
CASE STUDY

Eight years of nutrition intervention for a young person with an acquired brain injury

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Abstract

This case is about a 38-year-old man with an acquired brain injury (ABI). It is a qualitative analysis of eight years of nutrition intervention by a private dietetic practitioner in a nursing home setting. For the eight years of nutrition intervention, enteral formula met all his nutrition requirements. Optimal goal weight was reached and stable eight years after the initial injury. In the early postacute period, energy requirements were 16 MJ/day for a goal weight of 70 kg. Today, energy requirements are less than 7 MJ/day to maintain weight at or below 80 kg. Over the eight years, the dietitian reviewed the client 40 times and adjusted the regimen 12 times. Each review was one hour long; monthly reviews for the first four years, then bimonthly. Weight was the main clinical outcome directing nutrition decisions. No gross nutrient deficiencies were incurred. No pressure sores developed. Reflux resolved with changes to medication, enteral formula and regimen. One episode of aspiration pneumonia was recorded. Based on this case study, we recommend nutrition planning for postacute care include a two-hour initial assessment, then one-hour monthly review for the first 12–24 months. Weight should be recorded monthly, and routine biochemistry bimonthly with six-monthly nutrition-specific measures of trace elements, micronutrients, blood glucose, serum lipids, iron studies and protein markers. Long-term nutrition intervention for ABI is a mostly unexplored, challenging and growing area of dietetics. This case study provides preliminary information for developing long-term enteral nutrition services to people with an ABI.

Key words: benchmarking, brain injury, dietitian, enteral nutrition, long term.

INTRODUCTION

Acquired brain injury (ABI) is a major public health problem in Australia affecting 160 000 people, mostly men.¹ People with an ABI are among the most marginalised population in society because they have limited methods of communicating and interacting in society,² and only a small number of ABI cases receive ongoing funding.³

There are about 80–100 young people with an ABI in nursing homes across Victoria.² The number of young ABI cases needing a place in a nursing home is expected to increase with advances in medical care. A nursing home is the only accommodation for young people with an ABI who need 24-hour high-level care. Being placed in a nursing home may slow rehabilitation, because nursing homes are not suited to the intensive treatment people with an ABI need. For this reason, alternative accommodation is actively being sought in Victoria.⁴

There is evidence that a comprehensive and intensive multidisciplinary team is more effective compared with a 'natural recovery' for people with an ABI.⁵ Natural recovery means treatment is aimed at convalescence and maintenance, and not treatment directed towards rehabilitation and improvement. Nutrition can affect clinical outcome in the early postacute⁶ and rehabilitation periods.⁵ For this reason, nutrition goals will change over time, consistent with a move towards rehabilitation and improvement.

There is very little published evidence for nutrition intervention and clinical outcomes for long-term enterally fed ABI cases. Current literature for nutrition and ABI focuses on the acute and early postacute period (up to two years post injury). In this early postinjury period, gastrointestinal problems, and a high metabolic rate with high protein and energy requirements (100–160% of basal energy requirements), are well described.⁶ Despite this evidence, there is no consensus, or nutrition guidelines, for the acute treatment period.^{6,7}

This case study was one of the first in Victoria to obtain funding on the Victorian Government's Acquired Brain Injury: Slow to Recover program. It is one of the longest-running ABI cases in Victoria, where funding has been provided for nutrition services for eight years. This case provides evidence of nutrition-related intervention and

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outcomes over eight years. The report is timely as the Council of Australian Governments has committed much-needed funds to provide better care for young people in nursing homes.⁸

Case description

This case is of a 38-year-old man who sustained an ABI 10 years ago at the age of 27 years while on an international posting in a major city in SouthEast Asia. The specific cause of the brain injury in this case is not clear. What is known is that he was found unconscious and immediately hospitalised. Three weeks later he was sent to a large hospital in Australian capital city. His recorded medical condition on arrival at the hospital included multi-organ failure due to sepsis, posthypoxic ischaemia and cerebral haemorrhage, renal failure requiring dialysis, aspiration pneumonia and respiratory failure. His nutrition needs were met with enteral feeding.

In December 1996, six months after arriving at the hospital, the patient was considered medically stable and transferred to his new residence, an inner city nursing home. He had a percutaneous endoscopic gastrostomy (PEG) in place.

