Nutritional Support in the Perioperative Period

Topic 17

Module 17.4

Nutritional Goals in the Perioperative Period. Facilitating Oral or Enteral Nutrition

Mattias Soop

Learning Objectives

- To learn about common methods used to assess nutritional state in preoperative patients;
- To review caloric and protein requirements before and after surgery;
- To decide what is the most appropriate route of nutrition in various surgical diseases.
- To review the causes of postoperative gastrointestinal paralysis;
- To learn in some detail about the perioperative interventions that have been shown to promote postoperative gut function;
- In particular, to learn about the uses of epidural analgesia and multimodal analgesia to promote bowel function, the importance of fluid balance, and the role, if any, of prokinetic drugs;

Contents

Key Messages

- Only in intestinal failure should parenteral feeding be used;
- Subjective global assessment (SGA) is a simple and highly accurate "nutritional" test to predict post-operative complications;
- Preoperative parenteral feeding in malnourished patients for five to ten days is associated with a reduction in post-operative morbidity. Preoperative oral or enteral nutritional support in malnourished patients needs further evaluation;
- Post-operative caloric and protein requirements are not highly elevated in modern surgical care;
- Early oral nutrition is safe after lower gastrointestinal surgery, and decreases infectious morbidity and enhances recovery;
- Parenteral feeding in the post-operative patient who cannot be fed orally or enterally for a prolonged period has not been evaluated. Expert groups recommend waiting for at least five days before total parenteral nutrition is started in well-nourished patients.
- Postoperative ileus is preventable;
- The main alterable causes are inhibitory sympathetic activity, manipulation of the bowel, exogenous and endogenous opioids and fluid overload;
    - Mid-thoracic epidural analgesia promotes postoperative bowel function by blocking inhibitory reflexes, catecholamine release and eliminating the need for systemic opioid analgesia;

- NSAIDs and paracetamol reduce the need for opioids once the epidural analgesia is discontinued;
- Maintaining postoperative fluid balance, rather than fluid overload, helps prevent postoperative ileus;
- Prokinetic drugs have no current role in postoperative ileus, apart from magnesium oxide, which may be beneficial;
- Combining several of the above interventions in an enhanced-recovery protocol, it is possible to maintain a normal gastrointestinal transit time after colonic surgery.

1. Nutritional assessment in the preoperative patient

Even in modern surgical practice as many as 25% of surgical patients have been reported to be malnourished on admission (1).
There is little doubt that malnutrition adversely affects outcome from surgery (2). Preoperative parenteral feeding in malnourished patients for five to ten days is associated with a reduction in post-operative overall complication rates from approximately 40% to 30% (3) (Fig. 1). Therefore, it is important to identify patients who are malnourished before surgery. Unfortunately, all tests available in clinical practicetoday to assess nutritional status are also affected to various degrees by the metabolic abnormalities that are associated with most surgical disease, such as malignant and inflammatory conditions. For example, serum concentrations of proteins (e.g. albumin) are affected more by physiological stress than by malnutrition (see also Module 17.1).

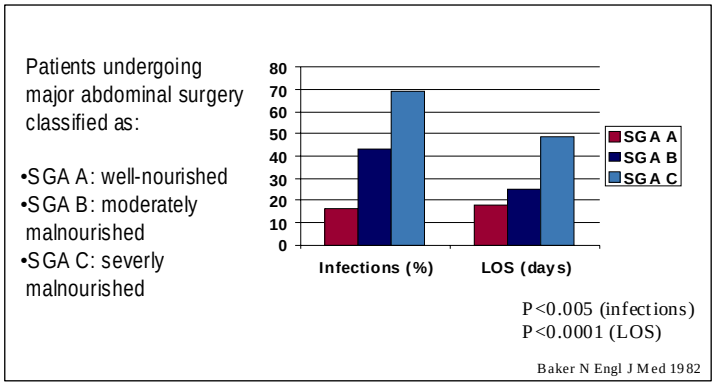

Figure 1 Preoperative malnutrition increases postoperative morbidity and length of hospital stay.

