Intensive Care Med (1999) 25: 95–101

Management of nutrition in European intensive care units: results of a questionnaire

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Accepted: 7 October 1998

With the participation of the European Society for Parenteral and Enteral Nutrition. This work was supported by an educational grant form Abbott International

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Abstract *Objective*: To describe the practical aspects of nutritional management in intensive care units (ICUs).
Design: A 49-item questionnaire was sent to the physician members of the European Society for Intensive Care Medicine. The issues addressed included: medical environment, assessment of nutritional status and current practice for enteral and parenteral nutrition.
Setting: 1608 questionnaires were sent in 35 European countries.
Analysis: The answers were pooled and stratified by country.
Results: 271 questionnaires were answered (response rate 17 %). Assessment of nutritional status was generally based on clinical (99 %) and biochemical (82 %) parameters rather than on functional (24 %), anthropometric (23 %), immunological (18 %) or questionnaire-based (11 %) data.
Two thirds of 2774 patients hospitalised in the corresponding ICUs at the time the questionnaire was answered were receiving nutritional support; 58 % of those were fed by the enteral route, 23 % by the parenteral route and 19 % by combined enteral and parenteral. The preferred modality was enteral nutrition, instituted before the 48th h after admission, at a rate based on estimated caloric requirements. Specific and modified solutions were rarely used. Parenteral nutrition was less commonly used than enteral, although the practices differed between countries. It was mainly administered as hospital-made all-in-one solutions, at a rate based on calculated caloric requirements.
Conclusions: European intensivists are concerned by the nutritional management of their patients. The use of nutritional support is common, essentially as early enteral feeding.

Introduction

The nutritional management of critically ill patients is increasingly gaining interest. The rationale for artificial nutritional support is based on the assumption that critically ill patients are prone to develop protein-energy malnutrition and that this condition is associated per se with a poor outcome and an increase in the rate of complications, including nosocomial infections and multiple organ failure [1]. This paradigm has been recently substantiated by a significant correlation between a body mass index below the 15th percentile and mortality of critically ill patients [2]. Besides having a role in preventing or attenuating malnutrition, enteral feeding may protect the gut mucosal function. The use of parenteral nutrition may be associated with specific complications, including catheter infection, and cholestasis and is more expensive. Hence, the use of the enteral route is recommended to feed critically ill patients [3]. However, several shortcomings may limit the use of enteral nutri-

tion in these patients, including impairments in gastric emptying, diarrhoea, sinusitis, oesophageal varices and the risk of inhalation of gastric contents. The presence of oesophagitis and gastric ulcer is also sometimes cited as a reason to remove the nasogastric feeding tube and discontinue enteral nutrition.

The intensivist is then faced with specific questions regarding nutritional management. The assessment of nutritional status is often difficult in critically ill patients, in whom the usual criteria of malnutrition may not be applicable. Therefore, the need for nutritional support and the estimation of the nutritional requirements may differ according to nutritional status assessment. Once nutritional support is decided on, the choice of the route of nutrition (enteral vs parenteral) may be based on several criteria. If the enteral route has been chosen, there are several specific issues that may influence its handling, including the time of initiation, the adaptation of the volume prescribed, the system of administration, the type of solutions and the prevention and treatment of complications. If the parenteral route is chosen, the amount and type of solution and the system of delivery are also important issues. The combination of the two routes is a third option in order to add the protective effect on gut mucosa to the provision of energy and proteins. However, the rate of complications may also be additive.

It is not known how European intensivists cope with these issues. To assess the current practice of nutritional management in European intensive care units (ICUs), we sent a questionnaire to the physician members of the European Society of Intensive Care Medicine.

Material and methods

A preliminary multiple-choice questionnaire was first sent to nine experts and subsequently altered according to their comments. The final version was approved by the Working Group of Nutrition and Metabolism of the European Society of Intensive Care Medicine (ESICM). The questionnaire was sent to 1608 physicians, ordinary members of ESICM, on behalf of the Working Group, with the participation of the European Society of Parenteral and Enteral Nutrition. Mailed and faxed answers were accepted up to 6 weeks after the questionnaire was sent. Respondents were allowed to identify themselves and to add written comments.

