

Review

Evidence-based Perioperative Management: Strategic Shifts in Times of Fast Track Surgery*

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Abstract. Changes in perioperative management is an ever evolving subject. The primary aim is to improve patient care and more recently to increase economic efficacy. Data from various randomized studies have caused a shift from traditional care concepts towards evidence based multimodal treatment strategies. They may lead to dramatic changes in perioperative patient care such as the routine use of nasogastric decompression, mechanical bowel preparation and established nutrition schemes. Further aspects of modern perioperative patient care include epidural analgesia, antibiotic prophylaxis, intraoperative fluid management and early mobilization. It has been generally accepted that these multimodal treatment concepts also known as "fast track surgery" show no differences in patient morbidity while significantly reducing patient discomfort and duration of hospitalization. However, despite the evidence-based superiority, widespread implementation has not yet occurred. The aim of this review is to highlight and discuss current changes and to show future perspectives of perioperative treatment strategies.

Perioperative management is an essential part of successful surgical therapy. It encompasses pre-, intra- and postoperative measures. In recent years, traditional treatment strategies have been questioned and various meta-analyses and evidence-based reviews produced a body of data supporting new approaches.

Prospective studies have shown that multimodal perioperative treatment concepts reduce negative side-effects of surgery and lead to a decreased morbidity with a faster recovery and earlier patient discharge. In addition, main factors of prolonged hospitalization after surgery have been identified. They include intraoperative hypothermia, fluid overload, post-traumatic immunological changes, pain, immobilization, gastrointestinal paresis and temporary malnutrition. A reduction of postoperative morbidity and hospitalization can be achieved through multimodal approaches. Referred to as "fast track" surgery these treatment concepts encompass prevention of intraoperative hypothermia, adequate analgetic covering, stress reduction, early nutrition and accelerated mobilization. In contrast to the traditional approach, several safety considerations have been abandoned resulting in technical changes such as an avoidance of nasogastric tubes, reduction of preoperative bowel clearance or a limitation of intraoperative fluid administration. Although various positive effects of fast tracking have been demonstrated and are generally accepted, widespread implementation has not yet occurred. Furthermore, various aspects of perioperative management have not been solved and remain controversial. This paper shows the current status of evidence-based perioperative management which is moving towards so-called fast track surgery.

Fast Track

Morbidity after elective colorectal surgery prolongs the duration of hospitalization, increases the time to recovery and poses a financial threat to the health systems. Various studies evaluating postoperative complications after conventional surgery show morbidity rates of up to 30% and hospitalization of 8-12 days (1). Pain, paralytic ileus and different organ dysfunctions have been identified as the main responsible factors in patients undergoing elective colorectal surgery. In order to improve this dissatisfaction situation and the postoperative course of surgical patients different

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interdisciplinary groups started to develop and apply multimodal therapy concepts. During the mid 1990s the term "fast track" was created and first studies showed a strong reduction of hospital stay for elective colorectal surgery to 2-3 days while respecting standard discharge criteria (2, 3). Substantial beneficial effects were observed regarding postoperative pain management. The regular use of thoracic epidural anesthesia for open bowel resections accompanied by a flexible regimen of non-opioid analgetics treats pain and allows immediate postoperative mobilization. Furthermore, the risk of an opioid-induced paralytic ileus is minimized and bowel activity is increased through sympathetic blockage (4). However, other authors showed that thoracic epidural catheters can be replaced by multimodal non-opioid analgesics in patients undergoing minimal invasive surgery (4). Under fast track therapy, the duration of paralytic ileus could be reduced from 96-120 h to 48-72 h with conventional treatment in more than 90% of patients (2, 4, 5). The decreased duration of paralytic ileus increases patient comfort, avoids abdominal distension while enhancing pulmonary function and oral nutrition (1, 6). The following lines address the impact of nasogastric tubes, oral feeding concepts, perioperative antibiotic treatment and mechanical bowel preparation on postoperative recovery.