The Subjective Global Assessment (SGA) (4) and experimental muscle function tests are the tests with the best track record in predicting post-operative complications of all current tests for malnutrition. The SGA is based on a careful history and physical examination and this simple and inexpensive assessment predicts post-operative morbidity with high accuracy (2).
Although it would be of great use to follow the nutritional state in the post-operative patient day-by-day, this is made virtually impossible by the fluid shifts and acute stress responses to surgery. Body weight, for instance, normally increases by 5-10 % due to fluid retention, masking any loss of body cell mass (see also module 17.1). One pragmatic way to ensure adequate post-operative nutritional intake is to keep a careful daily record of all nutritional intakes. The daily caloric intake is compared to calculated or measured energy expenditure, and adjusted if necessary.

2. Caloric and protein requirements before and after surgery

There is good evidence that five to ten days of total parenteral nutrition (TPN) at 30-35 kcal/kg^{-1}/day^{-1} and 0.16 - 0.20 g nitrogen/kg^{-1}/day^{-1} before major abdominal surgery in malnourished patients decreases overall post-operative morbidity (5 – 7) (Fig. 2).
Although similar beneficial effects would be expected from preoperative oral nutritional support in patients who tolerate it, no trials testing this hypothesis have been reported.

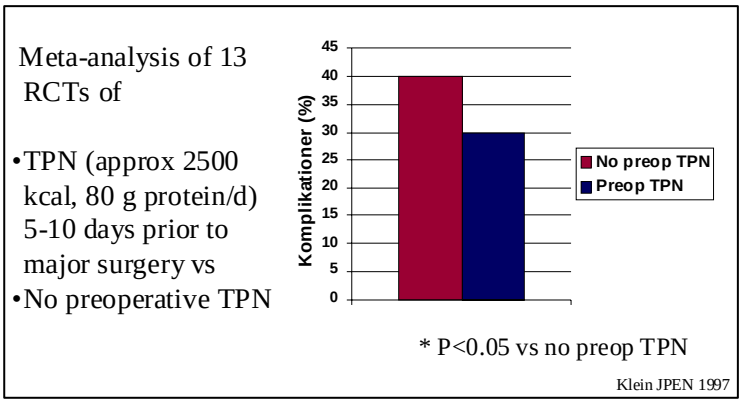

Figure 2 Preoperative TPN in malnourished patients decrease the risk of postoperative complications

Routine TPN in the post-operative phase, in contrast to preoperative TPN, has been found to significantly increase post-operative morbidity in meta-analysis (3, 8).

Caloric and protein requirements after major surgery in current perioperative care are lower than those quoted in traditional literature on post-operative metabolism (Fig. 3).

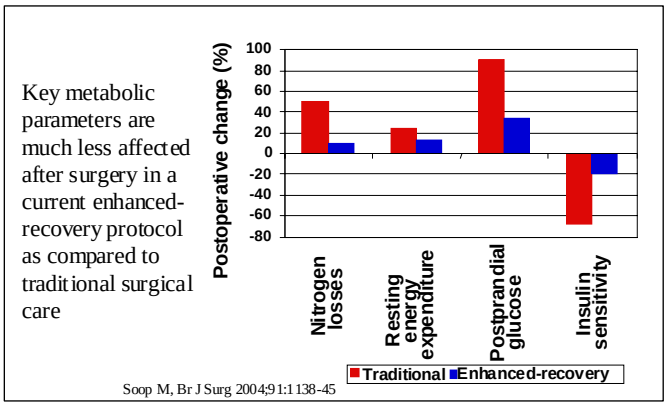

Figure 3 Metabolic response to surgery in traditional perioperative care vs enhanced-recovery protocol

Resting energy expenditure increased by only 13% after major colorectal surgery in recent study in an enhanced-recovery protocol, while urinary nitrogen losses were no higher than those in healthy volunteers (9).

Thus, a guideline for un-complicated, mobilising post-operative patients is to provide at least 25 kcal/kg^{-1}/day^{-1} and 0.15 g N/kg^{-1}/day^{-1}.

A field of current intense investigation is so-called immuno-nutrition with various specific nutrients such as arginine, glutamine, nucleotides and omega-3 fatty acids, given before or after surgery and often in various combinations. A recent meta-analysis found that such immunonutrition significantly reduced morbidity in critical illness, but not after elective surgery (10). In malnourished patients, preoperative immunonutrition has been associated with decreased post-operative morbidity and quicker recovery (11).

