

10. Taboada M, Rodríguez J, Bermudez M, Valiño C, Ulloa B, Aneiros F, Gude F, Cortés J, Alvarez J, Atanassoff PG: A “new” automated bolus technique for continuous popliteal block: A prospective, randomized comparison with a continuous infusion technique. *Anesth Analg* 2008; 107:1433-7
11. Taboada M, Rodríguez J, Bermudez M, Amor M, Ulloa B, Aneiros F, Sebate S, Cortés J, Alvarez J, Atanassoff PG: Comparison of continuous infusion *versus* automated bolus for postoperative patient-controlled analgesia with popliteal sciatic nerve catheters. *ANESTHESIOLOGY* 2009; 110:150-4
12. Fredrickson MJ, Abeysekera A, Price DJ, Wong AC: Patient-initiated mandatory boluses for ambulatory continuous interscalene analgesia: An effective strategy for optimizing analgesia and minimizing side-effects. *Br J Anaesth* 2011; 106:239-45
13. Ilfeld BM: Continuous peripheral nerve blocks: A review of the published evidence. *Anesth Analg* 2011; 113:904-25

(Accepted for publication January 19, 2012.)

Managing Patients with Abnormal Placentation: What Are the Best Anesthetic and Transfusion Strategies?

To the Editor:

I read with interest the article by Reitman *et al.*¹ describing the case scenario for a pregnant patient with placenta accreta, and wish to make several comments. Although I would concur with the authors that a neuraxial technique is a viable approach for planned cesarean section for these patients, no specific detail was provided by the authors in the “anesthetic management” section of the article about preferred modes of neuraxial anesthesia. As exemplified in recent case series of patients with abnormal placentation undergoing cesarean delivery, an epidural catheter-based technique – epidural *de novo* or combined spinal-epidural (as described in “surgical course”) – is advisable.^{2,3} For these cases, an epidural catheter allows epidural supplementation of local anesthesia to maintain adequate surgical anesthesia during an anticipated period of prolonged surgery. In addition, the epidural catheter can be employed postoperatively to provide epidural analgesia, especially as these patients often have large midline incisions. These patients may often experience moderate-severe intraoperative blood loss requiring transfusion therapy, therefore verifying that the platelet count and coagulation indices are within a normal range before postoperative epidural catheter removal is advised. Urgent cesarean delivery may also be required because of antenatal vaginal bleeding or spontaneous labor;⁴ however, the article did not include discussion of anesthesia in this setting. A general anesthetic is likely to be preferred over a neuraxial technique for cases requiring expedited cesarean delivery, as platelet count/function and coagulation indices may have been altered by the rate and magnitude of vaginal blood loss or may simply be because of pressure of time to deliver for fetal indications.

Although the authors correctly state major blood loss can occur perioperatively, the article underplays the critical im-

portance of early availability of adequate volume of blood products for these cases. The authors imply that the transfusion requirements for placenta accreta are moderate (4–6 units erythrocytes), but transfusion requirements can vary and be substantial for all subtypes of abnormal placentation, including placenta accreta. In a recent case series describing transfusion therapy in 66 cases of abnormal placentation (accrete, increta, percreta), massive transfusion (more than 10 units erythrocytes) was necessary for 26 patients with the majority (65%) diagnosed with placenta accreta.⁵ Before scheduled and, in particular, urgent cesarean delivery for patients with placenta accreta, an adequate quantity of blood products should be made available to obstetric anesthesiologists in the operating room to avoid communication and transport delays in the ordering, receipt, and delivery of blood products. Immediate access to blood products is especially important during the perioperative period, as placenta accreta is the most common cause for emergency postpartum hysterectomy for uncontrolled bleeding.⁶ As a result, the implementation of a massive transfusion protocol can prove life-saving for cases of life-threatening obstetric hemorrhage in this setting, as this critical initiative can ensure the ongoing availability of adequate amounts of essential blood products (erythrocytes, plasma, platelets) to the operating room until surgical control of active bleeding is achieved.^{7,8}

