

Application of Enhanced Recovery after Surgery (ERAS) to Spinal Surgery

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Introduction

Enhanced Recovery after Surgery (ERAS), or fast-track surgery, is an evidence-based, multimodal approach to patient care that was introduced to prepare patients for surgery, reduce the impact of the procedure and accelerate post-operative recovery. ERAS was first applied to colorectal surgery by Henrik Kehlet [1] but has more recently been implemented within a number of surgical sub-specialities. ERAS has been widely adopted within orthopaedic surgery and there is strong evidence to support the use of fast-track total hip and knee replacement pathways [2, 3]. Emerging research has proposed efficiency benefits of implementing ERAS to other orthopaedic pathways, such as total ankle [4] and shoulder replacement [5] and spinal procedures [6, 7]. However, despite significant data suggesting improved patient outcomes with the adoption of ERAS pathways, development and implementation has been limited amongst neurosurgical populations [8]. These populations can be associated with high morbidity, despite advances in surgical, technological, medical and anaesthetic techniques.

In the United Kingdom, the Enhanced Recovery Partnership Programme (ERPP) was introduced by the Department of Health and National Health Service (NHS) in 2009 to support the national implementation of ERAS for colorectal, orthopaedic, gynaecology and urology major elective surgical pathways [9]. The programme provided education and funding to hospitals to support the implementation of ERAS and collect data on national

impact. Analysis of the ERPP suggested that a higher compliance with an ERAS protocol is associated with a shorter length of stay [9].

To promote the national adoption of fast-track pathways, the ERAS Society (<http://erassociety.org>) was formed by a collaborative group of experts. The ERAS Society plays an essential role in developing perioperative care through research, education, audit and implementing best-practice. In addition, members of the ERAS society have collaborated to create clinical practice guidelines for Enhanced Recovery with the aim of standardising best-practice in line with ERAS principles.

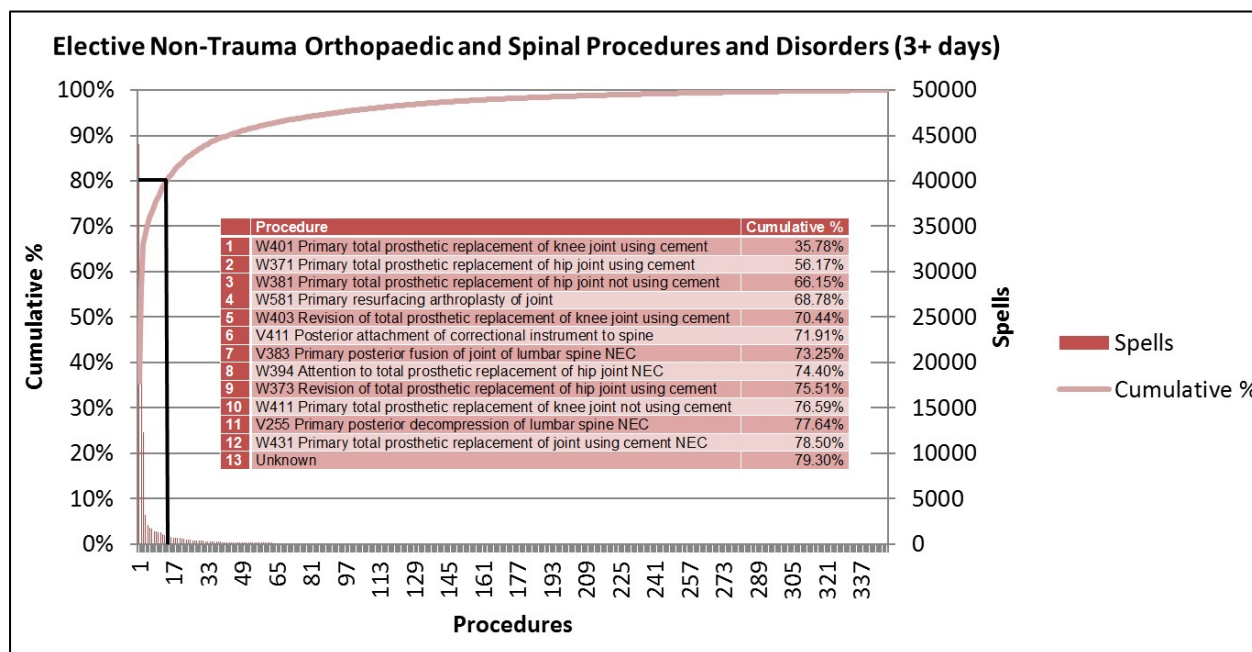
The NHS is currently facing serious economical and capacity challenges. Elective procedures are being cancelled to manage the demand for hospital beds by emergency admissions. Reducing length of stay in hospitals for high volume elective procedures is likely to create significant efficiency benefits for the NHS. Data extracted from Hospital Episode Statistics (HES) show us that length of stay for spine surgery has not changed significantly in recent years (table 1). In addition, an analysis of 124,249 elective orthopaedic and spinal procedures over the last twelve months showed that a combination of knee, hip and spinal procedures were responsible for 80% of all hospital stays longer than 3 days (figure 1). Therefore, the application of ERAS to spinal surgery has the potential to not only improve patient outcomes, but also contribute to productivity and efficiency gains to NHS hospital trusts.

