Enhanced recovery programmes for patients undergoing radical cystectomy

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Abstract | Radical cystectomy is associated with high rates of surgical morbidity. The magnitude of the surgical insult is associated with the degree of stress response, particularly in ageing patients with multiple comorbidities. Attempts to limit this response and identify areas of improvement with respect to patient selection and optimization, anaesthesia, surgical technique and postoperative care underpin the multimodal approach to enhanced recovery pathways. No single intervention significantly reduces morbidity, but the combination of many interventions at all levels of the pathway is likely to accelerate the patient journey from diagnosis to return to normal function.

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Introduction

Enhanced recovery programmes (ERPs), also known as enhanced recovery after surgery (ERAS) or fast-track surgery programmes, describe a multimodal approach to the patient's treatment pathway, with planned minimization of psychological and physiological disruption, from diagnosis to return of normal function. The goal of ERPs is not early discharge, but a smooth transition through the hospital episode and promotion of early return to normal function. The by-product of these programmes is likely to be a low complication rate, short length of stay and low readmission rate. ERPs were first described by Kehlet[1] in the 1990s and led to a dramatically reduced length of stay following colorectal surgery. Acknowledgement of their benefit and recent national directives in the UK[2] have led to a rapid increase in their adoption in urological surgery and the release of European guidelines for perioperative care after radical cystectomy.[3]

Radical cystectomy is a highly morbid procedure and attention to detail is paramount across the entire enhanced recovery pathway. Although the surgical episode is a critical component of this journey, the planning and delivery of care before and after surgery is equally important. Traditionally, the main focus has been on advances in surgical technique, with less scrutiny on the remainder of the components. In this Review, we discuss the current evidence in support of the different facets of an ERP. We also illustrate how different clinical units can consider preoperative, perioperative and postoperative factors to realize the potential benefits of fully embedding enhanced recovery principles across the entire cystectomy clinical pathway.

Preoperative considerations

Engagement with the pathway should commence preoperatively with the setting of expectations and education of the patient and their carers, as well as nutritional and physiological optimization (Box 1).

Patient education

Many of the preoperative optimization and assessment tools discussed here are generic to ERPs across many surgical specialties because we share a common goal—namely, to 'optimize' the patient prior to surgery, limiting perioperative morbidity and accelerating the return to normal function. Effective management of patient expectations is a central tenet of the ERP. Patient education offers benefits in many domains,[4] including the cognitive and ethical domains (improving patient knowledge and satisfaction), biophysiological domains (increasing understanding of anxiety, pain and morbidity), health promotion domains (advising on smoking cessation, alcohol reduction and improved nutrition), practical domains (stoma education, intermittent self-catheterization and social planning) and functional domains (helping patients and carers return to normal daily activities).

Patient education—whether it comes in the form of one-to-one counselling, written information, DVDs or interactive multimedia programmes—not only has the effect of setting expectations and goals, but also focuses patients and their carers on discharge criteria and facilitates discussion. Overwhelmingly, studies have shown that, although pain scores and analgesic requirements are not decreased by education, levels of patient anxiety are significantly reduced.[4] Although difficult to quantify in multimodal programmes, high anxiety levels have been correlated with complications, particularly wound infections,[5] increased length of stay[6] and postoperative fatigue with delayed return to normal activities.[7] The detrimental effects of smoking and alcohol abuse include impairment of cardiopulmonary function, immunocompromise, impaired wound healing, coagulopathy and muscle dysfunction;[8] cessation has been shown to reduce

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Key points

- Enhanced recovery programmes (ERPs) are multimodal and have preoperative, intraoperative and postoperative components
- The surgery itself is only one of many important steps; others include preoperative patient education, postoperative multimodal analgesia and early commencement of enteral nutrition
- Reappraisal of existing ERPs, assessment of patient experience and identification of areas of improvement are key to ensuring a consistently high level of care
- Discharge criteria are the tolerance of a normal diet, adequate pain control with oral analgesia, competence with either stoma care (conduit) or catheter care (neobladder) and the patient feeling adequately supported
- Follow-up support includes follow-up telephone calls, a scheduled date for clinical review and an emergency contact

