Enhanced Recovery After Cesarean Section

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Objectives

1. Provide background information on enhanced recovery (also known as ERAS) clinical pathways.
2. Consider why ERAS is a vital component of obstetric medicine
3. Review 3 other OB systems with ERAS in place
4. Discuss components of an effective ERAS for our facility
5. Empower multidisciplinary teams to start building ERAS protocols
6. Provide time for discussion and questions.
What is ERAS

Enhanced Recovery After Surgery

- Collections of evidence-based, best practices for preoperative, intraoperative, and postoperative management of patients undergoing a variety of major surgeries.

- Serves as a vehicle to implement multidisciplinary best practice guidelines by
  - breaking down isolated practice silos,
  - evaluating ongoing practices,
  - and creating collaborative relationships.
**Enhanced Recovery After Surgery**

- Originated in Colorectal surgery and has infiltrated rapidly into other surgical specialties
- Specific components of protocols differ among specialties and institutions, but core principles remain same
  - These principles span the perioperative period and address common reasons that delay patient recovery
    - Inadequate analgesia
      - Is more than just which pills one is taking
    - Impaired bowel motility
      - Involves more than just stool softeners and laxatives
    - Delayed ambulation
- These core principles that delay recovery may be very different in the obstetric population!!!
  - Ie: Breastfeeding or Depression
Purpose of ERAS

- Combines evidence based aspects of perioperative care to
  - Accelerate patient recovery
  - Improve patient satisfaction
  - Decrease LOS
  - Reduce readmissions
  - Decrease postoperative complications
Why Do We Need ERAS in OB?

- CS delivery rate in USA is 32% of all births, with over 1.27 million procedures performed annually
  - Falls 2nd only to cataracts (about 3 million annually)

- Majority of women are young and healthy
  - Potential for rapid recovery
  - Motivated to return to normal state of functioning to care for newborn
  - Plus, we get 40 weeks (most of the time) to educate and implement this process!

- Flip side: Our patients are getting sicker!
  - Opportunity awaits!
Current ERAS programs for CS

- University of Virginia Healthcare System
  - 368 patients (control 197, ERAS 171)
  - Evaluated post-cesarean opioid consumption
    - 38% reduction
    - Lower pain scores
  - LOS
    - 2.5 +/- 0.5 days vs 2.9 +/- 1.2 days
- St Peters Healthcare System
  - NewBrunswick, NJ
  - 5,000 babies annually
- University of California San Francisco
Enhanced Recovery Reduces Length Of Stay And Improves Value For Patients Undergoing Elective Cesarean Section
Attila Kett, MD, MBA, Elizabeth Cherot MD, MBA
Rachel Mauro, MD, Saint Peter’s Healthcare System

Abstract

The concept of an enhanced recovery program, although becoming a standard of care across the country, was developed initially in a few European institutions. Within this initiative, care practices and protocols are redefined and implemented to improve outcomes. In addition to the patients benefiting from this care, the hospital also improves the efficiency and effectiveness of care delivery. As a result, the hospital is able to reduce overall costs and improve customer satisfaction. The success of these initiatives is supported by a wide body of literature. Therefore, the objective of this study was to analyze the impact of an enhanced recovery program on patient outcome in a hospital setting.

Implementation

The aim of the initiative

- Improve postoperative nutrition
- Reduce post-operative fasting
- Enhance multidisciplinary care
- Enhance early mobilization
- Reduce postoperative nausea and vomiting response
- Improve patient satisfaction with post-operative analgesia
- Discharge twice to three days after the planned Cesarean Section

Timeline

1. Change Management
2. Protocol
3. Collect Patient Reported Outcomes
4. Patient relationship management
5. Financial analysis

Patient relationship management

- Engage with ERAS milestones
- Remind and educate patients to complete ERAS milestones
- Collect, graph, and filter customer surveys, including satisfaction data

Financial analysis

- Direct Variable Cost per Day
- Indirect Variable Cost per Day
- Total Variable Cost per Day

Summary

This enhanced recovery program demonstrates the potential to positively impact care delivery. Within this program, the patient is at the center of care delivery. The hospital’s efforts include reducing costs, improving patient outcomes, and ultimately providing better care. The program has been successful in reducing length of stay and improving overall satisfaction. Future enhancements to the program will continue to focus on improving outcomes and providing better care for patients.
Summary

Our data show that implementation of an ERAS program can be beneficial to patient outcomes without forcing hospitals to incur a necessary large expense in the name of improving delivery of quality health care.

