

# ENHANCED RECOVERY AFTER SURGERY PROTOCOLS

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### What is ERAS?

Enhanced Recovery after Surgery (ERAS), also known as “fast track” surgery or “enhanced recovery protocol” (ERP) is a multimodal perioperative care pathway designed to decrease major morbidity,<sup>1</sup> and length of stay<sup>2</sup> together with promoting accelerated postoperative recovery and minimisation of postoperative fatigue.<sup>3</sup> It compiles a range of perioperative techniques aiming to promote early mobilisation and attenuate the surgical stress response. These include a variety of interventions from anaesthetic and surgical disciplines as well as physician, nursing and allied health.

### Conception

Conceived by Dr Henrich Kehlet in the late 1990s, ERAS has amassed a considerable evidence base and undergone refinement over the past 15 years. His initial aim was to attenuate the body's response to surgical stress, typically characterised by an increase in cortisol, catecholamines, hormones promoting fluid retention, hypercoagulation and development of a catabolic state. It has been argued that this highly conserved response is unnecessary in the context of modern perioperative practice and may in fact be counterproductive in many of its aspects and is thought to contribute to postoperative morbidity.

Implementation of an ERAS protocol at Manukau Surgical Centre at CMDHB in 2005-2006 has seen a reduction in the average length of stay from a median of eight to four days (without an increase in readmission rate), a documented decrease in morbidity and cost savings (even when accounting for increased staff and setup costs). Dr Kehlet's group has refined this further, achieving ALOS of 2-3 days and even achieving <24 hour stay for colonic resections although three days appears to be a more realistic target.

### Surgical Stress Response

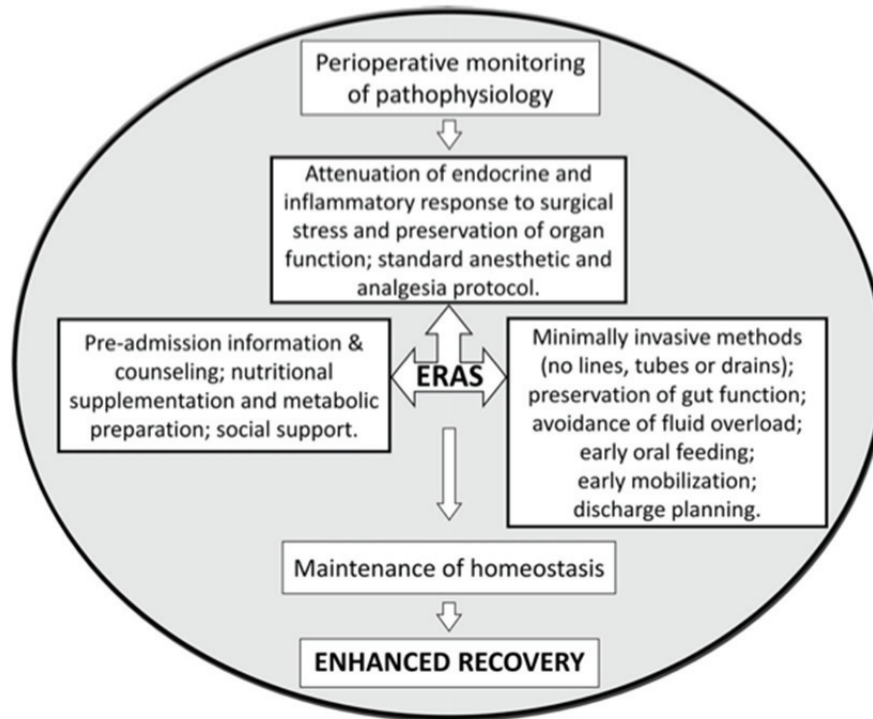
The Surgical Stress Response refers to the hormonal and metabolic surgical changes seen after the body's exposure to a traumatic event. These serve to prepare the body in a “survival mode” during a period of starvation and healing.

