Limited Impact of Total Parenteral Nutrition on Nutritional Status during Treatment for Small Cell Lung Cancer


University of Toronto, Toronto, Ontario, Canada M5G 1L7; [W. K. E., F. M., W. F., F. A. S., R. B., K. N. J.]; Biostatistics and Data Management Section, Clinical Oncology Program (R. B.); National Cancer Institute, Bethesda, Maryland 20215; University of Iowa College of Medicine, Iowa City, Iowa 52242 (G. H. C.); University of Florida, Gainesville, Florida 32610 (R. S. W.); University of California, Irvine, California 92664 (E. M.); and New York University, New York City, New York 10016 (R. B.)

ABSTRACT

During a randomized trial of total parenteral nutrition (TPN) in patients with small cell lung cancer, we evaluated the short- and long-term effects of 4 weeks of TPN on nutritional assessment parameters. All 119 patients who were accrued to the study received the same chemotherapy and radiotherapy protocol which extended over a 1-year period: 57 patients received TPN; and 62 served as controls. At base line, patients with >5% pretreatment weight loss had significantly lower levels of serum albumin, total iron-binding capacity, and creatinine/height index. TPN administration led to a significant increase in mean caloric intake and weight compared with controls (P < 0.0001). In the short-term study, body fat, as measured by triceps skinfold thickness, was maintained, and there was a small increase in arm muscle circumference. Serum albumin and hematocrit decreased but promptly returned to pretreatment levels when TPN was stopped. There were no long-term differences in any of the nutritional assessment parameters between the two groups.

INTRODUCTION

Pretreatment weight loss and low serum albumin in cancer patients often predicts for shortened survival (9, 14) and poor tolerance of the effects of antineoplastic therapy (6). Reversal of cancer-associated cachexia with TPN3 has been proposed in order to allow patients to tolerate intensive therapy (6, 11). Randomized trials of hyperalimentation as an adjunct to chemotherapy have generally shown that TPN can increase patients’ weight (6, 13, 15, 20, 22, 23, 25). However, it has been suggested that much of this weight gain is fat, water, or both (19). The results of randomized Phase III trials of TPN as an adjunct to intensive chemotherapy have demonstrated that TPN does not prolong survival (13, 15, 20, 21, 23). However, in these studies, it is not clear that malnutrition was reversed by TPN administration.

In 1979, a randomized trial of TPN as an adjunct to intensive chemotherapy and irradiation for SCLC was initiated by the Diet, Nutrition, and Cancer Program of the National Cancer Institute. Patients with SCLC were selected for study both because weight loss is commonly present at diagnosis and because the tumor responds well initially to intensive cytotoxic therapy. TPN was administered for 30 days at the initiation of antineoplastic therapy and was designed to be serially increased so that nutritional depletion would be achieved, if at all possible. It was hoped that nutritional support prior to and during initial chemotherapy would correct nutritional deficiencies and allow more intensive treatment to be given with less morbidity.

In this report, we describe the effects of TPN on parameters of nutritional status in patients undergoing treatment for SCLC both during and up to 1 year following the initiation of treatment. Detailed analyses of the effect of TPN on response rates and survival of patients with SCLC are presented in detail in a separate report (4).

PATIENTS AND METHODS

Patients. All patients had histologically or cytologically documented SCLC. None had been treated previously, and all had evaluable or measurable disease, life expectancy of greater than 8 weeks, and a performance status of 0, 1, 2, or 3 (ECOG Scale). Adequate bone marrow, hepatic, and renal function were required as indicated by the following laboratory determinations: WBC, >3,000/mc; platelets, >100,000/mc; bilirubin, <2 mg/dl; serum creatinine, <2 mg/dl; and blood urea nitrogen, <30 mg/dl. Patients were accrued to the study from the University of Iowa, the University of Toronto, the University of Florida, New York University, and the University of California, Irvine. The protocol was approved by the Human Ethics Committees of each of the participating institutions and written consent was given by all patients.

Patients were excluded from entry to the study by the following criteria: (a) recent myocardial infarction (less than 3 months from the date of diagnosis), congestive cardiac failure, or cardiac arrhythmia; (b) documented central nervous system metastases; (c) superior vena caval obstruction precluding central venous catheterization for TPN; (d) inappropriate antidiuretic hormone syndrome; (e) any other important comorbid disease which, in the opinion of the investigator, might increase the risk of serious complications from TPN or chemotherapy.