First, only reductions in direct variable costs were considered. This, coupled with disregarding the potential net revenue from increased surgical capacity and bed availability, likely underestimated the positive financial impact of the ERAS pathway. Perhaps most importantly, no considerations were made for the potential cost savings associated with improvement in patient outcomes and experience that have been reported in evaluations of numerous ERAS programs, both of which are important elements of most value-based purchasing contracts in the United States.

Based on our financial model the introduction of the Enhanced Recovery Program will yield a 216% ROI during the first year. The return will increase to 282% in subsequent years making the decision to proceed with the project straightforward.
<table>
<thead>
<tr>
<th>Days Before (72hr prior)</th>
<th>ANESTHESIA</th>
<th>OB</th>
<th>NURSING</th>
<th>PATIENT</th>
<th>PEDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anepartum Clinic visit</td>
<td>Patient education on &quot;What to expect&quot; for C-section, method of feeding, choosing pediatrician. Add Breastfeeding AVS.</td>
<td>Schedule surgery. HUSC will ask providers if eligible for ERAS. Verify Pediatrician (if none, baby will go to MZ Gen Ped Clinic)</td>
<td>Enroll in MyChart</td>
<td>Review educational material (EMMI and &quot;What to Expect&quot; handout)</td>
<td>Patient education material re: breastfeeding, newborn care, circumcision, establishing PCP for baby</td>
</tr>
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<table>
<thead>
<tr>
<th>DAYS Before</th>
<th>ANESTHESIA</th>
<th>OB</th>
<th>NURSING</th>
<th>PATIENT</th>
<th>PEDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Op evaluation by Anesthesia Provider</td>
<td>Provide patient with &quot;What to expect&quot; handout.</td>
<td>Confirm surgery date/time. D/c planning initiation including confirming ride home date and time for fed or nursing</td>
<td>Provide Boost Breeze</td>
<td>Receive Boost Breeze or other carbohydrate clear drink</td>
<td></td>
</tr>
<tr>
<td>Discuss Post-op pain regimen plan (i.e. Acetaminophen ATC, Ibuprofen ATC to minimize opioids)</td>
<td>Informed Consent</td>
<td>Provide hibicilens</td>
<td>Use hibicilens night before surgery</td>
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<table>
<thead>
<tr>
<th>DAYS PRE-OP</th>
<th>ANESTHESIA</th>
<th>OB</th>
<th>NURSING</th>
<th>PATIENT</th>
<th>PEDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review H&amp;P</td>
<td>Complete consent, 24-hour update, risks/benefits note</td>
<td>Complete pre-op RN checklists</td>
<td>No solids for 8 hours pre-op, can have clear liquids up to 2 hours preop (surgery may be delayed if consumed later)</td>
<td></td>
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<tr>
<td>Confirm NPO status &amp; allergies</td>
<td>Acetaminophen 1000mg PO once</td>
<td>Place PIV, give crystalloid 200mL/hour up to 1 L</td>
<td>Drink Boost Breeze prior to coming to hospital</td>
<td></td>
<td></td>
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<tr>
<td>Follow-up on preop labs</td>
<td>Bicitra 30mL PO once</td>
<td>Acetaminophen &amp; bicitra given with water (~50mL)</td>
<td>Incentive Spirometry education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confirm appropriate T&amp;S/T&amp;C sent</td>
<td>Skin-to-skin plan</td>
<td>Incentive Spirometry education</td>
<td>Drink Boost Breeze prior to coming to hospital</td>
<td></td>
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</tr>
<tr>
<td>Blood in room if high risk of hemorrhage.</td>
<td>Partner in OR determination</td>
<td>Incentive Spirometry education</td>
<td>Drink Boost Breeze prior to coming to hospital</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Drink Boost Breeze prior to coming to hospital</td>
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<tr>
<td>INTRA-OP</td>
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<tr>
<td><strong>FLUIDS</strong></td>
<td>Fluids wide open during spinal; 25-40 mL/kg (IBW) crystalloid during case (excludes pt w/ ESROC, CHF)</td>
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<tr>
<td><strong>TEMP</strong></td>
<td>Check &amp; Maintain patient temp above 36.0°C; Check that room temp set to 70°F</td>
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<tr>
<td><strong>ANTIBIOTIC</strong></td>
<td>Cefazolin 2g (lg if &gt;120kg)</td>
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<tr>
<td><strong>PA C/V</strong></td>
<td>PCN allergic: clindamycin 900mg IV + gentamicin 1.5mg/kg IV</td>
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<tr>
<td><strong>BLOOD PRESSURE</strong></td>
<td>Phenylephrine glp (start at 55mcg/min during spinal placement)</td>
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<tr>
<td><strong>ONABANSETRON</strong></td>
<td>4mg IV x 1 at start of case</td>
<td></td>
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<tr>
<td><strong>REGIONAL</strong></td>
<td>10mg IV x 1 PRN N/V</td>
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<tr>
<td><strong>ANESTHETIC</strong></td>
<td>NAB 12-13.5mg bupivacaine, 100 mcg morphone, +/- 50 mcg epil, +/-15mcg fentanyl</td>
<td></td>
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<tr>
<td><strong>TISSUE TENSION</strong></td>
<td>T1 level or higher to proceed, GA with RSI for inadequate level, patient refusal or contraindication of neuraxial</td>
<td></td>
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<tr>
<td><strong>TILT TABLE</strong></td>
<td>15° for LUD</td>
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<tr>
<td><strong>POST-DELIVERY</strong></td>
<td>Peth 200units in 500mL infusion</td>
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<tr>
<td><strong>IF POOR TONE</strong></td>
<td>Methamphetamine 0.2mg IM (avoid in HTN) OR nembutal 0.25mg IM (avoid in asthma) OR Metocurine 800 PIR/buccal</td>
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<tr>
<td><strong>IF ASKED</strong></td>
<td>Give azithromycin 500mg IV over 1 hr</td>
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<tr>
<td><strong>ASK OB</strong></td>
<td>If can tolerate 30mg IV x 1 at end of case</td>
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<tr>
<td><strong>IF NO DURAMORPH GIVEN</strong></td>
<td>Bil TAP blocks: Ropivacaine 0.2% 20cc per side</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>ATTENDING</th>
<th>Time-out prior to placement of spinal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SET ROOM TEMPERATURE</strong></td>
<td>To 78°F</td>
</tr>
<tr>
<td><strong>PLACE SCDS</strong></td>
<td>Turn on SCD machine</td>
</tr>
<tr>
<td><strong>AFTER SPINAL</strong></td>
<td>Place Foley</td>
</tr>
<tr>
<td><strong>RECORD FHR</strong></td>
<td>Strip if time from spinal to prep &gt;10min</td>
</tr>
<tr>
<td><strong>PREP ABDOMEN</strong></td>
<td>With chlorhexidine</td>
</tr>
<tr>
<td><strong>ATTACH SUCTION</strong></td>
<td>And bevle</td>
</tr>
<tr>
<td><strong>CALL FOR PEDS</strong></td>
<td>Prior to delivery &amp; communicate type of anesthesia</td>
</tr>
<tr>
<td><strong>COMMUNICATE</strong></td>
<td>Skin &amp; uterine incision &amp; delivery lines</td>
</tr>
<tr>
<td><strong>LITIGATION</strong></td>
<td>Vitamin K injection, erythromycin within 1 hour of delivery</td>
</tr>
</tbody>
</table>