3. Routes of nutrition in the surgical patient

It has been firmly established that the enteral route should be used for total or partial nutritional support as tolerated, as this route is associated with lower complication rates than the parenteral (12). Additional caloric needs are covered via the parenteral route. Contrary to traditional belief, early (< 24 h post-operative) feeding above a bowel anastomosis has not been associated with an increased risk of anastomotic dehiscence; indeed there was a near-significant risk reduction in a recent meta-analysis of trials comparing early feeding with late reintroduction of oral diet after gastrointestinal surgery (13) (Fig. 4).

Significant reductions of post-operative infectious complication rates and lengths of hospital stay were found with early feeding as compared to the traditional gradual reintroduction of diet (13).

Patients with an anastomosis in the upper gastrointestinal tract, however, are a subgroup for which trials of early oral intake of nutrients are lacking. Therefore, it may be prudent to feed these patient via a feeding jejunostomy or, perhaps more safely (14), via a naso-jejunal tube through the anastomosis.

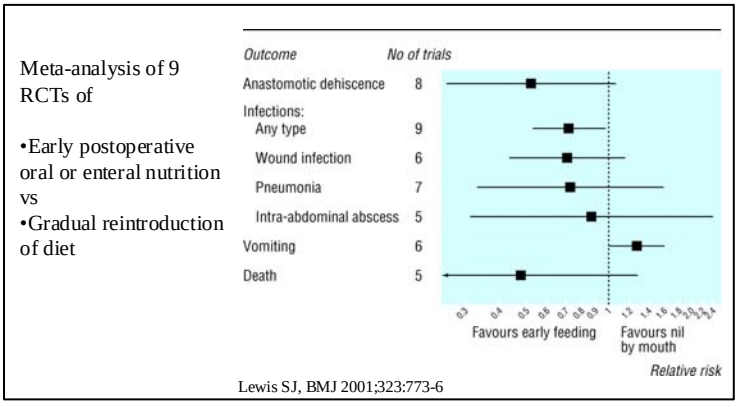

Figure 4 Postoperative eraly oral or enteral nutrition is safe and decreases postoperative infectious complications

In patients with gastrointestinal paralysis for any reason, partial or total parenteral nutrition must be initiated. Although no data has been reported on the effects of delayed TPN in prolonged post-operative ileus, expert groups recommend waiting at least five days before starting TPN in well-nourished patients, as too aggressive parenteral nutrition will increase complications in this group (3, 8). In malnourished patients, however, parenteral nutrition should be started earlier in post-operative ileus (8).

4. Postoperative gastrointestinal paralysis

Paralysis of the gastrointestinal tract has been a major problem in traditional surgical care, limiting the tolerance to oral or enteral nutrition (15). The time to recovery of gastrointestinal function has often been cited as 2-5 days. Delayed oral or enteral nutrition significantly delays recovery and increases the risk of infectious complications as compared to early reintroduction of feeding (13).
The causes of postoperative gastrointestinal paralysis are multifactorial. The main causes are inhibitory sympathetic activity in response to pain and dissection in the peritoneum, local release of inhibitory neurotransmitters in response to manipulation of the bowel, a direct inhibitory effect of exogenous and endogenous opioids, and fluid overload. Most of these effects can be influenced by perioperative interventions, minimising or even eliminating postoperative ileus (16).

5. Thoracic epidural analgesia

Catecholamine release occurs during and after surgery both systemically from the adrenal medulla in response to apprehension and pain, and locally from sympathetic nerve endings in response to dissection in the visceral peritoneum.
The adrenal medulla is innervated via segments T5-T11, the small bowel via T9-T12 and the colon via T11-L2.
Not surprisingly, an epidural block with a local anaesthetic at a mid-thoracic level effectively decreases circulating concentrations of catecholamines (17, 18) and significantly shortens the duration of postoperative ileus (6) as compared to systemically administered opioids (Fig. 5).

