after placental delivery, in the operating theatre, she began snoring and was not responding to verbal and physical stimulation. Her blood pressure was 128/86 mmHg and arterial oxygen saturation 99%. Her blood glucose was checked and found to be unmeasurable (Medisafe FIT®, Terumo, Tokyo, Japan), meaning that the concentration was below 1.1 mmol/L. Following rapid intravenous administration of 20 mL 50% dextrose, her blood glucose increased to 5.6 mmol/L. She regained consciousness and was discharged to the obstetric ward, after receiving an additional 20 mL. Ninety-five minutes after the placental delivery, in the obstetric ward, her blood glucose decreased to 3.8 mmol/L and a further 20 mL of 50% dextrose was administered. Subsequently, she resumed oral intake of food and did not experience further hypoglycemic events. On the first postoperative day her insulin requirement was 8 units of rapid-acting insulin analogue before every meal and 10 units of long-acting insulin analogue administered before sleep.

Several alternative diagnoses were considered for her sudden loss of consciousness, including cerebrovascular disease and high spinal block. This acute hypoglycemic event may be explained by a combination of factors. The patient's insulin requirements were higher during this pregnancy than during previous ones, possibly related to greater release of cytokines by the placenta during the current pregnancy. Insulin sensitivity increases suddenly following placental delivery.[2] In addition, high levels of placental tumour necrosis factor-alpha play an important role in diabetic patients in the disappearance of insulin resistance immediately after placental delivery.[3–5] Furthermore, decreased levels of catecholamines after spinal anesthesia and intrathecal fentanyl may contribute to acute hypoglycemia.[6] We did not have a maternal blood glucose level available before placental delivery, but it was likely equal to or more than 3.8 mmol/L, similar to the umbilical vein blood glucose level.[7] This suggests an abrupt fall in maternal blood glucose after delivery. She had not experienced hypoglycemia at the time of her sixth delivery, when the DM was diagnosed, possibly related to the absence of sympathetic inhibition induced by anesthetics and the decreased levels of tumour necrosis factor-alpha. To avoid acute hypoglycemia following placental delivery in patients with type-1 DM, this phenomenon must be considered. Furthermore, we recommend measuring pre-operative maternal blood glucose levels again after placental delivery. Finally, administration of fluid containing glucose or a dextrose and insulin titrated infusion should be considered, while monitoring the blood glucose and for symptoms of hypoglycemia.

M. Ida, K. Matsumura, M. Kawaguchi
*Department of Anaesthesiology*
*Nara Medical University, Kashihara, Nara, Japan*
*E-mail address:* nwnh0131@yahoo.co.jp

## References

1. Garcia-Patterson A, Gich I, Amini SB, Catalano PM, de Leiva A, Corcoy R. Insulin requirements throughout pregnancy in women with type 1 diabetes mellitus: three changes of direction. *Diabetologia* 2010;**53**:446–51.
2. Feldman AZ, Brown FM. Management of type 1 diabetes in pregnancy. *Curr Diab Rep* 2016;**16**:76.
3. Kirwan JP, Hauguel-De Mouzon S, Lepercq J, et al. TNF-alpha is a predictor of insulin resistance in human pregnancy. *Diabetes* 2002;**51**:2207–13.
4. Hu Y, Huang K, Sun Y, et al. Placenta response of inflammation and oxidative stress in low-risk term childbirth: the implication of delivery mode. *BMC Pregnancy Childbirth* 2017;**17**:407.
5. Xu J, Zhao YH, Chen YP, et al. Maternal circulating concentrations of tumor necrosis factor-alpha, leptin, and adiponectin in gestational diabetes mellitus: a systematic review and meta-analysis. *ScientificWorldJournal* 2014;**2014** 926932.
6. Cascio M, Pygon B, Bernett C, Ramanathan S. Labour analgesia with intrathecal fentanyl decreases maternal stress. *Can J Anaesth* 1997;**44**:605–9.
7. Fukuda I, Matsuda H, Sugahara S, Kazama T. The effect of intravenous glucose solutions on neonatal blood glucose levels after cesarean delivery. *J Anesth* 2013;**27**:180–5.

# Propofol, Zola, and the modern obstetric rapid sequence induction

We read with great interest the results of the latest national United Kingdom survey of practice on the conduct of rapid sequence induction (RSI) for caesarean section[1] and its findings of continuing heterogeneity in anaesthetic practice with respect to this clinical context. Last year, at King's College Hospital, we carried out a similar study which was recently presented at the 2019 Winter Scientific Meeting of the Association of Anaesthetists.

The case against thiopentone is bolstered by examples of inappropriate dosing, with underdosage carrying a risk of awareness[2] and inappropriately high dosing being implicated in maternal deaths.[3] We consider that these dosing misjudgements may well reflect a lack of familiarity with thiopentone. As the adage goes, the safest drug in a clinical scenario is often the one most familiar to the individual administering it.