**Skin-to-skin bonding** treatment is administered.
<table>
<thead>
<tr>
<th><strong>PACU MEDICATIONS</strong></th>
<th><strong>Pain management per anesthesia for 24 hrs post-delivery if neuraxial opioid given.</strong></th>
<th><strong>Labs:</strong> only if indicated</th>
<th><strong>Oxycodone PO PRN moderate pain</strong></th>
<th><strong>Incentive Spirometry x10 q1H</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxycodone 5-10mg PO q3h PRN moderate pain</td>
<td>Hydromorphone IV PRN severe pain</td>
<td>Complete Anesth-RN signout card</td>
<td></td>
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<tr>
<td>Hydromorphone 0.2-0.6mg IV q2h PRN severe pain</td>
<td>Ondansetron 4mg IV PRN N/V</td>
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<table>
<thead>
<tr>
<th><strong>FLOOR POD 0</strong></th>
<th><strong>Hydromorphone PCA +/- TAP block if inadequate analgesia. Anesthesia will order hydromorphone PCA.</strong></th>
<th><strong>Acetaminophen 1000mg PO q8H ATC</strong></th>
<th><strong>Vital signs q4, I&amp;O qshift, incision care.</strong></th>
<th><strong>Ankle pumps and circles in bed, 10x every hour</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ketorolac 30mg IV q8H ATC x 3 doses</td>
<td><strong>Advance to regular diet</strong></td>
<td><strong>Advance to regular diet</strong></td>
<td><strong>Check with patient if circumcision desired</strong></td>
<td></td>
</tr>
<tr>
<td>Oxycodone 5-10mg q3h PRN moderate pain, hydromorphone 0.2-0.6mg IV q2h PRN severe pain.</td>
<td><strong>Encourage incentive spirometry</strong></td>
<td><strong>Incentive Spirometry x10 q1H</strong></td>
<td></td>
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</tr>
<tr>
<td>d/c: Hydromorphone PCA if used by POD#1 Noon</td>
<td><strong>Dangle feet at bedside by 6 hr postop.</strong></td>
<td><strong>Well-baby visit</strong></td>
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<tr>
<td>Bowel regimen: Colace 250mg PO BID + Senna 17.2mg PO qbedtime + Milk of Magnesia 30mL daily, Miralax 17g daily PRN constipation, Bisacodyl 10mg suppository PRN#2</td>
<td><strong>Foley catheter to gravity. Try to walk to bathroom by 8hr postop.</strong></td>
<td><strong>Out of bed (OBB) with RN, SCDs when in bed</strong></td>
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<tr>
<td><strong>DVT Px:</strong> SCDs when in bed: Lovenox 40mg SQ QD starting 12-24 hr postop if high risk (hx VTE, thrombophilia, C-hyst, transfused &gt;4 RBC, &gt;2 uterotonic doses given, GA, IR embolization, ICU, BMI&gt;40, surgical time&gt;2hr) to continue until fully ambulating</td>
<td><strong>Dic foley 8-12 hours after c/s if able to walk to bathroom. Notify HO if not out by 12 hr</strong></td>
<td><strong>Out of bed (OBB) with RN, SCDs when in bed</strong></td>
<td><strong>Baby Vitamin K injection, erythromycin eye ointment</strong></td>
<td></td>
</tr>
<tr>
<td>Labs: only if indicated</td>
<td><strong>Evaluate wound. Assess pain control.</strong></td>
<td><strong>If pain not well controlled for 1st 24hrs postop, call Anesthesia</strong></td>
<td><strong>Decide if circumcision desired/notify RN</strong></td>
<td></td>
</tr>
<tr>
<td>Floor POD 1</td>
<td>Medications</td>
<td></td>
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<tr>
<td>Acetaminophen 1000mg PO q8h ATC</td>