The questionnaire had a total of 49 questions and was divided into six parts, addressing the issues of medical environment, nutritional status assessment, currently applied nutritional support, management of enteral nutrition and of parenteral nutrition and practical clinical situations. The enteral nutrition section addressed the issues of initiation (timing and starting rate of administration), criteria of volume adaptation, system for administration, type of solutions and prevention and treatment of complications. The parenteral nutrition section addressed the issues of type and amount of solutions and system of delivery. In the last section, four typical clinical situations were presented. The physicians had to choose one of four or five possible answers.

Table 1 Number of questionnaires answered by country or group of countries

Country/group of countries	No. of answers
Austria	11
Belgium/Luxembourg	26
France	17
Germany	49
Greece	9
Israel	2
Italy	19
Netherlands	32
Scandinavia	20
Spain/Portugal	18
Switzerland	14
United Kingdom	36
Eastern countries	20

All answers were processed, including those recorded from partially completed questionnaires. The data were tabulated and analysed using an IBM compatible Microsoft Excel 7.0 program. After primary analysis, the answers were stratified by country. Only the countries from which > 6 completed questionnaires were received were taken into account for the secondary analysis. Statistical analysis included a $\chi 2$ test with a level of significance at $p < 0.05$.

Results

A total of 271 completed questionnaires were received, yielding a response rate of 17 %. The absolute number of completed questionnaires per country or group of countries is shown in Table 1. Seventy-six of the 271 questionnaires were partially completed; of these, 22 were answered by paediatricians, for which the proposed amount of nutritional support was not relevant. The answers from paediatric intensivists that were unrelated to the amount of nutritional support were incorporated in the analysis.

Medical environment

The characteristics of the hospitals and ICUs of the responding physicians are shown in Table 2. The primary speciality of the physicians was anaesthesiology (59 %), with a further 18 % in internal medicine, 11 % in intensive care, 7 % in paediatrics, 3 % in surgery, 1 % in cardiology and 1 % in others. A multidisciplinary nutritional team was present in 29 % of the hospitals, ranging from 0 % in Austria and Sweden to 47 % in Italy ($p < 0.05$). An ICU physician was involved in such teams in 68 %.

Table 2 Characteristics of the hospitals and ICUs (expressed as a percentage of the answers)

Type of hospital	
University	45
University-affiliated	27
General	28
Total no. of hospital beds	
< 250	7
250–400	15
401–700	32
> 700	46
Total no. of ICU beds	
< 8	9
8–14	29
15–24	39
> 24	23
No. of beds in the responding physician's ICU	
< 6	7
6–8	26
9–12	34
13–18	20
> 18	14
Type of ICU	
Medical	4
Surgical	24
Medicosurgical	61
Coronary	1
Paediatric	8
Neurological	1

Assessment of nutritional status (Fig. 1)

The large majority of ICU physicians use mostly clinical and biochemical parameters to assess the nutritional status of their patients. Anthropometric and functional data are used by a quarter, immunological data by a fifth and a questionnaire is used by a tenth of the responding physicians. These features were quite similar in all countries, except that immunological data were used more in Spain (50 %) and anthropometric data more in the UK (33 %) than in the other countries ($p < 0.05$).

Current nutritional support (at the time of responding)

On the day the questionnaire was completed, 2774 patients were hospitalized in the ICUs concerned (median 9, range 1–52) with a total of 1889 patients (67 %) receiving nutritional support. Enteral and parenteral nutrition were provided to 1609 (58 %) and 638 (23 %) of these patients, respectively; 527 patients (19 %) were receiving enteral and parenteral nutrition simultaneously. The proportion of nutritionally supported patients ranged from 61 % in Spain to 81 % in Austria. The proportion of patients receiving enteral and parenteral nutrition also differed between countries (Fig. 2). The highest rate of enteral feeding was observed in Switzerland (92 %) and the lowest in Sweden (71 %). The highest rates of parenteral nutrition were recorded in Sweden (71 %) and the lowest in Austria (19 %, $p < 0.05$). The simultaneous administration of enteral and parenteral nutrition was most common in Switzerland (52 %) and the least common in Austria (4 %, $p < 0.05$).

