

Enhanced recovery pathway for thoracic surgery in the UK

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Background: Enhanced recovery (ER) refers to a combination of perioperative interventions designed to minimise the impact of surgery on patients' recovery in order to reduce postoperative complications and to allow an early discharge reducing hospital costs.

Methods: An ER protocol was established at our institution following a review of the best evidence available. We introduced a multi-disciplinary integrated perioperative pathway by engaging with every person involved, including the patients themselves. The programme was monitored using specifically-designed patients related outcome measures (PROMs).

Results: One-hundred and fifty-four ER patients were compared with 171 controls from the year before ER was introduced. There was an 80% increase in same-day admissions, with a net gain of more than 300 patient bed-days. The ER group had a significantly higher number of procedures performed by video assisted thoroscopic surgery (VATS) (ER, 32.9% *vs.* 9.4%, $P=0.0001$) and a lower rate of admission to the intensive care unit (ER, 5.8% versus 12.9%, $P=0.04$). Patients on the ER programme had a significantly reduced postoperative length of stay (mean ER, 5.2 *vs.* 11.7 days, $P<0.0001$). Patient satisfaction was higher in the ER group after a patient survey. The project resulted in a net saving of £214,000 for the Trust for the 2013/2014 financial year. We were also able to increase the number of patients who underwent thoracic surgery in 2013/2014 by 30% (159 patients) compared with 2012/2013.

Conclusions: The ER pathway has proven to be a safe perioperative management strategy to improve patient satisfaction and to reduce the length of hospital stay and cost after major thoracic surgery, without increasing morbidity or mortality.

Keywords: Thoracic surgery; enhanced recovery (ER)

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Introduction

Advances in thoracic imaging, diagnosis and surgery have meant that more patients can be offered thoracic surgery for both malignant and benign conditions. The operation still represents a significant trauma to the patient and is associated with a slow recovery and return to normal activities. The first national thoracic surgery activity report indicates that the average length of stay in the UK is more than 7 days after lung resection (1). The

concept of enhanced recovery (ER) was devised to address these concerns. Specifically, ER refers to a package of perioperative interventions designed to minimise the impact of surgery on patients' recovery. Implementation reduces postoperative complications and allows an early discharge of the patients (2,3), reducing hospital costs (4). The principle of ER has been demonstrated to work in the context of other surgical specialities (5-8), but has not been used for thoracic surgery. The concept of marginal gain is behind the development of the thoracic surgery ER. Whilst each

intervention taken individually might not make a difference, the sum of all of them is likely to translate into significant benefit. With that idea in mind we set out to develop our programme.

Methods

An ER protocol was established at our institution following a review of the best evidence available and by studying other surgical specialties. We re-engineered the perioperative pathway by engaging with every person involved, including the patients themselves. The programme was monitored using specifically-designed patients related outcome measures (PROMs). In addition, a wider multi-disciplinary integrated pathway was introduced, and the process involved working together with general practitioners, community nurses, social services and local chest physicians. Integration between primary, secondary and tertiary care allowed us to have a capillary follow-up even for every patient undergoing thoracic surgery and also facilitated data collection for clinical audit and governance purposes.

Preoperative preparation

We introduced a “one-stop clinic” strategy to include preoperative investigations, surgical review and consultant-led anaesthetic assessment (9), and this allowed us to start same-day admission. As part of the consent process, patients were informed that they were expected to take an active participation in their care and recovery. We fully embrace the concept of patients being “partners in care” with us.

We believed that patients education was paramount to the success of the project, so we developed a new booklet and DVD disc with detailed information on preoperative exercises, the in-patient pathway and what to expect following discharge, and give this to all patients. This was in addition to the information provided by specialist nurse and surgeons at traditional preoperative consultations. They also receive advice about preoperative fitness (10) and smoking cessation (11-13) where applicable. Each patient's medications are now analysed by a pharmacist. Patient with chronic obstructive pulmonary disease (COPD) should have their treatment optimised and those patients with a new diagnosis of COPD should be commenced on long-acting inhalers in line with NICE guidance (14-16). Malnourished patients are referred to community dieticians and prescribed nutritional supplements (17). Immobile patients can be referred for occupational therapy aids and

social services can be forewarned if support packages are required, a target date for discharge is set to allow patients and their relatives to plan appropriate support. Correction of anaemia (haemoglobin <11 g/dL in women and <12 g/dL in men) should be aimed in all patients (18). The main aim of this clinic is to ensure that patient's is in the best possible physical condition for surgery and their co-morbidities are fully optimised (19).