Nasogastric Decompression

The rationale for using prophylactic nasogastric decompression tubes has been a reduction of postoperative nausea and vomiting, a decrease of abdominal distension, less chance of pulmonary aspiration, reduced risk of wound separation and infection, earlier return of bowel function and shorter duration of hospital stay (7). The potential benefits of this procedure have been unquestioned for decades and it has been routinely applied in almost all patients undergoing major abdominal surgery. A meta-analysis by Cheathham *et al.* from 1995 discovered that postoperative vomiting and abdominal distension were reduced through routine nasogastric decompression although all other criteria were impaired (8). A more recent systematic review of 28 randomized controlled trials (RCT) by Nelson *et al.* in 2005 showed that patients without or selective nasogastric tubes experienced earlier bowel movements, a decrease in pulmonary complications and a marginal increase in wound infection and ventral hernia formation (7). They conclude that nasogastric decompression does not achieve the intended goals and should therefore be abandoned as a routine technique and only applied in selected cases. Comparable results were shown in a meta-analysis by Yang *et al.* in patients undergoing gastrectomy for gastric cancer. Time to complete oral nutrition was significantly shorter in patients without nasogastric decompression while time to flatus, anastomotic leakage rate, pulmonary complications and

length of hospitalization were similar (9). Furthermore, it should be mentioned that the introduction of nasogastric tubes may be associated with direct injuries to the oesophagus, the stomach and anastomosis if they can be reached by the tube.

Mechanical Bowel Preparation

Mechanical bowel preparation prior to abdominal surgery is aimed at cleaning the large bowel of feces and thereby reducing the probability of abdominal infections and postoperative complications. Traditional bowel cleansing has been performed through enemas in combination with oral laxatives. The current technique is based on the application of oral carthartic agents (e.g. polyethylene glycol) which induce diarrhea and expel fecal contents from the large bowel showing improved cleansing compared to previous methods. For decades the practice of bowel preparation has been considered as an essential part in the prevention of postoperative complications induced by bacterial contamination. The most feared consequences include local or generalized peritonitis, anastomotic leakage, systemic bacterial spread with synchronous inflammation (sepsis) and wound infections. Although the use of mechanical bowel preparation has been generally accepted, a mandatory correlation between prepared bowels and a reduction of postoperative morbidity was not clearly shown. On the contrary, studies evaluating the outcome of patients with filled bowels undergoing emergency surgery found no increase in anastomotic complications as might have been expected (10). These data suggest that the use of bowel cleansing may be unnecessary. Furthermore, various authors have pointed out that an empty colon impairs postoperative nutrition and potentially prolongs hospitalization (11). Additionally, mechanical bowel preparation causes significant discomfort due to nausea, abdominal bloating and diarrhea in almost all patients (12). Physiological changes include electrolyte imbalance and dehydration. Various randomized trials have compared the rate of abdominal complications between patients with and without mechanical bowel preparation (Table I). A multicenter study by Contant *et al.* showed no significant differences for anastomotic leaks and septic complications among both groups. In view of the possible disadvantages and the evidence of several randomized studies, mechanical bowel preparation in the classic way should be abandoned. A preoperative enema appears to be sufficient to remove solid parts of feces.

Early Oral Feeding and Nutrition

A traditional practice has been to keep patients under temporary starvation ("nil by mouth") for about 5 days after gastrointestinal surgery. In the early postoperative phase, fluids are applied intravenously and oral feeding is resumed only after bowel activity has been observed. The rationale for this cautious

Table I. Prospective randomized trials on mechanical bowel preparation.

Author	Year	n	Wound infections		Abdominal infections		Anastomotic leak	
			Prep	No prep	Prep	No prep	Prep	No prep
Burke (19)	1994	186	4.9	3.4	-	-	3.7	4.6
Santos (20)	1994	149	24*	12	-	-	10	5
Miettinen (21)	2000	267	4	2	2	3	4	2
Zmora (10)	2000	380	6.4	5.7	1.1	1.0	3.7	2.1
Contant (12)	2007	1354	13.4	14.0	2.2	4.7	4.8	5.4
Pena-Soria (22)	2008	129	24.6	17.2	4.6	0	5.4	6.2

Values represent percentages; *at significant difference; $p<0.05$ Prep=Bowel preparation; No Prep=No bowel preparation.