<td>Vital Signs q4h, I&amp;O shift, weight daily, surgical incision care, bowel assessment</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>BuPROPION 600mg PO q6h ATC</td>
<td>Lactation consultation</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Oxycodone 5-10mg q3h PRN moderate pain, Hydromorphone 0.2-0.6mg IV q2h PRN severe pain, Midazolam Hydrochloride PCA if used by POD1 Neon</td>
<td>DVT ppc SCDS</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Continue POD0 bowel regimen</td>
<td>Regular Diet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVT ppc SCDS when in bed, Continue POD0 DVT ppc plan Labs: CBC</td>
<td>Encourage ambulation</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Evaluate wound, Assess pain control. If pain not well controlled, consult Anesthesia.</td>
<td>Confirm car seat</td>
<td></td>
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<table>
<thead>
<tr>
<th>Floor POD 2</th>
<th>Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaminophen 1000mg PO q8h ATC</td>
<td>Vital Signs q4h, I&amp;O shift, weight daily, surgical incision care abdomen, bowel assessment</td>
</tr>
<tr>
<td>BuPROPION 600mg PO q6h ATC</td>
<td>Ambulation 3x a day</td>
</tr>
<tr>
<td>Oxycodone 5-10mg q3h PRN moderate pain, Hydromorphone 0.2-0.6mg IV q2h PRN severe pain, Midazolam Hydrochloride PCA if used by POD1 Neon</td>
<td>Regular Diet</td>
</tr>
<tr>
<td>Continue POD0 bowel regimen and DVT ppc plan</td>
<td>SCDS while in bed</td>
</tr>
<tr>
<td>TdAIP, Flu shot prior to discharge</td>
<td>Confirm ride home and discharge time for POD3</td>
</tr>
<tr>
<td>Evaluate wound, Assess pain control. If pain not well controlled, consult Anesthesia.</td>
<td>Discharge NP: Meds to Bed</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Floor POD 3</th>
<th>Goal discharge ready by noon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaminophen 1000mg PO q8h ATC</td>
<td>Vital Signs q4h, I&amp;O shift, weight daily, surgical incision care abdomen, bowel assessment</td>
</tr>
<tr>
<td>BuPROPION 600mg PO q6h ATC</td>
<td>Ambulation 3x a day</td>
</tr>
<tr>
<td>Oxycodone 5-10mg q3h PRN moderate pain, Hydromorphone 0.2-0.6mg IV q2h PRN severe pain, Midazolam Hydrochloride PCA if used by POD1 Neon</td>
<td>SCDS while in bed</td>
</tr>
<tr>
<td>Continue POD0 bowel regimen and DVT ppc plan</td>
<td>Confirm ride home and discharge time for POD3</td>
</tr>
<tr>
<td>Rx: Acetaminophen 1000mg PO q8h ATC x 3 days, then PRN, #50, 1 Refill.</td>
<td>Walk 3 times a day</td>
</tr>
<tr>
<td>Rx: BuPROPION 600mg PO q6h ATC x 3 days, then PRN, #50, no refill.</td>
<td>Incentive Spirometry ≤10 q/hr</td>
</tr>
<tr>
<td>Oxycodone 5-10mg PO q3h PRN x #4, no refill.</td>
<td>Regular Diet</td>
</tr>
<tr>
<td>Bowel Regimen Rx: Cholest 250mg BID PRN constipation #60, Refill 1</td>
<td>Regular Diet</td>
</tr>
<tr>
<td>Prior to discharge, notify. Anesthesia if any headache, back pain, neurologic symptoms</td>
<td>Establish baseline</td>
</tr>
<tr>
<td>Evaluate wound, Assess pain control. If pain not well controlled, consult Anesthesia.</td>
<td>Confirm post-discharge follow-up visit and discharge time for POD3</td>
</tr>
<tr>
<td>TdAIP, Flu shot prior to discharge</td>
<td></td>
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</table>
ERAS Cesarean Delivery