The endorsement of a 1:1:1 ratio of erythrocyte:plasma:platelets for massive obstetric hemorrhage based on evidence from the trauma literature should be viewed with caution. The implication that a high plasma to erythrocyte ratio leads to improved patient outcomes during trauma resuscitation patients has been questioned, as many of the studies supporting this postulated effect are observational, apply to young, healthy males with penetrating trauma and, most importantly, are confounded by survival and probable selection biases.⁹ The article that Reitman *et al.* reference to justify a 1:1:1 ratio also highlights a number of these methodologic limitations, and states that the “perfect plasma-to-erythrocyte ratio may be an illusory goal.”¹⁰ Recent guidelines from the American Association of Blood Banks do not recommend for or against a fresh frozen plasma:erythrocyte ratio of 3 or more for massive transfusion, which indicates continuing uncertainty regarding ideal transfusion ratios for trauma resuscitation.¹¹

Lastly, the coagulopathy associated with trauma is characterized by overt activation of the anticoagulant thrombomodulin protein C pathway and concomitant hyperfibrinolysis.^{12,13} However, results of recent studies of hemostatic changes during postpartum hemorrhage (PPH) suggest that decreased fibrinogen levels are significantly associated with severe PPH.^{14–16} Charbit *et al.* reported that fibrinogen, factor V, antithrombin, and protein C levels are significantly decreased in women with severe PPH compared with those with nonsevere PPH, and observed no differences in fibrinolytic parameters between severe and nonsevere PPH.¹⁵ As a result, therapeutic approaches for treating coagulopathy in

trauma patients may differ from strategies for managing coagulopathy related to severe PPH. The use of point-of-care technologies, such as thromboelastography (TEG[®]) or rotational thromboelastometry (ROTEM[®]), have been advocated for optimizing the treatment of coagulopathy associated with severe hemorrhage.^{9,17} These technologies may prove useful for goal-directing hemostatic therapy for obstetric patients experiencing obstetric hemorrhage and requiring massive transfusion. In this respect, I agree with the authors' final conclusion that more research and consensus regarding transfusion therapy for PPH are needed.

Alexander J. Butwick, M.B.B.S., F.R.C.A., M.S., Stanford University School of Medicine, Stanford, California. ajbut@stanford.edu

