An update in obstetrical hemorrhage

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"Obstetrics is a bloody business"

Williams Obstetrics 23 edition

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I have no relevant financial relationships to disclose

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Introduction

Hemorrhage constitutes the most frequent form of shock in obstetrical practice

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FELLOWS PLENARY

Abstracts 40-48

40 A Randomized Controlled Trial to Assess Prophylactic Methylergonovine in Patients Undergoing an Intrapartum Cesarean Section

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University of Iowa Hospitals and Clinics, University of Iowa Hospitals and Clinics, IA

OBJECTIVE: To evaluate whether the administration of prophylactic methylergonovine in addition to oxytocin in laboring patients undergoing an intrapartum cesarean section reduces the needs for additional uterotonic agents.

STUDY DESIGN: This was a single center randomized controlled trial of laboring patients undergoing an intrapartum cesarean section. Patients were randomized 1:1 to receive either intravenous oxytocin 300 mU per minute plus 1 ml of intramuscular normal saline or intravenous oxytocin 300 mU per minute plus 0.2 mg (1ml) of intramuscular methylergonovine. The primary outcome was the need for additional uterotonic agents. To detect a 2-fold decrease in the need for additional uterotonics (42% vs 21%) with a 2-sided type 1 error of 5% and power of 80%, a sample size of 76 patients per group was estimated.

RESULTS: From June 2019 to February 2021, 160 patients were randomized - 80 were assigned to prophylactic methylergonovine plus oxytocin, 80 were assigned to oxytocin alone. Patients who received prophylactic methylergonovine required significantly less additional uterotonic agents as compared to participants who received oxytocin alone (20% vs 55%, RR 0.36, 95% CI 0.22 - 0.59). Comparing secondary outcomes between groups, participants receiving methylergonovine were more likely to have an improvement in uterine tone (80% vs 41.2%, RR 1.94, 95% CI 1.46 - 2.56), a lower incidence of postpartum hemorrhage (35% vs 58.8%, RR 0.6, 95% CI 0.42 - 0.85) decreased need for a blood transfusion (5% vs 22.5%, RR 0.22, 95% CI 0.08 - 0.63), and lower mean quantitative blood loss (996 ml vs 1315 ml, P = 0.004).

CONCLUSION: The administration of prophylactic methylergonovine in addition to oxytocin in laboring patients undergoing an intrapartum cesarean section reduces the needs for additional uterotonic agents. Validity of the conclusion is supported by results for the secondary endpoints.

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Original Research

Second-Line Uterotonics for Uterine Atony

A Randomized Controlled Trial

Naida M. Cole, MD, Jimin J. Kim, MD, Mario I. Lumbreras-Marquez, MD, Kara G. Fields, MS, Laura Mendez-Pino, MD, Michaela K. Farber, MD, Daniela A. Carusi, MD, Paloma Toledo, MD, and Brian T. Bateman, MD

CONCLUSION: No difference was detected in uterine tone scores 10 minutes after administration of either methylergonovine or carboprost for refractory uterine atony, indicating that either agent is acceptable.

CLINICAL TRIAL REGISTRATION: ClinicalTrials.gov, NCT03584854.

(Obstet Gynecol 2024;00:1–10)
DOI: 10.1097/AOG.0000000000005744

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The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Tranexamic Acid for the Prevention of Blood Loss after Vaginal Delivery

Loïc Sentilhes, M.D., Ph.D., Norbert Winer, M.D., Ph.D., Elie Azria, M.D., Ph.D., Marie-Victoire Sénat, M.D., Ph.D., Camille Le Ray, M.D., Ph.D., Delphine Vardon, M.D., Franck Perrotin, M.D., Ph.D., Raoul Desbrière, M.D., Florent Fuchs, M.D., Ph.D., Gilles Kayem, M.D., Ph.D., Guillaume Ducarme, M.D., Ph.D., Muriel Doret-Dion, M.D., Ph.D., Cyril Huissoud, M.D., Ph.D., Caroline Bohec, M.D., Philippe Deruelle, M.D., Ph.D., Astrid Darsonval, Pharm.D., Jean-Marie Chrétien, M.Sc., Aurélien Seco, M.Sc., Valérie Daniel, Pharm.D., and Catherine Deneux-Tharaux, M.D., Ph.D., for the Groupe de Recherche en Obstétrique et Gynécologie*

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Table 2. Primary and Secondary Outcomes (Modified Intention-to-Treat Population).

Outcome or Event	Tranexamic Acid Group (N=1945)	Placebo Group (N=1946)	Risk Ratio (95% CI)	Difference (95% CI)*	P Value	
					Unadjusted	Adjusted†
Primary outcome — no./total no. (%)‡	156/1921 (8.1)	188/1918 (9.8)	0.83 (0.68 to 1.01)	−1.7 (−3.5 to 0.1)	0.07	—
Clinically significant postpartum hemorrhage, according to provider — no. (%)	151 (7.8)	203 (10.4)	0.74 (0.61 to 0.91)	−2.7 (−4.5 to −0.7)	0.004	0.04
Additional uterotonic agent for excessive bleeding — no. (%)	141 (7.2)	189 (9.7)	0.75 (0.61 to 0.92)	−2.5 (−4.2 to −0.7)	0.006	0.04
Severe postpartum hemorrhage — no./total no. (%)§	47/1921 (2.4)	57/1918 (3.0)	0.82 (0.56 to 1.21)	−0.5 (−1.6 to 0.5)	0.32	0.59
Blood loss — ml¶						
At 15 min	130.5±144.3	135.3±149.8	—	−4.7 (−14.1 to 4.6)	0.32	0.59
At bag removal	199.1±261.2	210.4±256.1	—	−11.3 (−27.7 to 5.0)	0.17	0.46
Estimated total	220.3±280.4	236.9±291.6	—	−16.7 (−34.7 to 1.4)	0.07	0.23
Blood transfusion — no. (%)	17 (0.9)	18 (0.9)	0.94 (0.49 to 1.83)	−0.1 (−0.6 to 0.5)	0.87	0.88
Arterial embolization or surgery for postpartum hemorrhage — no. (%)	3 (0.2)	5 (0.3)	0.60 (0.14 to 2.51)	−0.1 (−0.4 to 0.2)	0.73	0.86
Hemoglobin‖						
Peripartum change — g/dl	−0.77±1.23	−0.79±1.28	—	0.02 (−0.06 to 0.10)	0.64	0.83
Decrease >2 g/dl	269 (14.6)	274 (15.2)	0.96 (0.82 to 1.12)	−0.6 (−2.9 to 1.8)	0.63	0.83
Hematocrit**						
Peripartum change — percentage points	−2.05±3.89	−2.03±4.11	—	−0.02 (−0.29 to 0.25)	0.88	0.88
Decrease >10 percentage points — no. (%)	47 (2.7)	53 (3.1)	0.88 (0.59 to 1.29)	−0.4 (−1.5 to 0.7)	0.50	0.82