All pathology and cytology slides were reviewed centrally by a reference pathologist (Dr. Mary J. Matthews, National Cancer Institute, Naval Medical Oncology Branch, Bethesda, MD).

Nutritional Assessment. Upon entry to the study, all patients had a nutritional assessment consisting of measurements of weight, height, AMC, TSF, total serum proteins, serum albumin, TIBC, and CHI (1). The CHI was determined by measuring the
actual daily urinary creatinine excretion compared with an ideal value based on sex and height. This nutritional assessment was repeated every 3 weeks for 1 year in the control group and at the end of Weeks 1, 2, 3, and 4 and every 3 weeks thereafter for 1 year in the TPN group.

Experimental Design. Patients were stratified by disease extent (limited versus extensive), degree of weight loss during the 3 months prior to diagnosis (<5% versus >5%), performance status (ECOG Group 0, 1 versus 2, versus 3), and institution. Patients were randomized into 2 groups using a central randomization procedure: one group was to receive TPN for 4 weeks in hospital; while the control group continued with a self-regulated p.o. diet. Both groups received identical chemotherapy programs.

The initial TPN prescription was based upon pretreatment weight loss and nutritional status. Nutritional depletion was arbitrarily defined as any one of the following: (a) weight loss of greater than 5% in the 3 months prior to diagnosis; (b) serum albumin <3.4 g/dl; (c) total iron-binding capacity, <270 μg/dl; (d) CHI, <80% of normal for sex and height; (e) urine urea nitrogen, >12 g/liter; or (f) midarm muscle circumference, <21 cm for women and <23 cm for men.

Patients who were classified as nutritionally depleted and who were assigned to TPN received 48 calories/kg and 1.5 g protein/kg and were increased to 56 calories/kg and 1.7 g protein/kg if possible. Patients with normal nutritional status were started at 32 calories/kg and 1.0 g protein/kg and raised to 48 calories/kg and 1.5 g protein/kg. TPN consisted of amino acids (4.25% Travesol), hypertronic glucose, and lipid emulsion (10%). Nonprotein calories were divided equally between carbohydrate and fat. All patients randomized to TPN received electrolytes, vitamins, and trace elements in standard amounts (12).

Chemotherapy was initiated after 1 week of nutritional support in the TPN patients and on the day of randomization in the control patients. All patients received induction chemotherapy consisting of high-dose cyclophosphamide (1200 mg/sq m), doxorubicin (Adriamycin) (70 mg/sq m), and vincristine (2 mg). This regimen was given for 2 cycles at 3-week intervals. Dosage adjustments were made for severe toxicity. All patients were given 2 tablets containing trimethoprim (80 mg) and sulfamethoxazole (400 mg) twice daily from Days 8 to 18 during the first 2 cycles of CAV as prophylaxis against infection. At 6 weeks, all patients were reevaluated and classified as responders (partial or complete response) or nonresponders (stable disease or progression). Responding patients then received 2 cycles of moderate-dose chemotherapy consisting of cyclophosphamide (1000 mg/sq m, doxorubicin (50 mg/sq m) and vincristine (2 mg) i.v. (CAV') as well as prophylactic cranial irradiation after the second cycle of CAV'. (2000 rads in 5 fractions over 1 week). Partial responders with limited disease were also given locoregional radiotherapy (2500 rads in 10 fractions over 2 weeks). At this point, responders were switched to VP-16 (100 mg/sq m i.v. daily for 3 days), methotrexate (50 mg/sq m i.v.) and citrovorum factor (10 mg p.o. every 6 h for 6 doses), beginning 36 h after methotrexate for 5 cycles at 3 weekly intervals. Thereafter, patients crossed back to CAV', administered every 3 weeks, until a total cumulative doxorubicin dose of 450 mg/sq m was reached. Patients then received VP-16, methotrexate, and citrovorum factor for 5 more cycles to complete 1 year of chemotherapy. Nonresponders, after the first 2 cycles of CAV, received VP-16, methotrexate, and citrovorum factor every 3 weeks until progression.

Complete response to therapy was defined as complete disappearance of all tumor lesions, as assessed clinically and by chest radiography and liver and bone scans. Partial response was defined as a decrease by >50% in the product of perpendicular cross-sectional diameters of the primary lung lesion of at least 3 weeks duration without progression of disease elsewhere or occurrence of new lesions. Partial response, for lesions where only one dimension was measurable, required a >30% decrease in that dimension. Stable disease implied >50% reduction or an increase of <25% for a period of at least 3 weeks. Progression of disease was defined as a >25% increase in the product of the cross-sectional diameter of one or more outlined lesions or the occurrence of new lesions irrespective of response elsewhere.