Box 1 | Preoperative aspects of ERPs for cystectomy

Educational

- Set expectations
- Discharge planning
- ERP video
- Stoma education
- Smoking and alcohol cessation

Physiological

- Cardiopulmonary exercise testing
- Nutrition
- Iron replacement
- Avoid fasting (to directly limit the development of insulin resistance)
- Carbohydrate loading (to directly limit the development of insulin resistance)

Abbreviation: ERP, enhanced recovery programme.

perioperative morbidity.[9] Patients facing major surgery are highly motivated in this respect, but concurrent use of nicotine replacement[10] and dedicated alcohol withdrawal support groups—in conjunction with vitamins and long-acting benzodiazepines, such as chlordiazepoxide—are useful adjuncts.[11]

Full engagement of patients and their carers with the ERP multidisciplinary team is mandatory and underlines the fact that all components of the programme, not just the surgical episode, are important. In particular, stoma education focusing on the technique and timing of bag emptying and changing has been shown to reduce time to competence, hospital stay and unplanned community interventions.[12–14]

Nutrition and carbohydrate loading

Malnutrition is a recognized risk factor for surgical morbidity[15] and can be assessed using validated tools, such as the Malnutrition Universal Screening Tool (MUST) or Nutritional Risk Screening (NRS). The prevalence of malnutrition, defined as an NRS score ≥3, is estimated to be between 33% and 46% of patients undergoing major urological surgery.[16,17] For patients undergoing radical cystectomy, malnutrition is an independent predictor of 90-day mortality and decreased overall survival.[18] Confirmation of a causal relationship between preoperative nutritional optimization and decreased morbidity requires further investigation, but a consensus meeting at the North American Surgical Nutrition Summit recommended that all patients undergoing major surgery should have nutritional supplements before, during and after surgery.[19]

Immunonutrition—a combination of arginine, fish oils and nucleotides—has been examined over many years. A systematic review of 35 randomized controlled trials (RCTs) performed over 20 years found that immunonutrition significantly reduces rates of infectious complications and length of hospital stay,[20] although its role in radical cystectomy remains undefined, and immunonutrition is rarely used in this setting.

Preoperative bowel preparation is now considered to be detrimental, causing the patient electrolyte disturbance and distress.[21,22] A Cochrane review of 18 RCTs for elective colorectal surgery showed no difference in rates of anastomotic complication, wound infection, reoperation and mortality with mechanical bowel preparation compared with no bowel preparation or with rectal enema.[23] Bowel preparation for radical cystectomy with ileal conduit reconstruction has no benefit,[24,25] and one might extrapolate this lack of benefit to small bowel neobladder reconstruction. However, the role of bowel preparation for ileocolic or colonic reconstruction is undefined.

Mounting evidence has challenged the presumed benefit of preoperative fasting. A Cochrane review of 22 RCTs demonstrated no reduction in gastric emptying or the prevalence of complications for patients permitted clear fluids up to 2 h before surgery as opposed to fasting from midnight.[26] The practice has, therefore, been widely adopted and patients are advised to have no solids from 6 h before surgery, but should be permitted clear fluids ≥2 h prior to surgery.[27–29]

Carbohydrate loading has become a standard of care in surgical ERPs. Surgery results in the temporary development of insulin resistance, inducing a physiological state similar to type 2 diabetes mellitus during the recovery phase. The severity of the surgery is proportional to the degree of acquired insulin resistance. Furthermore, the greater the degree of insulin resistance, the longer the return to baseline levels.[30] The beneficial effects of carbohydrate loading 2 h prior to surgery are decreased thirst, hunger and anxiety,[26] and a ≤50% reduction in insulin resistance.[31] In addition, nitrogen and protein losses are reduced, and lean body mass and muscle strength are better preserved.[32–35] In 2013, a meta-analysis showed a significantly reduced length of stay following major abdominal surgery with preoperative carbohydrate loading.[36]