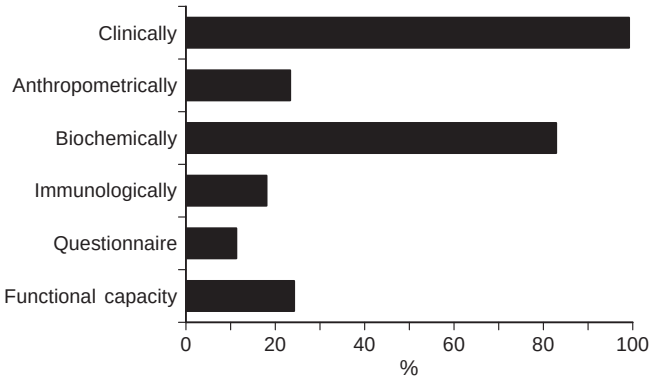

Fig. 1 Assessment of nutritional status, expressed as the percentage of "yeses" to the corresponding method

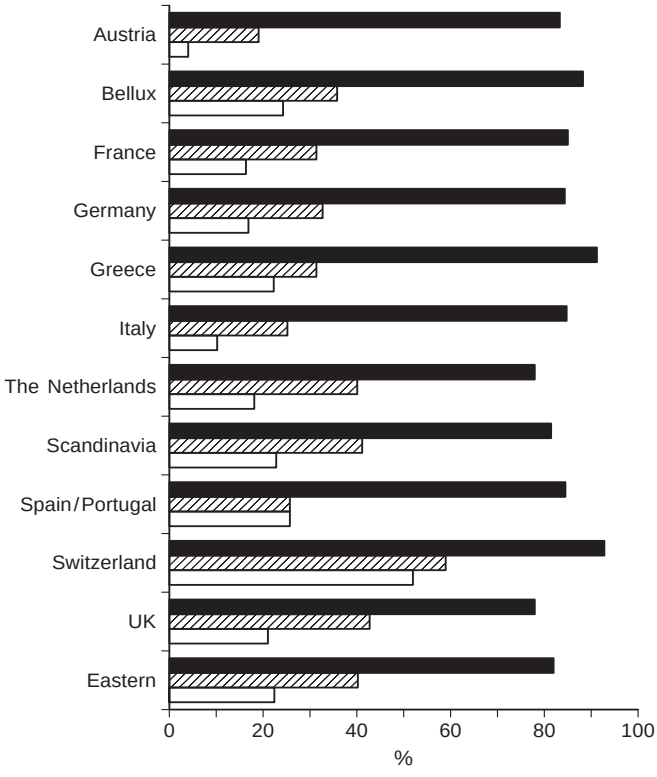

Fig. 2 Proportion of ICU patients receiving enteral (*black bars*), parenteral (*hatched bars*) or simultaneous enteral and parenteral (*open bars*) nutrition in the various countries, or group of countries, expressed as mean percentage of the total number of patients receiving nutritional support

Table 3 Characteristics and management of the naso- or orogastric feeding tubes (expressed as percentage of the answers)

Type of feeding tube	
PVC (Polyvinyl chloride)	35
PUR (Polyurethane)	35
Silicone	30
Other	1
Usual diameter (Fr)	
< 8	22
9–12	43
12–14	26
> 14	9
Placement	
At bedside	96
Fluoroscopic	1
Endoscopic	3
Positioning check	
Auscultation	95
Aspect of aspirate	74
Chest X-ray	65
Systematic replacement	
Yes	23
No	77
If replaced, how often do you change feeding tube?	
8–14 days	48
5–7 days	34
2–4 days	17
Once a day	2

Table 4 Use of specific and modified enteral feeding solutions and medications (expressed as the percentage of answers)

	Never	< 50 %	> 50 %	Always
Specific feeding solutions:				
Hypercaloric	35	55	7	3
Fibres	25	50	20	4
Protein-enriched	23	60	14	3
Iso-osmotic	13	28	29	30
Immuno nutrients	58	31	10	1
Modified solutions in cases of:				
Renal failure	27	24	23	26
Diabetes	43	22	16	19
Respiratory failure	41	35	13	11
Liver failure	32	32	17	18
Administration of medications during enteral feeding:				
Anti-H_2	32	48	12	7
Prokinetics	11	58	24	7
Antacids	50	33	11	7

Enteral nutrition

Initiation

Early enteral nutritional support is common practice in all countries. In the absence of a contraindication, enteral nutrition is started during the first 24 h (45 %), between 24 and 48 h (47 %) and after 48 h (8 %) following ICU admission. The volume of feeding solution administered during the first 24 h of enteral nutrition is 500 ml in 66 %, 1000 ml in 25 %, 1500 ml in 6 % and 2000 ml in 3 %. Once initiated, the feeding solution is administered continuously by 54 %, intermittently by 26 %, continuously during the day by 19 % and continuously overnight by 2 %. The system used for administration is a pump by 84 %, a gravity drip by 10 % and bolus syringe by 6 %.

