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Postoperative Nasogastric Tube Feeding in Patients with Head and Neck Cancer: a Prospective Assessment of Nutritional Status and Well-being

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Abstract—*The effects of controlled continuous nasogastric tube feeding with a non-elemental liquid diet (Nutrison high energy) were studied* 1 *day before, and* 1 *week and* 3 *weeks after radical surgery mostly for cancer of the tongue or floor of the mouth in* 20 *patients. Since the actually administered* 89% *of a planned dose of* 32 kcal/kg *body weight/day given to the first eight patients (group A) proved inadequate to prevent a decrease of body fat mass, the energy dose given to* 12 *successive patients (group B) was increased. The administration of* 95% *of* 43 kcal/kg *body weight/day to group B patients appeared to be sufficient. A marked decrease of the* 24 h *urinary excretion of creatinine and* 3-*methylhistidine was observed at* 1 *week and still existed at* 3 *weeks after operation in both groups. The decrease was significant in group A amounting to some* 40% *for both metabolites. In group B creatinine excretion decreased by some* 20% *(n.s.) and* 3-*methylhistidine by some* 35% *(n.s). These findings suggest diminished muscle protein breakdown, even in the presence of an ample nutritional supply of energy and protein. A transient decrease of serum albumin, iron and zinc in all patients is likely not to be related to nutritional intake, but to surgery itself. Analysis of trace minerals and vitamins in blood and amino acids in serum and urine showed no deficiencies or amino acid imbalance. Assessment of the psychosocial impact of the nasogastric tube feeding regimen revealed gastro-intestinal complaints in a minority, and feelings of being deprived of the act of eating and drinking in the majority of patients.*

INTRODUCTION

IT IS generally held that enteral feeding, whenever possible, is preferable to parenteral nutrition, the former being more physiological, more effective, easier to comply with, safer and less costly [1, 2]. Notwithstanding extensive research, parenteral nutrition is still considered as suboptimal [3]. A large number of commercially available non-elemental formula diets have been successfully introduced. Their compositions differ and, optimally, are based on recommended dietary allowances (RDAs) for vitamins, mineral and trace elements in normal adults [4]. There is still insufficient information on micronutrient requirements for the evaluation of artificial nutrition during particular states of disease or periods of physiological stress [5]. Similarly, the daily dosage of energy and macronutrients received by patients under various conditions is often ill-based [6]. The purpose of the present clinical study is a prospective survey of the effects of a generally accepted, relatively low-cost liquid formula diet after curative surgery for cancer mostly of the tongue or mouth floor. To answer the question how the needs of patients were met during the post-operative period continuous nasogastric tube feeding was administered at a predetermined dose level with assessment of the nutritional status, tolerance to the diet and well-being during 3 weeks. Since our observations showed that the nutritional dose in the first eight patients was inadequate, the dose was raised in the successive 12 patients. This made some comparisons between the effects of two different dose levels possible, although the present investigation was not designed as a prospectively randomized clinical trial.

MATERIALS AND METHODS

Twenty successively admitted patients (12 male and eight female, mean age ± S.D. of 19 patients

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Table 1. Surgically treated tumors (type of operation will be sent to readers on request)

	Tumor site Group A	Stage		Tumor site Group B	Stage
1.	Postcricoid pharynx	$T_2N_3M_0$	9.	Base of tongue	$T_4N_0M_0$
2.	Epiglottis	$T_1N_2M_0$	10.	Supraglottic	$T_2N_2M_0$
3.	Floor of the mouth	$T_2N_1M_0$	11.	Lymph node metastasis fixed to mandibula from lip primary resected 1 year previously	$-\ N_3M_0$
4.	Larynx (irradiated 6 years previously)	$T_2N_0M_0$			
5.	Floor of the mouth	$T_4N_1M_0$			
6.	Supraglottis	$T_4N_3M_0$	12.	Retromolar trigone	$T_2N_2M_0$
7.	Retromolar trigone	$T_3N_0M_0$	13.	Larynx irradiated 3 years previously; now necrotizing chondritis	—
8.	Tongue	$T_4N_0M_0$			
			14.	Floor of the mouth	$T_3N_0M_0$
			15.	Epiglottis	$T_3N_0M_0$
			16.	Tongue	$T_3N_0M_0$
			17.	Tonsil	$T_3N_2M_0$
			18	Larynx irradiated 8 years previously; necrotizing chondritis	—
			19.	Larynx recurrence irradiated 1 year previously	$T_1N_0M_0$
			20.	Floor of the mouth	$T_2N_1M_0$

