Home artificial nutrition in advanced cancer

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SUMMARY

Attitudes to home artificial nutrition (HAN) in cancer vary greatly from country to country. A 6-year prospective survey of the practice of HAN in advanced cancer patients applied by a hospital-at-home programme in an Italian health district was performed to estimate the utilization rate, to evaluate efficacy in preventing death from cachexia, maintaining patients at home without burdens and distress and improving patients' performance status, and to obtain information about costs. Patients were eligible for HAN when all the following were present: hypophagia; life expectancy 6 weeks or more, suitable patient and family circumstances; and verbal informed consent.

From July 1990 to June 1996, 587 patients were evaluated; 164 were selected for HAN (135 enteral and 29 parenteral) and were followed until 31 December 1996. The incidence of HAN per million inhabitants was 18.4 in the first year of activity and 33.2–36.9 in subsequent years, being 4–10 times greater than rates reported by the Italian HAN registers. On 31 December 1996, 158 patients had died because of the disease and 6 were on treatment. Mean survival was 17.2 weeks for those on enteral nutrition and 12.2 weeks for those on parenteral nutrition. Prediction of survival was 72% accurate. 95 patients had undergone 155 readmissions to hospital, where they spent 15–23% of their survival time. Burdens due to HAN were well accepted by 124 patients, an annoyance or scarcely tolerable in the remainder. The frequency of major complications of parenteral nutrition was 0.67 per year for catheter sepsis and 0.16 per year for deep vein thrombosis. Karnofsky performance score increased in only 13 patients and body weight increased in 43. The fixed direct costs per patient-day (in European Currency Units) were 14.2 for the nutrition team, 18.2 for enteral nutrition and 61 for parenteral nutrition.

The results indicate that definite entry criteria and local surveys are required for the correct use of HAN in advanced cancer patients, that HAN can be applied without causing additional burdens and distress, and that its costs are not higher than hospital costs.

INTRODUCTION

Attitudes to home artificial nutrition (HAN) in advanced non-curable cancer differ between countries[1]. A European multicentre survey[2] conducted in 1993 showed that the proportion of patients with a diagnosis of cancer receiving home parenteral nutrition (HPN) varied from 9% in the UK to 21% in France and 67% in Italy. National home enteral nutrition (HEN) registers indicate that cancer is the diagnosis in 20% of HAN patients in the Netherlands[3], 30% in the UK[4], 67% in Italy[5] and 70% in Switzerland[6]. In the USA malignancy is the most frequent indication for both HPN (42%) and HEN (43%)[7].

The basis of these different attitudes has not yet been clarified, but the main factors seem to be ethical and economic[8]. Advocates of HAN say that it avoids death from cancer cachexia, improves quality of life by allowing the patient to stay with family and reduces hospital admissions for nutritional support, thus cutting health care costs[1,8]. However, others point out that HAN may prolong suffering in patients with poorly controlled pain, increase distress by inducing complications, and reduce the quality of life by generating anxiety over management of this sophisticated therapy at home[9]. Furthermore, ethical and financial constraints may mean that priority should go to other health needs. No study has defined the cost-benefit and the cost-effectiveness of these different approaches[10].

In the Bologna health district (3.076 sq km, and 811 596 inhabitants), home care of advanced cancer patients is provided mainly by a hospital-at-home programme supported by a private non-profit-making organization, Associazione Nazionale Tumori (ANT). ANT consists of physicians and nurses supported by voluntary work, grants and donations[11]. Bologna health district previously lacked a

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HAN programme for advanced cancer patients, and in 1990 we set up an ANT-supported project, prospectively auditing our practice. Our aims were to estimate the utilization rate of HAN; evaluate the efficacy of HAN in preventing death from cachexia, maintaining patients at home without burdens and distress to patient and family and in improving patients' performance status; and obtain information about cost-determining items of HAN.

METHODS

Patient selection

The study started on 1 July 1990. Data on patients entered on HAN up to 30 June 1996 and followed up to 31 December 1996 are reported. Patients were considered to have advanced cancer when receiving only palliative care. Eligibility for HAN was determined by nutritionists applying the following criteria, all of which had to be met: hypophagia, defined as oral calorie intake absent or $<50\%$ of basal energy expenditure calculated by the Harris–Benedict formula; life expectancy $\geqslant 6$ weeks, estimated by clinical judgment; suitable patient and family circumstances (pain absent or controlled, no severe vital organ failure, emotional stability, willingness and ability to cope with HAN-related activities and suitable hygienic conditions); and verbal consent obtained after explanation of HAN methods and risks.