Criteria of volume adaptation

The issue of the criteria used to adapt the volume of enteral nutrition yielded different answers, between and within the various countries. The calculated caloric requirements is used by 43 % of the respondents, the caloric content of the solution by 24 %, the volume of solution by 21 %, the measured caloric requirements by 10 %, and the protein content of the solutions by 2 %.

System of administration

The type and size of feeding tube and route of placement use of naso- or orogastric are listed in the Table 3. In contrast use of percutaneous gastrostomy is uncommon. Gastrostomy is used routinely by 5 %, sometimes by 38 %, exceptionally in 45 % and never by 12 %. Insertion of the gastrostomy tube is endoscopic in 74 % and surgical in 24 %. Jejunostomy is more commonly used (57 %). For the continuous administration of enteral feeding solutions, pumps are used by 84 %, gravity drips by 10 %, while bolus administration by syringe is used by 6 %.

Type of solutions

The enteral solutions administered on a routine basis are polymeric in 88 % and semi-elemental in 13 %. These choices are similar in all countries. The use of specific and modified solutions is quite variable among ICUs (Table 4) and between countries. Hypercaloric solutions are less commonly used in Switzerland and Italy (never used in 71 and 63 %, respectively) than in the other countries. Fiber-enriched solutions are used more often in Sweden (used in > 50 % of patients by 57 % of the responding physicians) than in the other countries. Protein-enriched solutions are used less in Switzerland (never in 50 %). Iso-osmotic solutions are reported to be used less in France (never in 38 %) than in the other countries. This issue deserves further comment (see Discussion). The immunonutrients-enriched solutions are used more in the UK (never used in only 28 %) than in the other countries ($p < 0.05$).

The use of modified solutions suggested for particular diseases is rather uncommon, except for diabetes (Table 4). The use of modified solutions for renal or liver failure is slightly more common in Belgium/Luxembourg (used in > 50 % or always by 58 and 67 %, respectively).

Prevention and treatment of complications

Some 81 % of the respondents discontinue enteral feeding for endotracheal tube removal. To prevent a possible impairment in oral drug absorption, 25 % of the responders discontinue enteral feeding at the time of oral drug administration; 15 % monitor gastric pH. However, the use of anti-H_2 medications and antacids is uncommon during enteral feeding. Prokinetics drugs are more commonly used (Table 4).

In the case of diarrhoea, administration of the feeding solution is continued at a lower rate by 30 %, the type of solution is changed by 24 %, the feeding solution is administered with antidiarrhoeal medication, at the same or at a lower rate in 22 and 16 %, respectively; the administration is discontinued in 8 %.

Parenteral nutrition

Type and amount of prescribed solutions

Among the different types of solution available, "all-in-one" solutions are widely used (65 %), binary solutions (lipids separated from glucose/amino acids) are used by 33 % and separate administration of lipids, glucose and amino acids by 32 %. The "all-in-one" solutions used are prepared in the hospital in 65 %, while commercially available standard solutions are used by 35 %. The hospital-made solutions are prepared by a pharmacist in 79 %, a nurse in 20 % and a physician in 1 %. The solutions are generally prepared under horizontal laminar flow (68 %), less commonly in an isolation chamber (19 %) and in room air (13 %). The prescribed amount of parenteral nutrition is determined according to the caloric requirements in most cases, either calculated (61 %) or measured (13 %), rather than a fixed caloric content or a fixed volume (14 and 12 %, respectively).

System of delivery

Parenteral nutrition is delivered most often via a central catheter. The exclusive use of a central line is a more common practice (71 %) than preferential use of central line (referred to as "most often" in the questionnaire, 26 %) and indifferent use of a central or peripheral line (2 %). None of the responding physicians usually administer parenteral nutrition via a peripheral line. The central line used is more often one of the lines of a multichannel catheter (78 %) than a catheter used exclusively for parenteral nutrition (13 %) or a catheter also used for drug administration (10 %). The use of filters to administer parenteral nutrition is not common (19 %). However, if used, the diameter of the holes in the filters is usually 0.22 μm (56 %) and sometimes 1.2 μm (36 %).

Clinical situations

The reactions to given clinical situations are shown in Table 5.