Assessing patient fitness

The use of cardiopulmonary exercise testing (CPET) is expanding, but its specific role in ERPs is not yet defined. Research has shown that patients with limited functional reserves are at greater risk of surgical morbidity. Results from two studies that specifically included patients undergoing radical cystectomy demonstrated that patients can be risk-stratified with respect to likelihood of morbidity and mortality using the CPET parameter of an anaerobic threshold <12 ml $kg^{-1}min^{-1}$

or <10.9 ml kg^{-1}min^{-1}.[37,38] Using CPET to assess patient fitness can help clinicians and patients to make shared decisions about risk and also to plan high-dependency postoperative care when required. A clearer understanding of the patient's cardiopulmonary function should help the ERP multidisciplinary team to decide when strict adherence to the protocol might not be appropriate.

Beyond predicting perioperative morbidity, CPET could be used as a primary outcome measure for studies of prehabilitation, to improve patients' fitness preoperatively. The concept of prehabilitation is intuitive. For example, it is important to have a suitable training schedule before exposing one's body to the extreme cardiopulmonary stress of running a marathon, and carrying out a radical cystectomy with urinary diversion on an ageing deconditioned patient should be no different. Preoperative exercise schedules reduce postoperative complications and length of stay in both the cardiac and abdominal surgery settings.[39] The intensity and modality of training is also important. Results of a meta-analysis suggested that, for abdominal surgery, inspiratory muscle training confers benefit when applied for as little as 2 weeks.[39] A more-recent review highlighted the benefit of preoperative aerobic exercise training for cardiac surgery, but the benefit for intra-abdominal surgery was uncertain and the evidence base was small.[40] The challenge for future studies is to optimize the type of intervention, as the options include inspiratory muscle training, moderate intensity continuous aerobic exercise and high-intensity interval aerobic exercise. The other challenge within the context of bladder cancer relates to timing, and determining the optimal and practical length of intervention. The use of CPET is likely to expand in this field, resulting in improvements in cardiopulmonary function.

Perioperative considerations

The perioperative period is a critical time in the ERP pathway, and there are specific considerations from both the anaesthetic and surgical perspectives (Box 2).

Anaesthetic domains

Anaesthetic protocol details vary according to the surgical approach, patient characteristics and institutional preference or experience. Strategies for patient warming and antibiotic and venous thromboembolic prophylaxis can be standardized between units, but variability is inevitable in other aspects. The key enhanced recovery principles are avoidance of postoperative nausea and vomiting, minimization of the stress response, optimal analgesia to minimize opiate use and individualized goal-directed fluid therapy (IGDFT).

Premedication with long-acting benzodiazepines reduces psychomotor function and causes increased delirium in patients aged >65 years and is, therefore, discouraged.[41,42] Intraoperative short-acting agents (such as propofol for induction of anaesthesia and alfentanil or remifentenil for analgesia) are preferred, and neuromuscular blockade can be titrated according to the results of neuromuscular monitoring.[43]

Box 2 | Intraoperative aspects of ERPs for cystectomy

Anaesthetic
- Avoid preoperative benzodiazepines
- Short-acting anaesthetic agents
- Individualized goal-directed fluid therapy
- Neural blockade (to directly limit the development of insulin resistance)
- Patient warming
- Antibiotic prophylaxis
- Venous thromboembolism prophylaxis

Surgical
- Avoid preoperative benzodiazepines
- Cell salvage
- Minimize incision (minimally invasive surgery)
- Extraperitoneal dissection
- Reperitonealization
- Avoid nasogastric intubation
- Drain strategy

Abbreviation: ERP, enhanced recovery programme.