Intraoperative management

Adequate hydration facilitates intraoperative fluid management and reduces postoperative pulmonary complications. Hence, patients are asked to fast for only six hours for food and two hours for fluids (20). Premedication is no longer administered routinely, and patients are transferred to the operating theatre in a wheelchair; such intervention facilitates patient mobilisation right up to the time of surgery (21). Antibiotic prophylaxis should be given 60 minutes before the surgery and deep vein thrombosis prophylaxis should be prescribed as per current hospital protocol. Three key elements formed the ER pathway: video assisted thoroscopic surgery (VATS) (22,23); short-acting anaesthetic drugs and limited invasive monitoring; and aggressive pain management. Central venous access and urinary catheterisation is reserved for patients who are at high-risk of haemodynamic instability or likely to require inotropic support (21).

Postoperative management

In addition to standard care, immediate postoperative recovery focuses on aggressive pain control and antiemetic prophylaxis. Multimodal analgesia is prescribed using the combination of paracetamol, nonsteroidal anti-inflammatory drugs (not if patient underwent a pleurodesis), opioids (morphine patient control analgesia on day 0 and 1, later oral dihydrocodeine and morphine sulphate or oxycodone prolonged release tablets if patient underwent a thoracotomy) and a regional technique [paravertebral/extrapleural, epidural or intercostal block analgesia depending on the surgical approach (24,25)]. A detailed postoperative pain management in case of videothoracoscopic surgery or thoracotomy is described in the *Figures 1* and *2*. All patients are reviewed by a consultant anaesthetist within 15 minutes if their pain score is above 3/10.

The use of one drain is favourite whenever appropriate, as a recent review concluded that the insertion of one

Type of surgery	Days Post op – 0 (RECOVERY)	Days Post op – 0 (WARD)	Days Post op – 1–2	Days Post op – 3
Video-assisted thoracoscopic surgery (VATS) or other minimally invasive surgery	<p>Prescribe morphine boluses (2 mg/IV) to be administered at discretion of the practitioner up to a maximum of 10 mg morphine in total whilst in recovery.</p> <p>If patient is still in pain, an anaesthetist needs to review the pain control within 15 minutes.</p> <p>If the patient has a paravertebral or epidural catheter, ensure that infusion is connected and running in recovery.</p> <p>Add IV morphine patient-control analgesia unless there is a contraindication.</p>	<p>Continue morphine PCA overnight (unless epidural with fentanyl).</p> <p>Ensure that IV paracetamol is prescribed: for patients >50 kg 1 g QDS; for patients <50 kg 15 mg/kg QDS.</p> <p>Prescribe docusate ± senna according to Trust guidelines.</p> <p>Continue chronic pain medication if any (i.e., gabapentin).</p>	<p>Stop IV morphine PCA.</p> <p>Consider changing IV paracetamol to oral paracetamol if appropriate.</p> <p>Prescribe regular dihydrocodeine 30–60 mg QDS and morphine sulphate 10 mg/5 mL oral solution 5–10 mg orally PRN (2 hourly).</p> <p>Consider changing to oral tramadol 50 to 100 mg QDS if dihydrocodeine is not well tolerated or it is ineffective.</p> <p>For patients with poor pain control or chronic opioids users refer to the guidelines for acute pain management in opioid-tolerant patient.</p>	<p>Continue regular oral paracetamol.</p> <p>Continue dihydrocodeine 30–60 mg QDS PRN.</p> <p>Consider adding oral ibuprofen if there are no contraindications, renal function is normal and urinary output >0.5 mL/kg/hr, avoid NSAIDs in those who have undergone pleurodesis.</p>

Figure 1 Postoperative pain management for thoracic enhanced recovery programme-VATS. VATS, video assisted thoracoscopic surgery.