Evaluation was done by a nutrition support team (NST) who interviewed patients and family members recording: sex and age, height (cm), actual body weight (kg) and body weight change during the last 6 months; patient awareness of diagnosis; tumour primary site, histological type and metastasis; oral calorie intake; performance status; presence and degree of pain; and presence of vital organ failure. Protein-energy malnutrition was registered when body mass index (kg/m^2) was <20 in males and <19 in females or there had been a weight loss $\geqslant 10\%$ during the past 6 months. Performance status was assessed by the Karnofsky performance status (KPS) scale[12]—an 11-point rating scale that ranges from normal functioning (100) to dead (0)—and by their ability to go out and look after themselves. Indications for HAN were classified as anorexia, dysphagia and upper or lower gastrointestinal obstruction.

Technique

The NST consisted of a gastroenterologist-nutritionist and trained nurses (one up to 1993, two since 1994), supervised by a gastroenterologist-nutritionist from the local university hospital. The NST had a weekly meeting to evaluate patients' eligibility for HAN and to review patients already on HAN. The mode of access to the gastrointestinal tract (percutaneous endoscopic gastrostomy, jejunostomy, surgical gastrostomy) or the venous circulation was chosen by the NST, if devices were not already present on referral. Nutritional support was calculated for maintaining or improving protein-energy status, serum electrolyte level and urine output. For HEN, commercial solutions were utilized. Solutions for HPN were prepared by the hospital pharmacy up to December 1993. After that, bags containing standard formulas, infusion sets and dressing kits were bought from a specialist firm. Training of patients and/or relatives for HAN management was done at the patient's home whenever possible. Patients and/or relatives were taught all the procedures except central venous catheter dressing, which was always performed by a nurse. Catheter heparinization was avoided by 24-hour HPN infusion whenever this did not limit patient mobility. After the training period, nurses visited patients at home at least once a week taking care of both HAN and matters related to disease. The NST physician visited when HAN-related problems arose, while cancer related medical problems continued to be managed by ANT physicians. 24-hour immediate access to the NST and ANT physicians was available via telephone.

Monitoring

The use of HAN was estimated as incidence and prevalence, respectively calculated as number of new patients per million inhabitants and total days of treatment per year.

Efficacy of HAN was evaluated by: length of survival and cause of death; accuracy of the estimation of expected survival $<$ or $\geqslant 6$ weeks; number, causes and length of hospital readmissions; patients' and families' perception of burdens due to HAN management, categorized by the NST as 'well accepted' (they never complain), 'annoyance' (sometimes complain) or scarcely tolerated (constantly complain); frequency of HAN complications; variations of KPS score and mobility status within the first month of treatment, assessed by the NST physician; and variations of body weight, measured by NST nurses.

Cost analysis was performed on the basis of the number of patients treated from 1 July 1995 to 30 June 1996, only the fixed direct costs of HAN being considered—i.e. nutritional formula, infusion lines, dressing kits and salaries of the NST.

Statistics

When appropriate, data are reported as mean (standard deviation). In determining the accuracy of estimation of expected survival $<$ or $\geqslant 6$ weeks, we took into account the length of life of those patients who were not considered eligible for HAN because their predicted survival was <6 weeks[13]. Statistical differences were evaluated by Student's t-test for unpaired data, χ^2test and χ^2 test for trend.

RESULTS

Use of HAN

From 1 July 1990 to 30 June 1996, a total of 6838 cancer patients began on the ANT hospital-at-home programme. 587 patients were referred to the NST and 164 (110 males, 54 females; age 65 [14] years) were eligible for HAN (135 enteral and 29 parenteral). Only 50 patients (30%) who received HAN were aware of their diagnosis. In the 423 patients who were not eligible, reasons for exclusion were: absence of hyphophagia in 264, estimated life expectancy <6 weeks in 108, unsuitable home/family conditions in 30 and lack of consent in 21. The use of HAN is reported in Table 1. The incidence doubled from the first to the third year of activity then appeared stable, whereas the total days of treatment increased constantly through the years. The clinical characteristics of patients on starting HAN are shown in Table 2. 60% of patients had metastases, 40% had local advanced disease. 13 patients on HEN (8%) were able to go out and to look after themselves unaided; the remaining 151 were housebound.

