American Journal of Gastroenterology
© 2007 by Am. Coll. of Gastroenterology
Published by Blackwell Publishing

ISSN 0002-9270
doi: 10.1111/j.1572-0241.2007.01357.x

CME

Oral Refeeding After Onset of Acute Pancreatitis: A Review of Literature

Maxim S. Petrov, M.D.,[1] Hjalmar C. van Santvoort, M.D.,[1] Marc G.H. Besselink, M.D.,[1] Geert A. Cirkel, M.D.,[1] Menno A. Brink, M.D., Ph.D.[2] and Hein G. Gooszen, M.D., Ph.D.[1]
Department of Surgery, University Medical Center Utrecht, Utrecht, The Netherlands; and Department of Gastroenterology, Meander Medical Center, Amersfoort, The Netherlands

BACKGROUND: Oral refeeding in patients recovering from acute pancreatitis may cause pain relapse. Patients with pain relapse may be ill for prolonged periods, thereby consuming additional health care resources. We aimed to determine the incidence and risk factors of pain relapse on the basis of reviewing all studies on oral refeeding in acute pancreatitis.

METHODS: Relevant literature cited in three electronic databases (Cochrane Central Register of Controlled Trials, EMBASE, and MEDLINE) as well as the abstracts of major gastroenterological meetings was reviewed. Outcome measures studied were the incidence of pain relapse and length of hospital stay.

RESULTS: A total of three studies met the inclusion criteria. Sixty of 274 patients (21.9%) experienced pain relapse during the course of acute pancreatitis. In 47 of 60 (78.3%) patients pain relapse occurred within 48 h after commencement of oral refeeding. Two studies showed a significantly higher Balthazar's CT score on hospital admission in patients with pain relapse, whereas all three studies found no difference in the severity scores between patients with and without pain relapse. All three studies found a significant increase in the length of hospital stay in patients with pain relapse.

CONCLUSIONS: The incidence of pain relapse after oral refeeding in acute pancreatitis is relatively high. Thereby, the quest for new therapeutical modalities that can prevent pain relapse is of current importance.

(Am J Gastroenterol 2007;102:2079–2084)

INTRODUCTION

During the last decade, artificial nutrition in patients with acute pancreatitis has shifted from a tool to provide calories to a strong therapeutic device, aiming at reducing complications and promoting faster recovery and resolution of the disease process (1, 2). However, up to now one of the unanswered questions in the nutritional management of acute pancreatitis is the optimal timing of oral refeeding (3, 4).

In general, oral intake of limited amounts of calories is initiated when abdominal pain has subsided, parenteral narcotics are no longer required, abdominal tenderness has markedly decreased, nausea and vomiting have ceased, and/or bowel sounds are present (5). The current ESPEN guidelines state that in mild acute pancreatitis "oral food intake should be tried as soon as possible" (6). Nonetheless, premature initiation of oral refeeding may stimulate pancreatic secretion and leading to the relapse of pain as well as prolongation of the hospital stay, thereby increasing treatment costs (7). Future trials will have to address these issues. Before such studies can be initiated baseline data on the effects of oral refeeding are needed. To that extent this review was conducted, it assesses the incidence and risk factors of pain relapse after oral refeeding in patients with acute pancreatitis.

METHODS

We aimed to identify all relevant studies on oral refeeding in patients with acute pancreatitis. A computerized English literature search of the Cochrane Central Register of Controlled Trials, EMBASE, and Medline until December 31, 2006 was conducted using predefined search terms. The search strategy for PubMed was "acute pancreatitis"(Title/Abstract) or "pancreatitis"(Title/Abstract) and "refeeding"(Title/Abstract). The search strategy for Embase included next terms: "acute pancreatitis" and "refeeding" and [humans]/lim. The search strategy in Cochrane library was "acute pancreatitis" and "refeeding." Bibliographies of all selected articles that included information on oral refeeding in acute pancreatitis were reviewed for other relevant articles. The abstracts of major gastroenterological meetings (DDW, UEGW) since 2001 were also screened. The following selection criteria were used to identify published studies for

The present review demonstrates the high incidence of pain relapse after oral refeeding in patients with acute pancreatitis and underlines the need for further high quality clinical trials on the use of nutritional support in acute pancreatitis.