CONCLUSIONS

Among women with vaginal delivery who received prophylactic oxytocin, the use of tranexamic acid did not result in a rate of postpartum hemorrhage of at least 500 ml that was significantly lower than the rate with placebo. (Funded by the French Ministry of Health; TRAAP ClinicalTrials.gov number, NCT02302456.)

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ORIGINAL ARTICLE

Tranexamic Acid for the Prevention of Blood Loss after Cesarean Delivery

L. Sentilhes, M.V. Sénat, M. Le Lous, N. Winer, P. Rozenberg, G. Kayem, E. Verspyck, F. Fuchs, E. Azria, D. Gallot, D. Korb, R. Desbrière, C. Le Ray, C. Chauleur, F. de Marcillac, F. Perrotin, O. Parant, L.J. Salomon, E. Gauchotte, F. Bretelle, N. Sananès, C. Bohec, N. Mottet, G. Legendre, V. Letouzey, B. Haddad, D. Vardon, H. Madar, A. Mattuizzi, V. Daniel, S. Regueme, C. Roussillon, A. Benard, A. Georget, A. Darsonval, and C. Deneux-Tharaux, for the Groupe de Recherche en Obstétrique et Gynécologie*

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Table 2. Primary and Secondary Outcomes in the Modified Intention-to-Treat Population.*

Outcome	Tranexamic Acid Group (N=2222)	Placebo Group (N=2209)	Unadjusted Difference (95% CI)†	Adjusted Risk Ratio or Mean Difference (95% CI)‡	P Value§
Postpartum hemorrhage — no./total no. (%)¶	556/2086 (26.7)	653/2067 (31.6)	−4.9 (−7.7 to −2.2)	0.84 (0.75 to 0.94)	0.003
Calculated estimated blood loss >1000 ml	550/2084 (26.4)	650/2066 (31.5)	−5.1 (−7.8 to −2.3)	0.84 (0.75 to 0.94)	—
Red-cell transfusion by day 2	35/2221 (1.6)	30/2209 (1.4)	0.2 (−0.5 to 0.9)	1.16 (0.71 to 1.89)	—
Gravimetrically estimated blood loss — ml‖	689±887	719±920	−30.6 (−90.2 to 29.0)	−33.06 (−77.48 to 11.37)	NS
Gravimetrically estimated blood-loss category — no./total no. (%)‖					
>500 ml	1133/1774 (63.9)	1110/1754 (63.3)	0.6 (−2.6 to 3.8)	1.01 (0.93 to 1.09)	—
>1000 ml	545/1774 (30.7)	521/1754 (29.7)	1 (−2 to 4)	1.03 (0.92 to 1.16)	—
Clinically significant postpartum hemorrhage according to health care providers — no./total no. (%)	303/2220 (13.6)	327/2208 (14.8)	−1.2 (−3.2 to 0.9)	0.92 (0.79 to 1.08)	NS
Additional uterotonic agents for excessive bleeding — no./total no. (%)	130/2217 (5.9)	159/2206 (7.2)	−1.3 (−2.8 to 0.1)	0.81 (0.64 to 1.03)	NS
Blood transfusion — no./total no. (%)	42/2221 (1.9)	39/2208 (1.8)	0.1 (−0.7 to 0.9)	1.07 (0.69 to 1.66)	NS
No. of red-cell units transfused	3.1±1.9	3.2±2.2	−0.1 (−1.0 to −0.08)	−0.08 (−1.18 to 1.01)	—
Postoperative iron sucrose infusion — no./total no. (%)	60/2196 (2.7)	44/2185 (2.0)	0.7 (−0.2 to 1.6)	1.35 (0.91 to 1.99)	—
Arterial embolization, emergency surgery for postpartum hemorrhage, or hysterectomy — no./total no. (%)**	13/2221 (0.6)	7/2209 (0.3)	0.3 (−0.1 to 0.7)	1.84 (0.73 to 4.62)	NS
Transfer to intensive care unit — no./total no. (%)	32/2221 (1.4)	22/2209 (1.0)	0.4 (−0.2 to 1.1)	1.44 (0.83 to 2.47)	—
Calculated estimated blood loss — ml††	680±748	787±750	−107 (−152 to −61)	−107 (−152 to −63)	<0.001
Calculated estimated blood loss category — no./total no. (%)††					
>500 ml	1213/2084 (58.2)	1326/2066 (64.2)	−6.0 (−8.9 to −3.0)	0.91 (0.84 to 0.98)	—
>1500 ml	215/2084 (10.3)	263/2066 (12.7)	−2.4 (−4.4 to −0.5)	0.81 (0.68 to 0.97)	—
Hemoglobin‡‡					
Peripartum change — g/dl	−1.2±1.2	−1.4±1.2	0.2 (0.1 to 0.3)	0.18 (0.11 to 0.25)	<0.001
Peripartum decrease >2 g/dl — no./total no. (%)	397/2088 (19.0)	497/2071 (24.0)	−5.0 (−7.5 to −2.5)	0.79 (0.69 to 0.90)	—
Hematocrit††					
Peripartum change — percentage points	−3.5±3.7	−4.0±3.7	0.5 (0.3 to 0.8)	0.53 (0.31 to 0.75)	<0.001
Peripartum decrease >10 percentage points — no./total no. (%)	66/2086 (3.2)	93/2071 (4.5)	−1.3 (−2.5 to −0.2)	0.70 (0.51 to 0.97)	—

