



ELSEVIER

[www.obstetanaesthesia.com](http://www.obstetanaesthesia.com)

## EDITORIAL

# Enhanced Recovery After Cesarean (ERAC) – beyond the pain scores

Enhanced recovery protocols aim to optimize patient outcomes by modifying the inflammatory and metabolic changes associated with surgery. Multimodal evidence-based interventions that may reduce the surgical stress response have been organized into a specific care pathway which can shorten the recovery period and reduce peri-operative complications.<sup>1</sup> More than 20 years ago, Henrik Kehlet, a pioneer in peri-operative pathophysiology and rehabilitation, initiated the first enhanced recovery protocol for colorectal surgery.<sup>2</sup> Obstetrics can now be added to the long list of surgical specialties that have embraced the enhanced recovery concept.<sup>3</sup> The Society for Obstetric Anesthesia and Perinatology (SOAP), the American College of Obstetricians and Gynecologists (ACOG), and the Enhanced Recovery After Surgery (ERAS) Society have recently published their guidelines on Enhanced Recovery After Cesarean delivery (ERAC).<sup>4–8</sup> In the current issue of the *International Journal of Obstetric Anesthesia* (IJOA), two “before and after” ERAC pathways studies<sup>9,10</sup> report a significant reduction in opioid analgesic use, while also reporting overall unchanged pain scores.

Lester et al.<sup>9</sup> reported that, after implementing their ERAC protocol, the total mean inpatient oral morphine equivalents administered to women postpartum decreased by 42%, from 104.3 mg (range 0 to 474 mg) before ERAC to 60.3 mg (range 0 to 192 mg) after implementation ( $P < 0.001$ ). This decrease continued after discharge: 41% of mothers on the ERAC protocol used oxycodone within 24 h of discharge, compared with 74.6% who did so before institution of ERAC ( $P < 0.001$ ). In addition, despite the higher incidence of mobilization in the ERAC group, average pain scores (0–10) remained very low in both groups (1.6 vs 1.9 before ERAC,  $P = 0.037$ ). Their ERAC protocol included only eight of the 19 recommended core elements described in the SOAP Consensus Statement.<sup>4</sup> Not mentioned were: prevention and treatment of spinal anesthesia-induced hypotension; prevention of hypothermia; optimal administration of uterotonic drugs; antibiotic prophylaxis; intra-operative/postoperative nausea and vomiting prophylaxis and treatment; promotion of breastfeeding and maternal-infant bonding; promotion of resting periods; prophylaxis against venous thrombo-embolism; facilitation of early dis-

charge; remediation of anemia; and breastfeeding support.

Kleiman et al.<sup>10</sup> reported a 38% reduction in total postoperative morphine mg-equivalent consumption after implementing their ERAC protocol (from mean ( $\pm$ SD) 46.1 ( $\pm$ 37.0) mg before ERAC to 28.4 ( $\pm$ 24.1) mg after implementation,  $P < 0.001$ ). Despite increased activity in the ERAC group, the mean pain scores during hospitalization were similar. Women were also able to leave the hospital slightly earlier ( $2.5 \pm 0.5$  days vs  $2.9 \pm 1.2$  before ERAC,  $P < 0.001$ ). It is important to note that while ERAC programs may achieve earlier discharge (with resultant cost savings) compared with traditional care, it remains to be seen if patients receiving ERAC care are agreeable to earlier discharge (albeit desirable during the current COVID-19 pandemic). Patient-reported outcome measures will be an important part of future ERAC studies, as have been reported in the gynecology literature.<sup>11</sup> In the USA, health insurers must cover costs up to 96 hours after a cesarean delivery in compliance with the Newborns’ and Mothers’ Health Protection Act (NMHPA).<sup>12</sup> The ERAC protocol used by Kleiman et al. included 12 of 19 recommended core elements described in the SOAP Consensus Statement.<sup>4</sup> Not mentioned were: antibiotic prophylaxis; intra-operative/postoperative nausea and vomiting prophylaxis and treatment; promotion of resting periods; venous thrombo-embolism prophylaxis; facilitation of early discharge; remediation of anemia; and breastfeeding support.

Both studies reported a reduction in opioid analgesic use but unchanged pain scores when ERAC protocols were introduced. This reduction in opioid consumption is a welcome outcome in the current era of an “opioid epidemic”, in which 1 in 300 opioid-naïve mothers remain prescription opioid users after their cesarean delivery (CD).<sup>13</sup> Remarkably, the analgesia medication changes were minimal relative to the magnitude of reduced opioid use. In both studies, only scheduled pre-<sup>9</sup> and post-CD<sup>9,10</sup> oral acetaminophen were added to existing pre-ERAC pain regimens; traditional care in both centers already included scheduled non-steroidal anti-inflammatory drugs and neuraxial morphine (ranging from 100 to 200  $\mu$ g), and in both centers, discharge oxycodone prescriptions were capped at 15 and 20 doses

of oxycodone 5 mg. Significantly, both ERAC pathways included information and teaching sessions for prospective mothers before hospital admission. In these precesarean settings, the ERAC pathways and, importantly, anticipated pain severity were discussed and questions answered.