Desai et al. noted that the proportion of anaesthetists who theoretically support an alteration of first-line induction agent from thiopentone to propofol is double that of those who have already effected this change in practice (82% vs. 41%) – and that this speaks to unknown barriers to the use of propofol in this context. No doubt fear of criticism in an already litigious subspecialty plays a role. We suggest that a parallel exists between this and 'Zola's triggers', namely the reasons that lead patients to consult a doctor.[4] One of these trig-

gers is the act of a third party 'sanctioning' such a consultation. In this scenario it is we, as anaesthetists, who require sanctioning of a change to our practice. Locally we have attempted to do this by now also including propofol (and rocuronium) in our labour ward emergency drug box, in acknowledgement of the status of these agents as acceptable alternatives to the traditional drugs of thiopentone and suxamethonium. However, formal acknowledgement from an authority such as the Obstetric Anaesthetists' Association, preferably in the form of a published guideline, may be required before the relative trickle of propofol becomes a flood.

Finally, it is right that Desai et al. acknowledge both the original description and the controversial aspects of the classical RSI, now described almost half a century ago.[5] It is clear that the so-called 'modified' RSI of latter-day practice has indeed been altered beyond all recognition: we suggest it is high time that it is renamed the 'modern' RSI.

E.-J. Smith
*Lewisham and Greenwich NHS Trust, London*
*United Kingdom*
*E-mail address:* ej.smith@nhs.net

P. Groves
*Hospital NHS Foundation Trust, London*
*United Kingdom*

## References

1. Desai N, Wicker J, Sajayan A, Mendonca C. A survey of practice of rapid sequence induction for caesarean section in England. *Int J Obstet Anesth* 2018;**36**:3–10.
2. Pandit JJ, Cook TM, the NAP Steering Panel. NAP5. Accidental awareness during general anaesthesia. London: The Royal College of Anaesthetists and Association of Anaesthetists of Great Britain and Ireland, 2014.
3. Knight M, Kenyon S, Brocklehurst P, Neilson J, Shakespeare J, Kurinczuk JJ (eds.) on behalf of MBRRACE-UK. Saving Lives, Improving Mothers' Care—Lessons Learned to Inform Future Maternity Care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2009–12. Oxford: National Perinatal Epidemiology Unit, University of Oxford, 2014.
4. Zola IK. Pathways to the doctor-from person to patient. *Soc Sci Med* 1973;**7**:677–89.
5. Stept WJ, Safar P. Rapid induction/intubation for prevention of gastric-content aspiration. *Anesth Analg* 1970;**49**:633–66.

# Transabdominal continuous echocardiographic monitoring of fetuses

Continuous fetal monitoring is important in non-obstetric surgery during pregnancy. Electronic fetal heart rate monitoring is the main method of continuous fetal monitoring, using Doppler ultrasound to detect the heartbeat. It is indirect and is easily interfered with due to the mother's blood flow signal.[1] Furthermore, changes of fetal heart rate patterns can be due to maternal hypoglycemia or administration of drugs, in addition to fetal hypoxia.[2] Continuous echocardiographic monitoring by anesthesiologists has been successfully used to monitor patients.[3] Transabdominal continuous echocardiographic monitoring may also be an effective tool for physicians in assessing the status of a fetus.

A 31-year-old woman was scheduled for mitral valve replacement at 25 weeks' gestation. Another 34-year-old woman underwent the removal of an atrial myxoma at 18 weeks' gestation. During the surgeries, each fetus was continuously monitored by transabdominal echocardiography. This allowed direct continuous display of the structure and motion of the fetal heart and umbilical blood flow (Fig. 1).

A custom-made transducer holder was developed to affix the 2–5 MHz probe to the abdomen, to acquire the desired fetal echocardiographic images (Image A). Image B (Supplemental Digital Content Video) displays echocardiographic views of the mother's abdomen and the fetus's cardiac structures: the left atrium (LA), the left ventricle (LV), the right atrium (RA) and the right ventricle (RV). Image C (Supplemental Digital Content Video) shows the M-mode echocardiograph, used for heart rate calculation. In addition, other organs such as the placenta, uterine wall, umbilical cord and fetal lung were clearly displayed.

Obvious deceleration of the fetal heart was noted with the onset of cardiopulmonary bypass in both the cases. At the same time, the chamber size of the fetal heart reduced. These changes indicated deficient placenta perfusion, so the cardiopulmonary bypass flow was increased and the fetal heart rate recovered. Transabdominal continuous echocardiographic monitoring was not used until the end of the surgery. The anesthesiologists adjusted the blood pressure and acid-base balance of the mother or administrated magnesium sulfate to decrease uteroplacental resistance, to promote recovery of the fetal heart rate. After these two cardiac operations, serial fetal ultrasounds revealed normal fetal condition. The first woman subsequently had a normal vaginal delivery at 39 weeks' gestation and delivered a healthy baby. The second woman chose an induction of labor at 21 weeks' gestation because she was fearful about fetal malformation.

One of the peri-operative management objectives in non-obstetric surgery during pregnancy is to optimize or maintain uteroplacental blood flow and oxygen delivery. The standard method of continuous fetal monitoring uses Doppler ultrasound to detect the fetal heartbeat. This method is indirect and can be easily interfered with by the mother's blood flow signal,