67.8 ± 9.1 years; one other female patient was only 22 years of age) were studied after surgery. In Table 1 tumor site and stage and type of surgery are given for individual patients in groups A and B respectively. Reliable data concerning weight loss prior to diagnosis were difficult to obtain. Most patients had been consuming excessive amounts of alcohol and tobacco, and in general indicated some weight loss. However, body mass index (BMI) values indicated a sufficient average pre-operative weight corrected for height (Table 2). All patients gave their informed consent to the study. During operation a small-caliber nasogastric feeding tube was introduced in addition to the routinely used nasogastric catheter for drainage and lavage of the stomach early after operation. A commercially available, non-elemental formula diet (Nutrison high energy*) was administered by means of an Ivac infusion pump as continuous feeding over 24 h at a selected and controlled rate. Tube feeding was started on the first postoperative day after swallowed blood had been washed out from the stomach. The individual dose of energy administered over 24 h was calculated on the basis of lean body mass (LBM) and resting energy expenditure (REE). LBM was determined by subtraction of the body fat mass (BFM) from body weight (body mass or BM). BFM was assessed by the standardized measurement of four skin fold thicknesses [7]. The REE was derived from the *Nederlandse Voedingsmiddelentabel* (*Dutch Food Composition Table*) [8], recommending 1.1 kcal (4.60 kJ) per kg body weight per h ± 10% (S.D.) for an adult male (20–25 years old, 70 kg of which 15% is BFM) and 1.0 kcal (4.18 kJ) per kg body weight per h ± 10% (S.D.) for an adult female (20–25 years old, 60 kg of which 25% is BFM). Male and female healthy individuals then would consume 31, and 32 kcal per kg LBM per 24 h respectively. Since aging is generally associated with a gradual decrease of metabolically active cell mass and a corresponding decrease of REE, the assumption of a minimal requirement of 30 kcal per kg LBM per 24 h for male and female patients to cover their REE seemed both safe and practical. These figures correspond reasonably well with the WHO/FAO recommendations [9, 10]. To compensate for energy losses due to 'surgical and postsurgical stress' a dose increment of 50% was given initially. The weight loss observed in the first eight patients (group A) led to the decision to give a dose increment of 100% to the next 12 patients (group B). On the first postoperative day (day +1) only 50% of the calculated dose was scheduled, to be increased to the full dose rate on the second postoperative day. A daily minimal intake of 2000 ml of water by all patients was guaranteed by bolus administration of tap water if required. Part of the water was used to flush the tube regularly, especially after drugs had been given. Generally patients were allowed to drink water from the 10th postoperative day on. During the 3-week observation period no other nutrients were given.

The *nutritional status* of the patients was assessed by anthropometric measurements and laboratory tests on the day before surgery (day −1), and on days +7 and +21 after operation. Anthropometric measurements carried out by one trained investi-

*The composition of Nutrison high energy is well-balanced. Detailed information is available on request.