The sympathetic nervous system is activated, and pituitary hormones are released,<sup>4</sup> resulting in the development of a hypermetabolic, catabolic state. Hyperglycaemia (from insulin resistance, gluconeogenesis and glycogenolysis) is seen, in addition to promotion of protein breakdown and lipolysis (mostly through cortisol). Sodium and water retention is enhanced due to release of vasopressin, and activation of the renin-angiotensin-aldosterone pathway. Increased cardiac demand, splanchnic vasoconstriction, immunosuppression and hypercoagulation are manifest.

A further, less discussed outcome of the surgical stress response is the development of postoperative fatigue, which impairs the patient's functional recovery over the days to weeks following discharge. These are aspects of postoperative outcome that are usually hidden from the anaesthetist and therefore not typically considered as part of anaesthetic outcome audit process, but never the less is impacted on by the ERAS protocol.<sup>3</sup>

Attenuation of the surgical stress response is mainly achieved by regional anaesthesia, minimally invasive surgery and pharmacological intervention (dexamethasone, beta blockers and anabolic agents) and these have a corresponding importance in ERAS protocols. Neural blockade with local anaesthesia reduces endocrine and metabolic activation and suppresses sympathetic stimulation, but has no effect on inflammatory responses.<sup>5</sup>



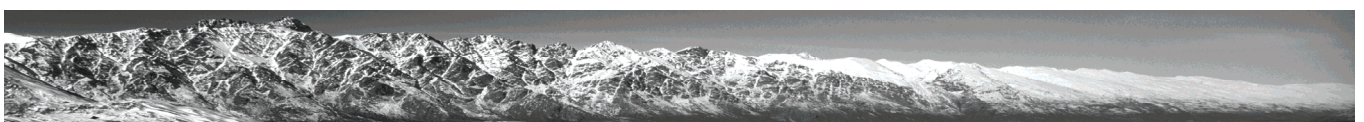


**Figure 1.** Philosophy of ERAS. (From Varadhan, 2010<sup>6</sup>)

## ERAS Protocols

ERAS protocols aim to achieve decreased morbidity and more rapid rehabilitation through an array of mechanisms.<sup>7</sup> The aims of these are, and mechanisms used to achieve this include –

1. Preoperative patient education
2. Surgical and anaesthetic techniques to reduce surgical stress response
  - a. Epidural anaesthesia and analgesia
  - b. Dexamethasone
  - c. Thermal control
  - d. Early nutrition
  - e. Intraoperative fluid management
  - f. Avoid overnight starvation / preoperative carbohydrate load
  - g. Avoid bowel preparation (left sided cases get fleet enema)
  - h. Minimally invasive surgical techniques
3. Aggressive postoperative rehabilitation
  - a. Early mobilisation
  - b. Short acting anaesthetic agents
    - i. Avoid premedications (midazolam OK)
  - c. Control of nausea, vomiting and ileus
    - i. Antiemetic protocols
    - ii. Opioid minimisation
4. Adherence to evidence based principles of perioperative care
  - a. Avoidance of drains, nasogastrics
  - b. Early withdrawal of urinary catheters

