

Enhanced recovery programmes in knee arthroplasty: current concepts

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ABSTRACT

The concept of a multimodal approach to improve the care of surgical patients was first proposed by Kehlet in the 1990s. Measures to optimise the surgical patient, and minimise perioperative stresses, aimed to improve postoperative outcomes. Although originally introduced in colorectal surgery, these 'enhanced recovery programmes' have now seen widespread uptake in multiple surgical specialities, including orthopaedics. Patients undergoing knee arthroplasty are well suited to an enhanced recovery approach. These programmes optimise the patient at each stage of the surgical journey, including preoperative optimisation of fitness, perioperative anaesthetic and surgical techniques and finally postoperative rehabilitation and discharge plans. The available evidence supports a number of improvements after programme introduction, including shorter length of stay, morbidity and economics. However, the impact on other outcomes is less clear. One of the issues in the field is a lack of consensus on what interventions an enhanced recovery programme should contain and the specifics of these interventions. As a result, individual units develop their own programmes, making the interpretation and comparison of their impact difficult. This article discusses interventions that could be considered for inclusion in an enhanced recovery programme for knee arthroplasty.

INTRODUCTION

Enhanced recovery programmes (ERPs) represent a multimodal approach to improving patient outcomes in surgery, through attempts at the minimisation of the physiological and psychological stresses of surgery. Such an approach was first proposed in 1997 by Professor Kehlet of Denmark, where he hypothesised that '*multimodal interventions may lead to a major reduction in the undesirable sequelae of surgical injury*'.¹ Opportunities for intervention exist throughout the care pathway, and cover the preadmission period, admission for surgery and the postoperative rehabilitation period (figure 1).² The earliest ERPs were established in colorectal surgery and represent the largest contributors to the evidence base surrounding ERPs. Reviews of such programmes have demonstrated improvements in morbidity, length of stay and complication rate, as well as economic benefits.^{3–6} The use of ERPs has seen uptake in many surgical specialities over the last two decades.⁷ Within orthopaedics, the elective arthroplasty patient represents an ideal target population in which to employ an ERP approach, and many centres now do so. There is evidence that such programmes improve outcomes for patients undergoing total hip

or knee arthroplasty.^{8,9} However, while there has been widespread uptake of ERPs, there is no standardised definition of what components constitute an ERP. As such individual centres devise their own ERP, making comparisons difficult.

This article outlines the potential opportunities for intervention as part of an ERP for patients undergoing knee arthroplasty (KA) and proposes a standardised approach that can be employed by units wishing to implement such changes.

INTERVENTIONS IN ERPS IN KA

For patients scheduled to undergo KA, a number of ERP components have been proposed. These include interventions aimed at optimising the patient prior to hospital admission (optimising the host), interventions to reduce the physiological stresses of surgery and finally interventions to encourage rapid mobilisation, accelerated rehabilitation and expedited discharge home.

Preoperative phase

The period of time before an individual undergoes KA represents opportunities for input from both the primary care and hospital teams.

Optimisation of comorbidities

According to the UK National Joint Registry, the median age of patients undergoing KA is 70 years,¹⁰ and the majority of patients have some degree of comorbidity as graded by the American Society of Anesthesiologists (ASA) system (approximately 90% of patients are ASA 2 or above).¹¹ ERPs therefore aim to optimise these comorbidities prior to the day of surgery. It is likely that older patient groups have the most to gain from ERPs.¹²

Within the UK, the preoperative assessment is an appointment recommended for inclusion in all ERPs.¹³ Directed medical testing to assess the cardiac, respiratory, renal and endocrine systems can identify undiagnosed, or suboptimally managed, medical conditions.¹⁴ In those with chronic conditions, assessment of parameters in advance can identify opportunities for optimisation of treatment in the community prior to admission (eg, blood pressure and blood sugar control). For individuals where there are additional clinical concerns, further investigations can be arranged (eg, lung function testing or echocardiography), formal anaesthetic review or referral to an alternative specialist prior to determining a date for surgery. These 'preoperative assessment' clinics are also an opportunity for the patient and surgeon to revisit the reasons for surgery, to address any patient concerns that may