As a result of the brain injury, this young man is fully dependent. He requires 24-hour nursing care, high-level medical care and ongoing allied health intervention. He is considered trapped in a profoundly disabled body and communication system. He can hear and understand, but cannot move, see much or speak. He communicates with facial expressions; a long blink for 'yes'. When in the nursing home, he spends much of the day in a customised wheel chair with splints on his arms for comfort, and to preserve his muscle shape, agility and reduce contractures in his body. He has a constant team of nursing, medical, allied health and specialist carers working to maximise and improve his health and quality of life.

Nutrition intervention started on arrival at the nursing home in December 1996 and continues today in 2007. At the nursing home, nutrition services were provided by a private accredited practicing dietitian. A nutrition review was of one-hour duration and included a visit to the client in the nursing home, assessment of medical records, speaking to staff and family, a short note in the medical history, and a complete nutrition care plan sent a few days later to the nursing home, family and relevant carers.

When discharged from hospital in December 1996, the patient weighed 62 kg (body mass index (BMI) 19 kg/m²). His healthy weight range for height (1.8 m) is 61–80 kg. His pre-illness weight was 85 kg (BMI 26 kg/m²), as reported by his mother. At the nursing home, weight was measured in the last week of every month, with the subject dressed in light clothing, without splints, using the same set of scales. The scales are Voyager lift with scale (Guardian, Hickory, NC, USA), designed to lift and hold the subject in a supported sling while the weight is digitally recorded. Scales are calibrated according to the manufacturer's instructions.

Severe reflux was a problem for the first year and a half at the nursing home. Reflux is common in people with head injury because of muscle spasms and rigidity throughout their body. Initially, reflux was managed with the insertion of a jejunostomy tube, use of a nutrient-dense formula, and low-rate 24-hour enteral regimen, consistent with recommendations.⁹ In early 1998, about 18 months after arriving at the nursing home, the problems with reflux were resolved when a baclofen pump was inserted. The baclofen pump is surgically implanted and administers the antispasmodic medication directly into the spinal fluid, alleviating the rigidity of muscles.

Estimated energy requirements (EER) were calculated with each change to regimen and yearly as part of goal setting. EER was calculated using Schofield equation, actual weight, a stress factor in the postacute period, then an activity factor as metabolic requirements decreased. A weight gain or weight loss factor was added as relevant. Fluid requirements were calculated on 35–45 mL/kg actual weight. Fluid was consistently given at the upper end of recommended fluid intake. Protein requirements in the first year were calculated at about 1.4–1.5 g/kg actual body weight. Once he was medically stable (from about 2001), protein was calculated as 0.8–1 g/kg.

In this first year at the nursing home, the patient started on a small amount of food (oral) of pureed and thickened consistency. His oral intake is much the same today, one pureed and thickened meal at lunch, contributing consistently less than 5% of his energy needs. Progress with oral intake was hindered by the need for specially textured food to be prepared and available, properly trained staff available, and adequate time to feed. The enteral regimen is designed to maximise appetite at the lunch-time meal.

His bowels are managed with aperients, and include a regimen of 150 mL of pear juice daily, with additional pear juice of 150 and 100 mL on four and three days of the week. Prune juice is given at 50 mL three days of the week. This has been with good effect. We recommended pear juice based on an Australian study on orthopaedic patients, and our concerns that prune juice may be too potent to use for this case.¹⁰

Routine bimonthly biochemistry measures included haematology, trace elements, protein markers, and urea and electrolytes. Every six months, blood results would include routine measures as well as iron studies, serum lipids and trace elements. Random blood glucose measures are performed. He takes anticonvulsant medication and has previously needed zinc supplements.

METHOD

This is a qualitative retrospective case study. Hard copy records were hand searched, and information was collected using data extraction tables with headings of: date of review, weight, biochemistry, EER, current regimen, intervention, new regimen, oral intake, clinical information and recommendation for next review. Records were cross-referenced with dates of review recorded in the medical history to