References

1. Reitman E, Devine PC, Laifer-Narin SL, Flood P: Case scenario: Perioperative management of a multigravida at 34-week gestation diagnosed with abnormal placentation. *ANESTHESIOLOGY* 2011; 115:852-7
2. Butwick AJ, Hilton G, Riley ET, Carvalho B: Non-invasive measurement of hemoglobin during cesarean hysterectomy: A case series. *Int J Obstet Anesth* 2011; 20:240-5
3. Lilker SJ, Meyer RA, Downey KN, Macarthur AJ: Anesthetic considerations for placenta accreta. *Int J Obstet Anesth* 2011; 20:288-92
4. Eller AG, Porter TF, Soisson P, Silver RM: Optimal management strategies for placenta accreta. *BJOG* 2009; 116:648-54
5. Stotler B, Padmanabhan A, Devine P, Wright J, Spitalnik SL, Schwartz J: Transfusion requirements in obstetric patients with placenta accreta. *Transfusion* 2011; 51:2627-33
6. Rossi AC, Lee RH, Chmait RH: Emergency postpartum hysterectomy for uncontrolled postpartum bleeding: A systematic review. *Obstet Gynecol* 2010; 115:637-44
7. Goodnough LT, Daniels K, Wong AE, Viele M, Fontaine MF, Butwick AJ: How we treat: Transfusion medicine support of obstetric services. *Transfusion* 2011; 51:2540-8
8. Burtelow M, Riley E, Druzin M, Fontaine M, Viele M, Goodnough LT: How we treat: Management of life-threatening primary postpartum hemorrhage with a standardized massive transfusion protocol. *Transfusion* 2007; 47:1564-72
9. Spahn DR, Ganter MT: Towards early individual goal-directed coagulation management in trauma patients. *Br J Anaesth* 2010; 105:103-5
10. Stansbury LG, Dutton RP, Stein DM, Bochicchio GV, Scalea TM, Hess JR: Controversy in trauma resuscitation: Do ratios of plasma to red blood cells matter? *Transfus Med Rev* 2009; 23:255-65
11. Roback JD, Caldwell S, Carson J, Davenport R, Drew MJ, Eder A, Fung M, Hamilton N, Hess JR, Luban N, Perkins JG, Sachais BS, Shander A, Silverman T, Snyder E, Tormey C, Waters J, Djulbegovic B, American Association for the Study of Liver, American Academy of Pediatrics, United States Army, American Society of Anesthesiology, American Society of Hematology: Evidence-based practice guidelines for plasma transfusion. *Transfusion* 2010; 50:1227-39
12. Brohi K, Cohen MJ, Ganter MT, Matthay MA, Mackersie RC, Pittet JF: Acute traumatic coagulopathy: Initiated by hypoperfusion: modulated through the protein C pathway? *Ann Surg* 2007; 245:812-8
13. Brohi K, Cohen MJ, Ganter MT, Schultz MJ, Levi M, Mackersie RC, Pittet JF: Acute coagulopathy of trauma: Hypoperfusion induces systemic anticoagulation and hyperfibrinolysis. *J Trauma* 2008; 64:1211-7
14. Huissoud C, Carrabin N, Audibert F, Levrat A, Massignon D, Berland M, Rudigoz RC: Bedside assessment of fibrinogen level in postpartum haemorrhage by thrombelastometry. *BJOG* 2009; 116:1097-102
15. Charbit B, Mandelbrot L, Samain E, Baron G, Haddaoui B, Keita H, Sibony O, Mahieu-Caputo D, Hurtaud-Roux MF, Huisse MG, Denninger MH, de Prost D, PPH Study Group: The decrease of fibrinogen is an early predictor of the severity of postpartum hemorrhage. *J Thromb Haemost* 2007; 5:266-73
16. de Lloyd L, Bovington R, Kaye A, Collis RE, Rayment R, Sanders J, Rees A, Collins PW: Standard haemostatic tests following major obstetric haemorrhage. *Int J Obstet Anesth* 2011; 20:135-41
17. Bolliger D, Görlinger K, Tanaka KA: Pathophysiology and treatment of coagulopathy in massive hemorrhage and hemodilution. *ANESTHESIOLOGY* 2010; 113:1205-19

(Accepted for publication January 20, 2012.)

In Reply:

We would like to thank Butwick for his interest in our Case Scenario.¹ He raises several issues that we were not able to address in depth as the Case Scenario format does not allow for an in-depth review of all aspects of the field. To address each point in turn, we agree that an epidural is indicated when the surgery is likely to outlast the duration of a spinal block. Since this is almost always the case when abnormal placentation is expected, if neuraxial analgesia is used, an epidural with or without an intrathecal dose is advisable. The article was written about a case done with regional anesthesia, but of course hemodynamic instability is a contraindication to regional anesthesia, and in this case general anesthesia is preferred.

Blood loss at cesarean hysterectomy is variable, and we agree that one should always be prepared for extensive transfusion. In spite of the reference cited by Butwick, the average blood loss at planned cesarean hysterectomy for placenta accreta is in the range of 5 units in other published series and in our experience.^{2,3} We meant to differentiate this from placenta percreta, which is more likely to require massive transfusion and, depending on the evidence for placental invasion, might cause the practitioner to favor general anesthesia from the start of the procedure.

Newer protocols for massive transfusion with higher ratios of plasma have emerged from the trauma literature. However, as we stated in our manuscript, "Additional clinical trials are needed to establish the cost-benefit and risk-benefit profiles for procoagulant drugs and to establish standards for treatment of massive bleeding in pregnancy."¹ The use of more plasma in obstetrical hemorrhage seems reasonable in massive obstetrical hemorrhage, as fibrinogen levels are often found to be low and may be associated with continued oozing even when surgical bleeding is controlled. On the other hand, pregnancy is associated with enhanced procoagulant risk, making the hematologic situation more complex. The use of thromboelastography and rotational thromboelastometry may have been advocated for management of