**Pre-Operative**
- Patient education; 1:1 meeting with provider
- Educational material in print provided to patient or accessible via the web
- Breastfeeding education
- Discuss NPO status, fluid and caloric intake (Fluids up to 2 hrs prior to surgery, carbohydrate drink)
- Hemoglobin optimization
- Contact patient the day before delivery to review ERAS goals

**Post-Operative**
- Early oral intake
- Regular oral and multimodal analgesia
- Early mobilization
- Early removal of urinary catheter
- Lactation consultant
- Neonatology team visit
- Audit of compliance and outcomes

**Intra-Operative**
- Prophylactic antibiotics
- Fluid colloid/prophylactic phenylephrine infusion
- Active warming
- Neuraxial anesthesia and neuraxial opioids
- PONV prophylaxis
- Delayed cord clamping
- Skin to skin contact/breastfeeding
ERAS Components for CS

- Patient Involvement in preoperative education
- No more NPO after midnight: Clears up to 2 hours before surgery
- Preoperative Hemoglobin Optimization
- Antibiotic Administration and Thromboprophylaxis
- Optimal Fluid Therapy
- Temperature Management
- Multimodal analgesia (preop, intraop, postop)
- Nausea and vomiting prophylaxis
- Delayed Cord Clamping
- Skin to Skin
- Early ambulation
- Promotion of GI motility (ambulate frequently, avoidance of opioids)
- Early removal urinary catheters
Patient Involvement

- Patients want to be proactively involved in their recovery process. (2)
- Achieved through
  - Comprehensive and timely preop education
    - Internet accessible or take home educational material to familiarize with ERAS concepts
  - Procedural information
    - Epidurals/CSE
    - Cesarean Section
    - Pain management goals
    - Breast feeding /lactation support
    - Early mobilization
  - Patients can be given a checklist with actions and goals to track their progress
Nil Per Os

- ASA Guidelines
  - 8 hour fast for solids
  - Clear liquids up to 2 hours before induction of anesthesia
- Benefit of high-caloric carbohydrate drink up to 2 hours before surgery
  - Reduces preoperative thirst, hunger, anxiety (3)
  - Reduces insulin resistance (4,5)
    - No literature in effects on the already insulin resistant state of pregnancy
  - Creates a higher anabolic state postoperatively (4,5)
- Choice of beverage?
  - Gatorade is easily acquired and affordable
American Society for Enhanced Recovery (ASER) and Perioperative Quality Initiative (POQI) joint consensus statement on perioperative fluid management within an enhanced recovery pathway for colorectal surgery

Consensus statements
Prior to surgery

1. We recommend unrestricted access to clear fluids for oral intake up to 2 h before the induction of anesthesia to maintain hydration while minimizing the risk of aspiration.