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ORIGINAL ARTICLE

Tranexamic Acid to Prevent Obstetrical Hemorrhage after Cesarean Delivery

L.D. Pacheco, R.G. Clifton, G.R. Saade, S.J. Weiner, S. Parry, J.M. Thorp, Jr., M. Longo, A. Salazar, W. Dalton, A.T.N. Tita, C. Gyamfi-Bannerman, S.P. Chauhan, T.D. Metz, K. Rood, D.J. Rouse, J.L. Bailit, W.A. Grobman, H.N. Simhan, and G.A. Macones, for the Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal–Fetal Medicine Units Network*

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Table 2. Primary and Secondary Outcomes.*

Outcome	Tranexamic Acid (N=5525)	Placebo (N=5470)	Relative Risk or Mean Difference (95% CI)†
Primary outcome: maternal death or blood transfusion by hospital discharge or 7 days post partum, whichever was earlier — no. (%)	201 (3.6)	233 (4.3)	0.89 (0.74 to 1.07)‡
Maternal death	0	1 (<0.1)	—
Blood transfusion	201 (3.6)	232 (4.2)	0.86 (0.71 to 1.03)
Estimated blood loss >1 liter — no./total no. (%)	339/4641 (7.3)	368/4573 (8.0)	0.91 (0.79 to 1.05)
Intervention in response to bleeding and related complications by 7 days post partum — no. (%)	892 (16.1)	986 (18.0)	0.90 (0.82 to 0.97)
Surgical or radiologic intervention by 7 days post partum — no. (%)	233 (4.2)	231 (4.2)	1.00 (0.84 to 1.19)
Uterotonic agent other than oxytocin by 48 hr post partum — no. (%)	649 (11.7)	732 (13.4)	0.88 (0.80 to 0.97)
Open-label use of tranexamic acid by 7 days post partum — no. (%)	108 (2.0)	109 (2.0)	0.98 (0.75 to 1.28)
Transfusion of any blood product by 7 days post partum — no. (%)	205 (3.7)	238 (4.4)	0.85 (0.71 to 1.02)
Change in hemoglobin level — g/dl§	−1.8±1.1	−1.9±1.1	−0.1 (−0.2 to −0.1)
Transfusion of blood products other than packed red cells by 7 days post partum — no. (%)	29 (0.5)	31 (0.6)	0.93 (0.56 to 1.53)
Blood transfusion of ≥4 units by 7 days post partum — no. (%)	20 (0.4)	19 (0.3)	1.04 (0.56 to 1.95)
Median postoperative duration of hospital stay (IQR) — days	3 (2 to 3)	3 (2 to 3)	0.0 (−0.1 to 0.0)
Acute kidney injury by 7 days post partum — no. (%)	30 (0.5)	27 (0.5)	1.10 (0.65 to 1.85)
Transfusion-associated reaction by 7 days post partum — no. (%)	5 (0.1)	3 (0.1)	1.65 (0.32 to 10.63)
Postpartum infectious complication by 6 wk — no./total no. (%)	162/5080 (3.2)	125/5009 (2.5)	1.28 (1.02 to 1.61)
Endometritis	54/5080 (1.1)	42/5009 (0.8)	1.27 (0.85 to 1.89)
Surgical-site infection	104/5080 (2.0)	81/5009 (1.6)	1.27 (0.95 to 1.69)
Pelvic abscess	7/5080 (0.1)	3/5009 (0.1)	2.30 (0.53 to 13.8)

* Blood transfusion was defined as the transfusion of packed red cells or whole blood or use of a cell-saver autotransfusion device. IQR denotes interquartile range.
† Relative risks are provided for analyses in which numbers and percentages of participants are reported, and mean differences for analyses in which mean or median values are reported. The primary-outcome analysis was adjusted for a preoperative hemoglobin level of less than 8 g per deciliter and used a 95.26% confidence interval (on the basis of a P-value threshold of less than 0.047). All the other analyses were unadjusted and used 95% confidence intervals.