Table 2. Change of anthropometric measures of nutritional status (mean ± S.D.) as measured on the day before surgery (t_0) and on day 7 (t_1) and 21 (t_2) after operation. Figures obtained at t_1 and t_2 are also expressed as a percentage of the t_0 values

		Group A $n = 8$			Group B $n = 12$		
		m			m		
Height	t_0	1.69 ± 0.05			1.69 ± 0.11		
		kg/m²			kg/m²		
Body mass index	t_0	23.49 ± 2.30			24.36 ± 3.15		
		kg	%	P-value*	kg	%	P-value*
	t_0	65.2 ± 9.3	100		73.7 ± 13.9	100	
Body weight	t_1	62.8 ± 8.6	96.6 ± 2.7	<0.01	72.5 ± 12.3	98.4 ± 2.7	n.s.
(BM)	t_2	62.0 ± 8.4	95.3 ± 3.6		73.3 ± 13.3	99.5 ± 2.6	
		kg	%		kg	%	
	t_0	47.4 ± 6.1	100		52.5 ± 9.3	100	
Lean body mass	t_1	46.8 ± 5.2	97.1 ± 2.3	n.s.	51.6 ± 8.0	98.8 ± 4.0	n.s.
(LBM)	t_2	46.3 ± 6.0	97.8 ± 4.0		51.5 ± 8.8	98.4 ± 2.9	
		kg	%		kg	%	
	t_0	17.8 ± 5.4	100		21.2 ± 8.2	100	
Body fat mass	t_1	16.1 ± 5.8	92.5 ± 7.1	0.02	20.8 ± 7.8	99.4 ± 6.0	n.s.
(BFM)	t_2	15.7 ± 4.5	89.3 ± 9.3		21.7 ± 7.6	104.2 ± 7.1	

*Comparison between t_0, t_1 and t_2, respectively (paired t-test).

gator included body weight (BM), length and four standardized skinfold thicknesses (triceps, biceps, subscapular and suprailiac) [11]. BFM and LBM were derived according to Durnin and Womersley [7]. Laboratory tests included, besides routine parameters, serum components with a relatively short half-life like albumin, transferrin [12] and vitamins B_1 (ETK) [13], B_2 (EGR) [14], B_6 (EGOT) [15], C [16] and folic acid (Simul TRAC kit of Becton Dickinson Immunodiagnostics; Orangeburg, U.S.A.), calcium, magnesium, inorganic phosphate, zinc (atomic absorption photometry), selenium [17] and amino acids [18] in blood, and urea, creatinine, calcium, inorganic phosphate, zinc and amino acids [18] excreted in urine over 24 h.

Non-fasting venous blood samples were collected between 8 and 9 a.m. in Venoject® glass tubes (Terumo Co., Tokyo, Japan). Serum and EDTA hemolysate from packed cells were stored at −20°C until analysis.

The patients' *well-being* was investigated by inquiring after specific nasogastric tube-related and nutrition-related complaints of distress. Furthermore, a standardized checklist of multiple choice questions concerning feelings of 'malaise' was administered, on days −1, +7 and +21. The technical procedure went as follows: physical and mental well-being were measured by a checklist of complaints, based on the results of a pilot study [19]. The items were divided into a malaise scale (four items) a psychological complaint scale (seven items), complaints related to the gastro-intestinal tract (10 items), and complaints related to thirst (three items). To the questionnaire 10 items were added, based on the Tube Feeding and Hospital Experiences Checklist—the TFHECL [20]. These items identify the subjective level of patient distress directly associated with tube feeding (Table 2). The scale was supplemented with a question concerning the importance one links to the color of the tube feeding. The patients were asked to score their complaints on a four-point scale as 'not at all' (0), 'a little' (1), 'quite a bit' (2) and 'very much' (3). The total score on the malaise scale could range from 0 to 12 and on the psychological complaint scale from 0 to 21. All questions were formulated in such a way that the patient was asked about the condition on the previous day.

The first administration of the checklist was on day −1 (baseline questionnaire). The items directly associated with the tube feeding were omitted, as the patients at that moment could still eat and drink. The complete questionnaire was filled out on day +7 and day +21. One of two psychologist-investigators was always on hand during the completion of the checklist to ensure that the questions were clearly understood.