Intraoperative neural blockade, either central or regional, can minimize intraoperative and postoperative opiate use and facilitate early enteral feeding and mobility. The superiority of thoracic epidural anaesthesia over patient-controlled analgesia has been widely documented in open colorectal surgery for pain relief, reduction in postoperative ileus and length of stay.[44,45] However, in laparoscopic colorectal surgery, thoracic epidural anaesthesia was inferior to spinal anaesthesia and inferior to patient-controlled analgesia in terms of intravenous fluid requirement, nausea, return to normal bowel function and length of stay.[46,47] For radical cystectomy, no prospective studies have compared modalities of perioperative analgesia in the enhanced recovery era. Different ERP units have demonstrated successful programmes for open radical cystectomy with thoracic epidural anaesthesia,[48–50] rectus sheath catheters[51,52] and patient-controlled analgesia alone.[53] Increasing uptake of minimally invasive surgery will continue to decrease the use of thoracic epidural anaesthesia, with a probable increase in regional blocks (such as the transversus abdominis plane block) and local anaesthetic infusion catheters (such as rectal sheath catheters).

IGDFT aims to optimize perfusion and oxygen delivery by maintaining normal physiological fluid balance and homeostasis. A balance is required between fluid overload, with resultant bowel oedema and interstitial pulmonary fluid, and volume depletion with resultant splanchnic hypoperfusion. Both of these irregularities lead to morbidity and gastrointestinal dysfunction.[54]

A number of monitoring tools can be used for IGDFT, including lithium dilution cardiac output and oesophageal Doppler ultrasonography, both of which provide a dynamic assessment of intraoperative cardiac stroke volume and the patient's response to fluid challenges. The aim is to maintain near-maximal stroke volume. The use of oesophageal Doppler ultrasonography, which measures the arterial blood-flow velocity in the descending thoracic aorta using an oesophageal flexible ultrasound probe, has been studied in a single randomized trial of open radical cystectomy.[55] Within the limitations of the trial,

which include the exclusion of patients with an American Society of Anesthesiologists categorization of ≥3 and its small sample size, the study showed decreased levels of nausea, vomiting and postoperative ileus, and a faster return to bowel opening, in the group with intraoperative fluid guided by Doppler ultrasonography compared with the control group who received standard intraoperative fluids.[55] The consensus of opinion amongst urologists and perioperative physicians favours IGDFT.[56,57]

Patient warming, antibiotics and VTE

The prevention of intraoperative hypothermia (defined as a core temperature of <36.0°C) helps to prevent wound infection, perioperative coagulopathy and myocardial ischaemia, as well as reduce length of stay.[58] Active warming strategies such as forced-air warming blankets and the instillation of warmed intravenous fluids are considered more effective than passive measures such as aluminium wraps and linen blankets.[59] The recommendation is that warming should continue in the recovery room, as shivering increases oxygen consumption.[60]

Radical cystectomy is regarded as a clean-contaminated procedure, as it involves entry into a body cavity that contains bacterial colonization. EAU guidelines recommend a single or 24 h antibiotic dosing regimen, although the duration of therapy can be extended to <72 h if the patient has specific risk factors or a prolonged operation. AUA guidelines recommend a second-generation or third-generation cephalosporin or a combination of gentamicin and metronidazole for 24 h in the absence of other patient-specific factors.[61,62] In terms of skin preparation and antiseptic, a systematic review found superiority of chlorhexidine gluconate plus alcohol over povidone iodine.[63]

The rate of venous thromboembolism (VTE) following radical cystectomy has been quoted as between 2.9% and 24.4%.[64–66] Although the incidence of pulmonary emboli is low (1.6%),[64] when they do occur, they are fatal in 20% of patients.[65] More than 50% of VTEs occur after discharge from hospital.[66] Although not specifically relating to radical cystectomy, a Cochrane review of in-hospital-only thromboprophylaxis versus extended postoperative thromboprophylaxis for 1 month demonstrated a significant benefit for extended use of low-molecular-weight heparin.[67] AUA guidelines recommend that intermittent pneumatic compression devices should be used during surgery, and suggest that pharmacological prophylaxis be considered in patients at high risk of VTE.[68] However, the National Institute for Health and Clinical Excellence in the UK have recommended extended pharmacological thromboprophylaxis for 28 days postoperatively for patients who have had major cancer surgery of the abdomen or pelvis.[69]