All patients were interviewed by a dietician or nutritionist in order to obtain a diet history and a 24-h recall. Where possible, a 3-day diet diary was collected during the initial assessment period. Patients recorded dietary intake for the 3 days prior to the scheduled administration of chemotherapy cycles 2, 3, and 5 and every 3 months thereafter until the end of the year of treatment. The 3-day diet diary was recorded just prior to the treatment day so that intake would not be influenced by acute toxicity from the chemotherapy and so that the data could be reviewed with the dietician to clarify portion size and dietary content, while they were still fresh in the patient's memory. Standardization of dietary data collection techniques was achieved through workshops conducted by the Diet, Nutrition and Cancer Program. Amounts of food consumed were converted to amounts of nutrients using Department of Agriculture Manual No. 8 (27) and the work of Church and Church (3).

Statistical Methods. The analyses used in this study, unless otherwise stated, were based on all the patients randomized to a treatment group irrespective of whether all received the assigned treatment. The nonparametric Wilcoxon rank-sum test was used to compare differences between the TPN and control groups with regard to changes between pretreatment and post-treatment nutritional assessment parameter values (5). The Pearson χ² (continuity corrected for 2 × 2 contingency tables) was used in the evaluation of categorical data. Due to missing values, the total number of patients analyzed for any particular factor does not always equal the total number entered on study. All P values correspond to 2-sided significance tests.

RESULTS

A total of 119 evaluable patients with SCLC were randomized on study. Sixty-two were assigned to receive no TPN (control group), while 57 were assigned TPN. Their base-line characteristics are shown in Table 1. The median age of the study population was 60 years. Seventy-five % of the study patients were male, and there was an equal distribution of patients by sex between the 2 arms of the study. Twenty-two (39%) patients in the TPN group had limited disease compared with 29 (47%) in the control group. Although the performance status of patients entered on study was generally excellent (87%; ECOG 0, 1), 91% of patients were classified as nutritionally depleted using the definition of nutritional depletion described in "Patients and Methods." The proportion
of depleted patients was similar in the TPN and control groups (86% versus 95%). In addition, the distribution of patients by extent of pretreatment weight loss (<5% versus >5%) was similar between the TPN and control groups; overall, 44.5% of patients on study had lost more than 5% of body weight in the 3 months prior to the start of treatment.

**Base-Line Nutritional Assessment.** There were no statistically significant differences between the 2 treatment groups at base line for weight (P = 0.84), AMC (P = 0.59), TSF (P = 0.16), TIBC (P = 0.82), serum albumin (P = 0.26), or CHI (P = 0.29).

When base-line nutritional assessment parameters were evaluated by disease extent (Table 2), patients with limited disease had a significantly lower weight at base line and smaller TSF than did the extensive-disease patients. They also had a higher serum albumin (P = 0.042), although the difference was not clinically impressive. No other differences in nutritional assessment parameters were noted.

Patients with less than 5% pretreatment weight loss at base line had a higher base line serum albumin, TIBC, and CHI, although in both groups the median albumin and TIBC values were within the normal range (Table 3).

**Short-Term Effects of TPN.** At base line and prior to any nutritional intervention, the caloric intake, as assessed by 24-h recall and/or 3-day diet diary, varied widely, as shown in Table 4. Nonetheless, there were no statistically significant differences between the mean or median values of the TPN and control groups. However, the caloric intake of the 2 groups differed significantly by the end of the first cycle of chemotherapy when patients assigned to TPN were receiving their maximally tolerated level of support (P < 0.0001). A wide range of caloric intake was noted in both the TPN and control populations. In the TPN group, this is explained by the fact that not all patients assigned to TPN were actually receiving it during the 3 days prior to the second cycle of chemotherapy when caloric intake was assessed, due to a variety of treatment-related problems. Nonetheless, the TPN group received on the average more than double their base-line caloric intake and approximately 1600 calories more than the control population (3634 versus 2007 calories; P = 0.0001). The mean caloric intake in the control group increased significantly by the end of the first cycle of chemotherapy when patients assigned to TPN were receiving their maximally tolerated level of support (P < 0.0001). The mean caloric intake in the control group increased from 1687 at base line to 2007 at Cycle 2 and to 2261 at Cycle 3. Prior to the third cycle of chemotherapy, the caloric intake of the TPN group was significantly decreased compared to the controls (P = 0.013), but from the fourth cycle onward, no significant differences were noted between the 2 groups. It should be stated that the calculated caloric intake obtained by the 3-day diet diaries may not have been representative of the average daily caloric intake during the whole 3-week interval between treatments, even though patients reported resumption of a "normal" diet in a median time of 0.5 to 2.0 days depending on treatment cycle. "Normal," however, generally meant resump-