Discussion

The answers to this first international questionnaire yielded interesting information about the management of nutrition in critically ill patients in Europe in 1997. The overall response rate (17 %) to this questionnaire may represent a limitation on the interpretation of the data. Nevertheless, this information may be of particular interest over the current practice in the absence of firmly established recommendations for the nutritional care of critically ill patients. The available guidelines advocate the use of enteral feeding whenever possible to provide 25–30 kcal/kg per day [3].

In view of the type of hospitals, the answers probably reflect more the practice in medicosurgical units of large centres. Also, the response rate varied between countries, perhaps reflecting disparities in the interest in nutrition. This distribution may also imply a greater interest in nutritional issues among the responding physicians than in the whole community of ICU physicians. The presence of a specialised nutritional team probably reflected hospital or even national policies. However, since the characteristics of a nutritional team were not defined in the questionnaire, the tasks assigned to these teams can differ between hospitals. Nevertheless, the presence of ICU physicians in these teams was common, suggesting a substantial interest in the nutritional problems associated with critical illness.

The criteria used for the assessment of nutritional status were essentially clinical and biochemical. The clinical approach probably implies the search for physical signs of malnutrition, as suggested by Detsky et al. [4]. The biochemical approach may imply the plasma albumin, pre-albumin, retinol binding protein, transthyretin level or the nitrogen balance, but the plasma albumin level was probably the most commonly used biochemical marker of the nutritional status in these critically ill patients [5, 6]. The low rate of utilisation of other measures, anthropometric parameters or a nutritional questionnaire reflected the difficulties in obtaining these data on critically ill patients. Also, immunological and

Table 5 Clinical situations. Response rate is shown as the percentage of corresponding answers

Situation 1: A 46-year-old man was admitted to your ICU yesterday in a coma following a cerebral haemorrhage. He is intubated and mechanically ventilated. How do you manage his nutrition?	
1. I wait for him to wake and to be extubated and then start a regular diet	1
2. I wait 2–3 days before evaluating the need for nutritional support	12
3. I place a gastric feeding tube to give him water today, in order to start enteral nutrition later	29
4. I start enteral nutrition today	51
5. I start parenteral nutrition today	7
Situation 2: A 58-year-old woman with chronic respiratory insufficiency was admitted 2 days ago for septic shock and ARDS, secondary to pneumonia. Vasopressor support was progressively decreased: she is now treated with dopamine (15 μg/kg per min). She is sedated and ventilated ($PaCO_2$ is 55 mm Hg). What do you do?	
1. I do not give nutritional support, as I hope to be able to stop sedation and mechanical ventilation in a few days	2
2. I wait for vasopressor support to be discontinued before starting enteral nutrition	2
3. I give her a limited amount of enteral nutrition feeding solution	52
4. I give her a standard amount of enteral nutrition feeding solution	31
5. I give her parenteral nutrition	15
Situation 3: A 73-year-old man underwent a colectomy 5 days ago for diverticulitis associated with microbial peritonitis. Postoperatively, he developed nosocomial pneumonia and transient renal failure. He was extubated 2 days ago and is still confused. Today, your abdominal auscultation reveals borborygmi for the first time. What do you do?	
1. I prescribe or continue parenteral nutrition	21
2. I give him water via the nasogastric tube	30
3. I immediately start enteral feeding	33
4. I start a light diet by mouth	16
Situation 4: A 67-year-old woman had a stroke, and has required mechanical ventilation for 14 days. Yesterday, the enteral feeding solution was not administered because her gastric residue was 500 cc. What do you do?	
1. I ask for the gastric residue to be checked before deciding how to feed her	18
2. I give her prokinetic medication and wait for a decrease in gastric residue before continuing enteral nutrition	26
3. I give her prokinetic medication and continue enteral feeding immediately	45
4. I discontinue enteral nutrition and start parenteral nutrition alone today	1
5. I start parenteral nutrition today and ask for the gastric residue to be checked before continuing enteral feeding	11

functional parameters may be difficult to interpret in this population.

The answers recorded from the current nutritional support section and the clinical situations addressed the reality of nutritional support, rather than theoretical considerations. Interestingly, two thirds of the hospitalized patients were receiving nutritional support. This rate is higher than those previously reported in UK [5] and Spain [7]. This may reflect the increasing understanding of the deleterious effects of malnutrition, even though a direct effect of nutritional support on mortality has not been conclusively shown [8]. However, a bias may result from a particular interest of the responding intensivists in nutrition. The enteral route was generally preferred, and the proportional use of enteral nutrition was higher than previously reported [5, 7]. The attitudes to clinical situation 1 (Table 5) confirmed that early use of enteral nutrition in people unlikely to eat soon is common. The answers to situation 2 suggest that enteral nutrition would be administered, even in the presence of concomitant vasopressor support. The answers to clinical situation 3 again confirmed the preferential use of the enteral route, even in patients recovering from gastrointestinal surgery. This may reflect the recognition of the beneficial role of enteral nutrition on gut mucosal function [3, 9, 10] and has already been reported in a longitudinal study [11].