Blood conservation strategies

The UK national dataset for radical cystectomy records a blood transfusion rate of 30%.[70] Given the immunosuppressive effects of allogeneic blood transfusion, much research has focused on the effect of this blood conservation strategy on overall survival and cancer-free survival after surgery. For patients undergoing radical cystectomy, some clinicians think that the association between perioperative blood transfusion and increased cancer recurrence and decreased survival relates to the fact that patients who receive these transfusions have more-advanced disease and surgical complexity.[71] However, another study has shown direct associations between perioperative blood transfusion and all-cause mortality, death from bladder cancer and cancer recurrence upon multivariate analysis.[72] The advent of minimally invasive surgery could obviate the need for blood transfusion, but attention should still be paid to detecting preoperative anaemia, with potential use of iron-replacement therapy. Allogeneic transfusion can be avoided with the use of intraoperative cell salvage for autologous transfusion,[73] which can be supplemented with leukocyte filtration or irradiation, to reduce any possible risk of transferring metastatic cells.[74]

Surgical considerations

Whether the surgical approach is open or minimally invasive, a number of intraoperative techniques can confer advantages. Single-institution studies have reported potential benefits with a mini-incision,[53] an extraperitoneal bladder dissection,[49,75] reperitonealization following lymphadenectomy[76,77] and stapled (rather than hand-sewn) anastomoses.[51]

The next-step change for ERPs is likely to be increased uptake of minimally invasive surgery, including robot-assisted approaches. Minimally invasive surgery reduces the body's stress response and development of insulin resistance[30] and uses smaller incisions, reducing analgesic requirements. Patients are less likely to require thoracic epidural anaesthesia, thereby avoiding hypotension and reducing intravenous fluid and postoperative opiate requirement. Minimally invasive surgery reduces bowel handling, and the increasing trend for intracorporeal urinary diversion leads to less bowel exposure and reduced insensible fluid losses.[78] Contemporary case series of minimally invasive surgeries confirm reduced blood loss, often obviating the need for transfusion of blood products, which might improve long-term survivorship.[79,80]

Open and robotic cystectomy have been compared in a meta-analysis that identified one RCT, eight prospective studies and four retrospective studies.[81] Use of ERPs was not universal, but the analysis concluded that robot-assisted radical cystectomy was associated with a statistically significant decrease in perioperative complications, blood loss and transfusion rates, and a shorter length of stay.[81] The single RCT[82] cited in this meta-analysis was conducted in the institution with the longest established ERP worldwide. The authors concluded that, although operative times were statistically longer in the robotic surgery group, blood loss, time to flatus, time to bowel movement and morphine analgesia use were all significantly improved compared with open surgery.[82] These data are encouraging, and the clinical benefit seems intuitive, but it is worth remembering that the number of patients in the RCT was small, so further large RCTs are required in the context of high-functioning ERPs before definitive conclusions can be drawn.

Regardless of the surgical approach, the use of intra-abdominal drains continues to be debated. Nasogastric tubes are no longer recommended. In colorectal surgery, meta-analyses have concluded that intra-abdominal drains confer no benefits in terms of anastomotic dehiscence, wound infection, reoperation, extra-abdominal complications or mortality.[83] For radical cystectomy and urinary reconstruction, the subject remains controversial, but observational studies have shown no detriment to omission or early removal of the drain, or to shortening the drain into a stoma bag.[49,51,75] With regard to nasogastric tubes, extrapolation is possible from level 1a evidence relating to colorectal surgery to show drains are not only unnecessary, but also detrimental.[84]

Postoperative considerations

Historically, a patient who has undergone cystectomy might be thought of as a patient who is nil by mouth, with a nasogastric tube *in situ,* who is bedbound and has a prolonged hospital stay. Within an ERP, almost the direct opposite is considered the required standard of care, owing to the consideration of a number of postoperative factors (Box 3).