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### Table 1

<table>
<thead>
<tr>
<th>Total no. of patients</th>
<th>Total no.</th>
<th>Age (yr)</th>
<th>Sex</th>
<th>Disease extent</th>
<th>Performance status</th>
<th>Nutritional status</th>
<th>Wt loss in previous 3 mo</th>
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<tbody>
<tr>
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<td>Male</td>
<td>Female</td>
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<td>Extensive</td>
<td>ECOCG 0, 1</td>
<td>ECOCG 2, 3</td>
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<td>59</td>
<td>38–75</td>
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<td>16</td>
<td>41</td>
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<tr>
<td>No TPN</td>
<td>62</td>
<td>61</td>
<td>48</td>
<td>38–77</td>
<td>48</td>
<td>14</td>
<td>48</td>
</tr>
<tr>
<td>Total</td>
<td>119</td>
<td>60</td>
<td>89</td>
<td>38–77</td>
<td>89 (75)*</td>
<td>30 (25)</td>
<td>51 (43)</td>
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</table>

* Numbers in parentheses, percentage.

### Table 2

<table>
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<th>Nutritional parameter</th>
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<th>Extensive</th>
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<td></td>
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<td>Arm muscle circumference</td>
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<td></td>
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<td>Serum albumin</td>
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<td></td>
<td>TIBC</td>
<td>278</td>
</tr>
<tr>
<td></td>
<td>CHI</td>
<td>87</td>
</tr>
</tbody>
</table>

|                       | Extensive | No. of patients | Range |
|                       | Wt       | 69.2 | 44–109 |
|                       | Arm muscle circumference | 24.3 | 67 | 16.3–30.4 |
|                       | TSF      | 13 | 67 | 7–39 |
|                       | Serum albumin | 3.8 | 68 | 2.2–4.9 |
|                       | TIBC     | 278 | 63 | 159–416 |
|                       | CHI      | 87 | 65 | 39–163 |

* NS, not significant.

### Table 3

<table>
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<th>Nutritional parameter</th>
<th>&lt;5% wt loss</th>
<th>≥5% wt loss</th>
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<td></td>
<td>Wt</td>
<td>No. of patients</td>
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<td></td>
<td>Arm muscle circumference</td>
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<td></td>
<td>TSF</td>
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<td></td>
<td>Serum albumin</td>
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<td></td>
<td>TIBC</td>
<td>260</td>
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<tr>
<td></td>
<td>CHI</td>
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<table>
<thead>
<tr>
<th></th>
<th>≥5% wt loss</th>
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<td>Arm muscle circumference</td>
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<tr>
<td></td>
<td>TSF</td>
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<td></td>
<td>Serum albumin</td>
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<td></td>
<td>TIBC</td>
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<tr>
<td></td>
<td>CHI</td>
<td>0.02</td>
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* NS, not significant.
To evaluate the effect of 4 weeks of TPN on weight, we compared the percentage weight change between the TPN and control group at Cycles 2, 3, and 4 for all patients who lived to at least Cycle 4 (Table 5). Patients in the TPN group had a significant weight gain by Cycle 2 compared with the control patients who actually lost weight (P < 0.0001). The difference in percentage weight change was still significant by Cycle 3 (P = 0.002) but only marginally significant at the fourth cycle of therapy. Thereafter, there was no significant difference between the 2 groups.

The impact of TPN on the nutritional assessment parameters was assessed by comparing the absolute change between the median base-line values and the median value at the start of Cycles 2 to 4 for each of the parameters (Table 6). The TPN group maintained TSF and hence body fat, whereas the control group had a decrease in TSF by Cycle 2. By Cycle 3, the difference no longer existed. A statistically significant difference in the change between base line and Cycle 2 was noted for AMC, due to a small increase in AMC in the TPN patients while control patients experienced a slight loss. Thereafter, no significant differences were noted. Although the control group maintained a higher CHI than did the TPN group, the difference was not statistically significant.

At the time of the second chemotherapy cycle, there was a reduction in the serum albumin level in the TPN group which was probably due to TPN-induced volume expansion. A similar decrease in hematocrit was also noted, and both abnormalities were promptly corrected when TPN was stopped.