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Table 3. Safety Outcomes.*

Event	Tranexamic Acid (N=5513)	Placebo (N=5457)	Relative Risk (95% CI)	P Value
Thromboembolic event, ischemic stroke, or myocardial infarction — no./total no. (%)	12/5069 (0.2)	13/4996 (0.3)	0.91 (0.42–1.99)	0.81
Thromboembolic event, venous or arterial†	8/5069 (0.2)	13/4996 (0.3)	0.61 (0.25–1.46)	0.26
Ischemic stroke	2/5069 (<0.1)	0/4996	—	0.50
Myocardial infarction	2/5069 (<0.1)	0/4996	—	0.50
New-onset seizure — no./total no. (%)	2/5069 (<0.1)	0/4996	—	0.50
Admission to ICU for more than 24 hr — no./total no. (%)	21/5069 (0.4)	17/4996 (0.3)	1.22 (0.64–2.30)	0.55
Maternal death — no./total no. (%)‡	2/5069 (<0.1)	2/4996 (<0.1)	0.99 (0.07–13.6)	>0.99
Thromboembolic event, ischemic stroke, myocardial infarction, new-onset seizure activity, admission to the ICU for more than 24 hr, or maternal death — no./total no. (%)	35/5069 (0.7)	32/4996 (0.6)	1.08 (0.67–1.74)	0.76
Hospital readmission — no./total no. (%)	199/5069 (3.9)	162/4996 (3.2)	1.21 (0.99–1.48)	0.07
Any side effect — no. (%)§	616 (11.2)	667 (12.2)	0.91 (0.82–1.01)	0.09
Nausea	362 (6.6)	403 (7.4)	0.89 (0.78–1.02)	0.09
Vomiting	266 (4.8)	273 (5.0)	0.96 (0.82–1.14)	0.67
Dizziness	156 (2.8)	186 (3.4)	0.83 (0.67–1.02)	0.08

* The safety population included all the participants who received tranexamic acid or placebo, according to the treatment they actually received. Risks of thromboembolic event, ischemic stroke, myocardial infarction, new-onset seizure, admission to intensive care unit (ICU) for more than 24 hours, maternal death, and hospital readmission were assessed until 6 weeks post partum.
† All the thromboembolic events that occurred were venous.
‡ Of the four deaths, one (in the placebo group) occurred 1 day after delivery and was counted as part of the primary outcome (cause of death was undetermined). The other three deaths occurred after discharge, and the causes were septic shock of fungal cause (in the tranexamic acid group), trauma-induced injury (in the tranexamic acid group), and opioid overdose (in the placebo group).
§ The analysis of side effects included all the events that occurred by 24 hours post partum.

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The effect of tranexamic acid on postpartum bleeding in women with moderate and severe anaemia (WOMAN-2): an international, randomised, double-blind, placebo-controlled trial

*The WOMAN-2 Trial Collaborators**

Methods This international, randomised, double-blind, placebo-controlled trial was done in 34 hospitals across four countries (Nigeria, Pakistan, Tanzania, and Zambia). We recruited women of any age in active labour with moderate or severe anaemia (haemoglobin <100 g/L). We randomly assigned women (1:1) who had given birth vaginally to receive 1 g of tranexamic acid or matching placebo by slow intravenous injection (over 10 min) within 15 min of the umbilical cord being cut or clamped. Women were randomly assigned by selection of the lowest numbered treatment

Interpretation In women with moderate and severe anaemia, giving tranexamic acid within 15 min of the umbilical cord being clamped did not reduce the risk of clinically diagnosed postpartum haemorrhage.

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WOMAN Trial

- Large international multicenter trial
- Low, middle, and high income countries
- TXA decreased mortality due to bleeding and need for reoperation for uncontrolled hemorrhage

Lancet 2017; 389:2105-16

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WOMAN Trial

- No difference in transfusion of blood products
- Benefit seen only within 3 hours of birth
- Maximum dose was 2 grams in 24 hours

Lancet 2017; 389:2105-16

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WOMAN Trial

WHO recommendation on tranexamic acid for the treatment of postpartum haemorrhage

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Key Messages

- The World Health Organization (WHO) recommends early use of intravenous tranexamic acid (TXA) within 3 hours of birth in addition to standard care for women with clinically diagnosed postpartum haemorrhage (PPH) following vaginal birth or caesarean section.
- Administration of TXA should be considered as part of the standard PPH treatment package and be administered as soon as possible after onset of bleeding and within 3 hours of birth. TXA for PPH treatment should not be initiated more than 3 hours after birth.
- TXA should be used in all cases of PPH, regardless of whether the bleeding is due to genital tract trauma or other causes.
- TXA should be administered at a fixed dose of 1 g in 10 mL (100 mg/mL) IV at 1 mL per minute (i.e., administered over 10 minutes), with a second dose of 1 g IV if bleeding continues after 30 minutes.
- TXA should be administered via an IV route only for treatment of PPH. Research on other routes of TXA administration is a priority.

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TXA for treatment of obstetrical hemorrhage

The following recommendations and conclusions are based on limited or inconsistent scientific evidence (Level B):

- When uterotonics fail to adequately control postpartum hemorrhage, prompt escalation to other interventions (such as tamponade or surgical techniques) and escalation of intensity of care and support personnel are indicated.
- Given the mortality reduction findings, tranexamic acid should be considered in the setting of obstetric hemorrhage when initial medical therapy fails.

Obstet Gynecol 2017;130(4):e168-86

Still unknown if benefits of this trial

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Percutaneous hypogastric artery balloon occlusion

16. **Clinical Science Research**

BALLOON-TIP CATHETER OCCLUSION OF THE HYPOGASTRIC ARTERIES IN THE SURGICAL MANAGEMENT OF PLACENTA ACCRETA

NM Zacharias, AF Gei, VR Suarez, R Prieto, LD Pacheco, AM Vidal, GR Saade, RB Vadhera, GDV Hankins. Maternal-Fetal Medicine and Obstetrical Anesthesiology Divisions, Department of Obstetrics and Gynecology. University of Texas Medical Branch