Kleiman's and Lester's findings align with previous reports<sup>14,15</sup> and emphasize the utility of a multimodal analgesic regimen and patient education, as cornerstones of an enhanced recovery program. Future studies must attempt to untangle the combined and likely inter-related effects of various ERAC interventions on outcomes, to clarify which pathway elements or combinations thereof best enhance recovery. Such information is needed to improve existing guidelines, which are based on very low levels of evidence for our specific obstetric population.<sup>4</sup>

Kleiman and Lester's studies also add to a growing body of literature that investigates the effects of ERAC interventions primarily by analyzing inpatient medical, administrative and billing records. Ironically, this approach lacks important post-discharge information which is crucial for truly gauging recovery and postpartum outcomes. It is important to remember that sufficient pain control is merely a prerequisite for enhanced recovery. Effective postoperative analgesia reduces the humoral and catabolic stress response, improves gastro-intestinal motility, facilitates early feeding, early mobilization, rate of breastfeeding and, importantly, maternal-fetal bonding and satisfaction. Researchers need to expand their horizon beyond the labor and delivery floor to the home arena, where most of the recovery occurs. It is still unknown whether ERAC protocols can influence postpartum depression, breastfeeding, neonatal safety or maternal ability to care for the neonate. Other potential areas to investigate include the impact of ERAC guidelines on postpartum chronic pain, the partner and family experience, and maternal morbidity. These are but some of the core questions that need to be addressed if we want to understand more comprehensively how ERAC protocols impact maternal and fetal recovery. Highlighting the impact of improved analgesia on these outcomes could have improved the message of these recent studies.

Also in this issue of IJOA, a review of the current ERAC literature by Sultan et al. found almost 100 different outcomes and 44 different ERAC protocols in 11 peer-reviewed studies (including Kleiman's study) and 34 non-peer reviewed meeting abstracts (including Lester's abstract).<sup>16</sup> The review does not recommend specific ERAC protocol components, but discovered commonalities among the many different ERAC protocols, including patient education, pre- and post-delivery fasting times and use of multimodal analgesia. The review found the Grading of Recommendations Assessment, Development and Evaluation (GRADE) level of

evidence regarding benefits to be low or very low for all outcomes, and it found no evidence of harm. This review highlights gaps in knowledge and the lack of high-level evidence, which is consistent with the levels of evidence presented in the SOAP<sup>4</sup> and ERAS<sup>6-8</sup> guidelines for ERAC. Future randomized controlled trials should address components of the SOAP and ERAS guidelines which lack level I evidence. Importantly, Sultan et al. reported a low risk-to-benefit ratio associated with ERAC implementation and recommended the use of ERAC protocols to potentially improve maternal outcomes.

The study by Sultan et al. highlights the obvious heterogeneity of outcomes assessed and ERAC protocols. Lester et al. used eight and Kleiman et al. used 12 of 19 recommended core ERAC elements. In an area in which standardization of care is thought to be a central factor for success, this raises commonly-asked questions about which pathway elements or combination thereof are the most important in optimizing cesarean delivery recovery, and how compliance can be improved. Recently, in a joint statement from the ERAS and ERAS USA Societies, Elias et al.<sup>17</sup> described a standardized framework for the reporting of ERAS-related studies. At a minimum, researchers should describe their ERAS protocol in detail, and should measure the adherence to their protocol.<sup>17</sup> While both Kleiman and Lester described their ERAC protocols, neither provided sufficient detail about protocol adherence. Lester et al. reported 92% adherence to patients receiving pre-operative acetaminophen, but did not indicate adherence to each of the individual ERAC protocol elements, before and after implementation. Critics might contend that if adherence is not measured and explicitly audited, this could be a case of "work perceived versus work completed" (e.g. an active mobilization order is not adequately implemented on the ward due to inadequate availability of staff). A recent study of gynecologic surgery showed that increasing adherence to ERAS guidelines was associated with an improvement in clinical outcomes, such as reduced length of stay and postoperative complications.<sup>18</sup> The key to increasing adherence and compliance is audit and feedback. Audit allows the enhanced recovery team to establish baseline compliance in the pre-implementation cohort such that, following formal implementation of the ERAS program, efforts can be targeted towards protocol elements where adherence is less than desired and in doing so improve outcomes. This is typically done through successive plan-do-study-act cycles.<sup>19</sup>

Curiously, despite the lack of level I evidence, ERAC protocols have gained widespread popularity, perhaps because the interdisciplinary approach required to create care pathways brings an opportunity to replace traditions that are poorly supported by evidence. It also

places patients before institutional needs and holds healthcare providers more accountable.

While it is encouraging to see enhanced recovery protocols associated with obstetric anesthesia and surgery, much work needs to be done. Future ERAC research should target evidence gaps, help identify crucial pathway elements (and maternal acceptance of these interventions), report on a consistent set of metrics including protocol compliance,<sup>17</sup> determine cost-effectiveness,<sup>20</sup> and illuminate the (patho-)physiological factors affecting maternal recovery and fetal wellbeing.