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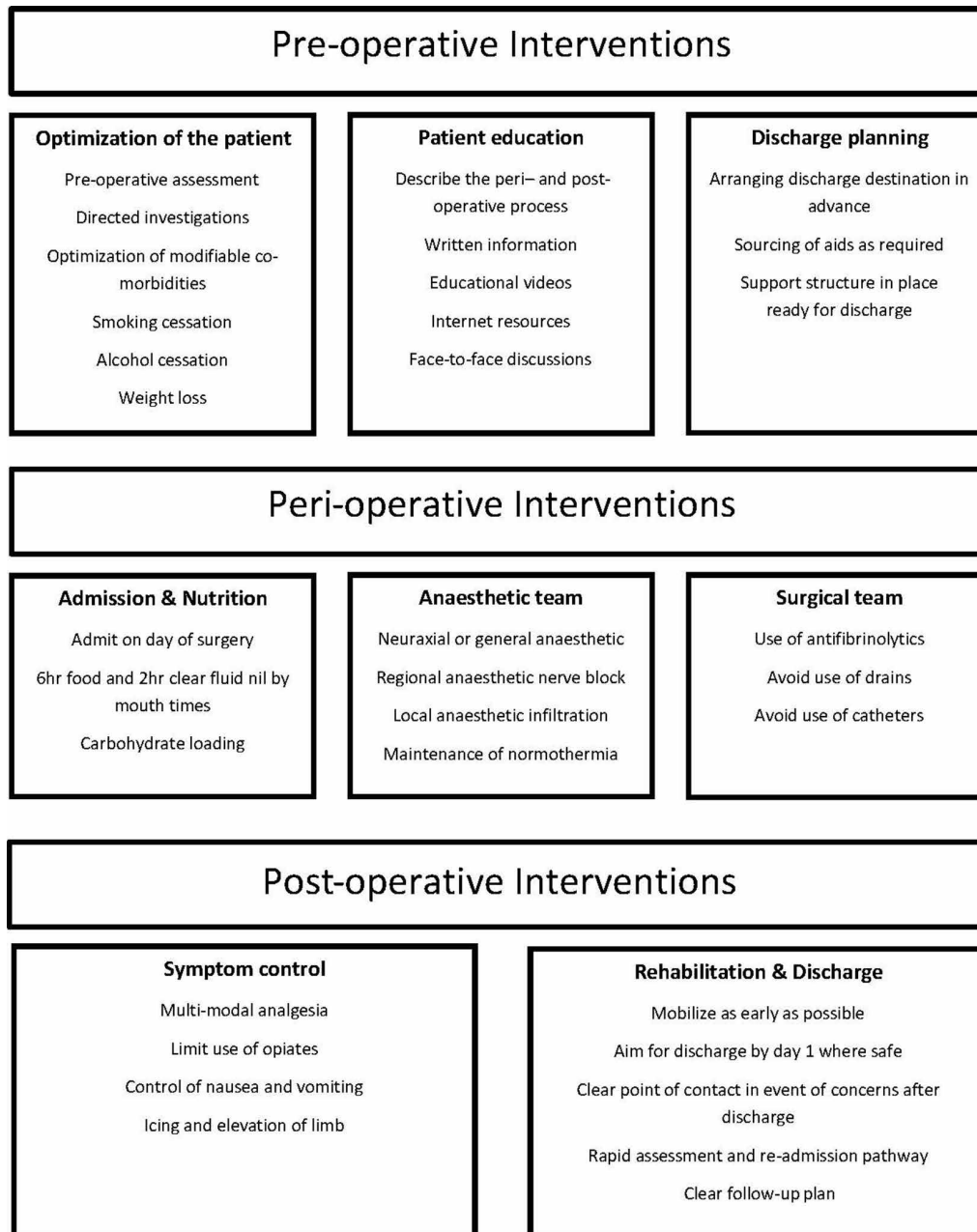


Figure 1 Summary of potential components of an enhanced recovery programme for knee arthroplasty patients.

have arisen and to undertake the consent process in advance as part of recommended practice.^{15 16}

Alongside the above, the decision to operate generates potential teachable moments to modify health risk factors. Specifically, both primary care and hospital teams should use these patient interactions as an opportunity to promote healthy weight loss, cessation of smoking and reduction in alcohol consumption, given their negative impact on outcomes after surgery.^{17–19}

Patient education/prehabilitation

The anxiety that can be experienced by some patients prior to surgery is associated with a negative impact on clinical outcome.^{20 21} Appropriate counselling prior to admission for surgery is effective in alleviating anxiety, with subsequent reductions in pain and improved outcomes observed.^{22–25} Such changes are likely related to greater patient understanding and increased patient confidence.

The format of patient education components is highly variable between ERPs. Possible delivery methods include written information booklets, educational videos, internet platforms and one-to-one teaching in ‘joint schools’ (multidisciplinary team delivered education sessions).

Patient education should address what to expect during admission, the surgical procedure to be performed and goals following surgery including early mobilisation and likely length of stay.

Alongside education programmes, prehabilitation, or preoperative physiotherapy, has been proposed as a useful adjunct to ERPs. However, meta-analyses have not demonstrated clear and significant benefits of such an intervention.^{25–27}

Discharge planning

Planning of discharge should begin prior to admission and in discussion with the patient. This may include input from physiotherapists and occupational therapists, such that support

equipment can be arranged in advance to prevent delays in discharge. Inclusion of those who will be supporting the patient after discharge can be of benefit. This planning can be started during the preoperative assessment (as discussed above).