Statistical evaluation was done by analysis of variance, the multiple comparison Student–Newman–Keuls' test and the paired or unpaired t-tests (for comparison within and between the groups respectively), as specified in Results [21]. For some parameters all patients were considered together, for some others a distinction was made between groups A and B.

RESULTS

Nutritional intake

The first eight patients (group A) received 89% of the scheduled daily energy dose of 45 kcal/kg LBM (approximating 32 kcal/body weight). Because of loss of BM, and especially of BFM, the energy dose given to the next 12 patients (group B) was increased by 50%. The daily dose actually administered to group B amounted to 95% of the planned 60 kcal/kg LBM (43 kcal/kg body weight). Various factors prevented the prescribed dose from being reached. Besides pump rate errors, transient obstruction of the feeding tube occurred. This happened mostly during the first part of the study period in patients receiving drugs via a small-bore (8G) nasogastric catheter. Problems were solved by prescribing liquid drug formulations whenever possible and by regularly flushing the tube with small amounts of water. To avoid further obstruction problems a large bore-size (10G) was selected after the first 10 patients. Two of patients needed surgical intervention for postoperative complications causing temporary interference with the feeding schedule. The planned intake was inadequate especially on days +1 (mean 53% in group A, and 40% in group B) and +2 (60% in group A, and 70% in group B). This was due to an intolerance of most patients to a full dose rate which caused feelings of fullness and nausea early after operation. The average dose rate was fairly constant from day +3 onwards, with an average coefficient of variation of 22% in group A and 11% in group B. As a minimal fluid intake of 2000 ml was judged desirable all patients of group A and five out of 13 patients of group B needed extra water.

Nutritional status

Anthropometry. Table 2 shows the mean values of BM, BFM and LBM monitored in 20 fully evaluable patients. Because of the variation between individuals at t_0 (day 1) changes of anthropometric values were also considered as a percentage of t_0-values. In group A, BM and BFM were significantly lower at t_1 (day +7) and t_2 (day +21) compared to t_0 ($P = 0.008$ for BM, $P = 0.02$ for BFM). Since LBM, calculated as the difference between individual BM and BFM, did not change significantly, the loss of BM was apparently due to a predominant loss of BFM. In group B, BM, BFM and LBM did not change significantly. These data demonstrate that an average dose rate of 57 kcal/kg LBM/day was sufficient to at least maintain BM, an average of 40.5 kcal/kg LBM/day being inadequate. Although group B patients showed a higher mean body weight compared with group A at t_0, other anthropometric measures were not significantly different between groups A and B at t_0 (unpaired t-test). The body mass index was similar in both groups indicating a sufficient average pre-operative weight for height in all patients (Table 2). A significant difference between groups A and B was observed at t_1 and t_2 for BM and BFM ($P < 0.01$), but not for LBM.

Laboratory tests

From the data obtained from blood and urine analysis,* it appeared that mean pre-operative blood levels were all normal. The concentration of serum albumin was significantly decreased at t_1 and t_2 when compared to t_0: group A: t_0 42.6 ± 5.2, t_1 37.0 ± 2.8 (P 0.05), t_2 37.6 ± 4.8 (P 0.05); group B: t_0 42.8 ± 2.7, t_1 36.9 ± 3.2 (P 0.0001) t_2 37.9 ± 3.0 (P 0.0001) g/l (mean ± S.D.). Serum transferrin levels also decreased. However, the difference between t_0 and t_1 was significant only when data from all patients were compared ($P < 0.05$), each group being apparently too small to show statistical significance.

