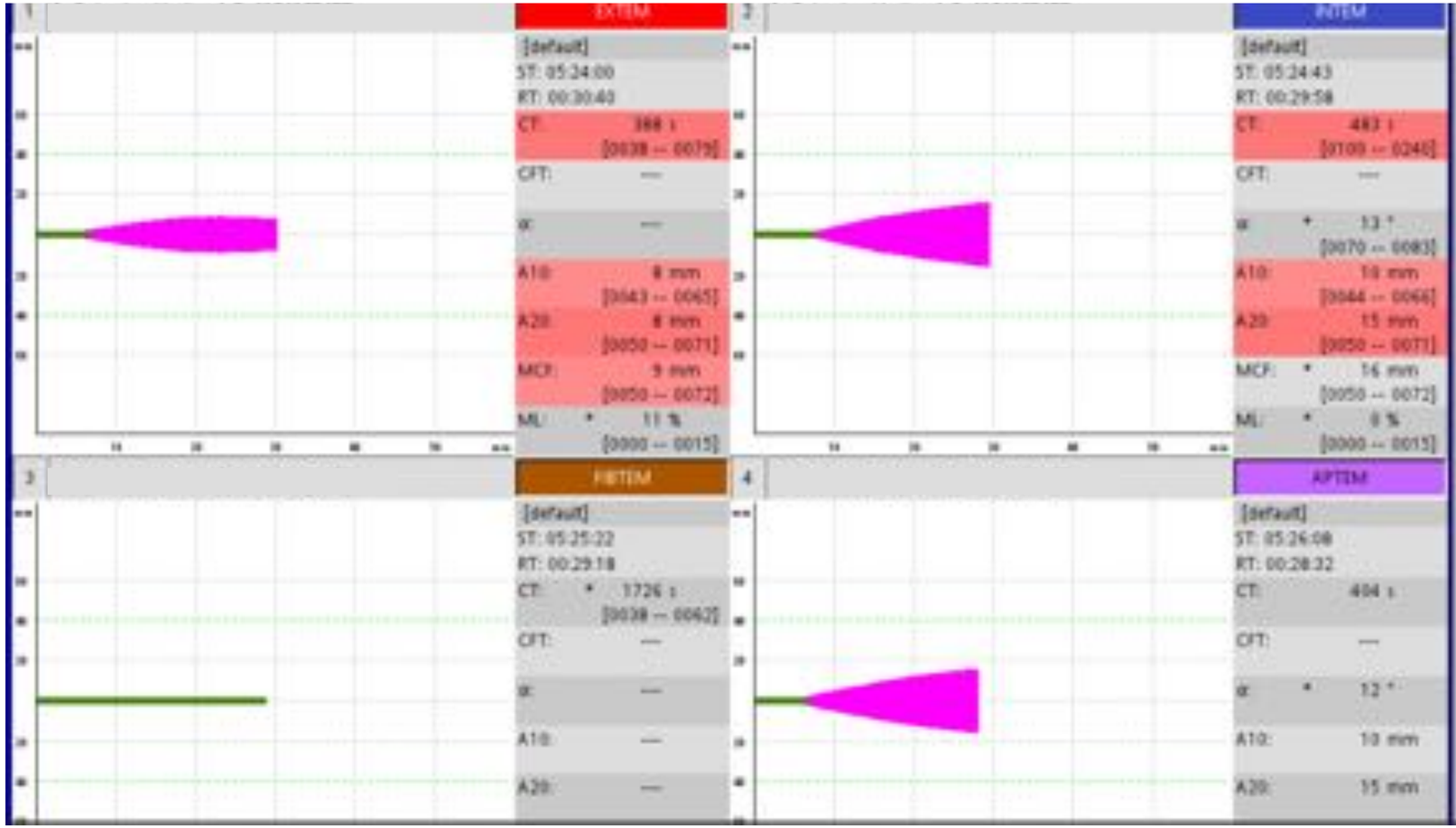
High risk of severe coagulopathy

- Placental abruption
- Amniotic fluid embolism



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ORIGINAL ARTICLE

Acute obstetric coagulopathy during postpartum hemorrhage is caused by hyperfibrinolysis and dysfibrinogenemia: an observational cohort study

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Abstract

Background: Postpartum hemorrhage (PPH) may be exacerbated by hemostatic impairment. Information about PPH-associated coagulopathy is limited, often resulting in treatment strategies based on data derived from trauma studies.