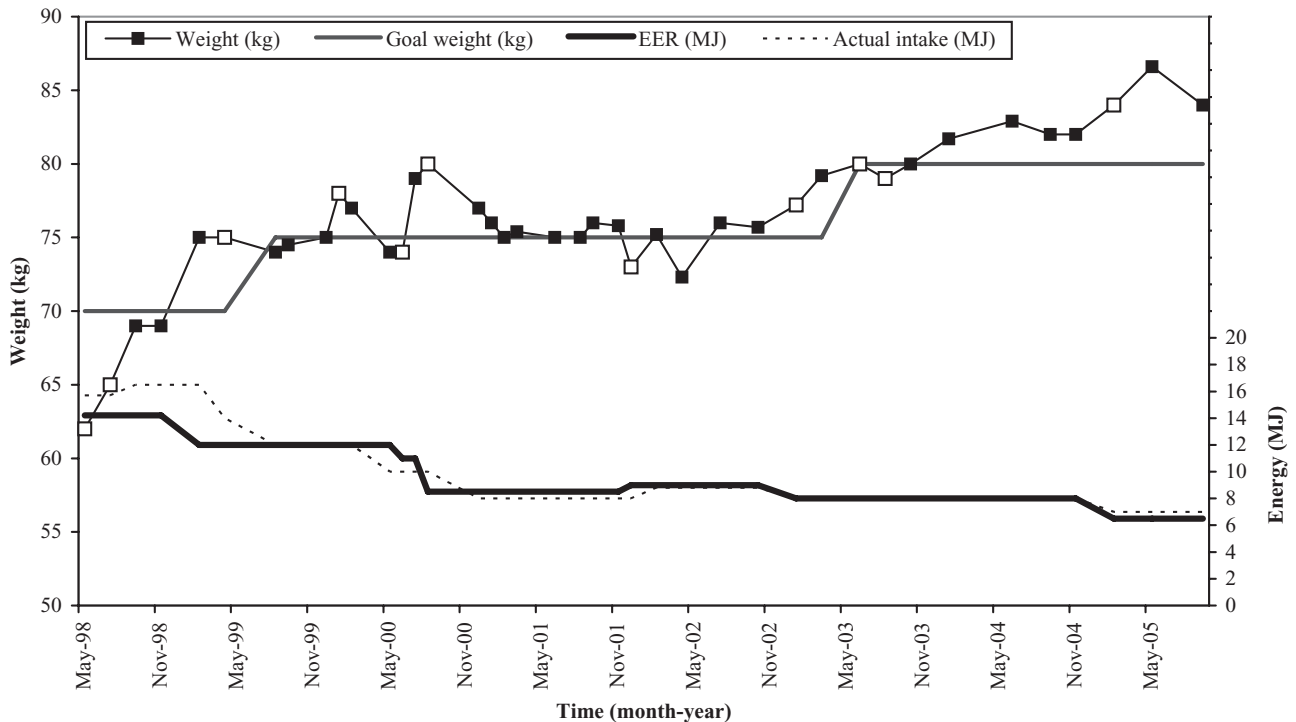


Figure 1 Weight change (kg) and energy intake (MJ) over eight years of nutrition intervention. Each square along the weight line represents a review by the dietitian. Twelve of these squares are white. The white squares indicate where an change to enteral regimen and energy input were made. Looking at energy requirements (MJ) over the eight years, energy requirements decreased over time. Actual intake was higher than calculated estimated energy requirements (EER) for the early postacute period (1998–1999), but matched EER after this period. There are four main results illustrated by this figure: (1) the dietitian saw the client 40 times over eight years (about 5 times a year), (2) the enteral regimen was adjusted 12 times in eight years (about 1.5 times a year), (3) his goal weight was reassessed as his health and recovery improved, and (4) there is a trend of decreasing energy input needed to achieve a higher goal weight; in 1998–2000, the patient needed more than twice as much energy input (16 MJ/day) as he does today (7 MJ/day) to maintain his goal weight.

identify possible missing hard copy records. Informed written consent was obtained from the subject's parents.

RESULTS

Figure 1 summarises the nutrition intervention over eight years, 1998–2005. Over the eight years, the dietitian saw the client 40 times (about 5 times a year), changed the enteral regimen 12 times (about 1.5 times a year), and goal weight was reassessed as the patient's health and recovery improved. Weight increased during winter months (May to September in Figure 1). From November 2001, nutrition reviews became bimonthly rather than monthly. Eight years after his ABI, he achieved a goal weight of 80 kg (BMI 25 kg/m²), comparable with his pre-illness weight (85 kg) and within his healthy weight range for height.

For the first two years in the nursing home, the patient had a continuous enteral regimen. Starting in December 1996 (data not shown), his enteral regimen was 125 mL/h for 15 hours with Deliver 2.0 (Novartis, Sydney, NSW, Australia), providing 16 MJ/day (EER 14.2 MJ: 1.5 stress factor). This was increased in mid-1998 to 140 mL/h, providing 16.5 MJ/day. In 1999, two years after arriving at the

nursing home, energy input was reduced to 14 MJ/day. In late 1999, rate increased to 180 mL/h for 12 hours, providing 12 MJ/day. This trend of decreasing energy requirements over time is illustrated in Figure 1. The decisions to change regimen were based on weight, EER, biochemistry, medical stability and perceived tolerance of regimen.