Group A had transferrin concentrations which were lower than in group B ($P < 0.02$). Elevated transferrin levels, indicating iron deficiency, were not observed. The 24 h urinary excretion of creatinine was significantly lower at t_1 (6.4 ± 2.2 mmol) and t_2 (6.5 ± 2.5 mmol), when compared to t_0 (10.7 ± 3.8 mmol) for group A ($P < 0.01$), indicating a decreased creatine turn-over. The 24 h urinary excretion of 3-methylhistidine dropped significantly, i.e. from 100% at t_0 to 66% at t_1 in both groups, to 53% and 58% at t_2 in groups A and B, respectively. However, when expressed per excreted gram of creatinine the excretion of 3-methylhistidine did not change in group A, but decreased in group B. Serum levels of alanine and glutamine, the major amino acid resources for gluconeogenesis, remained stable. Also the serum concentrations of the branched-chain amino acids valine, leucine and isoleucine did not change significantly.

The blood urea concentrations and 24 h urinary urea excretion showed an insignificant rise in group B. This tendency probably reflected the high nutritional protein load administered to these patients, rather than an increased breakdown of endogenous protein which would be more likely in group A.

The vitamin status gave no rise for concern, as all parameters remained stable, the serum folic acid concentration even significantly increasing at t_2 when compared to t_0 and t_1 in group B ($P = 0.00001$). The normotest value, used as a parameter for possible vitamin K deficiency, showed that the provision of vitamin K was sufficient during the observation period although no vitamin K_1 was added to the formula diet.

The other micronutrient parameters in serum and urine were quite stable with the exception of the serum iron and zinc concentrations and the 24 h

*Detailed data are available on request.

Table 3. Estimated nitrogen balance over 3 weeks of postoperative nasogastric tube-feeding*

		Group A		Group B	
Average Nutrison intake l/day		1.27		2.00	
Average nitrogen intake g/day		9.91		15.60	
Average urinary nitrogen loss (urea–N) g/day	t_0	6.80		7.08	
	t_2	6.64	6.54	10.39	9.93
	t_2	6.44		9.46	
Estimated average nitrogen loss via feces, skin, hair and nails g/day		2.0		2.0	
Average nitrogen balance g/day		+1.37		+3.67	

*An estimation of the nitrogen balance (average daily intake minus losses) over the 3 week observation period was done by assuming that the average of the 24 h urinary losses measured at t_1, and t_2 plus an estimated average loss via feces, skin, hair and nails represented a reasonable approximation.

urinary excretion of inorganic phosphate. Serum iron was lowest at t_1, differing significantly from t_0-values in group B ($P < 0.01$). The latent iron binding capacity did not change significantly. Serum zinc was also lowest at t_1 and significantly lower than at t_0 ($P = 0.02$) for all patients. The urinary zinc excretion did not significantly change, reaching however above normal range values at t_1 and t_2. The urinary phosphate excretion showed a highly significant decrease at t_1 and t_2 when compared to t_0 for all patients ($P = 0.00001$). Serum phosphate did not significantly change.

The results of blood and urine tests for sodium, potassium, calcium, magnesium and selenium revealed no significant trends.

Differences of t_0-values between group A and group B were due to chance, not to selection since all patients presenting for surgery were successively entered. Mean height and body mass index were very similar in both groups. Nonetheless, patients of group B seem to have started off with a somewhat better nutritional status compared to group A patients. This could be concluded from a trend to higher t_0-values in group B for body weight, serum total protein, creatinine, iron, transferrin, vitamins C, B_1, B_2, B_6 and various amino acids, whereas the urinary excretion of 3-methylhistidine was lower. However, two particularly tall and heavy male patients belonging to group B have influenced some of the mean figures a great deal.

In Table 3 a rough estimation is given of the nitrogen balance during the period of observation, indicating a just positive balance in group A, and a clearly positive balance in group B.