For HEN the access route was nasogastric tube in 50% of patients, percutaneous endoscopic gastrostomy in 18%, jejunostomy in 27%, and surgical gastrostomy in 5%; training, performed at the patient's home in 64% of cases and before hospital discharge in 36%, was given to patients in 11% of cases and to relatives in 89%; infusion was by pump in 83% of cases and by gravity in 17% and was always cyclical (diurnal or nocturnal). For HPN, access was by non-tunnelled percutaneous catheters in 79% of cases, tunnelled percutaneous catheters in 14% and totally implanted ports in 7%; training was at the patient's home and given to relatives in all the cases; infusion, always by gravity, was cyclical in 31% of cases and continuous in 69%.

Efficacy

On 31 December 1996, 158 patients (130 HEN, 28 HPN) had died because of their disease and 6 (5 HEN and 1 HPN) were still on treatment (Figure 1). Mean survival was 17.2 (19.5) weeks for those on HEN and 12.2 (8.0) weeks for those on HPN. The duration of life in patients grouped for characteristics on starting HAN and for the year of entry into the study is reported in Table 3. 47 (29%) patients survived <6 weeks. The percentage of those living <6 weeks was greater in the groups with a primary tumour located outside the gastrointestinal tract and the head–neck region and in the group with a KPS score $\geqslant 40$. The proportion surviving <6 weeks decreased during the first 3

Table 1 **Use of home artificial nutrition (HAN)**

		Year of follow-up					
		1	2	3	4	5	6
Patient entered on ANT hospital-at-home	No.	984	1030	1090	1202	1272	1260
ANT patients referred to nutrition team	No. (%)*	69(7.0)	118(11.4)	143(13.1)	88(7.3)	86(6.8)	83(6.6)
Started HAN							
No. (%)†		15(22)	27(23)	30(21)	28(32)	30(35)	34(41)
HEN		14	27	26	25	20	23
HPN		1	0	4	3	10	11
From inpatients	%‡	40	59	47	64	47	68
From outpatients	%‡	60	41	53	36	53	32
Incidence of HAN§							
Total		18.4	32.2	36.9	34.5	36.9	41.9
HEN		17.2	32.2	32.0	30.9	24.6	28.4
HPN		1.2	0.0	4.9	3.6	12.3	13.5
Prevalence of HAN							
Days of HAN		666	2300	2576	2660	3309	4565
Days of HEN		605	2300	2362	2511	2739	3673
Days of HPN		61	0	214	149	570	892

*% of patients entered on Associazione Nazionale Tumori (ANT) home-care
†% of patients referred to nutrition team
‡of total HAN
§No. per million inhabitants
HEN=Home enteral nutrition; HPN=home parenteral nutrition

Table 2 **Clinical characteristics of patients on starting home artificial nutrition (HAN)**

	HEN (n=135) *No. (%)*	*HPN (n=29)* *No. (%)*
Primary tumour site		
Head–neck	47 (35)	3 (10)
Gastrointestinal*	61 (45)	18 (63)
Lung	10 (7.5)	1 (3)
Genitourinary†	2 (1.5)	4 (14)
Others‡	15 (11)	3 (10)
Disseminated metastasis	74 (55)	26 (90)
Protein-energy malnutrition	111 (82)	24 (82)
Karnofsky score		
30–40	45 (33)	9 (31)
50–60	80 (59)	18 (62)
70–80	10 (8)	2 (7)
Pain		
Absent	76 (56)	12 (41)
Controlled	59 (44)	17 (59)
Indication for HAN		
Anorexia	6 (4)	0 (0)
Dysphagia	81 (60)	3 (11)
Upper GI obstruction§	44 (33)	9 (31)
Lower GI obstruction¶	4 (3)	17 (58)