To access a continuing medical education exam for this article, please visit www.acg.gi.org/journalcme.

Table 1. Summary of Study Characteristics for the Included Trials

Study	Year	Setting	Number of Patients	Design	Inclusion Criteria	Exclusion Criteria	Mean Severity (Score)
Levy *et al*.	1997	France	116	Multicenter prospective study	Pain; amylase/lipase >5 URL or CT/US; "severe enough to stop oral refeeding for 48 h"	Delay between onset of symptoms and refeeding >30 days; surgery due to AP	2.0 ± 0.4 (Ranson)
Pandey *et al.*	2004	India	28	Randomized controlled trial	Pain; amylase/lipase >5 URL or CT/US; "severe enough to stop oral refeeding for 48 h"	Delay between onset of symptoms and refeeding >30 days; patient was already on oral feeds at presentation; exacerbation of chronic pancreatitis; surgery due to AP	4.0 ± 1.7 (APACHE II)
Chebli *et al.*	2005	Brazil	130	Prospective study	Pain; amylase/lipase >3 URL or CT/US	CT >50% of pancreatic necrosis; organ failure; surgery due to AP	1 ± 1 (Ranson)

∗ URL = upper reference level.

inclusion in this analysis: (a) study design: prospective, (b) population: patients with acute pancreatitis, (c) intervention: oral refeeding, and (d) outcome variables: the frequency of pain relapse and length of hospital stay. Records extracted by the initial search were scanned to exclude obviously irrelevant studies, and then trials potentially meeting the inclusion criteria were identified. Full-text articles were retrieved and reviewed by two authors (MSP and HCvS) for the purpose of applying inclusion criteria independently. All differences were resolved by discussion among the authors of this review. Data from the studies were extracted using standardized forms.

RESULTS

A total of 17 publications were identified through the literature search. Fourteen of 17 publications were subsequently excluded because they were guidelines, editorials, or studies in which the outcome variables were not reported. A total of three trials were included in the review (8–10). The characteristics of included studies are presented in Table 1. Overall, 274 patients with acute pancreatitis were enrolled in these trials (Table 2). The primary end point of all studies was the incidence of pain relapse during an attack of acute pancreatitis. The treatment protocol of each study stated that oral feeding could be commenced at the decision of the responsible physician. No advice concerning optimal timing was given. Sixty of 274 patients (21.9%) suffered from a pain relapse during the course of disease. This percentage ranged from 21% to 27% among studies (24.3% on average). In 47 of 60 (78.3%) patients with pain relapse, this occurred within 48 h after refeeding was started (Table 3).

Levy *et al*. (8) carried out the first nonrandomized study assessing the frequency and risk factors of pain relapse during the refeeding period in patients with acute pancreatitis after a fasting period >48 h. Twenty-one percent of patients (24 of 116) presented a pain relapse and 12.0 ± 0.8 days delay between onset of symptoms and oral refeeding. The authors proposed the following formula in predicting the pain after refeeding: 0.64a + 1.11b + 2.18c – 9.06, where a = Balthazar's CT score, b = duration of painful period, c = serum lipase concentration on the day before refeeding <3 times the upper normal limit, and 9.06 = constant.

Pandey *et al*. (9) performed a randomized controlled trial to compare oral (N = 15) and jejunal tube (N = 13) nutrition in relation to refeeding pain in patients with acute pancreatitis. The median duration between onset of symptoms and start of refeeding was 5 (5–18) days in the oral refeeding group and 7 (6–17) days in the enteral-tube-refeeding group. There were no complications of enteral feeding. None of the patients in the enteral refeeding group had pain relapse, in comparison

Table 2. Demography of Patients in Included Trials

Study	Total Patients	Gender		Age	Etiology		
		Men	Women		Biliary AP	Alcohol AP	Other
Levy *et al.*	116	74 (64%)	42 (36%)	51 ± 4	54 (47%)	36 (31%)	26 (20%)
Pandey *et al.*	28	15 (53.7%)	13 (46.3%)	45.2 ± 17.8 38.6 ± 12.4*	14 (50%)	9 (32.1%)	(17.9%)
Chebli *et al.*	130	69 (53.1%)	61 (46.9%)	46.9 (23–75)	60 (46.2%)	42 (32.3%)	28 (21.5%)

*Oral/enteral refeeding groups.