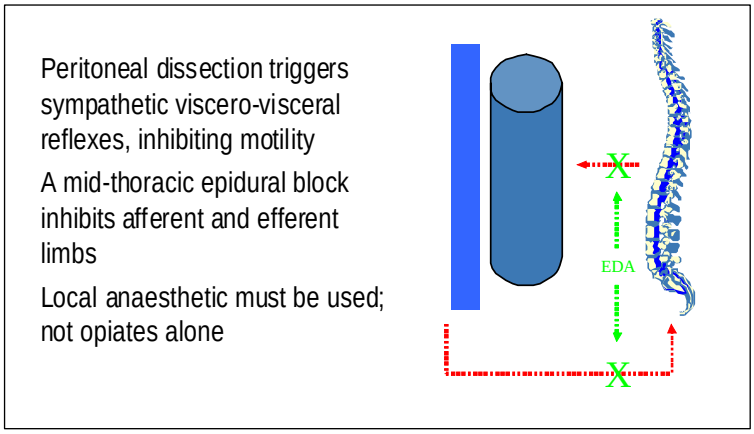

Figure 5 Peritoneal dissection and postoperative ileus

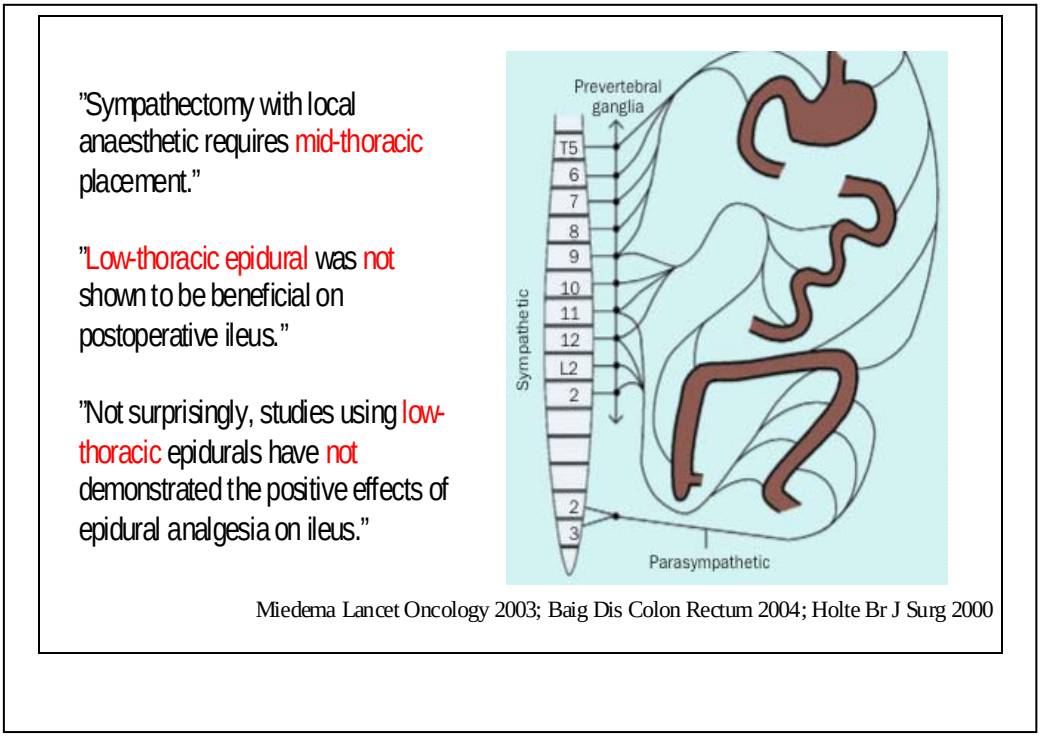

Figure 6 Mid-thoracic epidural is required for sympathetic block of the intestinal tract

As is apparent from the innervation of the adrenal medulla and the bowel, the epidural block must be mid-thoracic rather than low-thoracic or lumbar (20 – 22) to achieve this sympathetic block (Fig. 6). Thus, this requires a more cephalad level of epidural block than that required for analgesia alone in lower abdominal or pelvic surgery.
To increase the analgesic effect of epidurally administered local anaesthetics, opioids are often added to the epidural infusate. Although the addition of a low dose of opioids to the epidural infusate may contribute to postoperative ileus, the effect is small (20) and it allows for a lower dosage of epidural local anaesthetic, minimising lower limb paralysis.