Abstract:
Objective: To determine the role of pre-operative placement of balloon-tip catheters in the hypogastric arteries in the surgical management of placenta accreta.
Study design: Patients that underwent cesarean hysterectomies for placenta accreta (histologically confirmed) between 1992 and 2002 were identified. Complete records were available on 6 patients who had pre-operative placement of balloon-tip catheters in the hypogastric arteries (cases) and 14 who did not (controls). Demographics, operative findings and peripartum morbidity were compared using Mann Whitney U test, t-test and Fisher's exact test as appropriate (significance: $p<0.05$).
Results: Demographics were not significantly different between cases and controls; cases were twice as likely to be Caucasian and smokers. The cases had on average 45 minutes longer operative time (180 vs.135 min; NS). No significant differences were observed between the catheter and control groups with respect to estimated blood loss (3321 vs. 3450 ml), or number of blood product units transfused (median: 3). Cases were twice as likely to require intensive care (33% vs. 14%; NS), and in average were discharged one day later than the control group (postoperative day 6 versus 5; NS). Neonatal outcomes were similar between the two groups.
Conclusion: These results suggest that the preoperative placement of hypogastric artery balloon-tip catheters does not improve the outcome of patients undergoing hysterectomy for placenta accreta. A prospective randomized trial is needed to validate these findings.

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Systematic Review

Prophylactic Radiologic Interventions for Postpartum Hemorrhage Control in Women With Placenta Accreta Spectrum Disorder

A Systematic Review and Meta-analysis

Lisanne R. Bonsen, MD, Kosma Sleijpen, BSc, Joris Hendriks, MD, Thijs A. J. Urlings, MD, Olaf M. Dekkers, MD, PhD, Saskia le Cessie, PhD, Marc van de Velde, MD, PhD, Pema Gurung, MSc, Thomas van den Akker, MD, PhD, Johanna G. van der Bom, MD, PhD, and Dacia D. C. A. Henriquez, MD, PhD

CONCLUSION: Although the predominance of observational studies in the included literature warrants caution in interpreting the findings of this meta-analysis, our findings suggest that prophylactic placement of balloon catheters or sheaths before planned cesarean delivery in women with placenta accreta spectrum disorder may, in some cases, substantially reduce perioperative blood loss. Further study is required to quantify the efficacy according to various severities of placenta accreta spectrum disorder and the associated safety of these radiologic interventions.

SYSTEMATIC REVIEW REGISTRATION: PROSPERO, CRD42022320922.

(Obstet Gynecol 2024;144:315–27)
DOI: 10.1097/AOG.0000000000005662

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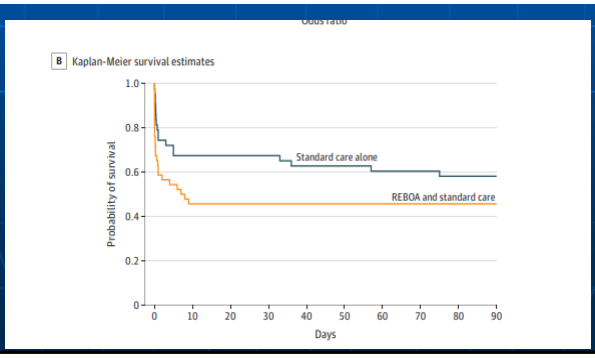
REBOA

JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Emergency Department Resuscitative Endovascular Balloon Occlusion of the Aorta in Trauma Patients With Exsanguinating Hemorrhage

The UK-REBOA Randomized Clinical Trial

Jan O. Jansen, PhD; Jemma Hudson, PhD; Claire Cochran, MSc; Graeme MacLennan, MSc; Robbie Lendrum, MBChB; Sam Sadek, MBBS; Katie Gillies, PhD; Seonaidh Cotton, PhD; Charlotte Kennedy, MSc; Dwayne Boyers, PhD; Gillian Ferry, MSc; Louisa Lawrie, PhD; Mintu Nath, PhD; Samantha Wileman, PhD; Mark Forrest, BSc; Karim Brohi, MBBS; Tim Harris, MBBS; Fiona Lecky, PhD; Chris Moran, MD; Jonathan J. Morrison, PhD; John Norrie, MSc; Alan Paterson, DPhil; Nigel Tai, MS; Nick Welch; Marion K. Campbell, PhD; and the UK-REBOA Study Group



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Cell saver in obstetrics

- Two theoretical major concerns:
  1. Iatrogenic AFE
  2. Maternal alloimmunization

May utilize in obstetrical surgery

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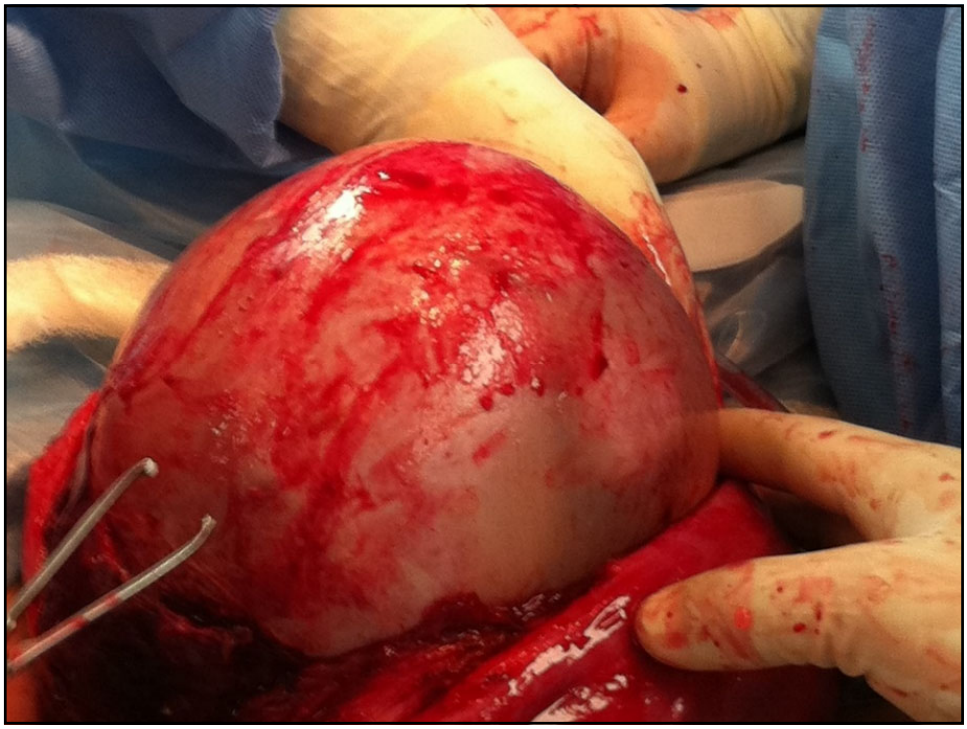