*oesophagus (20), stomach (46), large bowel (13)
†ovary (4), kidney (2)
‡pancreas (6), bone (3), skin (2), breast (2), brain (3), blood (2)
§oesophagus or stomach
¶small or large bowel
GI=gastrointestinal; HEN=home enteral nutrition; HPN=home parenteral nutrition

years of the study before becoming constant at about 25%. Among the 108 patients who were not considered eligible for HAN because of estimated survival <6 weeks, 31 (29%) lived $\geqslant 6$ weeks. This percentage did not change significantly during the 6 years of the study (33%, 26%, 31%, 17%, 29% and 38%). Over the whole period of follow-up, sensitivity, specificity, positive predictive value and accuracy of clinical estimation of survival $<$ or $\geqslant 6$ week were 79%, 63%, 72.5%, 71% and 72% respectively.

95 (61%) of the 158 patients who died had undergone 155 hospital readmissions (1.6 [0.9]/patient)—3 for HPN complications, 18 for palliative radiation or chemotherapy, 7 for jejunostomy positioning and 127 for the underlying disease. 88 readmissions (in 59 patients) were followed by a return to HAN and 67 were followed by death (13 HPN and 54 HEN). The percentage of patients who were readmitted to hospital as well as the number and the total days of readmission per patient increased in parallel with duration of survival. No significant difference was observed between HEN and HPN (Table 4).

Burdens for patient and family due to HAN management were judged 'well accepted' in 124 cases (39 aware of diagnosis, 19 HPN), an 'annoyance' in 30 (9 aware of diagnosis, 7 HPN) and 'scarcely tolerated' in 10 (1 aware of diagnosis, 3 HPN). The frequency of nasogastric tube blockage was 0.26 per year of HEN and that of dislodgment was the same. The percutaneous endoscopic gastroscopy site became infected in 1 patient and 2 required hub replacement. Frequency of complications per year of HPN was 0.67 for catheter sepsis, 0.16 for deep vein thrombosis and 0.50 for metabolic instability. During the first month of HAN, the KPS score increased (+11.5 [3.6]) in 13 patients (11 HEN, 2 HPN; KPS score on entry: 51 [11]; BMI on entry: 19.0 [2.7]; mean survival: 40 [31] weeks), decreased (-10.5 [2.2]) in 19 (14 HEN, 5 HPN; KPS score on entry: 57 [9]; BMI on entry: 20.9 [2.6]; mean survival: 18 [16] weeks, $p<0.02$ *versus* increased KPS) and was unchanged in 132 (110 HEN, 22 HPN; KPS score on entry: 49 [10]; BMI on entry: 19.5 [3.6]; mean survival: 15 [16] weeks, $p<0.0001$ *versus* KPS). 12 patients on HEN became able to go out and look after themselves unaided and 2 became housebound. Body weight was not measurable in 20 patients confined to bed; it increased in 43 (3.6[2.3] kg), decreased in 21 (3.0 [1.4] kg) and did not change in 80.

Costs

On the basis of the number of days of HAN from 1 July 1995 to 30 June 1996 (table 1) the cost of the NST was about 14.2 European Currency Units (ECU) per patient-day and the mean daily cost of solution, infusion line and dressing kits was 18.2 [5.8] ECU for HEN and 61 ECU for HPN.

DISCUSSION

In the Bologna health district, about 3000 people die from cancer each year[14]. Since ANT takes care of about one-third

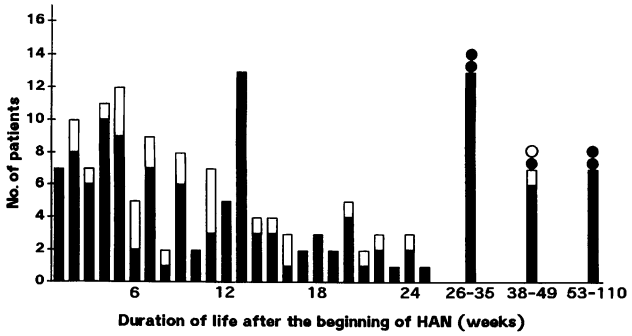

Figure 1 **Duration of life after beginning home artificial nutrition (HAN).** Patients who died during follow-up: ■ enteral nutrition, □ parenteral nutrition; patients alive at the end of follow-up: ● enteral nutrition, ○ parenteral nutrition