## Declarations of interest

None.

L. Bollag

Department of Anesthesiology & Pain Medicine  
University of Washington School of Medicine  
Seattle, WA, USA  
E-mail address: bollag@uw.edu

G. Nelson

Department of Obstetrics & Gynecology  
Cumming School of Medicine, University of Calgary  
Calgary, CA, Canada

## References

1. Kehlet H. Multimodal approach to control postoperative pathophysiology and rehabilitation. *Br J Anaesth* 1997;**78**:606–17.
2. Basse L, Hjort Jakobsen D, Billesbolle P, Werner M, Kehlet H. A clinical pathway to accelerate recovery after colonic resection. *Ann Surg* 2000;**232**:51–7.
3. Ituk U, Habib AS. Enhanced recovery after cesarean delivery. *F1000Res* 2018;**7**.
4. Bollag L, Tiouririne M, Lim G, et al. Society of Obstetric Anesthesia and Perinatology (SOAP) Enhanced Recover After Cesarean (ERAC) Consensus Statement. May 23, 2019. Available at: <https://soap.org//SOAP-Enhanced-Recovery-After-Cesarean-Consensus-Statement.pdf>. Accessed May 5, 2020.
5. ACOG Committee Opinion No. 750 Summary: Perioperative Pathways: Enhanced Recovery After Surgery. *Obstet Gynecol* 2018;**132**:801–2.
6. Wilson RD, Caughey AB, Wood SL, et al. Guidelines for antenatal and preoperative care in cesarean delivery: Enhanced Recovery After Surgery Society recommendations (Part 1). *Am J Obstet Gynecol* 2018;**219**(523):e1–e15.
7. Caughey AB, Wood SL, Macones GA, et al. Guidelines for intraoperative care in cesarean delivery: Enhanced Recovery After Surgery Society recommendations (Part 2). *Am J Obstet Gynecol* 2018;**219**:533–44.
8. Macones GA, Caughey AB, Wood SL, et al. Guidelines for postoperative care in cesarean delivery: Enhanced Recovery After Surgery (ERAS) Society recommendations (part 3). *Am J Obstet Gynecol* 2019;**221**(247):e1–9.
9. Lester SA, Kim B, Tubinis MD, Morgan CJ, Powell MF. Impact of an enhanced recovery program for cesarean delivery on postoperative opioid use. *Int J Obstet Anesth* 2020;**43**:47–55.
10. Kleiman AM, Chisholm CA, Dixon AJ, et al. Evaluation of the impact of enhanced recovery after surgery protocol implementation on maternal outcomes following elective cesarean delivery. *Int J Obstet Anesth* 2020;**43**:39–46.
11. Meyer LA, Lasala J, Iniesta MD, et al. Effect of an enhanced recovery after surgery program on opioid use and patient-reported outcomes. *Obstet Gynecol* 2018;**132**:281–90.
12. The center for consumer information and insurance oversight. Newborns' and Mothers' Health Protection Act (NMHPA). Centers for Medicare & Medicaid Services. 2019. Available at: [https://www.cms.gov/CCIIO/Programs-and-Initiatives/Other-Insurance-Protections/nmhpa\\_factsheet.html](https://www.cms.gov/CCIIO/Programs-and-Initiatives/Other-Insurance-Protections/nmhpa_factsheet.html). Accessed May 5, 2020.
13. Bateman BT, Franklin JM, Bykov K, et al. Persistent opioid use following cesarean delivery: patterns and predictors among opioid-naive women. *Am J Obstet Gynecol* 2016;**215**(353):e1–e18.
14. Hedderson M, Lee D, Hunt E, et al. Enhanced recovery after surgery to change process measures and reduce opioid use after cesarean delivery: a quality improvement initiative. *Obstet Gynecol* 2019;**134**:511–9.
15. Fay EE, Hitti JE, Delgado CM, et al. An enhanced recovery after surgery pathway for cesarean delivery decreases hospital stay and cost. *Am J Obstet Gynecol* 2019;**221**(349):e1–9.
16. Sultan P, Sharawi N, Blake L, Carvalho B. Enhanced recovery after caesarean delivery versus standard care studies: a systematic review of interventions and outcomes. *Int J Obstet Anesth* 2020;**43**:72–86.
17. Elias KM, Stone AB, McGinagle K, et al. The reporting on ERAS compliance, outcomes, and elements research (RECOVER) checklist: a joint statement by the ERAS((R)) and ERAS((R)) USA Societies. *World J Surg* 2019;**43**:1–8.
18. Wijk L, Udumyan R, Pache B, et al. International validation of Enhanced Recovery After Surgery Society guidelines on enhanced recovery for gynecologic surgery. *Am J Obstet Gynecol* 2019;**221**(237):e1–e11.
19. Nelson G, Dowdy SC, Lasala J, et al. Enhanced recovery after surgery (ERAS(R)) in gynecologic oncology – Practical considerations for program development. *Gynecol Oncol* 2017;**147**:617–20.
20. Ljungqvist O, Thanh NX, Nelson G. ERAS-value based surgery. *J Surg Oncol* 2017;**116**:608–12.