Table II. Prospective randomized trials analyzing the difference in patient outcome with early oral feeding compared to conventional feeding.

Author	Year	Specialty	Results for early feeding
Seenu	1995	Colorectal	No difference: ileus, hospital stay, vomiting
Hartsel	1997	Colorectal	No difference: nausea, vomiting, hospital stay
Pearl	1998	Gynecological	Shorter hospitalization, faster motility, no difference for vomiting and abdominal distension
Stewart	1998	Colorectal	80% Normal diet within 48 h, no significant difference
Cutillo	1999	Gynecological	Less ileus
Mamillan	2000	Gynecological	No difference: ileus, nausea

treatment is to prevent postoperative nausea and vomiting and to protect the intestinal anastomosis from mechanical stress. Further potential advantages of this generally accepted strategy are to avoid aspiration and wound breakdown. Based on these considerations, this concept has been applied for several decades although lacking fundamental scientific evidence. In contrast to this perception, several studies have suggested that early oral feeding may be advantageous for patients' comfort and surgical outcome (Table II). Animal trials have shown that starvation reduces collagen content in anastomotic scar tissues and impairs the healing process while feeding increases collagen deposition and strength (13, 14). Regarding these findings, several trials on humans undergoing gastrointestinal surgery were performed to evaluate differences between both concepts. A meta-analysis of 11 randomized trials by Lewis *et al*. showed that early enteral feeding may be beneficial for patients undergoing gastrointestinal surgery (15). Duration of hospitalization and risk of any type of postoperative infection was significantly reduced after early feeding. Furthermore a trend towards decreased rates of anastomotic leakage, wound infection and intraabdominal abscess was noted. An advantage of nil by mouth treatment was a significantly lower rate of postoperative vomiting. The authors conclude that there is little evidence to keep patients under temporary starvation after creation of intestinal anastomosis. Therefore nil by mouth should be avoided and early oral feeding implemented.

Perioperative Antibiotic Prophylaxis

Surgical infections caused by the opening of contaminated cavities such as intestines, stomach or vagina have been feared by surgeons for many decades. It has been reported that wound infections occur in approximately 40% of patients undergoing colorectal surgery without antibiotic prophylaxis (16). Therefore different strategies have been developed to reduce the rate of complications associated to bacterial contamination. Studies from the 1970s by Condon, Nichols and Gorbach clearly showed the benefits of antibiotic therapy in contrast to placebo in preventing postoperative superficial and deep surgical site infections (17, 18). Nevertheless, an important drawback of excessive antibiotic therapy is the increasing development of various multiresistant pathogens such as extended-spectrum beta-lactamases (ESBL), methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant *Enterococcus* (VRE). A rational application of antibiotic agents is therefore essential and guidelines for appropriate use are currently under development. The large variety of continuously newly developed antibiotics makes an adequate therapy difficult for non-specialists. It has been shown that a single shot prophylaxis of a standard combination is sufficient to prevent postoperative infections. In practice, a third-generation cephalosporin combined with metronidazole is mostly used.

Conclusion

Traditional perioperative care includes various treatment modalities which have been routinely practiced for several decades without fundamental scientific support. In recent years, evidence-based studies have shown that many of these methods do not significantly improve surgical outcome, prolong hospitalization and may even increase patient morbidity. As old principles such as routine use of nasogastric decompression, mechanical bowel preparation, nil by mouth feeding and restricted exercise are questioned, modern multimodal treatment strategies have achieved good results in patient outcome and cost reduction. Despite these substantial findings, traditional treatment methods remain common practice. This problem is obviously related to various reasons including limited acceptance of the data, insufficient information and a reluctance to change. However, a future implementation of standard operating procedures and treatment guidelines may enforce a further shift towards modern treatment strategies. Further prospective studies in all operative disciplines are really warranted. These studies should focus on clinical outcome and patient's quality of life, and should also include cost-effectiveness analyses.

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