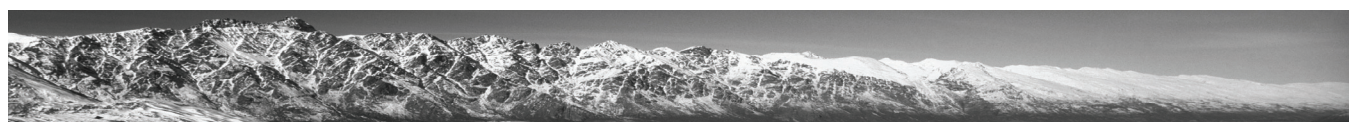


## Colonic Resection Enhanced Recovery After Surgery (ERAS) Protocol for CMDHB

Timing	Intervention
Preadmission	Preoperative assessment in a dedicated outpatient session Programme information given, including specific daily milestones Social issues are identified and addressed Preoperative ward visit and orientation
Preop	Preoperative carbohydrate loading (PreOP). Four drinks day before surgery, and two drinks two hours before surgery Patients admitted to hospital on the morning of their surgery Left-sided operations receive a phosphate enema on arrival at the hospital Mechanical bowel preparation is avoided
Intraop	Thoracic epidural inserted and bupivacaine epidural infusion started Limited intraop intravenous fluids (1–2L crystalloids / colloids) Transverse incisions for right-sided open surgery if appropriate Prophylactic nasogastric tubes not used Intra-abdominal drains not used Calf stockings applied at the end of surgery
Recovery room	Vasopressor agents in preference to intravenous fluids to treat epidural-related hypotension Intravenous morphine / fentanyl PCA initiated
Day of surgery	Patients are mobilised to a chair Oral intake of fluids is started, aiming for > 800 ml of oral intake on the day of surgery Pre-emptive regular antiemetics (5-HT <sub>3</sub> antagonists as first line) Subcutaneous low molecular weight heparin started for thrombo-prophylaxis
Day 1	Urinary catheter removed Full solid oral diet Resource supplement drinks (2–3 per day until discharge) Active mobilisation with nursing and physiotherapy input
Day 2	Epidural infusion is stopped, and epidural catheter removed Non opioid analgesia Oral opiates for break-through pain only
Day 3	Discharged home if fulfil following criteria – <ul style="list-style-type: none"> <li>▪ Tolerating full oral diet</li> <li>▪ Passing flatus</li> <li>▪ Adequate analgesia on oral medication</li> <li>▪ Ambulating independently</li> <li>▪ Satisfactory support at home</li> </ul>
After discharge	Patient given a phone number for contacting the ward if required Nursing staff contact the patients three days after discharge for a phone interview Follow up outpatient clinic appointment within seven days of discharge

## Elements With Anaesthetic Relevance

- Preoperative fasting and preoperative carbohydrate loading
  - Avoidance of overnight fasting, together with reduced use of bowel preparation (increases stress response and anastomotic leak rates) minimises patient hypovolaemia and electrolyte imbalance preoperatively. Carbohydrate loading prevents early formation of a catabolic state
- Premedication
  - Avoidance of premedication / use of short acting agents, designed to promote rapid postoperative mobilisation
- Prophylaxis against thromboembolism
- PONV prophylaxis
  - As part of PONV prophylaxis, dexamethasone is used to concurrently attenuate surgical stress response. The current evidence based dosage for this is 8mg<sup>8</sup> although lower doses may prove to be equally effective



- Preventing intraoperative hypothermia
  - Hypothermia may lead to augmented stress response during rewarming which increases cardiovascular demands and potential morbidity in at risk individuals, impairs coagulation and leucocyte function. Preservation of intraoperative and early postoperative normothermia has been shown to decrease surgical site infection, decrease intraoperative blood loss, postoperative cardiac morbidity and overall catabolism<sup>9</sup>

## Elements Subject to Controversy

### Urinary Drainage

In order to facilitate early mobilisation, for colonic resections, urinary catheters are removed on day one, prior to removal of the epidural (day 2). Despite initial concerns about the safety of this in context of retention, a CMDHB study showed no increase in retention compared with historical controls and in fact a significant decrease in renal complications due to a drop in urinary tract infections.<sup>1</sup>

### Postoperative Analgesia / Prevention of Postoperative Ileus

The use of epidurals is one of the more controversial areas of ERAS management due to concerns about epidural morbidity, postoperative hypotension in fluid restricted patients and presumed reduction in benefit for laparoscopic cases. The current ERAS consensus evidence based guidelines advocates T7/8 epidural use as part of an ERAS protocol in order to attenuate surgical stress response and maintain gut motility through opioid minimisation and blockade of visceral sympathetic innervation.<sup>9,10</sup>