Table 3. Frequency of Pain Relapse After Oral Refeeding in Included Trials

Study	Pain Relapse After Oral Refeeding	<48 h After Refeeding	>48 h After Refeeding
Levy *et al.*	24/116 (21%)	12 (50%)	12 (50%)
Pandey *et al.*	4/15 (27%)	4 (100%)	0 (0%)
Chebli *et al.*	32/130 (25%)	31 (97%)	1 (3%)

to 4 of 15 patients in the oral refeeding group ($P = 0.06$), but this may be due to a type II error. Mean length of hospital stay also tended to be shorter in the enterally refed group (12 ± 5 days *vs* 21 ± 18 days).

A recent prospective nonrandomized trial by Chebli *et al*. (10) aimed to assess the risk factors for pain relapse after oral refeeding in patients convalescing with mild acute pancreatitis. Mean number of days of abdominal pain before oral refeeding was 4.2 ± 0.9 in patients with pain relapse and 4 ± 2.7 in patients without pain relapse. According to the logistic regression model, the independent risk factors of pain relapse were presence of peripancreatic fluid collection, serum CRP on the fourth day, and serum lipase concentration on the day of oral refeeding. All 32 patients with pain relapse were managed with nasojejunal feeding (N = 27) or total parenteral nutrition (N = 5). The authors stated that nutritional support was well tolerated without adverse effects on the course of acute pancreatitis.

In each study a comparative analysis of patients with and without pain relapse was carried out (Table 4). Two studies (8,9) demonstrated a significantly higher Balthazar's CT score at admission in the group with pain relapse, whereas all three trials found no difference in the severity scores between patients with and without pain relapse. All studies also found a significantly longer length of hospital stay in patients with pain relapse. Two of them (8, 9) also reported that the hospital stay after the first attempt of oral refeeding, as well as the total duration of pain, were significantly prolonged in patients with pain relapse.

DISCUSSION

This first review on oral refeeding after the onset of acute pancreatitis reveals that pain relapse during oral refeeding occurs in about one-fifth of patients. Notably, patients that experience pain relapse stay longer in the hospital. Unfortunately, the clinical signs of disease have no predictive value in the detection of patients that will develop pain relapse after oral refeeding. Also, the laboratory and CT predictive factors of pain relapse have no consistency, do not provide a cutoff level

Table 4. Comparison of Patients With Pain Relapse Versus Patients Without Pain Relapse in Included Trials