Table 4. Number of patients who scored positively on the complaints related to the gastro-intestinal tract and the complaints related to thirst on days +7 and +21 (n = 20)

Having the feeling of a full stomach	5
Burping	4
Having heartburn	4
Vomiting	0
Feeling as if having to vomit	5
Being nauseated	4
Having abdominal cramps	3
Having sounds in the stomach	5
Having diarrhea	4
Having obstipation	7
Being thirsty	10
Having a dry mouth	12
Having to swallow more than usual	15

Well-being

The patients had no difficulty in completing the questionnaires. After a brief standardized instruction, they were able to do so on their own. On day −1, 50% of the patients scored positively on the malaise scale (mean score 3.9). On days +7 and +21 these percentages were 90 (mean score 3.8) and 85 (mean score 4.1) respectively. The difference in prevalence was not significant (Friedman test). With respect to the psychological complaint scale, the percentage of patients who indicated they had a complaint amounted to 80% on day −1 (mean score 5.3), 70% on day +7 (mean score 3.6) and 80% on day +21 (mean score 4.8), so that hardly any difference in prevalence on the three points of assessment could be observed. The patterns of the scores on the complaints related to the gastro-intestinal tract and on the complaints related to thirst, were very diffuse. Therefore, in Table 4 only the number of patients who scored positively on day +7 and/or on day +21 are given.

As can be seen from Table 4, relatively few patients scored on the complaints related to the gastro-intestinal tract. At least 50% of the patients stated they had a complaint relating to thirst.

In Table 5 the number of patients who scored on the items relating to distress directly associated with tube feeding is given. More than 50% of the patients at both points of assessment felt deprived of the act of eating. None of the patients on day +7 ascribed any importance to the color of the tube feeding. On day +21 only one patient stated he disliked the color.

DISCUSSION

The present study was undertaken to observe the effects of a widely accepted, low-cost liquid formula diet during 3 weeks after head and neck surgery in elderly patients with mostly cancer of the tongue or floor of the mouth. Since the nutritional intake was accurately known, various clinical and laboratory

Table 5. Number of patients who scored positively on the items based on the Tube Feeding and Hospital Experiences Checklist (TFHECL) (n = 20)

	Day 7	Day 21
Feeling deprived of tasting food	15	16
Having an unsatisfied appetite for certain foods	14	13
Feeling deprived of drinking liquids	13	7*
Feeling deprived of chewing or swallowing foods	12	9
Feeling deprived of socializing while eating	11	8
Minding being seen by others with a tube in nose	4	8
Minding that the tube looks so different	8	7
Having a sore nose or throat	11	7
Having a running nose	11	6
Having a sleepless night as a result of wearing the tube	10	6

*On day +21 10 patients were allowed to drink water. Of the remaining patients seven felt deprived of drinking liquids.

parameters could provide an assessment of the nutritional requirements during this period. Also, the physical tolerability and the psychosocial impact of exclusive nasogastric tube feeding could be assessed.

Although supported by few data from studies on enteral nutrition, it has been advocated that postoperative patients may have energy requirements of 1.25–1.5 times their resting energy expenditure [6, 22]. Our first eight patients (group A) were treated with 1.5 times the resting energy expenditure (REE). For this calculation the LBM rather than total body weight was used, since the body fat mass is generally considered to contribute very little to the REE [23–28]. On a LBM basis men and women received an equal dose. The possibility that the lean body mass may not always be a good basis for the assessment of REE should be recognized [10]. Bray *et al.* [29] and Miller and Parsonage [39] have found that REE of obese people correlated better with BFM than with LBM. However, as can be seen from Table 2, the patient population of the present study was not obese. Judged from the BMI and serum values in both groups, it was not evident that the patients were malnourished pre-operatively.