Bolus feeds were introduced in January 2000. This was six feeds of 237 mL Deliver 2.0, delivered by a pump at a rate of 240 mL/h, providing 12 MJ/day (calculations not available). Infusion rate was reduced to 200 mL/h five months later (May 2000) with reports of 'distress' noted by carers, suspected to be intolerance to a high infusion rate, reducing kilojoule input to 10 MJ/day. Two months later, energy input was reduced to 8 MJ/day because of a trend of increasing weight, and EER was recalculated (73 kg, 1.2 activity factor). Regimen then became four feeds of 237 mL Deliver 2.0 (8 MJ).

In December 2000, enteral formula was changed to Two-CalHN (Abbott Australasia Pty Ltd, Sydney, NSW, Australia) because Deliver 2.0 would no longer be available. In the same review, times for feeds were adjusted to further encourage an appetite for oral intake. One month later (January 2001), formula was changed to Novasource 2.0 (Novartis)

because carers reported an intolerance to TwoCalHN. Regimen then remained unchanged at 4×237 mL cans of Novasource 2.0 at 200 mL/h (8 MJ/day) for about one year.

During September to December 2001, the client had an admission to hospital with pneumonia. He lost 3 kg during this time because of interruptions to feeds and intermittent vomiting. Once he had recovered from pneumonia, enteral volume was increased to provide an additional 0.8 MJ/day to assist weight regain. This was a total of 8.8 MJ/day. The additional 0.8 MJ/day was decided based on EER, but also to keep a simple regimen; adding an extra 237-mL can on three days a week. This additional can was removed from the regimen one year later in January 2003 when weight reached 77 kg, 6 kg gain since the 0.8 MJ/day increase one year earlier.

Goal weight was adjusted from 75 kg (BMI 23 kg/m²) to 80 kg (BMI 25 kg/m²) in June 2003 (Figure 1). The goal weight of 80 kg was proposed by the medical team based on total protein and albumin results coming to within reference range at the higher weight of 80 kg. The 'albumin and weight' concept lacks conclusive scientific evidence, and such a relationship was not consistently demonstrated in this case. However, in conjunction with the rest of the team, 80 kg as the goal weight was agreed based on other factors, such as pre-illness weight (85 kg), carer-perceived lessened hunger (demonstrated by a reduction in teeth grinding), and increased energy levels (demonstrated by improved participation in rehabilitation program).

At the same time as goal weight was adjusted to 80 kg, enteral regime was reduced to 4×237 mL on four days and 3×237 mL on three days. This was an energy deficit of 1 MJ/day, a reduction from 8 to 7 MJ/day. A 1-kg reduction in weight was observed over the next two months. Enteral input was increased one month later because of weight loss below goal weight.

Over 2004, weight increased to 84 kg, 4 kg above goal weight of 80 kg, and now outside the patient's healthy weight range (Figure 1). In May 2005, his energy requirements were recalculated at about 6 MJ (80 kg, 1.2 activity factor, weight reduction factor of 2 MJ/day). Enteral was again reduced from 8 to 7 MJ/day, a deficit of 1 MJ/day. After this reduction in energy input, weight initially increased by 1 kg a month, then started to decrease by 1 kg a month over the next 4 months, with energy input remaining at 7 MJ/day. In June 2006, his weight reached 80 kg and remains stable today ± 1 kg (data not shown).

Over the eight years, biochemistry was within reference range except for zinc and albumin. Zinc was marginally deficient in January 2000 (10 g/L, with reference range 11–20 g/L) and supplements provided. Serum albumin was consistently at the lower end of the reference range (35–45 g/L), varying from 29 g/L (June 2000, weight 74 kg) to 37 g/L (October 2002, weight 76 kg).

There were other nutrition interventions not represented by Figure 1. These include recommendation for multivitamin and mineral supplements, analysis of food record chart, seasonal recommendations for fluid, and creation of fluid check charts.

DISCUSSION

We have described a case of a young man with an ABI and his nutrition intervention over eight years. Based on data presented in this case study, we recommend nutrition planning for postacute care include a two-hour initial assessment, then one-hour monthly review for the first 12–24 months. We recommend routine biochemistry bimonthly, and six-monthly nutrition-specific measures of trace elements (zinc, copper, selenium), micronutrients (include iodine, vitamin A and vitamin D), blood glucose, iron studies, serum lipids and protein markers. Weight should be recorded monthly.