When the above analyses were repeated excluding 2 patients...
Our understanding of the underlying mechanisms of weight loss disease, and it has a negative impact on survival (9, 14). Although in cancer patients is limited, it has been postulated that intensive nutritional support might reverse the cancer cachexia syndrome, reduce the toxicity of treatment, and improve survival (6, 11). However, controlled studies of hyperalimentation in patients with testicular cancer (23), lymphoma (21), colon (20), and non-SCLC (13) failed to show any favorable impact on response to treatment or survival. Although weight change and some nutritional assessment parameters were evaluated in these trials, a comprehensive survey of the impact of TPN on nutritional assessment parameters was not undertaken, nor were the late effects of intensive nutritional support evaluated.

In our lung cancer patient population, preillness weight loss of more than 5% of body weight was identified in 44.5% of patients, which is virtually the same percentage reported by others for patients with lung cancer (7, 9). When other parameters of nutritional depletion were used to define nutritional depletion such as CHI <90% of normal, serum albumin <3.4 g/dl, TIBC <270 µg/100 ml, urine urea nitrogen >12 g/liter, and AMC (males <23 cm, females, <21 cm), one or more abnormalities were present in 90% of patients. The vast majority of patients were therefore classified as nutritionally depleted. This stands in stark contrast to the fact that the performance status of the patients was excellent, with 87% of patients having few or no symptoms referable to their cancer.

Although the pathogenesis of weight loss in lung cancer patients is incompletely understood, anorexia is commonly recognized clinically. Our patients had a mean pretreatment caloric intake of approximately 1600 kcal/day. Costa, using Diet, Nutrition and Cancer Program methodology similar to that in this study, recently demonstrated that the average caloric intake of male lung cancer patients was 1778 kcal/day and significantly less than the caloric intake of normal, age-matched males (2358 kcal/day) (7). TPN reversed the caloric deficiency of these patients as the caloric intake prior to the second cycle of chemotherapy rose to a mean of 3634 kcal/day. Although TPN led to an increase in body weight, the rapidity of both the weight gain and its subsequent loss strongly suggested that most of the weight gain was due to water. This hypothesis is also supported by the transient fall in the concentration of serum albumin and its subsequent loss strongly suggested that most of the weight gain was due to water. This hypothesis is also supported by the transient fall in the concentration of serum albumin and its subsequent loss.
tive heart failure during TPN indicative of expansion of both intravascular volume and the extravascular fluid compartment (29). Although the transient increase in AMC noted at the end of Cycle 2 might be explained by an increase in lean body mass, it might also be due to an increase in intracellular water resulting from TPN-induced hyperglycemia and hyperinsulinemia, which would drive glucose, potassium, and water into cells. This would fit with observations on a subset of these patients in whom total body nitrogen was not increased by 4 weeks of TPN (24) and the observations of others that nutritional support leads to an increase in total body potassium (25).

Four weeks of TPN appear to assist in the maintenance of body fat. When data for all patients who survived to Cycle 4 were analyzed, a statistically significant change between TSF values at base line and Cycle 2 was observed between the TPN and control patients which suggested that TPN patients temporarily maintained body fat stores. Unfortunately, this difference was no longer apparent by Cycle 3. In patients surviving to 12 cycles of chemotherapy, the mean TSF for TPN patients was higher than for controls, although this difference was not statistically significant. There was no evidence that lean body mass was preserved. It is unclear whether the apparent conservation of body fat in the TPN patients delayed protein catabolism or helped to maintain well-being and functional capacity. Future studies should attempt to assess the patient’s functional capacity, perhaps by measures of muscle function.

It is apparent from this study that the “standard nutritional assessment parameters” do not sharply define the degree of malnutrition that exists in SCLC patients, especially when a set of measurements in an individual patient is considered independently. Although there were statistically significant differences in the median base-line values of serum albumin and TIBC between patients grouped by weight loss (Table 3), the median values for albumin and TIBC were in the normal range in both weight loss groups, and the range of values was wide. The median values for these proteins remained normal for 12 months despite progressive weight loss. We also noted, in a subset of these patients, that albumin levels remained in the normal range despite declining body nitrogen (24). Although some investigators have suggested that changes in these proteins are sensitive and specific measures of nutritional status (2), the usefulness of these measures is diminished in patients receiving TPN. In a recent study, Starker et al. (26) examined nitrogen balance, albumin concentrations, body weight, and sodium balance in 14 medical patients during 14 days of TPN. Seven patients lost weight, had a decrease in ECF, and had an increase in serum albumin level. Seven others gained weight and increased ECF, while serum albumin levels remained unchanged. These investigators concluded that serum albumin levels and body weight cannot be used as accurate indicators of nutritional status because of the variability in the response of body fluid compartments to nutritional repletion. In our patients, the predominant response was one of ECF volume expansion with dilutional hypoalbuminemia.