Table 1: Mean and median length of stay for extradural spine major and scoliosis or other spinal deformity. CC = complications and co-morbidities

Year	Extradural Spine Major 1* without CC		Scoliosis or Other Spinal Deformity without CC	
	Mean	Median	Mean	Median
2009-2010	5	3	5	1
2010-2011	4.3	3	3.8	1
2011-2012	4.1	3	6.2	3
2012-2013	4.6	3	6.3	2
2013-2014	4.4	3	6.7	2
2014-2015	4	2	6	2
2015-2016	4	2	5	2

*Extradural spine major HRG4 code includes: Posterior instrumental fusion, cervical and lumbar disc replacement (1 level), cervical, thoracic and lumbar revision fusion (1 level), non-rigid stabilisation of spine (>1 level), revision decompression cervical spine, posterior atlantoaxial fusion, anterior lumbar interbody fusion and anterior cervical discectomy and fusion.

Figure 1: Analysis of orthopaedic and spinal procedures with hospital stays longer than 3 days



ERAS Rationale

ERAS pathways aim to modulate and reduce the surgical stress response, thereby improving patient outcomes and the speed of recovery. These pathways adopt an evidence-based approach to care and require interdisciplinary involvement between professions to provide a multidisciplinary plan of care. Components and interventions are informed by the global evidence-base as opposed to often restricted standard care and the outcome criteria are clearly defined [10]. Insulin resistance is a major factor that affects surgical outcome, and this is caused by a combination of hormonal and inflammatory responses to the trauma. By implementing components such as regional analgesia, perioperative feeding and minimally invasive surgery, perioperative insulin sensitivity can be managed [7]. In addition, preoperative education, nutrition and physical optimisation, a multimodal opioid sparing approach to anaesthesia and analgesia and early mobilisation are central tenets to ERAS pathways.

Application of ERAS to Spine Surgery

The current evidence for the adoption of ERAS within spinal procedures is limited but offers a strong theoretical case for the implementation of fast-track pathways. Application of ERAS principles to pathways has been found to reduce length of stay and complication rates in elective spinal surgery patients [11]. At follow-up, 100% of the patients within this cohort rated their care as good or excellent. ERAS components included the preoperative use of carbohydrate drinks, laxatives, patient information resources with details on what to expect post-surgery and an estimated discharge date. Communication between spinal consultants and other allied health professionals helped nurses and therapists plan to mobilise patients appropriately and ensure consistency with practice. In addition, a standardised anaesthetic regime was developed to avoid the use of large doses of opioids. Mobilisation was encouraged on the day of surgery, along with food and drink intake. Daily aims were agreed with the patient and a team of community-based nurses were able to provide care at home

once the patient was discharged. Following the implementation of ERAS to this trust, mean length of stay was reduced from 6 days to 2.9 days and readmission rate reduced from 7% to 3%.