Table 3 **Duration of life after starting home artificial nutrition (HAN) in patients grouped for clinical characteristics on starting HAN and for year of activity of the nutrition team**

		Weeks of life from starting HAN to 31 December 1996			
	Patients	<6 No. (%)	6–11 No. (%)	12–17 No. (%)	>17 No. (%)
Primary tumour site					
Head–neck	50	10 (20)	8 (16)	12 (24)	20 (40)
†Gastrointestinal	79	19 (24) §	20 (25)	14 (18)	26 (33)
‡Others	35	18 (52) §	5 (14)	5 (14)	7 (20)
Metastasis					
Disseminated	100	35 (35)	25 (25)	20 (20)	25 (25)
Local	64	17 (27)	8 (12)	11 (17)	28 (44)
Protein-energy malnutrition					
Present	135	39 (29)	27 (20)	27 (20)	42 (31)
Absent	29	8 (28)	6 (20)	4 (14)	11 (38)
Karnofsky score					
30–40	54	20 (37)¶	15 (28)	8 (15)	11 (20)
50–60	98	26 (27)¶	16 (16)	22 (22)	34 (35)
70–80	12	1 (8)¶	2 (17)	1 (8)	8 (67)
Year of programme					
1	15	8 (54)**	2 (13)	1 (7)	4 (26)
2	27	9 (33)**	3 (11)	7 (26)	8 (30)
3	30	7 (23)**	12 (40)	6 (20)	5 (17)
4	28	7 (25)	4 (14)	7 (25)	10 (36)
5	30	8 (27)	5 (17)	6 (20)	11 (36)
6	34	8 (23)	7 (21)	4 (12)	15 (44)

*On 31 December 1996 158 dead and 6 alive
†oesophagus, stomach, small and large bowel;
‡ovary, uterus, bladder, kidney, pancreas, bone, skin, breast, brain
§=$P<0.01$
¶=$P<0.04$
**=$P<0.05$

of these patients the potential yearly incidence of HAN would be three times greater than we observed—that is, about 80 HEN and 40 HPN per million inhabitants. These figures are many times greater than those reported by the Italian registers (1.24 for HPN and 6.8 for HEN)[5,15] and by the other European registers[2–4,6], but resemble those observed in the USA[7] where the yearly prevalence of HPN is about 120 and that of HEN is 415 per million population (40% for cancer patients).

How effective was HAN in preventing death from cachexia? This judgment depended on clinical estimation of life expectancy, which was 72% accurate. Estimation of survival is a critical point in the decision-making process of starting HAN in advanced cancer. We considered patients at risk of death from cachexia if they had hypophagia and life expectancy $\geqslant 6$ weeks. In healthy individuals loss of lean body mass becomes incompatible with life after 2–3 months of starvation[16]. When we corrected for the expected presence of malnutrition and increased nitrogen catabolism due to the cancer, we thought 6 weeks an acceptable period. Analysis of the single years showed a learning curve over the first 3 years of follow-up for prediction of survival $\geqslant 6$ weeks but no improvement for prediction of survival <6 weeks. Several clinical and nutritional indices have been used to estimate prognosis in cancer patients but none seems to work well[17]. The best results were obtained by Bruera *et al.*[18], who observed that cognitive failure, dysphagia and weight loss of 10 kg were independently associated with poor prognosis and in a given patient predicted survival of <4 weeks with an accuracy of 74%.

HAN was effective in maintaining patients at home without causing additional burdens to patient and family but improved the performance status in only a few cases. Hospital readmission occurred in 61% of patients who spent 15–23% of their survival time in hospital, with a mean of 1.6 episodes per patient, mainly due to the cancer

Table 4 **Hospital readmissions in patients dead at the end of the follow-up, grouped by duration of life after starting home artificial nutrition (HAN) and type of HAN**