	Patients With Pain Relapse			Patients Without Pain Relapse			
Parameter	Levy *et al.* (N = 24)	Pandey *et al.* (N = 4)	Chebli *et al.* (N = 32)	Levy *et al.* (N = 92)	Pandey *et al.* (N = 24)	Chebli *et al.* (N = 98)	*P* Value (Study)
Age, yr	51 ± 4	41.5 ± 26.4	47.5 ± 16.3	51 ± 2	41.4 ± 14.1	46.8 ± 15.4	NS
Men/women, %	63/37	NA	53/47	64/36	NA	51/49	NS
Biliary AP (%)	8 (33%)	NA	14 (44%)	46 (50%)	NA	46 (47%)	NS
Alcohol AP (%)	8 (33%)	NA	10 (31%)	28 (30%)	NA	32 (33%)	NS
Other (%)	8 (33%)	NA	8 (25%)	18 (20%)	NA	20 (20%)	NS
Duration of pain before admission, days	1 (0–6)	1 (1–8)	3.1 ± 1.4	1 (0–2)	2 (1–10)	1.6 ± 1.1	<0.01 (Chebli)
Total duration of pain, days	11.0 ± 1.7	12 (6–18)	NA	6.0 ± 0.5	6 (3–15)	NA	<0.002 (Levy) <0.02 (Pandey)
Mean severity (score)	2.3 ± 0.4 (Ranson)	5 (2–14) (APACHE II)	1.1 ± 1.0 (Ranson)	1.9 ± 0.2 (Ranson)	5 (2–14) (APACHE II)	0.9 ± 1.1 (Ranson)	NS
Balthazar's CT score	3.9 ± 0.5	3.5 (3–7)	NA	2.2 ± 0.2	2 (1–7)	NA	<0.002 (Levy) <0.02 (Pandey)
Mean serum amylase level before oral refeeding	2.2 ± 0.7	NA	2.1 ± 0.8	1.6 ± 0.2	NA	1.3 ± 0.4	<0.01 (Chebli)
Mean serum lipase level before oral refeeding	4.0 ± 1.3	NA	2.3 ± 1.9	2.4 ± 0.3	NA	1.3 ± 0.6	<0.01 (Chebli)
Hospital stay after the first attempt of oral refeeding, days	18 ± 3	43.5 (32–48)	NA	7 ± 1	6 (6–21)	NA	<0.001 (Levy) <0.001(Pandey)
Total length of hospital stay, days	33 ± 3	50.5 (35–60)	12.5 ± 4.5	18 ± 1	9.5 (8–25)	7.5 ± 3.0	<0.001 (Levy) <0.004 (Pandey) <0.01 (Chebli)

of parameters, and thereby cannot be readily implemented in day-to-day practice.

The pathophysiology of pain relapse in acute pancreatitis is still unclear. Because patients with pain relapse tended to have a longer duration of initial abdominal pain (10), persistent elevation of serum enzymes (10), and higher Balthazar's scores on admission (8, 9), it may well be that patients with pain relapse are those with more severe acute pancreatitis (11). However, due to the significantly longer postrefeeding length of hospital stay (8, 9) and the absence of difference in the severity scores between patients with and without pain relapse (8–10), premature oral refeeding could also be responsible for the pain relapse. Refeeding pain may be caused by restimulation of pancreatic secretion by oral bolus feeding, which may activate both dormant enzymes and the inflammatory process (12). It is suggested that if refeeding pain is to be prevented the following aspects have to be taken into account: mechanical tolerance (*e.g.*, absence of bloating, nausea, vomiting, abdominal distension, or ileus), biochemical tolerance (*e.g.*, absence of secondary electrolyte or other metabolic derangements), and tolerance involving assimilation (*e.g.*, adequate absorption and absence of diarrhea) (13).

In an attempt to prevent pain relapse in acute pancreatitis after oral refeeding, a French research group suggested the use of a long-acting somatostatin analogue (14). In their study, only 1 of 23 (4.3%) patients treated with one intramuscular injection of lanreotide 30 mg on the day before refeeding had a recurrence of pain from acute pancreatitis, but 15 (65.2%) patients also experienced at least one adverse effect from the drug. Since this was an uncontrolled pilot study, a multicenter randomized placebo-controlled double-blind trial was undertaken further (15). Unfortunately, the injection of lanreotide 30 mg 24 h prior to oral refeeding had no influence on either the rate of pain relapse within the week following oral refeeding or the length of hospital stay.

A possible alternative strategy to prevent pain relapse is the use of enteral tube feeding. A recent randomized trial by Pandey *et al*. (9) compared oral bolus refeeding (started 5 [5–18] days after the onset of acute pancreatitis) and jejunal refeeding (started on 7 [6–17] days) and found a lower risk of pain relapse in jejunally refeed patients. Further, a randomized trial by Eatock *et al*. (16) demonstrated no difference in pain and analgesic requirement between early nasogastric and nasojejunal tube feeding administered within 72 h after onset of pain in patients with severe acute pancreatitis. Notably, it showed that pain measured by visual analogue score decreased markedly from 7 on the first day to 0 on the third day of nutrition in both groups. Similarly, the mean analgesic requirement in the nasojejunal and nasogastric groups was 0 mg of pethidine on the third day of enteral feeding.