Objectives: To investigate hemostatic changes associated with PPH.

Patients/Methods: From a population of 11 279 maternities, 518 (4.6%) women were recruited with PPH ≥ 1000 mL or placental abruption, amniotic fluid embolism, or concealed bleeding. Routine coagulation and viscoelastometric results were collated. Stored plasma samples were used to investigate women with bleeds > 2000 mL or those at increased risk of coagulopathy defined as placenta abruption, amniotic fluid embolism, or need for blood components. Procoagulant factors were assayed and global hemostasis was assessed using thrombin generation. Fibrinolysis was investigated with D-dimer and plasmin/antiplasmin complexes. Dysfibrinogenemia was assessed using the Clauss/antigen ratio.

Results: At 1000 mL blood loss, Clauss fibrinogen was ≤2 g/L in 2.4% of women and 6/27 (22.2%) cases of abruption. Women with very large bleeds (>3000 mL) had evidence of a dilutional coagulopathy, although hemostatic impairment was uncommon. A subgroup of 12 women (1.06/1000 maternities) had a distinct coagulopathy characterized by massive fibrinolysis (plasmin/antiplasmin > 40 000 ng/mL), increased D-dimer, hypofibrinogenemia, dysfibrinogenemia, reduced factor V and factor VIII, and increased activated protein C, termed acute obstetric coagulopathy. It was associated with fetal or neonatal death in 50% of cases and increased maternal morbidity.

Conclusions: Clinically significant hemostatic impairment is uncommon during PPH, but a subgroup of women have a distinct and severe coagulopathy characterized by

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- 11’279 pregnancies
- 518 (4.6%) with PPH ≥ 1000ml
- OBS Cymru treatment protocol

J Thromb Haemost. 2023;21:862-879.

Coagulation

- Red blood cell transfusion: 26%
- Fibrinogen concentrate: 3.7%
- Fibrinogen ≤ 2g/l: 2.4% (placental abruption 22%)

