**Multimodal approach to postoperative recovery**

Henrik Kehlet

Introduction

The concept of multimodal, evidence-based interventions to improve postoperative outcome (the fast-track methodology) was introduced more than 10 years ago [1] and is now well documented in several recent reviews [2,3,4,5] to hasten postoperative recovery and reducing the need for hospitalization, morbidity and convalescence. The evidence for the concept is most evident in colonic procedures [5].

Despite the availability of the scientific evidence for the fast-track surgery concept and the improvements in outcome, including socio-economic benefits [4,5], there is an agreement across many countries that translation into clinical practice remains slow [4,6].

The purpose of this review has, therefore, been to update and integrate recent findings within specific perioperative care components of fast-track surgery. Furthermore, the purpose is also to provide proposals for future strategies to enhance adaptation of the fast-track methodology into clinical practice.

Recent advances in components of the fast-track methodology

The fast-track surgery concept is built on the realization that postoperative outcome is determined by a multiplicity of factors, including preoperative assessments (improvement of preexisting organ dysfunction), intraoperative factors (type of anesthesia and surgical technique, including minimal invasive surgery) and postoperative care (analgesia, fluid management, nutrition, mobilization, nursing care, planned recovery programs and so on) (Table 1). Many of these factors are well established, including preoperative abstinence from smoking and alcohol abuse, whereas perioperative use of stress-modifying agents such as β-blockade, statins, anabolic agents and control of hyperglycemia with insulin therapy still remains under debate, despite some positive data [4,5,7]. The benefits of minimal invasive surgery as part of the fast-track methodology are beyond any doubt in certain operations such as reflux, obesity and adrenal surgery in which the alternative is a long incision, but it remains more controversial in other types of surgery. One of the best examples is colonic surgery, in which the design of previous studies hinders exact interpretation of outcome data, as perioperative care in the ‘open’ groups has not been adjusted to the fast-track evidence-based methodology [8]. This methodological problem still appears in recent literature to compare the benefits of laparoscopic against open surgery [9].

Fast-track surgery includes a multidisciplinary collaboration including anesthesiologist and in which recent evidence [3] has emphasized a focus on appropriate procedure-specific evidence of regional anesthesia and multimodal, nonopioid analgesia on procedure-specific basis [the Procedure-Specific pain management (PROSPECT)
collaboration, www.postoppain.org]. Principles for perioperative fluid management have achieved an increased attention in recent years, as a crystalloid (especially isotonic saline) excess increases postoperative morbidity [10]. The concept of ‘goal-directed’ perioperative fluid management [11], which is based on individual optimization of cardiac stroke volume, has been demonstrated to improve outcome across several procedures and should be more widely adopted in high-risk patients [11]. The future ‘optimal’ fluid management approach will probably include the ‘goal-directed’ optimization in high-risk patients combined with crystalloid administration according to external losses. A ‘best evidence’ for perioperative fluid therapy has been evidenced for a long period [4*,5] and with supportive data of reduced postoperative morbidity in addition to reduction of hospital stay [20,21*,22,23]. Recent data have also shown enhanced recovery after ileostomy closure with fast-track programs [24,25]. What is now required is organizational changes to implement the firm evidence. In this context, the discussion on length of stay should be adjusted to the advantages achieved on early recovery with the documented preoperative information and well defined care programs [5]. Other arguments for prolonged stay, such as organization and traditions [26], should be adjusted to available evidence. Also, future studies [4**,5,27] should focus on the combination of the laparoscopic approach, the fast-track methodology and pharmacological modification of stress responses to further enhance recovery.

**Colorectal surgery**

More data have appeared to supplement previous firm evidence [5] that fast-track colonic surgery is well tolerated and feasible [19] and with supportive data of reduced postoperative morbidity in addition to reduction of hospital stay [20,21*,22,23]. Recent data have also shown enhanced recovery after ileostomy closure with fast-track programs [24,25]. What is now required is organizational changes to implement the firm evidence. In this context, the discussion on length of stay should be adjusted to the advantages achieved on early recovery with the documented preoperative information and well defined care programs [5]. Other arguments for prolonged stay, such as organization and traditions [26], should be adjusted to available evidence. Also, future studies [4**,5,27] should focus on the combination of the laparoscopic approach, the fast-track methodology and pharmacological modification of stress responses to further enhance recovery.

**Esophageal resection**

Evidence-based care programs to improve outcome [5,28] have been further supported by fast-track clinical pathways [29].

**Pancreatic surgery**

An increasing amount of data support that the fast-track methodology can also be applied in pancreatic duodenectomy with significant reductions in length of stay as well as a potential to reduce morbidity [30–32]. These data in a high-risk operation should stimulate future studies [4**,10,11,15*,16,17,18*], in which surgical technique, use of drains, tubes, stents, fluid management, early oral nutrition and so on are reconsidered and adjusted to recent evidence.

**Liver surgery**

A limited number of fast-track programs have been published in liver resection with positive results [33,34], again stimulating for future research and documentation of the concept.
Thoracic surgery
Several efforts have been made to shorten hospital stay by the fast-track methodology, in which the most important factors include optimized pain relief (www.postoppain.org) and principles for removal of chest drains. So far, the recent results are positive but require further procedure-specific information in relation to open versus video-assisted procedures [35,36].