6. Avoidance of opioids

The gut paralytic effect of opioids is four times as strong as their analgesic effect (23). One benefit of epidural analgesia is that it eliminates the need for postoperative systemic opioid analgesia.
When epidural analgesia is discontinued, non-steroidal anti-inflammatory drugs (NSAIDs) and paracetamol reduce the need for opioid analgesia and can be expected to decrease postoperative ileus.
However, even though the systemic administration of opioids can be avoided by multimodal analgesia based on epidural analgesia, NSAIDs and paracetamol, endogenous opioid production is significant in the postoperative period (24). Locally active oral opioid receptor antagonists, although still experimental, have been shown to significantly decrease postoperative ileus (25).

7. Perioperative fluid balance

It is traditional to substitute real and perceived fluid losses during and after surgery liberally. This practice, which originated in trauma surgery, has recently been shown to be detrimental to gastrointestinal function (26) and postoperative morbidity (27) in elective surgery. From animal studies, it is clear that such fluid overload causes oedema and paralysis of the stomach wall.
In humans, a perioperative fluid regime aiming at maintaining fluid balance rather than the traditional fluid overload has been shown to significantly decrease the time to return of bowel function and discharge following colonic resection (26) (Fig. 7).
Three factors partly responsible for an increased need for perioperative fluids are preoperative bowel preparation, preoperative overnight fasting and epidural analgesia.
The negative effects of these factors can be minimised in modern perioperative care.

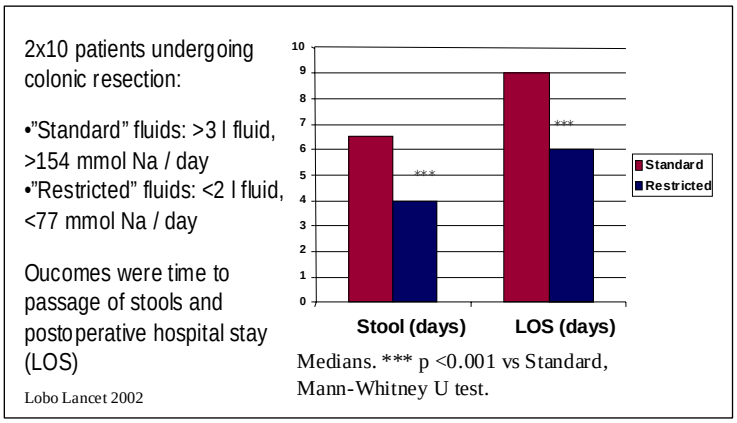

Figure 7 Postoperative fluid and sodium balance promotes gastrointestinal function

In colonic surgery, routine preoperative bowel preparation is now known to confer no clinical benefits, and in fact increases the risk of anastomotic dehiscence (28). Preoperative overnight fasting has also been shown to confer no benefits (see module 17.2). Epidural-induced vasodilatation is preferably treated by vasopressants rather than fluid boluses (29).

8. Other interventions to limit postoperative ileus

Preoperative patient education and coaching has been shown to confer multiple benefits to postoperative recovery as compared to general reassurance, among those an earlier return of bowel function (30). This is a simple, inexpensive intervention that is easily implemented.
Prokinetic drugs have had a disappointing track record in affecting postoperative ileus (23). Cisapride had significant clinical effects in some trials, but has now been withdrawn. Metoclopramide, although still popular, has been shown to have no effect on postoperative ileus (23).

A postoperative laxative agent has been shown to significantly shorten the time to return of bowel function in a double-blinded study in patients after appendicectomy (31) (Fig. 8).
Postoperative bowel stimulation with magnesium oxide has now been part of enhanced-recovery protocols in elective colonic surgery for several years without an increase in complications (32).
Surgical technique may influence the duration of postoperative gastrointestinal paralysis.
Interestingly, mere manipulation of the small bowel causes the same distribution and duration of postoperative intestinal ileus as does extensive dissection of the right or left colon in a primate model (33). Thus, efforts to minimise the magnitude of the surgical trauma, such as the use of minimal abdominal wall incisions, may be beneficial on postoperative bowel function. Laparoscopic colonic surgery may promote gastrointestinal function as compared to open surgery (23), although no such benefit was seen in a recent blinded study within an enhanced-recovery protocol (34).
Routine postoperative nasogastric drainage not only prevents oral feeding, but has been shown not to be of any benefit and should be abandoned after elective laparotomy (35).