Admission and intraoperative measures

Admission timing

Admission on the day of surgery is recommended and, where possible, staggered for those due for surgery later in the day. Such measures aim to maximise patient time at home (thus potentially reducing the anxieties of being in hospital), reduce medicalisation of the relatively well elective patient and reduce institutional demands. However, evidence is lacking in support of achieving these aims.

Nutrition

Traditionally in patients undergoing general anaesthesia, a fasting period of 6 hours was recommended. Several evidence-based guidelines now recommend that patients should be allowed to consume clear fluids until 2 hours prior to surgery (solid food and milk remain at 6 hours).^{13 28 29} However, if during anaesthetic assessment risk factors for regurgitation or aspiration are identified, it is appropriate to increase the fluid nil-by-mouth time. One rationale behind this change of practice is to avoid the physiological stress associated with prolonged fasting and disturbances in fluid status. Similarly, oral fluid intake should be resumed as early as possible following surgery.

The use of carbohydrate loading to induce an anabolic state prior to surgery has seen uptake into some ERPs for KA. For example, an audit of UK centres demonstrated inclusion in 30% of ERPs.³⁰ However, it is unclear if such interventions are of significant benefit.^{31 32}

Anaesthesia and analgesia

As originally described by Kehlet, the primary aim of an ERP is to reduce the stress response to surgery. Neuraxial anaesthesia (local anaesthetic agents injected into the epidural or subarachnoid space) contributes to this via sympathetic blockade.^{2 31} Proposed benefits of neuraxial over general anaesthesia include more rapid functional recovery, reduced length of stay and reductions in risk of perioperative mortality, cardiac events, respiratory tract infections and venous thromboembolic events, although these benefits have not been universally demonstrated.^{33–37} Contributors to this uncertainty include changing practices over time, variations in specific techniques, anaesthetic agents and research methodology.

Regional nerve blocks are additional analgesic techniques in KA, providing effective pain relief and reduction in opiate requirements. However, the blockade of the femoral, sciatic and obturator nerves, while providing pain relief, also result in a degree of muscle weakness and can therefore delay early mobilisation. An alternative to these is the adductor canal block, which preserves motor function. A recent meta-analysis found that adductor canal block demonstrated equivalent analgesic requirements and complications to femoral nerve block, but with faster mobilisation.³⁸

Local infiltration of anaesthetic (LIA) about the knee during KA as part of a multimodal analgesic programme has gained popularity over the last two decades. Review of available evidence suggest that this is a useful addition in the postoperative period.^{39 40} However, the composition of agents is highly varied (specific anaesthetic agent and the inclusion or not of non-steroidal anti-inflammatories and epinephrine), so the

optimal choice is not known.⁴¹ When using LIA alongside other routes of local anaesthetic administration (eg, regional blocks or neuraxial routes), clinicians must remain vigilant as to the total dose of local anaesthetic used to avoid potential toxic effects.

Ultimately, the anaesthetic technique selected depends on a discussion between the patient, anaesthesiologist and surgeon.

Antifibrinolytics

The use of tranexamic acid to reduce the chance for postoperative bleeding and the possible need for blood transfusion has increased in recent years, with reductions in transfusion requirements demonstrated without increased thrombotic events.^{42 43} Intravenous and topical administration have both shown clinical efficacy.^{44 45}

Thermoregulation

Measures to maintain and promote normothermia should be taken and can include patients ambulating to theatre, intraoperative temperature monitoring, forced air heating systems and warmed fluids. Hypothermia should be avoided given potential negative effects such as increased rates of infection, cardiac events and bleeding, as well as reduced patient satisfaction.⁴⁶ These may be linked to the release of stress hormones in response to hypothermia (which is contrary to the principles of enhanced recovery).^{1 2 47}

Drains/urinary catheters

To date, the use of wound drains remains controversial, with evidence failing to demonstrate significant benefits with their use.^{48 49} As such, avoidance of their use or early removal is advocated.

The routine use of urinary catheters is not recommended given their associated risk of urinary tract infection, as well as contributing to the medicalisation of the elective patient.^{50 51}

Venous thromboembolism (VTE) prophylaxis

Lower limb arthroplasty is known to be associated with a high risk of VTE. To reduce the risk of VTEs, centres employ various VTE prophylaxis regimes. These can include both chemical agents (eg, aspirin, low-molecular weight heparin and warfarin or non-vitamin K antagonist oral anticoagulants) and mechanical options (such as thromboembolic deterrent stockings and intermittent pneumatic compression devices). The specific components of these regimes vary and reflect a degree of controversy as to the ideal strategy and the balance between bleeding risk and symptomatic VTE risk. We recommend that units follow local or specialty guidelines on VTE prophylaxis in surgery.