2. We recommend that the clear fluid used to maintain oral hydration contain at least 45 g of carbohydrate to improve insulin sensitivity (except in type I diabetics due to their insulin deficiency state). We suggest that complex carbohydrate (e.g., maltodextrin) be used when available.
What about DM II?

- Preoperative Carbohydrate Loading in Enhanced Recovery After Surgery Pathways is Safe in Patients with Type II Diabetes. Stephanie D. Talutis MD, Boston University School of Medicine, Boston, MA, 2Department of Surgery, University of Nevada, Las Vegas, NV

- IRB approved retrospective chart review (10/1/15 – 9/30/16)
- Excluded DM 1, Diet controlled DMII

- Conclusion:
  - ERAS patients with DMII safely tolerate CHO as part of an ERAS pathway without an increase in insulin requirements or increase in complications
Preoperative Hemoglobin optimization

- Prevalence of Fe def anemia in pregnancy 18%
- Differing opinions among professional organizations and govt health agencies about benefits for routine screening for anemia and iron supplementation in asymptomatic pregnant women
- ACOG
  - Routine screening
  - Fe supplementation for those with anemia
- Preoperative anemia is a significant predictor of severe postpartum anemia which has been linked to depression and fatigue (6)
More ERAS components

- Intraoperative antibiotic prophylaxis
- Thromboprophylaxis
  - SCDs routine
  - One or more risk factors = pharmacologic thromboprophylaxis as well (7)
ERAS Component: Optimal Fluid Therapy

- Both too little and excessive fluid during the intraoperative period can adversely affect patient outcome.
- Evidence is mounting that fluid therapy guided by flow based hemodynamic monitors improve perioperative outcome.
  - Area for much improvement in OB
    - Non-invasive hemodynamic monitoring
      - Using bedside echo to assess volume status
      - CO monitors
      - SV estimation
- It is unclear whether crystalloid or colloid fluids or a combination of both produce the optimal patient outcome and in what clinical context.
Fluid Management in CS utilizing ERAS

- Physiology considered...
  - Almost 50% increase in plasma volume by 32 wga
  - 50% increase in CO due to both SV and HR
  - Reduction in oncotic pressure and accompanying increase in capillary hydrostatic pressure
    - Favors edema formation in late pregnancy
    - Further reduction in oncotic pressure (nadir at 12 hours post delivery) and then slow return to intrapartum levels at 24 hours

- Main Point: parturients are prone to fluid overload!
Fluid management in CS

- Physiology of hypotension
  - Spinal-mediated hypotension
  - Hypotension best avoided by vasopressor infusion

- Timing
  - Preload vs coload
    - Coload is best
    - 15-20 mL/kg at time of spinal

- Choice of hydration
  - Crystalloid vs colloid
    - Colloids may be best, BUT not standard due to cost, possibility of anaphylaxis, and effects on the coagulation system
      - decrease in platelet aggregation, dilution of clotting factors-->prolongation PT and aPTT
Temperature Management

- Intraoperative hypothermia defined
  - Core body temp less than 36 degrees Celsius
- Associated with poor outcomes in general surgery population
- Outcomes in obstetric patients less clear, but we know neonatal hypothermia effects:
  - RDS, hypoglycemia, neonatal mortality (esp in preterm and very low birth weight) (8)
- Outcomes with active warming
  - Patient comfort, facilitates maternal bonding, decreases hypothermia and shivering, facilitates faster PACU times, and decreases neonatal hypothermia

OK, OK, OK, it's actually anesthesia's fault!!!