There is reason to believe that enteral feeding is superior to parenteral feeding (that is not different from the nil-per-mouth regimen in terms of the gut rest) in improving the tolerance of oral refeeding in patients with acute pancreatitis. A randomized controlled trial from the United States (17) demonstrated that reintroduction of oral feeding was better tolerated in those patients who were randomized to enteral feeding, with 80% (21 of 26) advancing to an oral diet without problem, in comparison to 63% (17 of 27) in the parenterally fed group. Further, in the trial by Gupta *et al*. (18), 17 patients with acute pancreatitis were randomized (9 in the enterally fed group, 8 in the parenterally fed group). Enteral nutrition was initiated within 6 h of admission and led to no nutrition-associated complications. Bowel function returned to normal more quickly in the enteral nutrition group as evidenced by passing flatus (1 [0–2] days *vs* 2 [1–5] days, $P = 0.07$) and stool (2 [0–3] days *vs* 3 [2–9] days, $P = 0.01$) as well as by resumption of full oral intake (2 [0–3] days *vs* 3 [2–9] days, $P = 0.02$). Fatigue, estimated by visual analogue score, improved more rapidly in the enteral than in the parenteral group (significantly different on day 3, $P = 0.01$). Further, when gastrointestinal motility is not impaired, orally administered enteral polymeric formula, provided on day 2 after admission, is feasible and leads to no clinical or biochemical deterioration in most patients with acute pancreatitis (19).

The apparent benefit of enteral tube feeding is in keeping with current views on the importance of luminal nutrition for the stimulation of postprandial gut motility (20). The potential consequence of impaired intestinal motility, as evidenced by disturbance in the migrating motor complex (often referred to as "the housekeeper of the gut") is decreased gut propulsion (21–23). There is substantial evidence that migrating motor complex's cycle length during acute pancreatitis and/or starvation is significantly decreased and that this may lead to less proximal propulsion, small bowel bacterial overgrowth, and bacterial translocation (22, 24, 25). Together with mucosal barrier dysfunction and reduced immune response this may drive to a local inflammatory response and eventually to SIRS and organ failure in patients with acute pancreatitis (25, 26). Thus, these data question the rationale of fasting patients with acute pancreatitis prior to oral refeeding.

Another relevant issue in acute pancreatitis is the cost of treatment. Two-thirds of the actual cost of treatment is attributable to hospitalization (27). Recently, Jacobson *et al*. (28) randomized 121 patients with a mild course of disease to receive either a clear liquid diet or a low-fat solid diet and found that the initiation of feeding with a low-fat solid diet was as well tolerated as a clear liquid diet, but did not result in a shorter length of hospital stay. Hypothetically, the administration of enteral tube feeding, by prevention (attenuation) of ileus and/or improving the tolerance of oral refeeding, should reduce the risk of pain relapse after acute pancreatitis and, likely, the length of hospital stay in this category of patients (Fig. 1). Taking into account that 80–85% of patients with acute pancreatitis have an uneventful course of disease but nevertheless usually need 5–7 days of hospitalization (29, 30), such an approach might provide considerable fund savings.

In conclusion, the present review has identified a 22% rate of pain relapse after oral refeeding in patients with acute pancreatitis that is associated with a significant increase in