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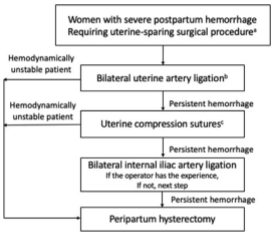
Uterine-sparing surgical procedures to control postpartum hemorrhage

Hanane Bouchghoul, MD, PhD; Hugo Madar, MD; Benoit Resch, MD; Beth L. Pineles, MD, PhD; Aurélien Mattuizzi, MD; Alizée Froeliger, MD; Loïc Sentilhes, MD, PhD

FIGURE 6
A proposed algorithm of surgical technique to control postpartum hemorrhage refractory to medical treatment



The *superscript letter a* denotes this is only a proposal. The choice, in particular for the first uterine-sparing surgical procedure, between uterine artery ligation and uterine compression sutures depends mainly on the operator's preference. The *superscript letter b* denotes uterine artery ligation or Tsirulnikov's triple ligation or stepwise uterine devascularization. The *superscript letter c* denotes B-Lynch or Cho suturing techniques.

Bouchghoul. Uterine-sparing surgical procedures. Am J Obstet Gynecol 2024.

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Original Research

Effectiveness of the Intrauterine Balloon Tamponade Compared With an Intrauterine, Vacuum-Induced, Hemorrhage-Control Device for Postpartum Hemorrhage

Laurence E. Shields, MD, Catherine Klein, MSN, RN, Jennie Torti, MPH, Mindy Foster, MSN, RN, and Curtis Cook, MD

CONCLUSION: Transfusion and blood loss after device placement were similar with both hemorrhage-control devices. Earlier hemorrhage-control device placement reduced device failure and the need for transfusion.

(Obstet Gynecol 2024;00:1–7)
DOI: 10.1097/AOG.0000000000005770

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Intrauterine devices in the management of postpartum hemorrhage

Eve Overton, MD; Mary D'Alton, MD; Dena Goffman, MD

FIGURE 1
Bakri postpartum balloon tamponade device

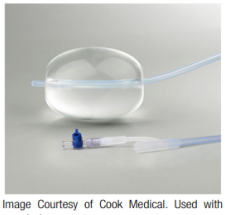
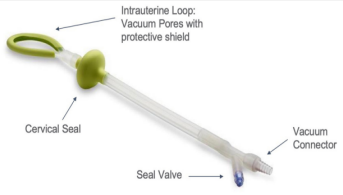


Image Courtesy of Cook Medical. Used with permission.

Overton. Intrauterine devices for postpartum hemorrhage management. Am J Obstet Gynecol 2024.

Only use in settings with access to surgery and blood bank (2 RCT's showed harm)

FIGURE 3
The Jada System intrauterine vacuum-induced hemorrhage-control device



The Jada System intrauterine vacuum induced hemorrhage-control device. The device consists of a soft silicone intrauterine loop lined with vacuum pores and covered with a protective shield, a cervical seal, and in-line tubing for inflation of the seal valve and connection to tubing for an external vacuum source. Image courtesy of Organon Health. Used with permission.

Overton. Intrauterine devices for postpartum hemorrhage management. Am J Obstet Gynecol 2024.

Mostly studied with EBL < 1500 mL
Expensive

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Massive Transfusion

- Classic transfusion guidelines include

  Early crystalloid administration

  FFP to correct PT/aPTT >1.5x

  Platelets to maintain >50K

  Cryoprecipitate if fibrinogen <150-200 mg/dL

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Massive Transfusion

- The latter guidelines IGNORE coagulopathy until it becomes overt
- New concept is haemostatic resuscitation

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Haemostatic resuscitation

- Limit early crystalloid, consider mantaining Ps 80-100 mmHg (controlled hypotension)
- Ratio PRBC:FFP:Platelet (1:1:1)
- Early use of activated factors

Crit Care Med 2010;38(9):S411-S420

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Figure 1. Disseminated intravascular coagulation pathophysiology.

- Obstetrical conditions resulting in passage of tissue factor to maternal circulation (e.g. placental abruption, amniotic fluid embolism)
- Severe inflammatory response with tissue factor expression within inflammatory cells (sepsis, pancreatitis, severe hemorrhage resulting in tissue hypoperfusion/ischemia, trauma, burns, cancer)

↓

TISSUE FACTOR binds FACTOR VII activating clotting cascade through extrinsic pathway

↓

Diffuse clot formation with consumption of clotting factors and platelets

Compensatory activation of fibrinolysis (elevated D-dimer)

↓

Thrombotic manifestations: Micro vessel occlusion results in organ ischemia with multiorgan failure including confusion, respiratory failure, myocardial dysfunction, ischemic hepatitis, acute kidney injury, bowel ischemia

Hemorrhagic manifestations: Clotting factors and platelet consumption may result in bleeding, especially if DIC onset coincides with ongoing surgical procedures like a cesarean delivery