- Thermoregulation is altered in spinal anesthesia by inhibition of vasomotor and shivering responses and a redistribution of circulation/heat into the periphery
  - Drop in temp by 1.3 degrees C
  - Around 4 hours to recover back to baseline
Pain Management Strategies

- **Preoperative:**
  - PO or rectal acetaminophen

- **Intraoperative:**
  - GOLD STANDARD: Neuraxial morphine
  - IF GA or morphine allergy: TAP block, Local wound infiltration
  - Ketorolac

- **Postoperative**
  - Acetaminophen PO 1000 mg Q6 + with Ketorolac 15mg Q6 hours
  - Acetaminophen 650 mg Q8 hours + Ibuprofen 800mg Q 8hours
  - Acetaminophen 650mg TID and Ibuprofen BID
  - PRN oxycodone for breakthrough pain
  - PRN IV narcotic for severe pain
  - Consider Gabapentin for chronic opioid users
Study comparing scheduled acetaminophen with PRN opioids vs PRN acetaminophen with PRN opioids showed scheduled acetaminophen showed significant reduction in total opioid consumption (14)

NSAIDS and acetaminophen have synergistic effect and BOTH should be routinely scheduled after CS (15)

Alternative nerve blocks and wound infiltration strategies
- Transversus Abdominis Plexus Block
  - Improve postoperative analgesia in patients who did not receive neuraxial morphine (16, 17)
    - i.e.: allergy/General anesthetic
- Local infiltration
  - Unclear benefits in those patients who receive neuraxial morphine
    - St Peter’s Healthcare experimenting with liposomal bupivacaine
  - Definite benefit in patients who did not receive neuraxial morphine
TAP block provides superior analgesia compared with placebo and can reduce the first 24 h morphine consumption in the setting of a multimodal analgesic regimen that excludes spinal morphine. TAP block can provide effective analgesia when spinal morphine is contraindicated or not used.
Narcotic Free Cesearean Section
Elizabeth Cherot MD, MBA, Attia Kett, MD, MBA, Rachel Mauro MD, Saint Peter’s Healthcare System

BACKGROUND
Cesarean delivery is the most common in-patient surgery performed in the United States. Opioids are frequently prescribed post-operatively: this can lead to misuse or even illegal distribution.

Until recently, there has been little interest in enhanced recovery after Cesarean Section; however, since 2012, multiple obstetrical units in the United Kingdom introduced enhanced recovery programs and demonstrated improved quality of care and significant savings with superior patient satisfaction. Our partnership with leading experts from the Royal Hallamshire Hospital in the United Kingdom provided us with the unique opportunity to pioneer this pathway in the United States.

Management of pain in the OR & in the PACU:

METHODS
Our ERAS pathway standardized post-operative management with intrathecal morphine, scheduled Ketorolac and Ofloxacin for the first 24 hours intravenously. To further reduce opioid consumption, we infiltrated liposomal bupivacaine at the time of fascia closure of a Pfannenstiel incision, after delivery and repair of the hysterotomy. An 80cc solution was divided into four infusions of 5cc of Liposomal Bupivacaine, 0.5% Bupivacaine and 9cc of Normal Saline each. Half of the solution was injected laterally under the fascia and the remaining was distributed evenly subcutaneously. Scheduled PO Ibuprofen and acetaminophen were continued for forty-eight hours postoperatively. Oxycodeone was ordered as needed but no scheduled opioids were ordered. Mean morphine equivalents were used to compare narcotic ingestion.

We used our SeamlessMD smartphone application to engage our patient population to collect data on pain levels, narcotic use, and patient satisfaction. We reviewed in-patient charts and out-patient EMR records post-operatively for two weeks.

RESULTS
Of the 11 cases, five patients used no narcotics, and one outlier was identified as a potential abuser. The mean morphine equivalent was 7.5mg or one 5mg oxycodone during the in-hospital period. This represents an 87% reduction in opioid use compared to our traditional pathway (59 mg morphine equivalent) and a 76% reduction in opioid use compared to our ERAS pathway (31 mg morphine equivalent). The average length of stay was 2.2 days. The response rate was 42% to patient satisfaction questions.