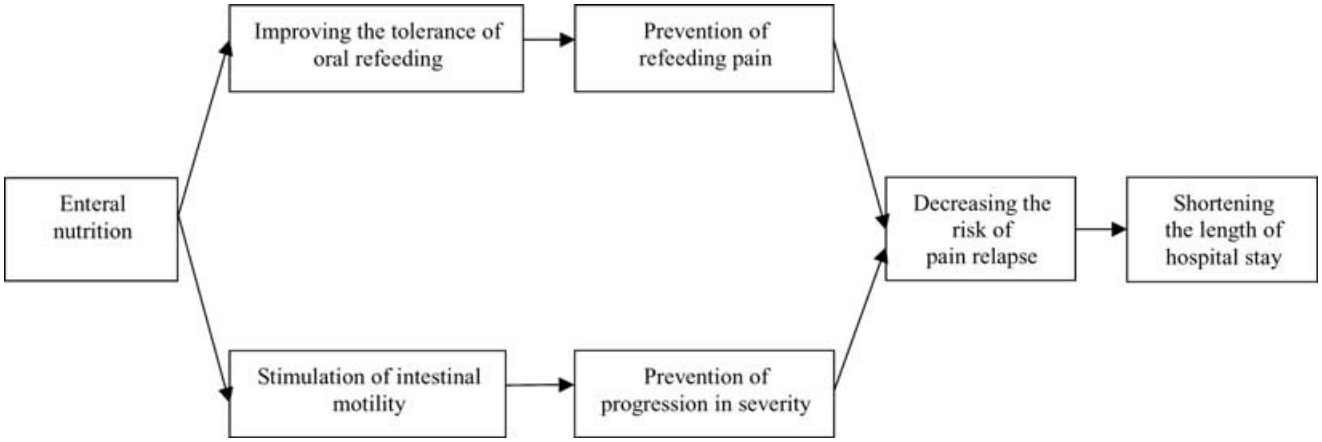

Figure 1. Hypothetical mechanism of action of enteral nutrition in acute pancreatitis.

hospital stay. Enteral nutrition might be a valuable modality to reduce a risk of pain relapse, thereby potentially shortening the length of hospital stay. Further, adequately powered studies are needed to address this question and assess whether such an approach will be cost-effective.

Reprint requests and correspondence: Professor H.G. Gooszen, Department of Surgery, University Medical Center Utrecht, P.O. Box 85500, HP G04.228, 3508 GA Utrecht, The Netherlands.
Received January 25, 2007; accepted April 10, 2007.

REFERENCES

1. McClave SA, Chang WK, Dhaliwal R, et al. Nutrition support in acute pancreatitis: A systematic review of the literature. JPEN J Parenter Enteral Nutr 2006;30:143–56.
2. Heinrich S, Schafer M, Rousson V, et al. Evidence-based treatment of acute pancreatitis: A look at established paradigms. Ann Surg 2006;243:154–68.
3. Pezzilli R, Fantini L, Morselli-Labate AM. New approaches for the treatment of acute pancreatitis. JOP 2006;7:79–91.
4. Radenkovic D, Johnson CD. Nutritional support in acute pancreatitis. Nutr Clin Care 2004;7:98–103.
5. Banks PA, Freeman ML; The Practice Parameters Committee of the American College of Gastroenterology. Practice guidelines in acute pancreatitis. Am J Gastroenterol 2006;101:2379–400.
6. Meier R, Ockenga J, Pertkiewicz M, et al. ESPEN guidelines on enteral nutrition: Pancreas. Clin Nutr 2006;25:275–84.
7. McClave SA, Ritchie CS. Artificial nutrition in pancreatic disease: What lessons have we learned from the literature? Clin Nutr 2000;19:1–6.
8. Levy P, Heresbach D, Pariente EA, et al. Frequency and risk factors of recurrent pain during refeeding in patients with acute pancreatitis: A multivariate multicentre prospective study of 116 patients. Gut 1997;40:262–6.
9. Pandey SK, Ahuja V, Joshi YK, et al. A randomized trial of oral refeeding compared with jejunal tube refeeding in acute pancreatitis. Indian J Gastroenterol 2004;23:53–5.
10. Chebli JM, Gaburri PD, De Souza AF, et al. Oral refeeding in patients with mild acute pancreatitis: Prevalence and risk factors of relapsing abdominal pain. J Gastroenterol Hepatol 2005;20:1385–9.
11. Windsor JA. Eating after mild pancreatitis. J Gastroenterol Hepatol 2005;20:1315–7.
12. Frossard JL, Hadengue A. Acute pancreatitis: New physiopathological concepts. Gastroenterol Clin Biol 2001;25:164–76.
13. Mallampalli A, McClave SA, Snider HL. Defining tolerance to enteral feeding in the intensive care unit. Clin Nutr 2000;19:213–5.
14. Levy P, Hastier P, Arotcarena R, et al. Efficacy of lanreotide 30 mg on prevention of pain relapse after oral refeeding in patients with necrotizing acute pancreatitis. A phase II prospective multicentre study. Pancreatology 2004;4:229–32.
15. Levy P, Ponchon T, Hastier P, et al. Use of lanreotide in the prevention of pain relapse following reintroduction of oral diet in patients following an acute episode of acute necrotizing pancreatitis: Multicentre prospective randomized placebo-controlled double-blind study. Gut 2005;54(Suppl VII):A222.
16. Eatock FC, Chong P, Menezes N, et al. A randomized study of early nasogastric versus nasojejunal feeding in severe acute pancreatitis. Am J Gastroenterol 2005;100:432–9.
17. Abou-Assi S, Craig K, O'Keefe SJ. Hypocaloric jejunal feeding is better than total parenteral nutrition in acute pancreatitis: Results of a randomized comparative study. Am J Gastroenterol 2002;97:2255–62.
18. Gupta R, Patel K, Calder PC, et al. A randomised clinical trial to assess the effect of total enteral and total parenteral nutritional support on metabolic, inflammatory and oxidative markers in patients with predicted severe acute pancreatitis (APACHE II > or = 6). Pancreatology 2003;3:406–13.
19. Pupelis G, Snippe K, Plaudis H, et al. Early oral feeding in acute pancreatitis: An alternative approach to tube feeding. Preliminary report. Acta Chir Belg 2006;106:181–6.
20. Dervenis C. Enteral nutrition in severe acute pancreatitis: Future development. JOP 2004;5:60–3.
21. Vantrappen G, Janssens J, Hellemans J, et al. The interdigestive motor complex of normal subjects and patients with bacterial overgrowth of the small intestine. J Clin Invest 1977;59:1158–66.
22. Li YF, Newton TJ, Weisbrodt NW, et al. Intestinal migrating myoelectric complexes in rats with acute pancreatitis and bile duct ligation. J Surg Res 1993;55:182–7.
23. Husebye E. Gastrointestinal motility disorders and bacterial overgrowth. J Intern Med 1995;237:419–27.
24. Moody FG, Haley-Russell D, Muncy DM. Intestinal transit and bacterial translocation in obstructive pancreatitis. Dig Dis Sci 1995;40:1798–804.