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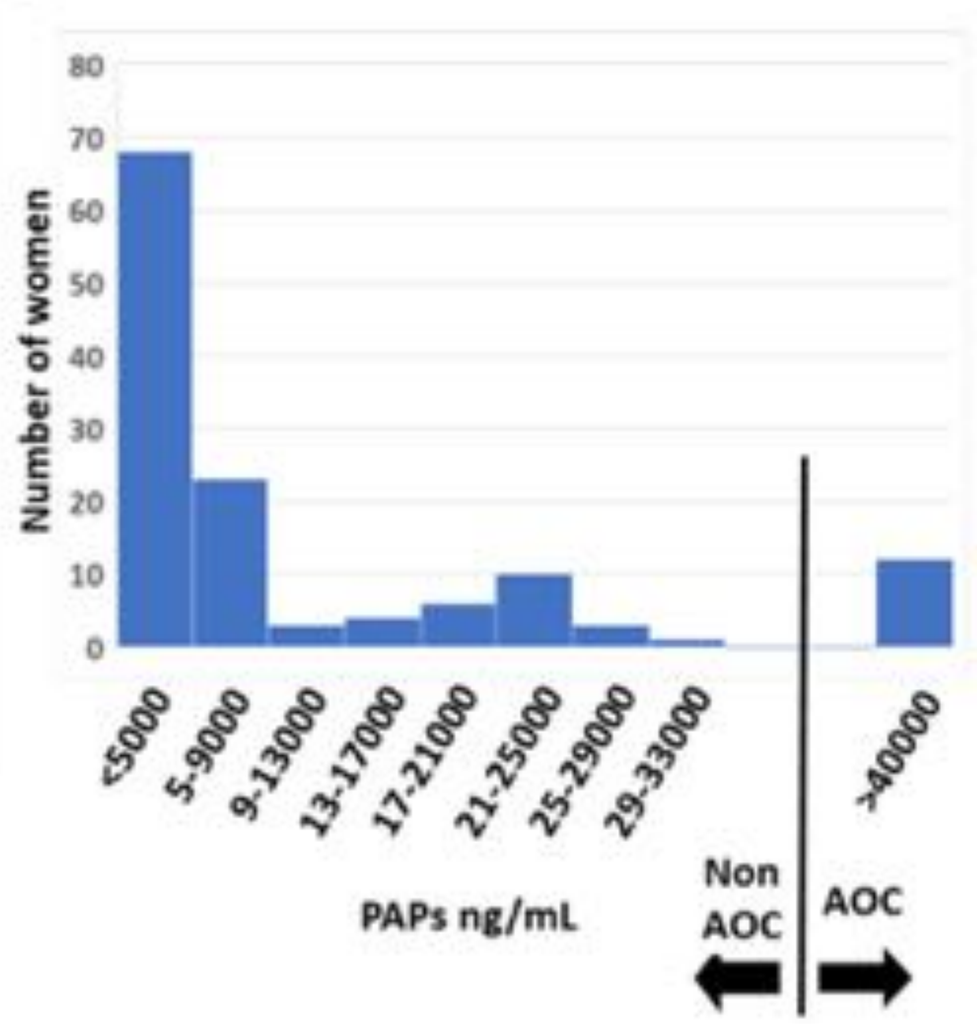
Plasmin generation (plasmin/antiplasmin complex)



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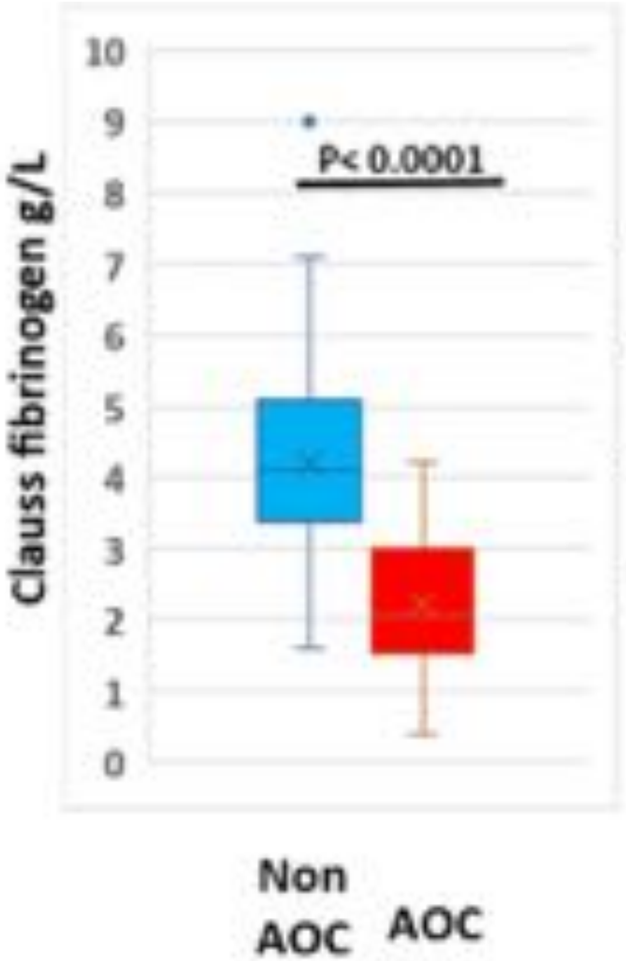
Acute obstetric coagulopathy



- 1 in 1000 maternities
- Blood loss not different
- D-dimer increased
- Platelets decreased
- FV, FVII, FIX, FXIII decreased
- Intrauterine or neonatal death 50%

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