The main limitation in reporting this case study is missing data. We suspect at least four hard copy records were not found for the year 2000, and data for 1997 cannot be located. This means that important outcome measures such as weight, hospital admissions, calculations and changes to regimen are omitted. This limits the scope of reporting and comparing this case study with other ABI cases, and broader clinical outcomes affected by nutrition intervention. However, we believe the records retrieved provide sufficient information to describe the nutrition service to a satisfactory level. Another limitation is that the present study only focuses on nutrition care; nutrition is only one part of the complex needs of ABI clients to maximise recovery and health.

At times, decisions were driven by funding rather than clinical outcome. For example, the recommendation to move from monthly to bimonthly review was because of reduced funding. Funding cuts meant that basic nutrition services, such as correspondence, minor changes, nutrition advice and extraordinary reports between review times, were provided as a duty of care and goodwill by the dietitian. The dietitian maintained 1998 prices for nutrition services so nutrition intervention remained within budget. These non-funded activities to maintain nutrition intervention are not sustainable, and for legal reasons, should be avoided.

Nutrition recovery was achieved over a number of years. Optimal goal weight (80 kg, BMI 25 kg/m²) was reached at the eighth year post injury. Goal weight could have been achieved earlier with a higher kilojoule input. However, the goal was to match kilojoule input to weight gain in lean body mass, not fat mass. There is evidence that overfeeding, or rapid refeeding, promotes fat mass rather than lean body mass.¹¹ In this case study, promotion of lean body mass could only be achieved with a moderate kilojoule input over a number of years. This is because only a small amount of exercise was possible in the first few years; exercise ability has improved over the last four years. We do not have body composition data to support our expectation that the regimen and timing of feeding maximised lean body mass. However, we expect that a gradual weight gain over time (Figure 1), coupled with exercise, is more likely to promote lean body mass over fat mass.

A high nutrition requirement with rapid protein breakdown in the initial postacute ABI phase (6–12 months post injury) is characteristic of head injury.⁶ In this case study,

energy provision was at 16 MJ/day in the early postacute phase, decreasing to 8 MJ/day over the next 2–3 years. The high EER calculated for this case, and the decreasing requirements over time, is consistent with other data.⁶ We suggest that the high nutrition requirement extended past the second year post injury in this case because of the body rigidity and muscle spasms persisting. These were later managed by the insertion of a baclofen pump, resulting in a reduced requirement for energy input over the following year from 16 to 12 MJ/day.

A recent nutrition review in September 2006 by the dietitian included an audit of the enteral formula against the nutrient reference values (NRV) and recommended dietary intakes (RDI).¹² In the current provision of enteral formula, iodine and vitamin A are below recommended intake. Biochemistry results in September 2006 show vitamins A and D, and iodine to be marginally below the reference range. It is because of these recent clinical results, and similar deficiencies reported in the literature,¹³ that we recommend these vitamins are measured as part of the six-monthly, nutrition-specific, biochemical analysis. We are investigating a multivitamin, suitable for a PEG, that contains vitamin A and iodine, and have recommended routine sun exposure.

Today, the patient's kilojoule intake and estimated requirements are about 7 MJ/day, almost half the kilojoule requirement he needed in the first two years of intervention. We speculate that energy requirements may continue to fall as nutrition recovery is achieved. We suggest this based on the trend presented in this case study of decreasing energy requirements to maintain weight over eight years. The clinical challenge now is to create a regimen using a nutrient-dense formula, which is nutritionally complete in the volume needed to meet his 7 MJ/day requirements. The regimen is also to fit a time plan around physical activity and lunch, and does not leave too long a gap between meals.

We support a shift in thinking of nutrition intervention for ABI clients from one of convalescence and maintenance to one of active treatment and rehabilitation. Therefore, as the man in this case study is nutritionally and medically healthy, our focus now is to optimise nutrition intervention to reduce chronic disease risk. The National Health and Medical Research Council NRV and RDI include recommendations for intake of fatty acids such as omega 3, antioxidants and fibre as part of eating to minimise chronic disease risk.¹² We are investigating the type and amount of fatty acids and antioxidants provided in the enteral formula, and the availability of a fish oil supplement suitable for a PEG.

This case documents the high-level and changing nutrition needs for a young person with an ABI over eight years. Our recommendations on the number and length of reviews, biochemistry, weight and other outcomes to be measured, can be used to advocate for funding and long-term planning for nutrition care for ABI clients in nursing homes, as well as

for ABI cases returning home. Scientifically and politically, the greater challenge is to attain and maintain an evidence-based nutrition profile, and adequate funding, to maximise the health of all people with an ABI.

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