Early feeding

Within 24 h of the initiation of starvation, the body develops insulin resistance, but early feeding can reduce this resistance, with beneficial effects on muscle function, wound healing and sepsis.[85] Concern has traditionally focused on the risk of bowel complications, but a meta-analysis of major abdominal surgery (not including cystectomy) concluded that pneumonia, anastomotic dehiscence, wound infection and mortality were all less likely with early feeding. Secondary end points, including time to flatus, time to bowel motion and length of stay, are all also improved by early feeding.[86] Intravenous fluids should be minimized postoperatively to prevent fluid overload and bowel oedema. If normovolaemic hypotension is seen with thoracic epidural anaesthesia, it should be corrected with vasopressors;[87] if parenteral fluids are required, balanced crystalloid such as Hartmann's solution should be used in preference to 0.9% saline to protect against electrolyte disruption and hyperchloraemic metabolic acidosis.[88]

Gum chewing

Gum chewing is a form of sham feeding that has been studied specifically in the context of open and robot-assisted radical cystectomy in two trials that showed a significantly decreased time to flatus and first bowel motion in both open and robotic groups with chewing.[89,90] However, drugs that enhance gastrointestinal motility —specifically, erythromycin and metoclopramide— have shown no benefit in decreasing time to flatus or first bowel movement.[91,92] However, in light of this evidence, metoclopramide was removed from one of the most-established ERPs for radical cystectomy, resulting in a significant increase in levels of nausea and vomiting and prompting its reinstitution to facilitate tolerance of early enteral intake.[93]

Box 3 | Postoperative aspects of ERPs for cystectomy

Limit postoperative ileus
- Limit intravenous fluids
- Early enteral intake (to directly limit the development of insulin resistance)
- Multimodal analgesia
- Minimize opiates
- Chewing gum
- Antiemetics
- Early mobilization (to directly limit the development of insulin resistance)

Practical
- Early stoma engagement
- Discharge planning
- Extended thromboprophylaxis training
- Measure quality-of-life outcomes or patient-reported outcome measures

Abbreviation: ERP, enhanced recovery programme.

μ-Opioid receptor antagonists

Much enthusiasm exists for alvimopan, a peripherally active μ-opioid receptor antagonist that helps patients to tolerate a solid diet and was shown to decrease time to flatus in series of patients undergoing colorectal surgery.[94] The use of alvimopan in radical cystectomy reduces length of stay and costs associated with postoperative ileus.[95] The results of an RCT published in 2014 showed a significantly decreased length of stay and quicker bowel recovery for alvimopan treatment compared with placebo.[96] However, this study included a high proportion of patients who underwent open radical cystectomy, and the use of alvimopan with minimally invasive surgery and established ERPs is undefined, particularly as minimally invasive surgery using multimodal analgesia has shown lower morphine requirements than open surgery.[52,82]

Multimodal analgesia

The aim of multimodal analgesia is to provide effective pain relief and to minimize adverse effects, especially those that are associated with opioids. The use of minimally invasive surgery and regional, rather than central, nerve blockade remains the mainstay of pain relief. The use of regular intravenous or oral paracetamol as well as NSAIDs has been a well-documented aspect of many cystectomy ERPs,[48–51,75,93] but concerns exist regarding cardiac toxicity and anastomotic dehiscence with these treatments. The cardiac risk with chronic NSAID use is greatest with diclofenac, followed by ibuprofen and then naproxen, and has not been quantified in the acute perioperative setting.[97] A Danish multicentre cohort study involving 2,766 patients undergoing colorectal surgery concluded that diclofenac was associated with a significantly higher anastomotic leak rate, but no difference in mortality, compared with patients who received alternative medication, whereas ibuprofen was associated with a higher leak rate that did not reach statistical significance.[98] Cyclo-oxygenase (COX)-2-selective NSAIDs (such as diclofenac) might have a higher microthrombotic effect that is more likely to affect anastomotic

blood supply than nonselective or COX-1-selective NSAIDs (such as ketoralac, ibuprofen and naproxen),[98] although these concerns have not been apparent in cystectomy series.