From the observed loss of body weight, especially of body fat, the energy dose administered to group A appeared to be insufficient. In contrast, an energy dose of 2.0 times REE given to the next 12 patients (group B) was adequate. The fact that in group A only 89% and in group B 95% of the planned dose was actually reached does not constitute sufficient explanation for the difference observed between groups A and B. The conclusion that the average postoperative energy requirement of these patients approaches 2.0 × rather than 1.5 × REE seems justified. It should be stressed here that in the literature various definitions of REE have been given. Our conclusions are based upon the method of calculating REE which we have chosen, as explained and argued above. Even if body weight instead of LBM would have been used for the calculation for each individual patient [8], the assessed REE would hardly differ on average. The observed energy requirement seems strikingly high as the surgery performed was of moderate extent and generally not followed by large complicating tissue damage from infection, necrosis etc. However, immediate pre-operative nutritional intake may have been suboptimal. The LBM as calculated from body weight and BFM did not significantly change. Nevertheless a significant decrease of serum albumin and transferrin was observed in all patients, and the transferrin levels in group A were significantly lower than in group B. These findings suggest the possibility of a diminished protein synthesis/breakdown ratio, becoming especially apparent after 1 week. Also, significant changes in muscle protein metabolism were observed. The urinary excretion of creatinine, generally regarded as representative of muscle mass, decreased in both groups, but only significantly in group A. The finding that serum creatinine did not change indicates that this decrease was not due to some drastic impairment of kidney function, but should be ascribed to a decreased muscle breakdown. Even more clearly, the excretion of 3-methylhistidine, which is largely a product of muscle catabolism [31, 32], fell to much lower levels, persisting until three weeks after surgery. The drop of the urinary 3-methylhistidine:creatine ratio was most apparent in group B, in which the decrease of creatinine excretion was smaller compared to group A. Since it is unlikely that the impressive decreases of creatinine and especially of 3-methylhistidine excretion reflect a parallel decrease of muscle mass, the observations rather suggest a diminished breakdown, possibly due to the physical insult of surgery and anaesthesia. The rough estimate of the average nitrogen balance, as shown in Table 3, was just positive in group A, but more clearly so in group B patients. We realise that nitrogen losses via wound drains in the early postoperative period, via sputum, feces, skin, nails and hair could not be measured. Serum selenium concentrations remained constant. The observed decrease of serum zinc levels and the non-significant increase of urinary zinc excretion may be weakly related to the decrease of zinc-binding serum proteins like albumin and transferrin, but the precise reason remains largely unknown. The increase of the urinary zinc excretion to above-normal values seems to be even more abnormal when the simultaneous decrease of creatinine excretion is considered, as zinc excretion is generally related to creatinine excretion [33]. It is not clear why urinary phosphate excretion fell to an average of less than 50% of the t_0-value.

From clinical observation and from the more specific data which were collected by questionnaire it appeared that Nutrison high energy was well tolerated. On all three measurement points a relatively high percentage of patients stated they had a complaint on the malaise scale or the psychological complaint scale, with no significant difference in incidence for the former and hardly any difference for the latter scale at the various time points. The mean scores on both scales were relatively low. It can thus be concluded that the incidence of complaints scored on these scales was similar before surgery and at 1 and 3 weeks after operation, and that the complaints seemed not very serious. However, the checklist used had not been applied to this very category of surgical patients before and may not be optimally suitable. On days +7 and +21 only a minority of patients scored positively on gastrointestinal complaints. Transient diarrhea occurred in only four out of the 20 patients. At least 50% of the patients had a complaint related to thirst. The 'high energy' form offers the advantage of avoiding large volumes, but generally does not seem justified when daily doses of some 2000 kcal or less are required since the amount of fluid administered may be insufficient. More than 50% also felt deprived of the act of eating. These findings are similar to the observations reported by Padilla and Grant [34]. Finally, the patients linked no importance to the white-coffee color of the formula diet. Apparently they considered it as a medicine rather than as a form of food.

In conclusion, an energy dose of 2 × REE (as calculated on the basis of lean body mass) with a nitrogen:calorie ratio of 1:190 was found to be sufficient to maintain a positive energy and nitrogen balance and to provide an adequate supply of micronutrients over 3 weeks postoperatively. For patients of average body composition, having a lean body mass of 65–70% of their body weight, the appropriate energy dose per day would amount to 40 kcal per kg body weight. Although obviously tube feeding may be a necessary medical procedure, its psychosocial impact should be recognized, especially when nasogastric tube feeding has to be administered for prolonged period of time.

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