	Patients		Readmissions			
	On HAN No.	Readmission No. (%)	Total No.	No./patient* Mean [SD]	Days/patient* Mean [SD]	%Survival time* Mean (SD)
Weeks of life after starting HAN						
<6	47	19 (49)†	20	1.0 [0.2]	5.4 [4.5]	22 [15]
6–11	33	18 (55)†	27	1.5 [0.7]	12.2 [10.3]	23 [20]
12–17	31	21 (68)†	27	1.2 [0.4]	15.4 [17.4]	17 [20]
>17	47	37 (79)†	81	2.1 [1.1]	28.4 [27.6]	14 [13]
Type of HAN						
HPN	28	18 (64)	34	1.8 [0.9]	14.0 [13.3]	17 [16]
HEN	130	77 (59)	121	1.5 [0.9]	18.8 [23.1]	18 [17]

*Patients readmitted
†$P > 0.0001$
SD=Standard deviation; HPN=home parenteral nutrition; HEN=home enteral nutrition

complications. Under 2% of hospital readmissions were due to HAN complications. Frequency of hospital readmissions was directly associated with the length of survival. Since long life expectancy is a main indication for HAN, the risk of readmission does not seem a reason for avoiding the treatment. Only a few patients and families (5%) found the burdens of HAN barely tolerable, but data on acceptability were obtained by the NST and not a third-party observer, so may be underestimates. Another consideration was that only 30% of patients knew they had advanced cancer. Unawareness of the diagnosis could condition a patient's feelings towards nutrition, whose common symbolic value is one of maintaining life; in such patients, feeding could only have had a positive value. By contrast, those aware of their diagnosis might view feeding merely as a way of postponing death. Comparable data are available from a few retrospective studies on HPN. King *et al.*[19] reported that in their 61 patients KPS score and activity level did not change after starting HPN and 74% were readmitted to hospital (9% because of HPN complications). Hurley *et al.*[9] observed a mean hospital readmission rate of 2.5 per patient. Data from the USA registers[7] indicated a yearly hospital readmission rate for cancer complications of about 4 per patient on HPN and about 2.5 per patient on HEN. August *et al.*[20], examining the records of 17 patients, reported that HPN was a burden in only 1. Like King *et al.*[19], we found that performance status remained stable in most patients. The baseline body mass index did not statistically differ between the patients grouped according to the KPS changes after starting HAN, but the length of survival was longer in the patients who had an increase of KPS. In patients with cancer, KPS decreases as disease progresses. This negative effect could have counteracted the positive effect of HAN in most of the cases even if, trying to minimize the interference due to cancer progression, we analysed the changes of the KPS during the first month of treatment. The longer survival of patients who had an increase of KPS may reflect a slower progression of the disease. This would suggest that, in malnourished patients in whom the wasting effect of cancer is still limited, nutritional support might have a positive effect on functional status. The aim of the present audit was not to evaluate whether HAN offers any advantage over alternative treatments such as simple hydration. This would have required a control group of patients receiving such treatment. So far, no study has addressed this issue, but guidelines on artificial nutrition versus hydration in terminal cancer have been developed by a committee of experts[21]. Key elements for the decision were defined as the oncological and clinical condition, the expected survival (estimated by clinical judgment as more or less than 2 months), hydration and nutrition status, symptoms, oral nutrient intake (more or less than 75% of basal energy expenditure), patient's psychological attitude, gut function and the route for giving nutrients and water and health service availability to provide nutrition. Our criteria for evaluating patient eligibility seem to fit well with these guidelines.

The daily fixed direct cost of HAN was about 32.4 ECU for HEN and 75.2 ECU for HPN. A complete evaluation of costs must also consider the access route device and its positioning, laboratory tests, management of complications and administrative costs[10]. Furthermore, the costs due to the hospital-at-home programme must be considered.

Preliminary data on cost analysis of ANT assistance for patients receiving neither HAN nor chemotherapy, including fixed costs (staff salaries, physiotherapy, patient and health professional transport, overhead costs and loss of income by family members due to commitments at home) and variable costs (family doctor, laboratory, radiology and drugs) gave a daily amount of about 53 ECU per patient—two-thirds lower than hospital costs[22].

Summarizing our 6 year prospective study, we conclude that (*a*) definite entry criteria and local surveys are required for the correct planning of HAN use; (*b*) HAN can maintain patients at home without causing additional burdens and distress to patient and family; (*c*) this health technology can be offered at home with the combined efforts of patient and family for costs that are not obviously higher than hospital costs.

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