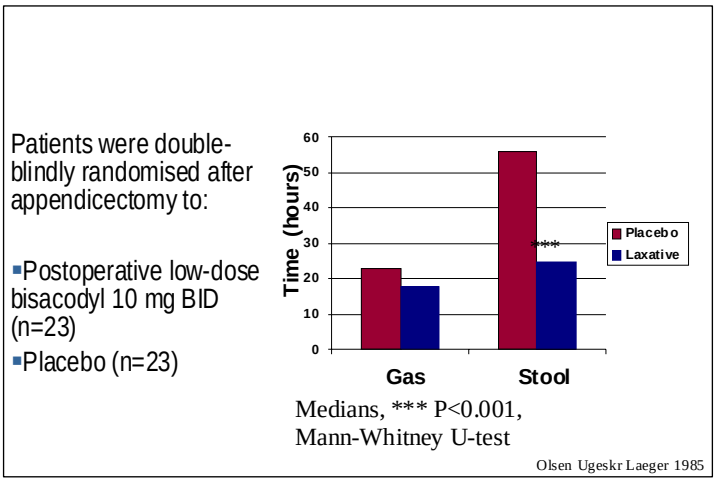

Figure 8 Postoperative laxatives shorten time to recovery of gastrointestinal functionestinal function

9. Gastrointestinal function after colonic surgery in enhanced-recovery protocols

Enhanced-recovery protocols combine several of the interventions described above. The effect on postoperative gut function is impressive. Gastrointestinal transit was unaffected by colonic resection in a protocol combining thoracic epidural analgesia and postoperative magnesium oxide, as compared to healthy controls (16). Such protocols allow for oral intake of solid food and oral nutritional supplements early after surgery (36).

References

1. McWhirter, J.P. and C.R. Pennington, Incidence and recognition of malnutrition in hospital. Bmj, 1994. 308(6934): p. 945-8.
2. Baker, J.P., et al., Nutritional assessment: A comparison of clinical judgement and objective measurements. N Engl J Med, 1982. 306: p. 969-972.
3. Klein, S., et al., Nutrition support in clinical practice: review of published data and recommendations for future research directions. JPEN, 1997. 21: p. 133-156.
4. Detsky, A.S., J.P. Baker, and R.A. Mendelson, Evaluating the accuracy of nutritional assessment techniques applied to hospitalized patients: Methodology and comparisons. JPEN, 1984. 8: p. 153.
5. Bellantone, R., et al., Preoperative parenteral nutrition in malnourished surgical patients. Acta Chir Scand, 1988. 22: p. 249-251.
6. Meguid, M., M. Curtas, and V. Meguid, Effects of pre-operative TPN on surgical risk - preliminary status report. Br J Clin Prac, 1988. 42(Suppl): p. 53-58.
7. Moghissi, K., J. Hornshaw, and P. Teasdale, Parenteral nutrition in carcinoma of the oesophagus treated by surgery: nitrogen balance and clinical studies. Br J Surg, 1977. 64: p. 125-128.
8. Braunschweig, C.L., et al., Enteral compared with parenteral nutrition: a meta-analysis. Am J Clin Nutr, 2001. 74(4): p. 534-42.
9. Soop, M., et al., Randomized clinical trial of the effects of immediate enteral nutrition on metabolic responses to major colorectal surgery in an enhanced recovery protocol. Br J Surg, 2004. 91(9): p. 1138-45.