With respect to the practical aspects of enteral nutrition, pump-driven continuous enteral nutrition is mentioned by the vast majority of the respondents. However, the amount of feeding solution provided in the first 24 h was rather low, probably in order to prevent early complications [12]. At the time of admission, priority was thus given to the protection of gut mucosa over the provision of calories and proteins. However, the caloric content of enteral feeding still appears to be an important issue, as reflected by the criteria chosen to adapt the volume of feeding. The method of enteral feeding is bedside placement of a naso- or orogastric mid-size feeding tube, while the use of gastrostomy is still infrequent. The rate of jejunostomy is higher, but it is likely that a significant proportion of the jejunostomy catheters are inserted prophylactically at the time of abdominal surgery. Therefore, the decision to insert a jejunostomy catheter may not be a part of the nutritional management by the intensivist. Regarding the type of solution used, it is clear that most intensivists use standard solutions on a routine basis. Since most standard solu-

tions are iso osmotic, it can be assumed that a proportion of the answers corresponded to an ignorance of this feature. Specific or modified solutions are used less than in a recent American survey [6]. The clinical effects of the solutions enriched with "immunonutrients" may have been less convincing for the clinicians in Europe than for those in the United States [13—15]. The use of modified solutions for patients with renal failure probably reflect the fear of fluid, sodium and protein overload, by analogy with the diet of patients with chronic renal failure. The low rate of use of the other modified solutions probably reflects the lack of demonstrated benefit during critical illness.

The management or the prevention of the complications of enteral nutrition is also an important issue. Possible complications of enteral feeding include inhalation of gastric contents at the time of extubation, impaired absorption of oral drugs, gastro-oesophageal reflux, oesophagitis, delay in gastric emptying, intestinal dilatation and diarrhoea [13]. The high rate of discontinuation of enteral feeding before extubation probably reflects the fear of inhalation of gastric contents. On the other hand, the absorption of oral drugs, the acidity of gastric juice and the risk of gastroduodenal ulcer during enteral feeding do not appear to be major concerns. The high rate of use of prokinetic medications (also confirmed in the answers to clinical situation 4) might indicate that the delay in gastric emptying is well controlled in this manner. The management of diarrhoea during enteral feeding is quite variable. Interestingly, very few clinicians discontinue enteral feeding because of diarrhoea. Besides the decrease in the rate of administration of the feeding solution, the use of antidiarrhoeal medications and switching to another type of solution are common practices.

The use of parenteral nutrition was lower than in previous studies [5, 7], probably reflecting the growing interest for the enteral route, the high costs related to parenteral nutrition and the fact that some of the usual contraindications of enteral feeding (absence of bowel sounds, pancreatitis) may have become obsolete. The differences in the frequency of parenteral nutrition use between countries may reflect differences in the reimbursement system of these solutions, or of marketing policies [16]. Interestingly, the parenteral nutrition solution is most often administered centrally, via a specially dedicated line (via either a single or multichannel catheter). Administration of drugs via the same catheter is usually avoided, probably reflecting the fear of bacterial contamination.

In conclusion, the answers to this questionnaire demonstrate that, at least in large centres, the intensivists are concerned with the nutritional management of their patients. Even if the modalities of nutritional support sometimes differ between countries, early enteral nutrition is increasingly used, while the use of parenteral nutrition decreases. Specialised and modified solutions are seldom used.

Acknowledgements The authors wish to acknowledge all those who contributed to this survey: Members of the Working Group of the European Society of Intensive Care Medicine on Nutrition and Metabolism: G Biolo, R. Chiolero, G. Grimble, P. Jolliet, X. Leverve, G. Nitemberg, I. Novak, C. Pichard, M. Planas, J.-C. Preiser, E. Roth, A.M. Schols, J. Wernerman, P. Jespers, V. Liévin, C. Van Cleemput, S. Vereecken, S. Smitz-De Smet, C. Todorov, D. De Boom and G. Scott for their valuable assistance.

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