The CHI proved to be a poor indicator of nutritional status in these patients. Although CHI was significantly lower in those patients with more than 5% weight loss, values did not fall significantly in either the TPN or control group despite progressive weight loss. At base line, a very wide range of values was observed, and the range of change in patient values between base line and Cycles 2, 3, and 4 was also remarkably wide in both arms of the study. This degree of variation might be explained, in part, by inaccurate urinary collections, by laboratory error, or by the fact that urinary creatinine excretion may vary by as much as 25% from day to day even in normal individuals (28). In addition, it must be recognized that CHI does not take into account, and this may have contributed to the wide range of base line values seen (16).

When allowed to eat ad libitum, the mean caloric intake of these patients ranged from 1672 to 2261 kcal/day. This level of caloric intake is substantially below the caloric intake of 2400 kcal/day recommended by the National Research Council for males weighing 70 kg, and 51 to 75 years old (18). It is also below the average caloric intake of 2056 kcal/day ingested by males 65 years or older according to the Nutrition Canada Survey (10).

It was of interest to note that the caloric intake of the control patients increased from a mean of 1687 kcal/day at base line to 2261 kcal/day prior to Cycle 3, as a result of either tumor response to chemotherapy or the close attention from dieticians and nurses that these patients received as part of the study, even though no direct dietary counseling was provided. It was commonly observed that the patient’s spouse took an active interest in the study and encouraged the patient to maintain or increase food intake. It would be of considerable interest to know whether intensive dietary counseling alone would enable patients to increase their caloric intake to recommended levels.

Apart from diminished intake, other factors are undoubtedly contributory to the patients’ progressive weight loss. It has been demonstrated that patients with SCLC have an elevated basal energy expenditure (22). Furthermore, the intensive and prolonged chemotherapy may have depressed protein synthesis. This hypothesis is supported by observations on a subset of these patients of a decline in total body nitrogen as measured by prompt gamma analysis during the 2 weeks following chemotherapy despite the infusion of adequate amounts of calories and protein (24). Finally, the repetitive administration of nauseating therapy over a 1-year period and the psychological stress created by the illness and its treatment undoubtedly contributed to the malaise and anorexia experienced by many of these patients. The summation of these factors effectively negated any potential long-term benefits of TPN.

It was disappointing that 4 weeks of TPN was ineffective in increasing lean body mass as measured by AMC and CHI. This observation was also confirmed by the failure to increase TBN, as measured in a subset of these patients (24). This study has shown that the administration of TPN to patients with SCLC receiving intensive chemotherapy does not lead to an increase in lean body mass, although body fat and water may be increased. The limited impact of TPN on the nutritional assessment parameters must also be considered with the knowledge that TPN did not improve response rates to chemotherapy or affect overall survival. Toxicities were not lessened; rather, a high frequency of complications related to volume overload and infections was observed (29). If increased nitrogen retention is the aim of nutritional intervention, then future studies should attempt to promote nitrogen retention by increasing the duration of nutritional support and by augmenting the intake of protein and intracellular elements such as zinc and magnesium which are known to aid nitrogen retention.
A greater understanding of the underlying metabolic disturbances induced by cancer is urgently required before recommendations can be made regarding the value of nutritional support in patients with cancer.

ACKNOWLEDGMENTS

The authors thank Mary H. Owen, Rosie L. Roberson, Juanita Martinez, Phyllis Stumbo, Wairetta Jones, Karen Paul, and Sandra Mitchell for collection of the dietary data and Linda Hudson, Mary Monahan, Christna Ann Sinbey, Kim Thompson, Linda Millband, Mame Clark, Bette Mullis, and Diane Taylor for data collections related to all other aspects of this project. We extend special appreciation to Elaine Wolfe for her assistance in the preparation of the data and to Chris Allen for her generosity in donating Travesol solution, the Upjohn Company for donating multivitamin solutions, and American Cyanamid for donating leucovorin tablets. We also thank the Abbott Company for initially reducing the cost of Liposyn used in these studies.

REFERENCES

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