25. Van Felius ID, Akkermans LM, Bosscha K, et al. Interdigestive small bowel motility and duodenal bacterial overgrowth in experimental acute pancreatitis. Neurogastroenterol Motil 2003;15:267–76.
26. Nieuwenhuijs VB, Verheem A, van Duijvenbode-Beumer H, et al. The role of interdigestive small bowel motility in the regulation of gut microflora, bacterial overgrowth, and bacterial translocation in rats. Ann Surg 1998;228:188–93.
27. Neoptolemos JP, Raraty M, Finch M, et al. Acute pancreatitis: The substantial human and financial costs. Gut 1998;42:886–91.
28. Jacobson BC, Vandervliet MB, Hughes M, et al. A prospective, randomized, controlled trial of clear liquids vs. low-fat solid diet as the initial meal after mild pancreatitis. Gastroenterology 2006;130(Suppl II):A82.
29. Working Party of the British Society of Gastroenterology; Association of Surgeons of Great Britain and Ireland; Pancreatic Society of Great Britain and Ireland; Association of Upper GI Surgeons of Great Britain and Ireland. UK guidelines for the management of acute pancreatitis. Gut 2005;54(Suppl 3):1–9.
30. Fantini L, Tomassetti P, Pezzilli R. Management of acute pancreatitis: Current knowledge and future perspectives. World J Emerg Surg 2006;1:16–21.

CONFLICT OF INTEREST

Guarantor of the article: Maxim S. Petrov, M.D.
Specific author contributions: MS Petrov – planning, conducting, and drafting the manuscript, HC van Santvoort – conducting and drafting the manuscript, MGH Besselink – conducting and drafting the manuscript. GA Cirkel – conducting and drafting the manuscript, MA Brink – drafting the manuscript, HG Gooszen – drafting the manuscript.
Financial support: None.
Potential competing interests: None.