Postoperative period

Following surgery, ERPs aim to maintain effective pain control, facilitate early mobilisation and timely discharge. Early mobilisation (<48 hours) after surgery is associated with reduced complications, reduced length of stay and reduced costs.^{52 53} Achieving successful mobilisation depends in part on other components of the ERP such as adequate analgesia, avoidance of nausea and vomiting and patient education. The aim for patients undergoing KA enrolled in an ERP should be mobilisation as early as safely possible.

Analgesia

The use of multimodal analgesia postoperatively is common, often represented by a combination of opiates, non-steroidal anti-inflammatories (where not contraindicated), paracetamol

and gabapentinoids. In addition, some centres include intra-articular local anaesthetic via a catheter in the immediate postoperative period. The use of opiates however should be minimised as common side effects (such as nausea/vomiting and confusion) can impair the success of ERPs.

The use of gabapentinoids in ERPs for KA is common in the UK, with one audit demonstrating inclusion in 48% of centres.³⁰ However, the use of gabapentinoids following KA is controversial. Hamilton *et al* reported that gabapentinoid use after KA did not have a clinically significant impact on either pain scores or opiate use following meta-analysis.⁵⁴

As well as pharmacological methods to reduce pain, the use of simple measures should not be overlooked. Elevation of the operated limb while not mobilising, and the use of ice packs, contribute to reductions in swelling and pain. Reassurance and encouragement of patients is also recommended.

Antiemetics

Postoperative nausea and vomiting is common following lower limb arthroplasty, can be caused by various perioperative factors and can delay mobilisation.^{31 55 56} Management requires identification of those at risk and administration of antiemetics. These may be given preoperatively, intraoperatively or postoperatively depending on the assessed risk. As part of an ERP, inclusion of antiemetic agents is recommended. However, patient response is variable, so multiple options or combination regimens should be available.

Discharge

Planning for discharge following KA should have begun preoperatively. Following surgery, discharge should be considered appropriate when it is safe. Many institutions use a target-based approach whereby patients can be discharged as soon as they have been assessed and approved by the surgical and physiotherapy teams. Crucial to this is a well-motivated and supported patient. As discussed previously, patient education prior to admission can empower the patient, and avoids the expectations of a prolonged hospital admission. In appropriate patients, discharge within 24 hours of surgery is a reasonable aim, with several centres reporting success with such a target.

Access to care and follow-up

Given the reduced length of stay in patients enrolled in ERPs, clear information on routes of care access should be provided to patients in the event of concerns postdischarge. Patients should be provided with a clear method to contact the clinical team in the event of concerns, and routes for rapid assessment and readmission should be available. Finally, a clear description of follow-up arrangements should be provided to the patient.

DISCUSSION

ERPs represent an approach to improving outcomes in surgery, including KA. The central theme is to reduce the physiological stress induced by surgery and its influence on outcomes. To date, the length of stay has been the primary outcome measure in many assessments of ERPs, but secondary measures including readmission rates, complications, mortality and satisfaction are now receiving more attention.⁵⁷

However, there exists a lack of consensus in ERPs in lower limb arthroplasty.³⁰ There is no agreed definition of what constitutes an ERP in KA or the specific interventions it should contain. As a result, individual centres devise their own ERPs, with different interventions and/or differences in how those interventions are

delivered. As such, comparisons in the literature are difficult, with issues surrounding heterogeneity of ERPs, patient selection and timing bias. However, overall, as a concept, ERPs appears to be of benefit to both patients and care providers.^{3 4 31 58–60}

Further investigation of individual interventions included in ERPs is warranted. The establishment of ERP specific groups, such as the American Society for Enhanced Recovery (www.aserhq.org) and the Enhanced Recovery After Surgery Society (www.erassociety.org) are of value in the development of standardised evidence-based specialty-specific guidelines. However, at present neither of these groups have published ERPs directed at lower limb arthroplasty. As such, we recommend that centres produce local evidence-based ERPs with input from both the multidisciplinary team and from patients.

Current concepts

- ▶ Enhanced recovery programmes represent a multimodal approach to patient care to improve outcomes.
- ▶ Programmes can include interventions at all stages of patient care.
- ▶ Lengths of stay can be improved by enhanced recovery programmes.

Future perspectives

- ▶ There is variability on how enhanced recovery programmes are delivered between institutions, making comparisons challenging.
- ▶ Future research is required to determine the value of specific interventions and to determine the optimum recovery programme.
- ▶ Specialist societies (eg, Enhanced Recovery After Surgery Society and American Society for Enhanced Recovery) will be essential in standardising recovery programmes as additional evidence becomes available.

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