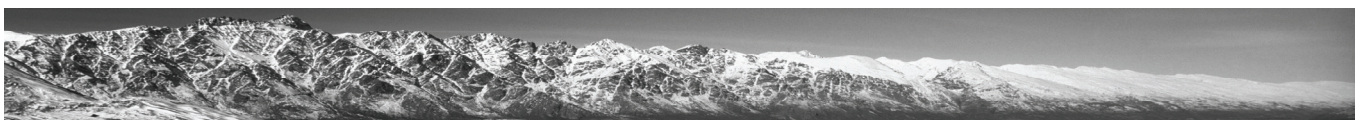
The place of laparoscopic surgery is currently not clear with several small trials showing improved analgesia and one showing improved bowel function, however a recent RCT<sup>11</sup> comparing 91 patients randomised into three arms of PCA, epidural or intrathecal morphine within an ERAS programme found epidural use worsened length of stay, bowel function and increased fluid administration. The use of transversus abdominus plane blocks is very unclear with little evidence for benefit beyond 12 hours in caesarian section. A recent Cochrane review combining TAP blocks and rectus sheath blocks for abdominal surgery found morphine sparing for the first 24 hours only, but with significant heterogeneity in the results.<sup>12</sup> Further studies on this topic are currently in progress.

### Perioperative Fluid Management

Initial studies into fluid administration in colorectal surgery focused on limiting administration of crystalloid in an effort to promote postoperative bowel function. This was based on early work in Mecray in 1937 in animal studies. Lobo,<sup>13</sup> Brandstrup<sup>14</sup> and Nisanevich<sup>15</sup> all showed improved outcome with “restricted” intraoperative fluid administration. This became known as “fluid restriction” although on further review in subsequent years in the literature these studies are more correctly considered to be “neutral fluid balance” compared with “liberal” fluid.

The use of fluid regimes compared with traditional regimes was initially viewed with concern relating to increased morbidity. Historically, large volumes of crystalloid have been administered to compensate for preoperative starvation, mechanical bowel preparation, epidural preloading, abdominal evaporative losses and “3rd spacing.” It has become clear that these replacement fluids are not required in modern ERAS practice and in some case have been based on severely limited scientific rationale. ERAS patients have limited preoperative starvation, avoid bowel preparation and are supplied with preoperative carbohydrate fluids. As a result they are not volume deplete at commencement of surgery. Recent RCT evidence in obstetric anaesthetic literature has shown “preloading” for neuraxial anaesthesia does not prevent the requirement for vasopressor use. The need for replacement of abdominal evaporative losses by crystalloids or free water has been exaggerated previously and is insignificant.<sup>16,17,18</sup> Opinion on the “third space” described by Shires has shifted. Translocation of fluid into peritoneal and pleural spaces can occur but the magnitude of the third spacing detected and described cannot be replicated reliably and probably represents a measurement artifact.<sup>16</sup> Taken to excess, fluid restriction lower than neutral fluid balance is likely to result in adverse outcomes.

Goal directed therapy has emerged in a parallel line of research to be beneficial in colorectal surgery in terms of morbidity and length of stay outcomes. Its use has been advocated by the National Health Service UK National Institute of Clinical Excellence (NICE) and consideration of use by the ERAS group on a case by case basis. Its place within ERAS as a routine instrument of fluid management is currently unclear,<sup>19</sup> as is which “goal” to consider in differing populations such as colonic resections.





## Non Colorectal ERAS Programmes

ERAS guidelines are emerging for areas outside of the original area of colorectal surgery. These differ from previous care pathways in their emphasis on suppression of surgical stress response and early mobilization. Whilst they are likely to translate to improvements in efficiency and patient outcomes, the evidence base in various areas need to be established. Similarly, the temptation to import all aspects of ERAS principles wholesale may not be appropriate in other surgical areas (eg-fluid restriction is unhelpful in daystay or laparoscopic cholecystectomy). Review of the pre-existing literature pertaining to the operative procedures planned and future research and audit is required in these areas.

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