Type of surgery	Days Post op – 0 (RECOVERY)	Days Post op – 0 (WARD)	Days Post op – 1–2	Days Post op – 3
Thoracotomy	<p>Prescribe morphine boluses (2 mg/IV) to be administered at discretion of the practitioner up to a maximum of 10 mg morphine in total whilst in recovery.</p> <p>If patient is still in pain, an anaesthetist needs to review the pain control within 15 minutes.</p> <p>If the patient has a paravertebral or epidural catheter, ensure that infusion is connected and running in recovery.</p> <p>Add IV morphine patient-control analgesia unless there is a contraindication.</p>	<p>Maintain extrapleural or epidural local anaesthetic infusion.</p> <p>Continue morphine PCA overnight (unless epidural with fentanyl <i>in situ</i>).</p> <p>Ensure that IV paracetamol is prescribed: for patients >50 kg 1 g QDS; for patients <50 kg 15 mg/kg QDS.</p> <p>Prescribe docusate ± senna according to Trust guidelines.</p> <p>Continue chronic pain medication if any (i.e., gabapentin).</p>	<p>Stop IV morphine PCA and give the first dose of oxycodone prolonged release tablets 10 mg orally BD (12 hourly). Very elderly patients or those with mild to moderate renal impairment will require a reduced dosage. Oxycodone prolonged release tablets are contraindicated in severe renal impairment.</p> <p>Prescribe oxycodone 5 mg/5 mL oral solution 5 mg orally PRN maximum 4 hourly (for breakthrough pain). A reduction in dosage may be appropriate if the patient is very elderly or has renal impairment.</p> <p>Maintain extrapleural or epidural local anaesthetic infusion until chest drains are removed (maximum 3 days for epidural).</p> <p>Consider changing IV paracetamol to oral paracetamol on day 2.</p> <p>Consider adding oral Ibuprofen if there are no contraindications. Avoid NSAIDs in those who have undergone pleurodesis.</p>	<p>Stop controlled-release oxycodone tablets.</p> <p>Continue regular oral paracetamol.</p> <p>Start regular dihydrocodeine 30–60 mg QDS (or oral tramadol 50–100 mg QDS if appropriate).</p> <p>Epidural infusion should be discontinued and catheter removed after 72 hours.</p> <p>Extrapleural infusion should be stopped and catheter removed.</p> <p>For patients with poor pain control or chronic opioids users refer to the guidelines for acute pain management in opioid-tolerant patient.</p>

Figure 2 Postoperative pain management for thoracic enhanced recovery programme-thoracotomy.

chest drain confers less postoperative pain as shown by a randomized controlled trial (26). Portable suction systems are now employed instead of traditional suction which requires the outlet to be connected to a wall suction system (27,28). This allows immediate mobilisation by physiotherapists and reduced the number of X-rays required. Suction is not routinely recommended. A recent meta-analysis concluded that it is not necessary to use suction in the absence of a clinically important postoperative space and that early drain removal could result in shorter hospital stays (29-31). Suction above 4 KPa is not recommended, as there is no evidence in the literature.

Postoperative patients are seen by physiotherapists twice on day 1, then once or more as required daily thereafter (32-34). The nursing and physiotherapy team ensure that patients are mobilized on the day of surgery or as soon as possible thereafter. For patients who find it difficult to walk, a stationary bicycle is provided to maintain momentum with physiotherapy exercises.

Supplemental oxygen is discontinued once oxygen saturations more than 90% (35). To improve the psychological perception of the disease we ask patients to eat their meals at a table rather than in bed, this is an attempt to replicate home conditions and give a feel of progression toward return to normality.

We have also instituted a daily multidisciplinary ward round where all patients are discussed by a team of surgeons, physiotherapists, nurses, occupational therapists, dieticians and pharmacists.

Discharge

In order to prevent administrative delays, discharge medications are ordered when the chest drains are removed. On discharge, patients are asked to contact the thoracic ward if concerns arise. It has been our experience that the majority of questions can be addressed on the telephone by either nursing or medical staff, thereby preventing a visit to the GP or local hospital.

Results

The ER programme for thoracic surgery was compared with traditional surgical pathway. This analysis was confined to consecutive patients undergoing lung resection for cancer to reduce selection bias. Data were compared using student's *t*-test and Fishers exact test. One-hundred and fifty-four

ER patients were compared with 171 controls from the year before ER was introduced. Baseline characteristics were similar in both groups. There was an 80% increase in same-day admissions, with a net gain of more than 300 patient bed-days. The ER group had a significantly higher number of procedures performed by VATS (ER 32.9% *vs.* 9.4%, $P=0.0001$) and a lower rate of admission to the intensive care unit (ER 5.8% *vs.* 12.9%, $P=0.04$). Patients on the ER programme had a significantly reduced postoperative length of stay (mean ER 5.2 *vs.* 11.7 days, $P<0.0001$). Patient satisfaction was higher in the ER group after a patient survey. The project resulted in a net saving of £214,000 for the Trust for the 2013/2014 financial year. We were also able to increase the number of patients who underwent thoracic surgery in 2013/2014 by 30% (159 patients) compared with 2012/2013.

Conclusions

The ER pathway is considered standard of care at a growing number of institutions. Our analysis has proven that the ER pathway is a safe perioperative management strategy to reduce the length of hospital stay and the costs after major thoracic surgery, without increasing morbidity or mortality. Patient satisfaction was also increased and the protocol's multidisciplinary nature connects different medical discipline for an improved patient care.

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Footnotes

Conflicts of Interest: The authors have no conflicts of interest to declare.

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