SUMMARY
Liposomal Bupivacaine reduces opioid use in the post-operative time period for cesarean section. It increased patient satisfaction and improved pain control, shortening length of stay. Further randomized control studies to determine the best delivery method are warranted. Multimodal analgesia combined with a long-acting local anesthetic may lead to narcotic-free Cesarean Section.
Nausea/Vomiting

- Common side effect of neuraxial opioids, spinal anesthesia, and exteriorization of the uterus
  - Intrathecal morphine
    - Dose dependent increase in side effects
      - Studies show 100 mcg vs >100 mcg reduced side effects and no difference in post op opioid consumption (though time to request for first analgesic was 4 hours longer (9)

- Therapies for ERAS:
  - Avoidance of hypotension with phenylephrine drip
  - Prophylactic scopolamine patch(10,11), metoclopramide, dexamethasone, and ondansetron
  - Avoidance of uterine exteriorization
Neonatal Components of ERAS for CS:

- Delayed cord clamping
- Skin to skin
  - Decrease maternal anxiety
  - Decrease post-partum depression
  - CAUTION: Maternal intent to breastfeed may be associated with increased LOS (14)
    - Successful ERAS will need
      - To support early initiation of breast feeding
      - To CONSIDER a more natural birthing experience in the OR
        - Transparent surgical drapes
        - Skin to skin in OR
    - Greater rating of birthing experience and higher breastfeeding in the “natural” CS group. (12)
Postoperative ERAS Components

- Early oral intake
  - Promotes return of bowel function, early ambulation, decreases LOS, reduces time to breastfeeding
- Early removal of urinary catheter
  - Recommended to remove within 24 hours
  - In a published audit of ERAS protocol for CS, catheters removed at 7 hours without complications (18)
Predictors of Success of ERAS

- Not all elements equally weighted
  - Bowel surgery predictors of success:
    - Of 23 elements studied, only 3 predicted success
      - Minimally invasive approach, early termination of IV fluids, early mobilization
  - Success doesn’t require 100% compliance in each component
    - Recently study reported compliance in all phases was only 20%
      - However, compliance with postoperative elements was independently associated with increase in optimal recovery
        - Factors that play biggest role
          - Delay in oral intake (N/V, ileus)
          - Delay ambulation (pain, fatigues, foley catheters)
          - Limit stress response
ERAS Template for Success

- Needs assessment:
  - Identify surgical population
  - Define a problem
- Identify champions at each level of care:
  - Administration
  - Surgery: surgeon, surgical clinic nurse manager
  - Anesthesiology: anesthesiologist(s), +/- CRNA
  - Nursing: preop, intraop, PACU, floor providers/clinicians (NP or PA)
  - Lactation Support
  - Floor champions
  - Pharmacists
- Set an achievable goal:
  - Conservative
  - Use the SMART criteria for goal setting
Antepartum Phase

- Antenatal clinic should have patient engagement resources
  - Information about upcoming CS
  - Patient expectation of hospital stay
- Staff education about ERAS and achievable goals
- Establish a team spirited approach to CS care
- Establish a risk assessment tool
Intrapartum Phase

- Patient arrives 2 hours prior to surgery
- Confirm compliance with ERAS educational material
- IV placement
- OB check
- Transfer to OR after checklist med
- Active warming
- Spinal
  - Fluid coload and PHE infusion at 50 mcg/min
- Time out
- Incision, delivery, delayed cord clamping
- Pitocin on pump
- Skin to skin/breastfeeding
Post Partum Phase

• PACU recovery: Ice chips and early feeding
• Multimodal scheduled Non-Opioid Analgesia.
• Oxycodone 5mg for breakthrough pain.
• Resume feeding when in postpartum ward.
• Early mobilization soon after block wears off.
• Urinary catheter removal 12 hours postpartum.
• VTE prophylaxis.
• Lactation visit.
• Neonatology visit.
• Decannulate IV 12-24 hours
• Post discharge phone call
Caution!

- We need to define "recovery"
  - Ie: The moment when a patient has reached his/her preoperative functional level
    - Can take months!
      - Based on patient’s expectations
      - Social circumstances

- Concern about narrow approach to define accelerated recovery
  - Current definitions:
    - LOS, readmission rates, health care costs
    - Early discharge may not equal improved functional recovery at home

- Our focus should be COMPLETE recovery and should include post-discharge care and follow-up
The ultimate goal of an enhanced recovery after cesarean delivery is to provide parturients with the best quality of care with a systematic and tailored approach to enhance their physical, mental and psychological wellbeing following a long journey into motherhood and to equip them with the necessary tools to care for their newborn without compromising on originality, judgment and clinical excellence.

ERAS ≠ FAST TRACK
Next Steps

- Create a multidisciplinary team dedicated to this process
- Identify core principles that delay recovery in the post-CS population
  - Preoperative
  - Intraoperative
  - Postoperative
  - Postdischarge!!!
    - This arena is new territory for ERAS, but it is a critical one for our OB population
- Begin a pilot phase
Questions?
Resources


Resources