Appropriate analgesia can facilitate mobility and early mobility is, therefore, thought to counteract insulin resistance, to reduce chest infections and thromboembolic risk and to increase muscle strength.[99,100] Studies of patients who have undergone laparoscopic colorectal surgery with ERPs have shown that early mobilization is associated with improved outcomes, and lack of adherence to early mobilization protocols is associated with longer length of stay.[101] Early ambulation is widely practiced in established cystectomy ERPs.[102]

Discharge criteria and patient experience

Criteria for safe discharge include good pain control, tolerance of normal diet, evidence of normal bowel activity, absence of clinical and biochemical concern and stoma or neobladder competency. Patients should feel well supported and routine telephone consultation, as well as the provision of an emergency patient hotline, has been suggested as a standard of care.[51,75]

Assessment of the patient experience should underpin ERPs. Quality-of-life measures and specific cancer-related outcomes have not always been documented with conventional care. One study,[103] involving randomized allocation of patients to conventional care or enhanced recovery for radical cystectomy, assessed outcomes according to European Organization for Research and Treatment of Cancer (EORTC) quality of life (QLQ-30) questionnaires. Emotional functioning scores were significantly higher for more than half of the measured domains at time of discharge in the ERP group compared with the conventional care group. This study was the first of its kind to demonstrate emotional benefits for patients undergoing ERPs for radical cystectomy.[103]

Conclusions

ERPs are critical-care pathways designed to focus attention on all parts of the patient journey, to add value and reduce inconsistency. This model has been adapted from industry and is sometimes referred to as 'lean thinking'. The lean approach (derived from the management philosophy of the Toyota Production System that helped the Japanese company become one of the world's largest manufacturers of cars) has been targeted by health-care innovation and improvement teams in the UK to assess whether similar approaches to patient care can lead to improvements in the quality and effectiveness of surgical care. The lean philosophy identifies areas of potential added value and eliminates three things: 'muda', which is Japanese for 'activity that is wasteful'; 'mura', which is Japanese for 'inconsistency'; and 'muri', which is Japanese for 'absurdness'.[104] The application of muda, mura and muri to surgical practice underpin ERPs as they involve questioning historical principles, upholding the many that add value and changing those that hamper patient progress.

ERPs are also examples of process innovation. Surgeons are often quick to adopt product innovation, as exemplified by the advent of minimally invasive technologies; however, process innovations represent important and much-needed opportunities to improve outcomes and reduce costs by improving the entire patient pathway. Opportunities exist at many steps of this pathway to add value and remove outdated practice. The surgical episode is, of course, critically important, but we are learning to see that the patient journey involves many important episodes, from diagnosis to the return of normal activity.

The greatest challenge is identifying and reducing the mura, or inconsistency, within units and between different hospital units. Educational conferences, dissemination of practice, evaluation of the patient experience and continuous reappraisal of existing ERPs are key to this process, and the goal is to ensure a high standard of consistent clinical care for patients. We hope that the current enthusiasm for ERPs will contribute to an increased momentum for defining the current standard of care for patients undergoing radical cystectomy, and that the change from traditional care to ERPs will continue to herald further 'kaizen' (meaning 'changes for the best' in Japanese).[105]

Review criteria

A literature review was performed for original articles published between January 1997 and April 2014 focusing on enhanced recovery and its elements in MEDLINE and PubMed. Eligible articles included meta-analyses, randomized controlled trials and cohort studies. The reference lists of identified articles were also analysed for valuable articles. All papers identified were English-language full text papers.

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Author contributions

J.S. researched data for the article and wrote the article. All authors made a substantial contribution to discussion of its content and reviewed/edited the manuscript before submission.