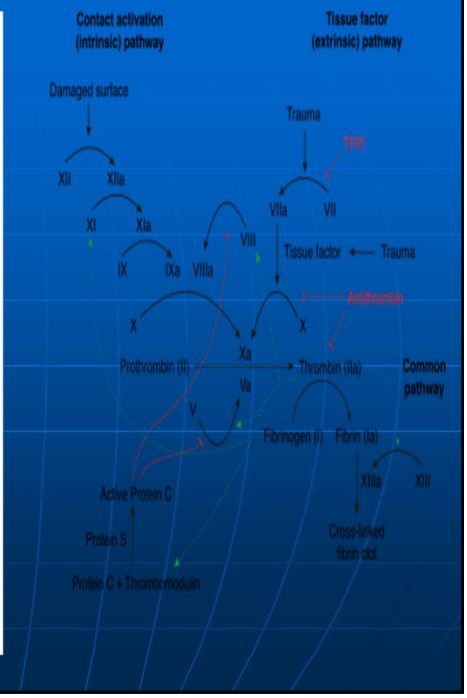

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TABLE

Massive transfusion protocol in obstetrics

	PRBCs	FFP	Platelets	Cryoprecipitate
Round 1	6 U	6 U	6 U	10 U
Round 2	6 U	6 U	6 U	10 U
Round 3	Tranexamic acid 1 g intravenously over 10 min			
Round 4	6 U	6 U	6 U	

Consider activating the protocol when hemorrhage is expected to be massive (anticipated need to replace 50% or more of blood volume within 2 hours), bleeding continues after the transfusion of 4 U of packed red blood cells within a short period of time (1–2 hours), or systolic blood is pressure below 90 mm Hg and heart rate is above 120 beats per minute in the presence of uncontrolled bleeding. Once activated, blood bank personnel will continue preparing blood products until the surgical team inactivates the protocol. After round 4, if not inactivated, the protocol will start again from round 1.

FFP, fresh-frozen plasma; *PRBC*, packed red blood cell; Adapted from Pacheco et al.[4]

Pacheco. Massive transfusion protocols in obstetrics. Am J Obstet Gynecol 2016.

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PROPPR Randomized trial

- In severe trauma, patients randomized to plasma/platelets/packed red cells ratio of 1:1:1 versus 1:1:2
- No difference in primary outcomes of mortality at 24 hours or 30 days
- 1:1:1 ratio had faster hemostasis and less mortality from exsanguination

JAMA 2015;313(5):471-482

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The Efficacy of Low-Titer Group O Whole Blood Compared With Component Therapy in Civilian Trauma Patients: A Meta-Analysis

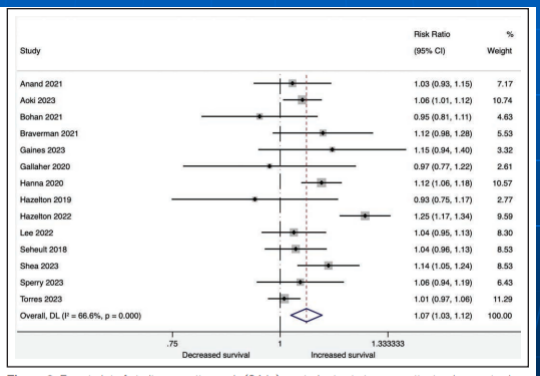

Figure 2. Forest plot of studies reporting early (24-hr) survival rates in trauma patients who received low-titer group O whole blood (LTOWB) compared with component therapy ($n = 16,152$). LTOWB was significantly associated with improved early survival compared with component therapy (relative risk [95% CI] = 1.07 [1.03–1.12], $p = 0.001$). DL = DerSimonian and Laird.

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Whole blood transfusion reduces overall component transfusion in cases of placenta accreta spectrum: a pilot program

Jessian L. Munoz[a,b], Alison M. Kimura[a,b], Elly Xenakis[a,b], Donald H. Jenkins[c], Maxwell A. Braverman[c], Patrick S. Ramsey[a,b] and Kayla E. Ireland[a,b]

[a]Division of Maternal Fetal Medicine, University of Texas Health Sciences Center at San Antonio, San Antonio, TX, USA; [b]Department of Obstetrics & Gynecology, University Health System, San Antonio, TX, USA; [c]Division of Trauma and Emergency Surgery, The University of Texas Health Science Center at San Antonio, San Antonio, TX, USA

Table 2. Operative characteristics.

Factor	Whole blood ($n = 16$)	Component ($n = 18$)	p Value
Admission hemoglobin (g/dl)	10.5 ± 1.5	10.7 ± 1.3	.626[a]
Operative time (min)	319.6 ± 161.1	230.7 ± 128.5	.08[a]
Urinary stent placement	13 (81)	11 (61)	.27[c]
Uterine artery embolization	8 (50)	3 (17)	.076[c]
EBL (ml)	2600 (2000, 4750)	3000 (1875, 5250)	.90[b]
Component transfusion			
Whole blood	3.5 (1.3, 4)	–	–
Red blood cells	0 (0, 2)	4.5 (2, 6.8)	**.003[b]**
Platelets	0 (0, 0.8)	0 (0, 1)	.89[b]
Fresh frozen plasma	0 (0, 3.3)	3 (0, 5)	**.001[b]**
Cryoprecipitate*	0 (0, 0)	0 (0, 0)	.18[b]
Volume transfused (ml)**	2607	4683	.03[a]
GU injury	3 (19)	3 (17)	1.0[c]
Intentional cystotomy	3 (19)	3 (17)	1.0[c]
Incidental cystotomy	0	2 (11)	.49[c]
Ureteral injury	1 (6)	0	.47[c]
PAS by Pathology			
Accreta	1 (6)	4 (22)	.34[c]
Increta	3 (19)	3 (17)	1.00[c]
Percreta	12 (75)	11 (61)	.47[c]
Post-operative Hemoglobin (g/dl)	10.3 ± 2.0	10.3 ± 2.4	.98[a]
Post-operative LOS	4 (3, 5.8)	4 (2.8, 5)	.44[b]

EBL: estimated blood loss; GU: genitourinary; PAS: placenta accreta spectrum.
Values presented as mean ± SD, median [P25, P75] or N (column %).
p Values: [a]t-test, [b]Mann–Whitney's test, and [c]Fisher's exact.
Bold values suggest $p < .05$.
*One patient in each group received cryoprecipitate.
**Utilizing standard transfusion volumes as follows: whole blood (500 ml), red blood cells (350 ml), fresh frozen plasma (300 ml), six pack of platelets (250 ml), and cryoprecipitate (150 m).