Two studies from the same group of authors evaluated the implementation of a fast-track programme for idiopathic scoliosis surgery [12, 13]. Both studies found rapid-recovery pathways to result in decreased pain, faster mobilisation, reduced frequency of opioid-related side effects and earlier discharge. One study found baseline average length of stay to reduce from 5.7 to 4 days [13]. The other study observed a mean length of stay of 5 days for conventional pathway patients and 3.5 days for those on a rapid-recovery pathway [12].

An ERAS approach has previously been developed and implemented for patients undergoing one or two level lumbar transforaminal interbody fusion [14]. The authors reported the pathways to be feasible and successful for reducing blood loss, operative time and length of stay. Similarly, the application of a comprehensive multimodal pain treatment has led to a reduction of opioids on postoperative days 1 and 2 and earlier mobilisation following multilevel spine surgery [15]. Length of stay lowered from 9 days pre-intervention to 7 days post-intervention. Further evidence includes the introduction of a fast-track protocol for patients undergoing stabilisation of one or two segments for degenerative lumbar spine pathologies [16]. The pathway reduced length of stay by 4.7 days, as well as increasing patient satisfaction.

ERAS pathways in unselected patients undergoing open spinal surgery for degenerative lumbar and cervical conditions were found to be feasible [17]. The authors report an increase in the number of patients receiving 'day case' surgery, whereby they can be discharged on the same day as their surgery as a result of identifiable and correctable medical and social factors.

In addition, specific components of ERAS pathways have been evaluated in isolation amongst cohorts of spinal surgery patients [6]. There is good quality evidence that supports

multimodal pain management protocols for improving pain control with less reliance on opioids [18]. Tranexamic acid has been reported as an effective management strategy for blood loss and transfusion rate [19]. Major spinal surgery has been linked to a significant post-operative decrease in nutritional parameters in populations who were previously well-nourished [20].

ERAS programmes encourage identifying high-risk patients and offering oral nutrition supplements with macronutrients and micronutrients [21]. Early mobilisation is reported to significantly reduce the incidence of perioperative complications [22], shorten duration of in hospital stay and contribute to improved perioperative functional status [23] in spinal surgery patients. Delaying ambulation by just 24 hours may contribute to higher complication rates and inferior functional outcomes [23]; however the benefit of early mobilisation to patients with certain complex spinal reconstruction has been questioned [24].

Implementing ERAS

ERAS is a quality improvement method that requires systematic implementation at both a local and a national level in order to create an impact within patient populations. To be successful, a quality improvement intervention is dependent upon strong leadership, organisational culture, effective data infrastructure and information systems and the use of a well-designed and validated quality improvement approach to standard practice [25]. Developing standardised guidelines based on best evidence facilitates the adoption of an ERAS programme [26]. Explicit guidelines are lacking for the spinal patient population [8] and the publication of ERAS guidelines by the ERAS Society later this year is likely to encourage adoption from hospitals who do not currently implement enhanced recovery pathways. It is also important to highlight that compliance to process measures will help to improve patient outcomes. The use of databases such as EnCare (<https://www.encare.net/>) allows surgical teams to understand the perioperative care process and facilitates best practice through their implementation programme and interactive audit system.

Summary

Current evidence presents an exciting opportunity for spinal teams to embrace ERAS and deliver improvements to patient care and health systems. Spinal disorders are among the most frequently encountered problems in clinical medicine and can lead to significant pain and neurologic dysfunction [8]. Improving quality of care to spinal procedures has significant potential efficiency gains. Due to the complex nature of spine surgery, there is a need for procedure specific research to evaluate ERAS interventions. Following the publication of best-practice clinical guidelines by the ERAS Society, more ERAS specific research and systematic implementation will be required in order to develop practice further.

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