Urology
Further positive data in open nephrectomy have been published [37], although not with an optimized evidence-based program regarding oral intake and drain removal. Radical cystectomy is a relatively high-risk procedure with initial positive effects of enhanced recovery programs [38,39]. However, these results can be improved by further implementation of evidence-based care [4**,10,11,18**], calling for more studies. Previous studies of fast-track radical prostatectomy [4**] showed short hospital stays of around 1–2 days, which is out of context with recent ‘fast-track’ data in laparoscopic radical prostatectomy [40] with a hospital stay of around 3.6 days [40]. More data are required with increased attention to updated care programs [4**] and the potential role of psychosocial factors in this procedure.

Other procedures
In addition to previous information [4**], more data have appeared with fast-track laparoscopic bariatric gastric bypass surgery with a focus on optimizing anesthesia and analgesia leading to hospital stays of 2 days [41]. More evidence has also appeared in fast-track hip and knee replacement with discharge to home within 3 days [42] and with the interesting results of demonstrating surgery performed during the first weekdays to have shorter stay than performed during the end of the week [42]. Previous data from open aortic surgery with stays of around 3 days [4**] were not matched in recent ‘fast-track’ programs [43,44], which, however, did not include optimized multimodal programs with sufficient epidural analgesia, fluid restriction, nonopioid analgesia and early nutrition [43,44].

Conclusion
The past 1–2 years have further documented the value of the concept of fast-track surgery (multimodal perioperative rehabilitation care programs). What is needed now is primarily to secure implementation of the fast-track methodology evidence and in controversial areas to analyze barriers and facilitators for implementation and further developments, as done in fast-track breast cancer surgery [45]. In this context, it should be remembered that the ultimate goal is not to decrease hospital stay but to enhance recovery, perioperative organ dysfunction and morbidity. If successful, this will obviously lead to a decreased need for hospitalization. However, in this process, it is important to take a new look on traditions of care, including common excuses for early discharge such a psychosocial factors, requirement for post-discharge rehabilitation programs and support services [26] and so on, all of which most often are not evidence based and in which previous data on fast-track surgery have shown decreased convalescence, fatigue and similar or better patient satisfaction compared with traditional care programs [4**,5,46]. In the implementation process, it is most important for achieving a success to monitor own results combined with those of others and then to act on both local and national levels if major discrepancies are apparent or when recent scientific data may suggest room for improvements [47]. Finally, the multidisciplinary efforts to implement the fast-track methodology [23] are facilitated by educational nursing care programs and provision of evidence-based daily perioperative care maps to secure uniform provision of care in each department (www.periopnursing.dk).

Multimodal perioperative rehabilitation programs (fast-track surgery) have come to stay, should be implemented according to existing evidence and be improved by optimizing individual components of care with the ultimate goal of achieving a ‘pain and risk-free’ operation. In this process, careful monitoring and multidisciplinary collaboration are required.

References and recommended reading
Papers of particular interest, published within the annual period of review, have been highlighted as:

• of special interest

** of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 375).

A multidisciplinary effort to provide consensus on clinically useful guidelines for perioperative fluid management.

A comprehensive review of available techniques for reducing postoperative ileus, perioperative fluid management.

A multidisciplinary effort to provide consensus on clinically useful guidelines for perioperative fluid management.

An important large-scale randomized study for the first time to demonstrate the feasibility of early oral nutrition after major upper abdominal surgery.


An important multicenter, large randomized study to document fast-track surgery to reduce postoperative morbidity and length of stay and with additional information on the importance of epidural analgesia and avoidance of a fluid excess.

An important multicenter, large randomized study to document fast-track surgery to reduce postoperative morbidity and length of stay and with additional information on the importance of epidural analgesia and avoidance of a fluid excess.


A comprehensive review of available techniques for reducing postoperative ileus, an important step for a successful fast-track program after abdominal surgery.

Allowing normal food at will after major upper gastrointestinal surgery does not increase morbidity: a randomized multicenter trial. Ann Surg 2009; 249:203–209. The most updated review to further document that routine mechanical bowel preparation should be omitted, a factor that may contribute to a successful fast-track program.


The most updated review to further document that routine mechanical bowel preparation should be omitted, a factor that may contribute to a successful fast-track program.

The most updated review to further document that routine mechanical bowel preparation should be omitted, a factor that may contribute to a successful fast-track program.

The most updated review to further document that routine mechanical bowel preparation should be omitted, a factor that may contribute to a successful fast-track program.

The most updated review to further document that routine mechanical bowel preparation should be omitted, a factor that may contribute to a successful fast-track program.

The most updated review to further document that routine mechanical bowel preparation should be omitted, a factor that may contribute to a successful fast-track program.

The most updated review to further document that routine mechanical bowel preparation should be omitted, a factor that may contribute to a successful fast-track program.

The most updated review to further document that routine mechanical bowel preparation should be omitted, a factor that may contribute to a successful fast-track program.

The most updated review to further document that routine mechanical bowel preparation should be omitted, a factor that may contribute to a successful fast-track program.

The most updated review to further document that routine mechanical bowel preparation should be omitted, a factor that may contribute to a successful fast-track program.

The most updated review to further document that routine mechanical bowel preparation should be omitted, a factor that may contribute to a successful fast-track program.