10. Heyland, D.K., et al., Should immunonutrition become routine in critically ill patients? JAMA, 2001. 286: p. 944-953.
11. Gianotti, L., et al., A randomized controlled trial of preoperative oral supplementation with a specialized diet in patients with gastrointestinal cancer. Gastroenterology, 2002. 122(7): p. 1763-70.
12. Moore, F.A., et al., Early enteral feeding, compared with parenteral, reduces post-operative septic complications: the result of a meta-analysis. Ann Surg, 1992. 216: p. 172-183.
13. Lewis, S.J., et al., Early enteral feeding versus "nil by mouth" after gastrointestinal surgery: systematic review and meta-analysis of controlled trials. Bmj, 2001. 323(7316): p. 773-6.
14. Zapas, J.L., S. Karakozis, and J.R. Kirkpatrick, Prophylactic jejunostomy: a reappraisal. Surgery, 1998. 124(4): p. 715-9; discussion 719-20.
15. Watters, J.M., et al., Immediate postoperative enteral feeding results in impaired respiratory mechanics and decreased mobility. Ann Surg, 1997. 226(3): p. 369-380.
16. Basse, L., J.L. Madsen, and H. Kehlet, Normal gastrointestinal transit after colonic resection using epidural analgesia, enforced oral nutrition and laxative. Br J Surg, 2001. 88(11): p. 1498-500.
17. Tsuji, H., et al., Attenuation of adrenocortical response to upper abdominal surgery with epidural blockade. Br J Surg, 1983. 70: p. 122-124.
18. Uchida, I., et al., Effect of epidural analgesia on postoperative insulin resistance as evaluated by insulin clamp technique. Br J Surg, 1988. 75(6): p. 557-62.
19. Jorgensen, H., et al., Epidural local anaesthetics versus opioid-based analgesic regimens on postoperative gastrointestinal paralysis, PONV and pain after abdominal surgery. Cochrane Database Syst Rev, 2000(4): p. CD001893.
20. Holte, K. and H. Kehlet, Postoperative ileus: a preventable event. Br J Surg, 2000. 87(11): p. 1480-93.
21. Miedema, B.W. and J.O. Johnson, Methods for decreasing postoperative gut dysmotility. Lancet Oncol, 2003. 4(6): p. 365-72.
22. Baig, M.K. and S.D. Wexner, Postoperative ileus: a review. Dis Colon Rectum, 2004. 47(4): p. 516-26.
23. Holte, K. and H. Kehlet, Postoperative ileus: progress towards effective management. Drugs, 2002. 62(18): p. 2603-15.
24. Brix-Christensen, V., et al., Endogenous morphine levels increase following cardiac surgery as part of the antiinflammatory response? Int J Cardiol, 1997. 62(3): p. 191-7.
25. Taguchi, A., et al., Selective postoperative inhibition of gastrointestinal opioid receptors. N Engl J Med, 2001. 345(13): p. 935-40.
26. Lobo, D.N., et al., Effect of salt and water balance on recovery of gastrointestinal function after elective colonic resection: a randomised controlled trial. Lancet, 2002. 359(9320): p. 1812-8.
27. Brandstrup, B., et al., Effects of intravenous fluid restriction on postoperative complications: comparison of two perioperative fluid regimens: a randomized assessor-blinded multicenter trial. Ann Surg, 2003. 238(5): p. 641-8.
28. Slim, K., et al., Meta-analysis of randomized clinical trials of colorectal surgery with or without mechanical bowel preparation. Br J Surg, 2004. 91(9): p. 1125-30.
29. Holte, K., et al., Epidural anesthesia, hypotension, and changes in intravascular volume. Anesthesiology, 2004. 100(2): p. 281-6.
30. Disbrow, E.A., H.L. Bennett, and J.T. Owings, Effect of preoperative suggestion on postoperative gastrointestinal motility. West J Med, 1993. 158(5): p. 488-92.
31. Olsen, O., T. Hakansson, and J.I. Forrest, [Bisocadyl in the treatment of postoperative intestinal atony]. Ugeskr Laeger, 1985. 147(39): p. 3070-1.
32. Basse, L., et al., A clinical pathway to accelerate recovery after colonic resection. Ann Surg, 2000. 232(1): p. 51-7.
33. Graber, J.N., et al., Relationship of duration of postoperative ileus to extent and site of operative dissection. Surgery, 1982. 92(1): p. 87-92.
34. Basse, L., et al., Functional recovery after open versus laparoscopic colonic resection: a randomized, blinded study. Ann Surg, 2005. 241(3): p. 416-23.
35. Nelson, R., B. Tse, and S. Edwards, Systematic review of prophylactic nasogastric decompression after abdominal operations. Br J Surg, 2005. 92(6): p. 673-680.
36. Henriksen, M.G., H.V. Hansen, and I. Hessov, Early oral nutrition after elective colorectal surgery: influence of balanced analgesia and enforced mobilization. Nutrition, 2002. 18(3): p. 263-7.