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Maternal Morbidity and Mortality: *Current Commentary*

Damage-Control Surgery for Obstetric Hemorrhage

Luis D. Pacheco, MD, M. James Lozada, DO, George R. Saade, MD, and Gary D. V. Hankins, MD

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The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 NOVEMBER 4, 2010 VOL. 363 NO. 19

Safety of Recombinant Activated Factor VII in Randomized Clinical Trials

Marcel Levi, M.D., Jerrold H. Levy, M.D., Henning Friis Andersen, M.Sc., and David Truloff, D.V.M.

Table 2. Odds Ratios for Thromboembolic Events.

Thromboembolic Event	rFVIIa (N=2583)	Placebo (N=1536)	Odds Ratio (95% CI)*	P Value
	number (percent)†			
All events	264 (10.2)	134 (8.7)	1.17 (0.94–1.47)	0.16
Arterial events	141 (5.5)	49 (3.2)	1.68 (1.20–2.36)	0.003
Venous events	137 (5.3)	88 (5.7)	0.93 (0.70–1.23)	0.61

* Odds ratios were calculated by means of logistic regression with adjustment for age and type of bleeding.
† The percentage of thromboembolic events was calculated as the number of patients with events as a proportion of the number of patients who received the assigned study drug.

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Prothrombin complex concentrates

- Concentrates of K dependent clotting factors
- 4 factor concentrates (Kcentra, FEIBA)
- More data needed

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JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Efficacy and Safety of Early Administration of 4-Factor Prothrombin Complex Concentrate in Patients With Trauma at Risk of Massive Transfusion

The PROCOAG Randomized Clinical Trial

CONCLUSIONS AND RELEVANCE Among patients with trauma at risk of massive transfusion, there was no significant reduction of 24-hour blood product consumption after administration of 4F-PCC, but thromboembolic events were more common. These findings do not support systematic use of 4F-PCC in patients at risk of massive transfusion.

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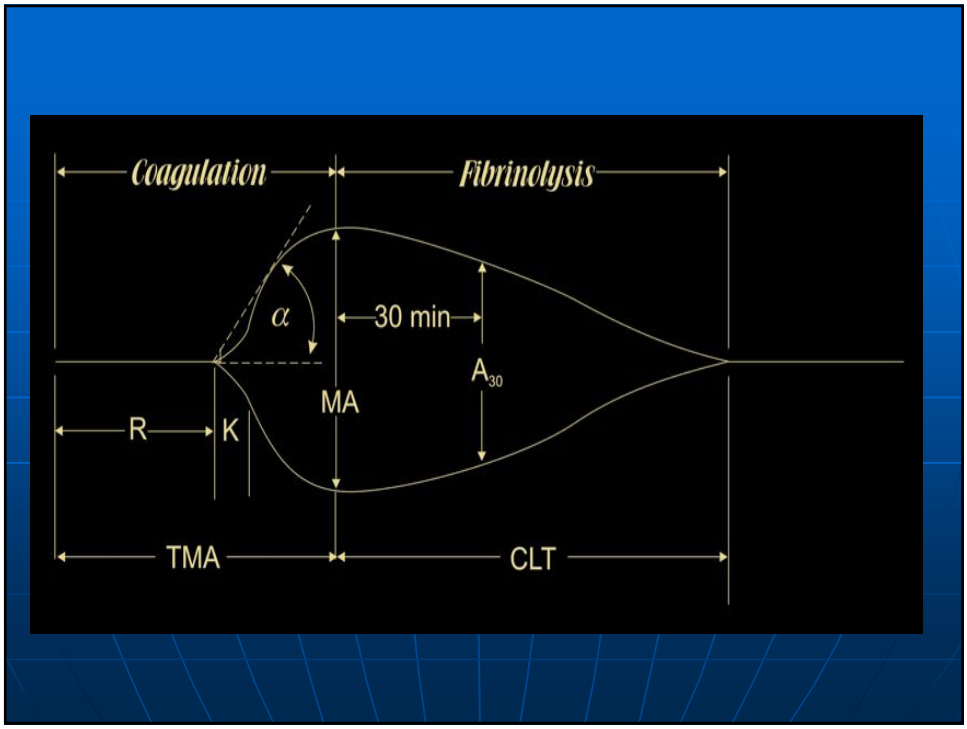
Coagulation
Fibrinolysis
α
30 min
A30
MA
R
K
TMA
CLT

41


143
CTH
146
CT
1.0
CTR
18.8 hPa
CS
17.2 hPa
PCS
1.6 hPa
FCS

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Options in Jehovah´s Witnesses

- Pre-op iron,folic acid, EPO
- Antifibrinolytics
- Desmopressin
- Recombinant activated Factor VII
- Cell saver
- Normovolemic hemodilution
- Blood substitutes (Polyheme)

Am J Med 2006;119(12): 1013-1018
J Am Coll Surg 2002; 195: 445-452

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Thank you

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